EUROCARGO TECTOR

6 TO 10 t

REPAIR MANUAL

IVECO

"This document provides data, characteristics, instructions and methodology to perform repair interventions on the vehicle and its components.

Anyhow, this document is addressed to qualified and specialised personnel. Iveco commercial and assistance network personnel as well as all Iveco authorised points of assistance are specifically qualified and equipped to perform the repair interventions that are indicated in this document.

Before performing any intervention, check to have available the document relating to the vehicle model on which the intervention is being performed and also make sure that all accident prevention devices, such as, as a rough guide, goggles, helmet, gloves, shoes, as well as work tooling, lifting and transport tooling, etc., are available and efficient, and further make sure that the vehicle is put such a way that an intervention can be made in safety conditions.

Making interventions strictly observing the indications given here, as well as using specific tooling indicated, assures a correct repair intervention, execution timing observance and operators' safety.

Each repair intervention must be finalised to the recovery of functionality, efficiency and safety conditions that are provided by Iveco.
Each intervention, on the vehicle, that is finalised to a modification, alteration or else, which is not authorised by Iveco, involves the exclusion of any responsibility for Iveco, and, in particular, where the vehicle is covered by a guarantee, each such intervention involves an immediate lapse of the guarantee.

Responsibility for Iveco in repair intervention execution is excluded.

Iveco is available to provide all clarifications necessary to make interventions, as well as to provide indications in cases and situations not included in this document.

Data and information contained in this document could result not to be updated owing to modifications made by Iveco at any moment for technical or commercial reasons, or because of the need to adapt the vehicle to law requirements in different countries.

In the case of a difference between what contained here and what actually found on the vehicle, please contact Iveco network before making any intervention."

The data contained in this publication might fail to reflect the latest changes which the Manufacturer may introduce at any time, for technical or sales purposes, or to meet the requirements of local legislation.

Copy, even partial, of text and drawings is forbidden.

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PRELIMINARY REMARKS

Manuals for repairs are split into Sections, each one of which is marked by a numeral; the contents of these sections are indicated in the general table of contents.
Each section is generally dedicated to a main Unit (e.g.: engine, gearbox, electric system, etc.).
Sections with mechanical contents include technical data, tightening torque collections, tool lists, connections – disconnections of units to/from the vehicle, overhauls at the bench and relating troubleshooting.
On the electric/electronic system section there are the descriptions of the electric network and vehicle electronic systems, electric schemes, components electric characteristics, components codes and troubleshooting relating to the central units specific of the electric system.
The manual uses proper symbols in its descriptions; the purpose of these symbols is to classify contained information. In particular, there have been defined a set of symbols to classify warnings and a set for assistance operations.

SYMBOLS – WARNINGS

Danger for persons
Missing or incomplete observance of these prescriptions can cause serious danger for persons' safety.

Danger of serious damage for the vehicle
Partial or complete non observance of these prescriptions can cause serious damages to the vehicle and sometimes guarantee lapse too.

General danger
It includes the dangers of above described signals.

Environment protection
It indicates correct behaviour in order that vehicle use is environmentally friendly as much as possible.

NOTE It indicates an additional explanation for a piece of information.

SYMBOLS – ASSISTANCE OPERATIONS

Removal Disconnection
Refitting Connection
Removal Disassembly
Fitting in place Assembly
Tighten to torque
Tighten to torque + angle value
Press or caulk
Regulation Adjustment
Visual inspection Fitting position check
Measurement Value to find Check
Equipment
Surface for machining Machine finish
Interference Strained assembly
Thickness Clearance
Lubrication Damp Grease
Sealant Adhesive
Air bleeding
Replacement Original spare parts

Intake
Exhaust
Operation
Compression ratio
Tolerance Weight difference
Rolling torque
Rotation
Angle Angular value
Preload
Number of revolutions
Temperature
Pressure
Oversized Higher than.... Maximum, peak
Undersized Less than.... Minimum
Selection Classes Oversizing
Temperature < 0 °C Cold Winter
Temperature > 0 °C Hot Summer

PRODUCT CODE

Each title or subtitle concerning operations being performed is preceded by a six–figure number named PRODUCT CODE. This number represents the **PRODUCT CODE** referred to by the repair operation contained in both REPAIR TIMES and TROUBLE CODE document.
As a quick reference there are shown below the guide lines to read this code (see Repair Timing, too).

Product Code:

5 0				7 6		
PRODUCT	UNIT	SUB–ASSEMBLY COMPONENT		PRODUCT	UNIT	SUB–ASSEMBLY COMPONENT

The first and second figures identify the PRODUCT within motor vehicle.

Example :

Product 50 = Vehicle chassis;
Product 52 = Axles;
Product 53 = Transmission;
Product 76 = Electric ssystem.

Unit Code:

	0 1				0 3	
PRODUCT	UNIT	SUB–ASSEMBLY COMPONENT		PRODUCT	UNIT	SUB–ASSEMBLY COMPONENT

The third and fourth figures identify the UNIT within the PRODUCT.

Example :

Product 50 = Vehicle chassis;
Unit 01 = Chassis;
Unit 02 = Bumpers;
Unit 03 = Alternator.

Sub–assembly Code:

		4 0				1 3
PRODUCT	UNIT	SUB–ASSEMBLY COMPONENT		PRODUCT	UNIT	SUB–ASSEMBLY COMPONENT

The fifth and sixth figures exactly identify the SUB–ASSEMBLY and Component of a Unit within a PRODUCT.

Example :

Product 50 = Vehicle chassis;
Unit 01 = Chassis;
Sub–assembly 40 = Chassis cross members;
Sub–assembly 13 = Rotor.

GENERAL WARNINGS

Warnings shown cannot be representative of all danger situations possibly occurring. Therefore, it is suggested to contact immediate superiors where a danger situation occurs which is not described.

Use both specific and general–purpose toolings according to the prescriptions contained in respective use and maintenance handbooks. Check use state and suitability of tools not subjected to regular check.

The manual handling of loads must be assessed in advance because it also depends, besides weight, on its size and on the path.

Handling by mechanical means must be with hoisters proper as for weight as well as for shape and volume. Hoisters, ropes and hooks used must contain clear indications on maximum carrying capacity acceptable. The use of said means is compulsorily permitted to authorised personnel only. Stay duly clear of the load, and, anyhow, never under it.

In disassembling operations, always observe provided prescriptions; prevent mechanical parts being taken out from accidentally striking workshop personnel.

Workshop jobs performed in pairs must always be performed in maximum safety; avoid operations which could be dangerous for the co–operator because of lack of visibility or of his/her not correct position.

Keep personnel not authorised to operations clear of working area.

Learn operation and safety knowledge necessary relating to the vehicle prior to each intervention on it. Scrupulously observe all safety warnings on the vehicle. Apply suitable signals for the vehicles being repaired. Once the repair intervention has been completed, before starting up the vehicle, perform all checks indicated on paragraph "Controls care of user" of Use and Maintenance handbook.

In lack of visibility in operating from the vehicle, charge a person on the ground with assistance. Do not leave unmanned a vehicle in motion during repair interventions.

Keep the vehicle stationary by proper chocks.

In the case of an intervention on a vehicle lifted from the ground, check the vehicle to be quite steady on special support stands and, in the case of lifting by means of a lift, check manual/automatic safeties to be activated.

When it is necessary to perform an intervention on methane–fed vehicles, observe the indications contained inside the document, as well as all specific safety regulations provided.

Only remove radiator cap when the engine is cold by cautiously unscrewing it in order to let system residual pressure out.

Inflammable fuel and all inflammable fluids and liquids must be handled with care, according to what contained on harmful materials 12–point cards. Refuelling must be performed outdoors with the engine off, avoiding lit cigarettes, free flames or sparks in order to prevent sudden fires/bursts. Adequately store inflammable, corrosive and polluting fluids and liquids according to what provided by regulations in force. Compulsorily avoid to use food containers to store harmful liquids. Avoid to drill or bore pressurised containers, and throw cloths impregnated with inflammable substances into suitable containers.

Worn out, damaged or consumable parts must be replaced by Iveco original spares.

During workshop activity, always keep the work place clean; timely clear or clean floors from accidental liquid or oil spots. Electric sockets and electric equipment necessary to perform repair interventions must meet safety rules.

For every intervention on vehicle hydraulic, pneumatic, conditioning and AIR – BAG systems, scrupulously observe indications specified in relating manual sections.

GENERAL WARNINGS

Put on, where required by the intervention, garments and protections provided in accident prevention rules; contact with moving parts can cause serious injuries. Use suitable, preferably tight–fitted garments, and avoid to use jewels, scarves, etc.

Do not leave the engine in motion at workshop locations not provided with a pipe to scavenge exhaust gas outside.

Avoid to breathe fumes coming from heating or from paint welding because they can cause damages to health; operate outdoors or in suitably ventilated areas. Put on proper inspirator if paint powder is present.

Avoid contact with hot water or steam coming from the engine, radiator and pipings because they could cause serious burns. Avoid direct contact with liquids and fluids present in vehicle systems; where an accidental contact has occurred, refer to 12–point cards for provisions to make.

Clean units or assemblies detached from the vehicle and carefully check their integrity before overhaul. Tidy up detached or disassembled parts with their securing elements (screws, nuts, etc.) into special containers.

Check for the integrity of the parts which prevent screws from being unscrewed: broken washers, dowels, clips, etc. Self–locking nuts with an insert made of nylon must always be replaced.

Avoid contact of rubber parts with diesel oil, petrol or other not compatible substances.

Before washing under pressure mechanical parts, protect electric connectors, and central units, if present.

Tightening screws and nuts must always be according to prescriptions; IVECO commercial and assistance network is available to give all clarifications necessary to perform repair interventions not provided in this document.

Before welding:

- ❑ Disconnect all electronic central units, take power cable off battery positive terminal (connect it to chassis bonding) and detach connectors.
- ❑ Remove paint by using proper solvents or paint removers and clean relevant surfices with soap and water.
- ❑ Await about 15 minutes before welding.
- ❑ Equip with suitable fire resistant protections to protect hoses or other components where fluids or other materials flow which may catch fire easily on welding.

Should the vehicle be subjected to temperatures exceeding 80°C (dryer ovens), disassemble drive electronic central units.

The disposal of all liquids and fluids must be performed with full observance of specific rules in force.

GENERAL WARNINGS ON THE ELECTRIC SYSTEM

If an intervention has to be made on the electric/electronic system, disconnect batteries from the system; in this case, always disconnect, as a first one, the chassis bonding cable from batteries negative terminal.

Before connecting the batteries to the system, make sure that the system is well isolated.

Disconnect the external recharging apparatus from the public utility network before taking apparatus pins off battery terminals.

Do not cause sparks to be generated in checking if the circuit is energised.

Do not use a test lamp in checking circuit continuity, but only use proper control apparatuses.

Make sure that the electronic devices wiring harnesses (length, lead type, location, strapping, connection to screening braiding, bonding, etc.) comply with IVECO system and are carefully recovered after repair or maintenance interventions.

Measurements in drive electronic central units, plugged connections and electric connections to components can only be made on proper testing lines with special plugs and plug bushes. Never use improper means like wires, screwdrivers, clips and the like in order to avoid the danger of causing a short circuit, as well as of damaging plugged connections, which would later cause contact problems.

To start up the engine, do not use fast chargers. Start up must only be performed with either separate batteries or special truck.

A wrong polarisation of supply voltage in drive electronic central units (for instance, a wrong polarisation of batteries) can cause them to be destroyed.

Disconnect the batteries from the system during their recharging with an external apparatus.

On connecting, only screw up connector (temperature sensors, pressure sensors etc.) nuts at prescribed tightening torque.

Before disconnecting the junction connector from an electronic central unit, isolate the system.

Do not directly supply electronic central units servo components at nominal vehicle voltage.

Cables must be arranged such as to result to be parallel to reference plane, i.e. as close as possible to chassis/body structure.

Once the intervention on the electric system has been completed, recover connectors and wiring harnesses according to original arrangement.

Key memorisation procedures are influenced by electromagnetic jamming (mobile phones, etc.). Therefore, during key memorisation:
1 Pay attention that jamming sources are not present in the cab or near the keys.
2. Keys not insered in the panel must be at least 1 meter away.

NOTE Connectors present must be seen from cable side. Connectors views contained in the manual are representative of cable side.

Bonding and screening

Negative leads connected to a system bonded point must be both as short and possible and "star"–connected to each other, trying then to have their centering tidily and properly made (Figure 1, re. M).

Further, following warnings are to be compulsorily observed for electronic components:

– Electronic central units must be connected to system bonding when they are provided with a metallic shell.

– Electronic central units negative cables must be connected both to a system bonding point such as the dashboard opening bonding (avoiding "serial" or "chain" connections), and to battery negative terminal.

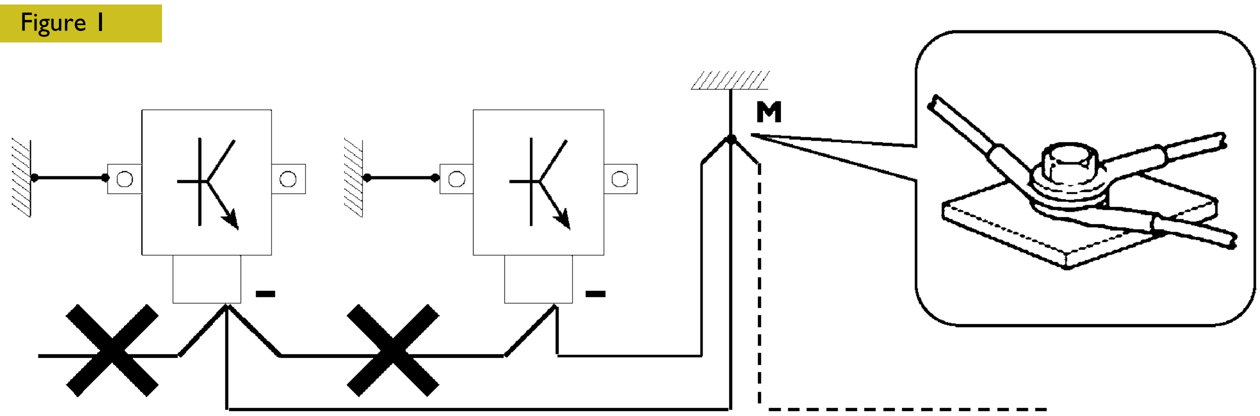
– Analog bonding (sensors), although not connected to battery negative system/terminal bonding, must have optimal isolation. Consequently, particularly considered must be parasitic resistances in lugs: oxidising, clinching defects, etc.

– Screened circuits braiding must only electrically contact the end towards the central unit entered by the signal (Figure 2).

– If junction connectors are present, unscreened section **d**, near them, must be as short as possible (Figure 2).

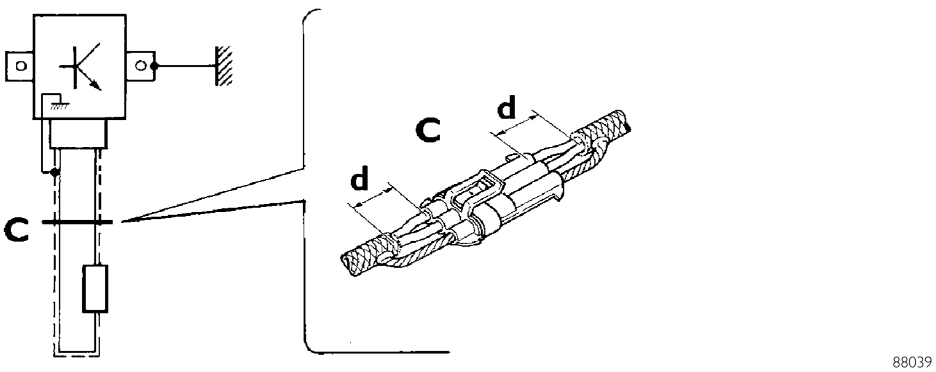
– Cables must be arranged such as to result to be parallel to reference plane, i.e. as close as possible to chassis/body structure.

Figure 1



1. NEGATIVE CABLES "STAR" CONNECTION TO SYSTEM BONDING **M**

Figure 2



2. SCREENING THROUGH METALLIC BRAIDING OF A CABLE TO AN ELECTRONIC COMPONENT – **C.** CONNECTOR **d.** DISTANCE → 0

OPTIONAL ELECTRICAL AND MECHANICAL PARTS INSTALLATIONS

Accessories mounting, additions and modifications on the vehicle are to be performed complying with IVECO mounting instructions (specific document “Instructions for transformation and preparation” is available at Assistance Network workshops).
It is reminded that, especially about the electric system, several electric sockets are provided for as series (or optional) sockets in order to simplify and normalise the electrical intervention that is care of preparation personnel.
For any exception to mounting instructions, IVECO’s authorisation is necessary.
Lack of observance of above described prescriptions involves guarantee lapse.

It is absolutely forbidden to make modifications or connections to electric central units wiring harnesses; in particular, the data interconnection line between central units (CAN line) is to be considered inviolable.

CONVERSIONS BETWEEN THE MAIN UNITS OF MEASUREMENT OF THE INTERNATIONAL SYSTEM AND MOST USED DERIVED QUANTITIES

Power

1 kW	=	1.36 metric HP
1 kW	=	1.34 HP
1 metric HP	=	0.736 kW
1 metric HP	=	0.986 HP
1 HP	=	0.746 kW
1 Hp	=	1.014 metric HP

Torque

1 Nm	=	0.1019 kgm
1 kgm	=	9.81 Nm

Revolutions per time unit

1 rad/s	=	1 rpm x 0.1046
1 rpm	=	1 rad/s x 9.5602

Pressure

1 bar	=	1.02 kg/cm^2
1 kg/cm^2	=	0.981 bar
1 bar	=	10^5 Pa

(Nm and bar units are converted according to 10:1 and 1:1 for the sake of simplicity)

1 kgm	=	10 Nm
1 kg/cm^2	=	1 bar

Temperature

0° C	=	32° F
1° C	=	(1 x 1.8 + 32) ° F

EUROCARGO TECTOR
6 TO 10 t

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Base – October 2004

UPDATE DATA

Section	Description	Page	Revision date

Print 603.93.381

INDEX OF SECTIONS

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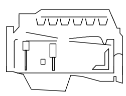
SECTION 1

General Specifications

COMPOSITION OF THE MODELS

UNITS \ MODELS			ML60E13	ML60E13/P	ML60E13R	ML60E13R/P	ML60E13K	ML60E13KR	ML60E15	ML60E15/P	ML60E15R	ML60E15R/P	ML60E15K	ML60E15KR	ML65E13	ML65E13/P	ML65E13R	ML65E13R/P	ML65E13K	ML65E13KR	ML65E15	ML65E15/P	ML65E15R	ML65E15R/P	ML65E15K	ML65E15KR
	F4AE0481D	(130HP)	•	•	•	•	•	•							•	•	•	•	•	•						
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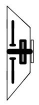	Single plate	13”	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
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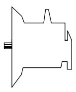	2855S.5		•	•			•		•	•			•		•	•			•		•	•			•	
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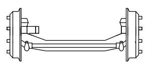	5833																									
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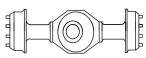	4517		•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
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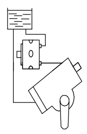	TRW-TAS 30		•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
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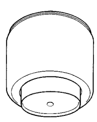	Front pneumatic																									
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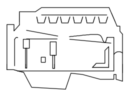
P = Vehicles with air suspension on rear axle
FP = Vehicles with front and rear air suspension
D = Vehicles with double cabin
K = Vehicles with dump body
R = Towing vehicles

COMPOSITION OF THE MODELS

UNITS		MODELS	ML75E13	ML75E13/P	ML75E13R	ML75E13R/P	ML75E13K	ML75E13KR	ML75E15	ML75E15/P	ML75E15R	ML75E15R/P	ML75E15K	ML75E15KR	ML75E17	ML75E17/P	ML75E17R	ML75E17R/P	ML75E17K	ML75E17KR	ML75E18	Ml65E18/P	ML75E18R	ML75E18R/P	ML75E18K	ML75E18KR
	F4AE0481D	(130HP)	•	•	•	•	•	•																		
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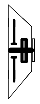	Single plate	13”	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•						
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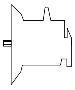	2855S.5		•	•			•		•	•			•		•	•			•		•	•			•	
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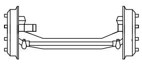	5833																									
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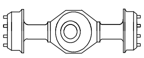	4517		•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
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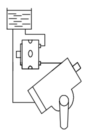	TRW-TAS 30		•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
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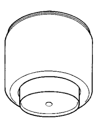	Front pneumatic																									
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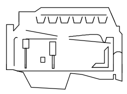
COMPOSITION OF THE MODELS

UNITS		MODELS	ML80EL15	ML80EL15/P	ML80EL15R	ML80EL15R/P	ML80EL17	ML80EL17/P	ML80EL17R	ML80EL17R/P	ML80E17	ML80E17/P	ML80E17/FP	ML80E17D	ML80E17D/P	ML80E17R	ML80E17R/P	ML80E17R/FP	ML80E17DR	ML80E17DR/P	ML80E17K	ML80E17DK	ML80E17KR	ML80E17DKR	ML80E18	ML80E18/P
	F4AE0481D	(130HP)																								
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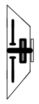
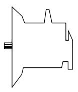
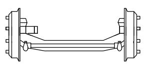
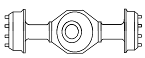
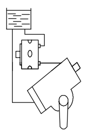
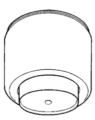
	F4AE0681E	(180HP)																							•	•
	F4AE0681D	(210HP)																								
	Single plate	13”	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•		
		13”/14”																							•	•
		14”																							•	•
	2855S.5		•	•			•	•																		
	2855S.6		•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
	2865S.6																									
	2870S.9										•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
	5833										•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
	5833/1		•	•	•	•	•	•	•	•																
	4517		•	•	•	•	•	•	•	•																
	4521										•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
	TRW-TAS 30		•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
	ZF 8090																									
	Front mechanical		•	•	•	•	•	•	•	•	•	•		•	•	•	•		•	•	•	•	•	•	•	•
	Rear mechanical		•		•		•		•		•			•		•			•		•	•	•	•	•	
	Front pneumatic												•					•								
	Rear pneumatic			•		•		•		•		•	•		•		•	•		•						•

P = Vehicles with air suspension on rear axle
FP = Vehicles with front and rear air suspension
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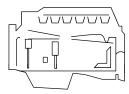
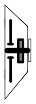
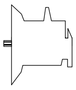
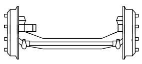
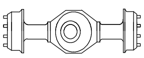
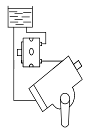
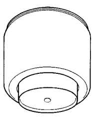
R = Towing vehicles

COMPOSITION OF THE MODELS

UNITS \ MODELS			ML80E18/FP	ML80E18D	ML80E18D/P	ML80E18R	ML80E18R/P	ML80E18R/FP	ML80E18DR	ML80E18DR/P	ML80E18K	ML80E18DK	ML80E18KR	ML80E18DKR	ML80E21	ML80E21/P	ML80E21/FP	ML80E21D	ML80E21D/P	ML80E21R	ML80E21R/P	ML80E21R/FP	ML80E21DR	ML80E21DR/P	ML80E21K	ML80E21DK
	F4AE0481D	(130HP)																								
	F4AE0481C	(150HP)																								
	F4AE0481A	(170HP)																								
	F4AE0681E	(180HP)	•	•	•	•	•	•	•	•	•	•	•	•												
	F4AE0681D	(210HP)													•	•	•	•	•	•	•	•	•	•	•	•
	Single plate	13”																								
		13”/14”	•	•	•	•	•	•	•	•	•	•	•	•												
		14”	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
	2855S.5																									
	2855S.6		•	•	•	•	•	•	•	•	•	•	•	•												
	2865S.6														•	•	•	•	•	•	•	•	•	•	•	•
	2870S.9		•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
	5833		•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
	5833/1																									
	4517																									
	4521		•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
	TRW-TAS 30		•	•	•	•	•	•	•	•	•	•	•	•												
	ZF 8090														•	•	•	•	•	•	•	•	•	•	•	•
	Front mechanical		•	•	•	•	•		•	•	•	•	•	•	•	•		•	•	•	•		•	•	•	•
	Rear mechanical			•		•			•		•	•	•	•	•			•		•			•		•	•
	Front pneumatic		•					•									•					•				
	Rear pneumatic		•		•		•	•		•						•	•		•		•	•		•		

P = Vehicles with air suspension on rear axle
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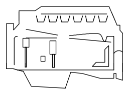
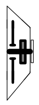
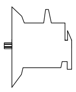
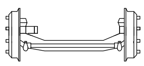
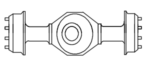
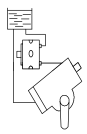
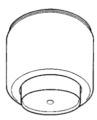
R = Towing vehicles

COMPOSITION OF THE MODELS

UNITS \ MODELS			ML80E21KR	ML80E21DKR	ML90E17	ML90E17/P	ML90E17/FP	ML90E17D	ML90E17D/P	ML90E17R	ML90E17R/P	ML90E17R/FP	ML90E17DR	ML90E17DR/P	ML90E17K	ML90E17DK	ML90E17KR	ML90E17DKR	ML90E18	ML90E18/P	ML90E18/FP	ML90E18D	ML90E18D/P	ML90E18R	ML90E18R/P	ML90E18R/FP
	F4AE0481D	(130HP)																								
	F4AE0481C	(150HP)																								
	F4AE0481A	(170HP)			•	•	•	•	•	•	•	•	•	•	•	•	•	•								
	F4AE0681E	(180HP)																	•	•	•	•	•	•	•	•
	F4AE0681D	(210HP)	•	•																						
	Single plate	13”			•	•	•	•	•	•	•	•	•	•	•	•	•	•								
		13”/14”																	•	•	•	•	•	•	•	•
		14”	•	•															•	•	•	•	•	•	•	•
	2855S.5																									
	2855S.6				•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
	2865S.6		•	•																						
	2870S.9		•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
	5833		•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
	5833/1																									
	4517																									
	4521		•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
	TRW-TAS 30				•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
	ZF 8090		•	•																						
	Front mechanical		•	•	•	•		•	•	•	•		•	•	•	•	•	•	•	•		•	•	•	•	
	Rear mechanical		•	•	•			•		•			•		•	•	•	•	•			•		•		
	Front pneumatic						•					•									•					•
	Rear pneumatic					•	•		•		•	•		•						•	•		•		•	•

P = Vehicles with air suspension on rear axle
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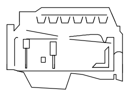
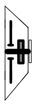
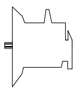
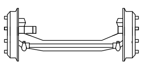
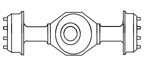
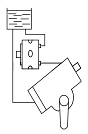
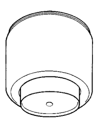
COMPOSITION OF THE MODELS

UNITS		MODELS	ML90E18DR	ML90E18DR/P	ML90E18K	ML90E18DK	ML90E18KR	ML90E18DKR	ML90E21	ML90E21/P	ML90E21/FP	ML90E21D	ML90E21D/P	ML90E21R	ML90E21R/P	ML90E21R/FP	ML90E21DR	ML90E21DR/P	ML90E21K	ML90E21DK	ML90E21KR	ML90E21DKR	ML100E17	ML100E17/P	ML100E17/FP	ML100E17D
	F4AE0481D	(130HP)																								
	F4AE0481C	(150HP)																								
	F4AE0481A	(170HP)																					•	•	•	•
	F4AE0681E	(180HP)	•	•	•	•	•	•																		
	F4AE0681D	(210HP)							•	•	•	•	•	•	•	•	•	•	•	•	•	•				
	Single plate	13”																					•	•	•	•
		13”/14”	•	•	•	•	•	•																		
		14”	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•				
	2855S.5																									
	2855S.6		•	•	•	•	•	•															•	•	•	•
	2865S.6								•	•	•	•	•	•	•	•	•	•	•	•	•	•				
	2870S.9		•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
	5833		•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
	5833/1																									
	4517																									
	4521		•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
	TRW-TAS 30		•	•	•	•	•	•																		
	ZF 8090								•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
	Front mechanical		•	•	•	•	•	•	•	•		•	•	•	•		•	•	•	•	•	•	•	•		•
	Rear mechanical		•		•	•	•	•	•			•		•			•		•	•	•	•	•			•
	Front pneumatic										•					•									•	
	Rear pneumatic			•						•	•		•		•	•		•						•	•	

P = Vehicles with air suspension on rear axle
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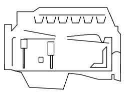
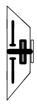
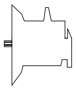
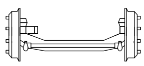
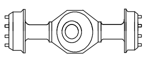
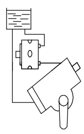
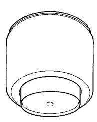
COMPOSITION OF THE MODELS

UNITS \ MODELS			ML100E17D/P	ML100E17R	ML100E17R/P	ML100E17R/FP	ML100E17DR	ML100E17DR/P	ML100E17K	ML100E17DK	ML100E17KR	ML100E17DKR	ML100E18	ML100E18/P	ML100E18/FP	ML100E18D	ML100E18D/P	ML100E18R	ML100E18R/P	ML100E18R/FP	ML100E18DR	ML100E18DR/P	ML100E18K	ML100E18DK	ML100E18KR	ML100E18DKR
	F4AE0481D	(130HP)																								
	F4AE0481C	(150HP)																								
	F4AE0481A	(170HP)	•	•	•	•	•	•	•	•	•	•														
	F4AE0681E	(180HP)											•	•	•	•	•	•	•	•	•	•	•	•	•	•
	F4AE0681D	(210HP)																								
	Single plate	13”	•	•	•	•	•	•	•	•	•	•														
		13”/14”											•	•	•	•	•	•	•	•	•	•	•	•	•	•
		14”											•	•	•	•	•	•	•	•	•	•	•	•	•	•
	2855S.5																									
	2855S.6		•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
	2865S.6																									
	2870S.9		•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
	5833		•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
	5833/1																									
	4517																									
	4521		•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
	TRW-TAS 30																									
	ZF 8090		•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
	Front mechanical		•	•	•		•	•	•	•	•	•	•	•		•	•	•	•		•	•	•	•	•	•
	Rear mechanical			•			•		•	•	•	•	•			•		•			•		•	•	•	•
	Front pneumatic					•									•					•						
	Rear pneumatic		•		•	•		•						•	•		•		•	•		•				

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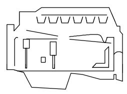
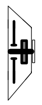
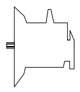
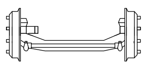
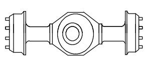
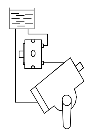
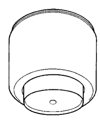
COMPOSITION OF THE MODELS

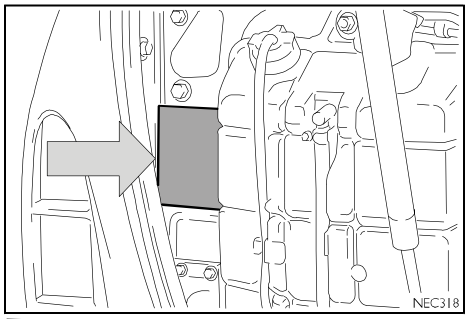
UNITS \ MODELS			ML100E21	ML100E21/P	ML100E21/FP	ML100E21D	ML100E21D/P	ML100E21R	ML100E21R/P	ML100E21R/FP	ML100E21DR	ML100E21DR/P	ML100E21K	ML100E21DK	ML100E21KR	ML100E21DKR
	F4AE0481D	(130HP)														
	F4AE0481C	(150HP)														
	F4AE0481A	(170HP)														
	F4AE0681E	(180HP)														
	F4AE0681D	(210HP)	•	•	•	•	•	•	•	•	•	•	•	•	•	•
	Single plate	13”														
		13”/14”														
		14”	•	•	•	•	•	•	•	•	•	•	•	•	•	•
	2855S.5															
	2855S.6															
	2865S.6		•	•	•	•	•	•	•	•	•	•	•	•	•	•
	2870S.9		•	•	•	•	•	•	•	•	•	•	•	•	•	•
	5833		•	•	•	•	•	•	•	•	•	•	•	•	•	•
	5833/1															
	4517															
	4521		•	•	•	•	•	•	•	•	•	•	•	•	•	•
	TRW-TAS 30															
	ZF 8090		•	•	•	•	•	•	•	•	•	•	•	•	•	•
	Front mechanical		•	•		•	•	•	•		•	•	•	•	•	•
	Rear mechanical		•			•					•		•	•	•	•
	Front pneumatic				•					•						
	Rear pneumatic			•	•		•		•	•		•				

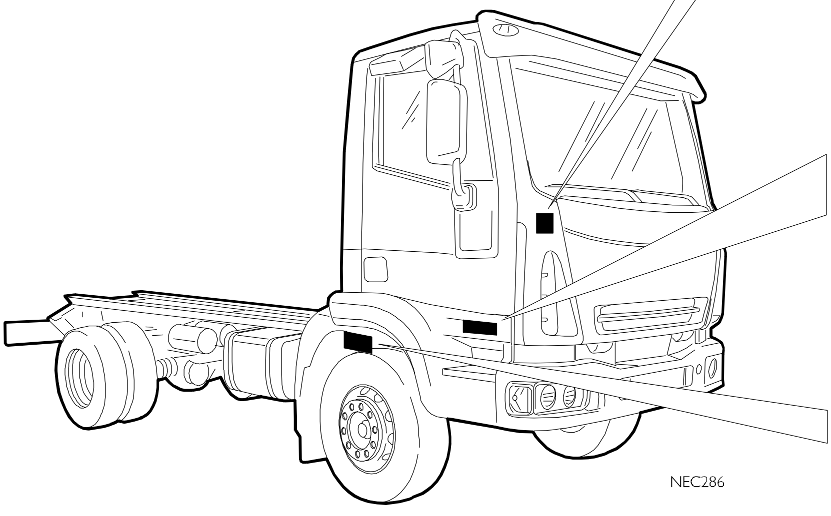
P = Vehicles with air suspension on rear axle
FP = Vehicles with front and rear air suspension
D = Vehicles with double cabin
K = Vehicles with dump body
R = Towing vehicles

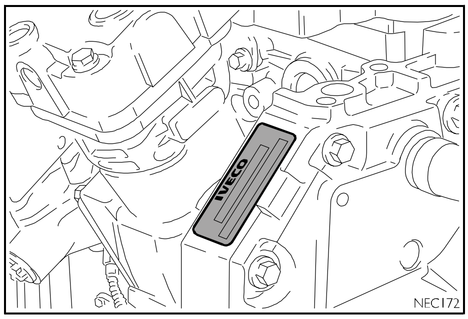
IDENTIFICATION DATA AND LOCATION ON VEHICLE

Manufacturer's plate

For vehicle identification to comply with EC directions (under front radiator grille)

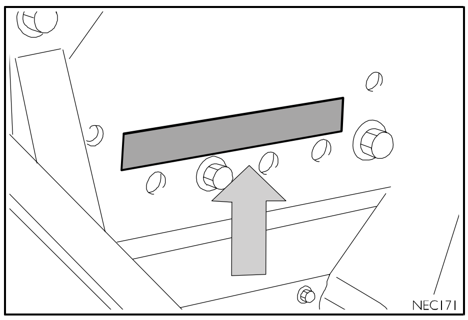






Engine

Flywheel cover plate on the box (left side)



Chassis

Marking (on right side member front end)

FILLING UP

LUBRICANTS RECOMMENDED BY IVECO	PARTS TO FILLED UP		Quantity Litres	Quantity kg
Acea E3/E5 Urania LD5	Engine – 4 cylinders			
		min.	5.3	4.8
		max	8.3	7.5
			1	0.9
	Engine – 6 cylinders			
		min.	8	7.2
		max	10.8	9.7
			1	0.9
Tutela ZC 90	Gearbox	2855S.5	5.5	5
		2855S.6	5.5	5
		2865S.6	9	8.1
		2870S.9	5	4.5
Tutela W140/M - DA	Front hubs (individual)		0.1	-
	Rear axle	4517	3	2.7
		4521	5	4.5
Tutela GI/A	Power steering	TRW - TAS30	-	-
		ZF 8090	-	-
Tutela TRUCK DOT SPECIAL	Brake circuit		1.9	1.7
	Clutch circuit		0.4	-
Paraflu[11]	Cooling system Total capacity		-	-
Tutela LHM	Cab tipping system		0.7	0.65

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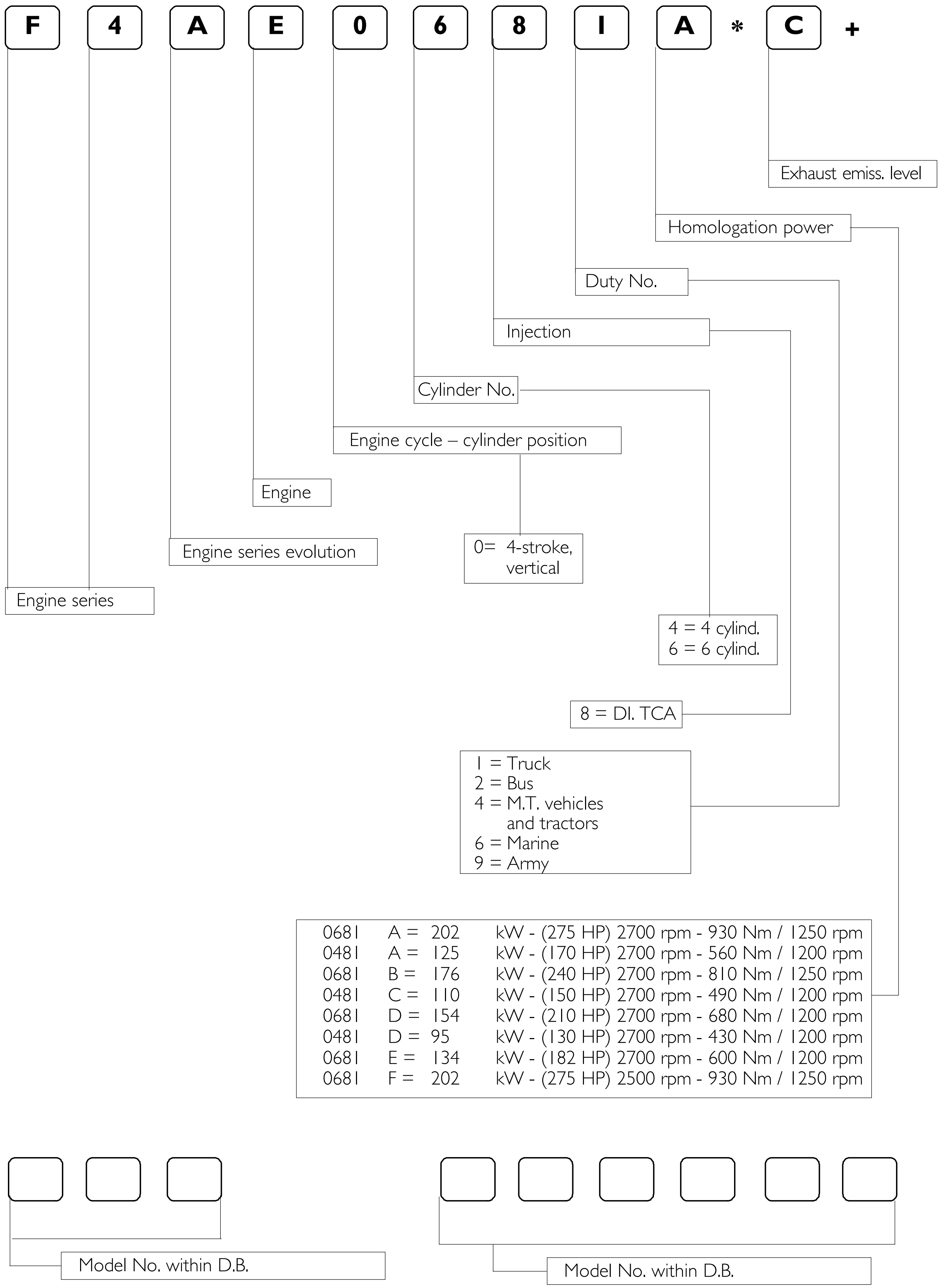
INTERNATIONAL LUBRICANT DESIGNATION

Description		FL Products	
Engine oil Compliant with ACEA E2 specifications		Urania Turbo	
Engine oil Compliant with ACEA E3 and ACEA E5 specifications		Urania LD5	
Differential and wheel hub oil Compliant with MIL-L-2105 C and API GL-5 specifications	SAE 80W/90 SAE 85W/140	Tutela W 90/M-DA Tutela W140/M-DA	(Cold climates) (Hot and temperate climates)
Manual gearbox oil Contains non EP wear resistant additives Compliant with MIL-L2105 or API GL 3 specifications	SAE 80W/90	Tutela ZC 90	
Automatic gearbox and power steering oil Compliant with A.T.F. DEXRON II specifications		Tutela GI/A	
Grease for general use Lithium-soap base grease, N.L.G.I. n. 2		Tutela MR 2	
Specific grease for bearings and wheel hubs Lithium-soap base grease, N.L.G.I. n. 3		Tutela MR 3	
Non-mineral base grease, compatible with brake system materials and suitable to lubricate brake system components		SP 349	
Grease for general use, suitable for components not requiring special grease (e.g., joints, pins and pivots, levers, tie rods, sliding shoes, brake callipers, etc.) Lithium-soap base grease, N.L.G.I. n. 2		Tutela Zeta 2	
Hydraulic brakes and clutch fluid Compliant with N.H.T.S.A. N. 116 ISO 4295 – SAE J 1703 CUNA NC 956-01 specifications and IVECO STANDARD 18-1820		Tutela TRUCK DOT SPECIAL	
Mineral oil for hydraulic circuits Wear resistant and very low pour point		Tutela LHM	
Window liquid, mixture of alcohols, water and surface-actives, CUNA NC 956-11		Arexons DP1	
Antifreeze, 50% concentration for temperatures up to –35°C		Paraflu 11	

SECTION 2

Engine

ENGINE IDENTIFICATION CODE



MAIN SERVICING OPERATIONS TO BE PERFORMED ON ENGINE FITTED ON VEHICLE

WARNINGS

Follow warnings below before operations concerning or involving fuel system components.

- ❑ Before any engine intervention always carry out the engine/vehicle test with the proper IVECO test equipment, then print the results.
- ❑ To replace the EDC7 control unit follow the Iveco procedure for electronic control unit run engines.
- ❑ The following fuel system components shall not be overhauled but replaced: pressure relief valve, fuel pressure sensor, rail, high-pressure pump, CP3 pump and pressure control valve.
- ❑ All the Common Rail system parts are packed by the supplier in oilpaper sheet and then in cardboard boxes. They shall be protected from humidity and unpacked just before assembling.
- ❑ The parts shall always be clean during their handling and assembling (even for simple operations such as filter or pre-filter replacement) to avoid dust or filth. Therefore, the hydraulic part protection caps shall be removed only immediately before the part assembling.
- ❑ Always follow assembling direction for electrical connections.
- ❑ Threaded connections shall be clamped to the prescribed coupling.

High pressure CP3 pump

The high pressure pump body cannot be overhauled. Only allowed interventions are: pressure regulator integral replacement and control gear replacement.

When servicing operations on high pressure pipe are required, the hexagon on pump side shall be held with proper wrench.

Rail and fittings

The flow limiter and the pressure limiting valve can be assembled 5 times consecutively before being replaced. They shall be lubricated with a little oil before assembling.

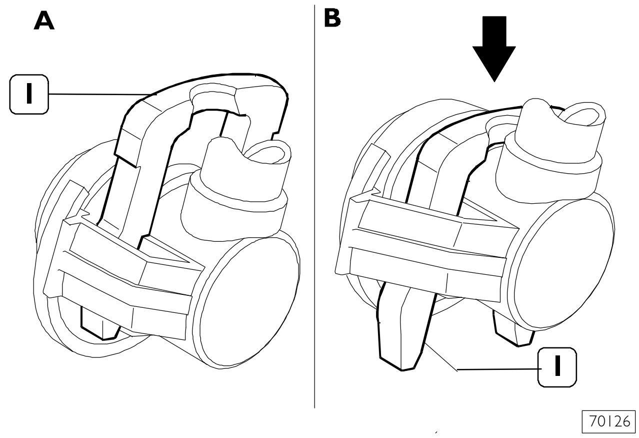
Lubricate the overpressure valve as well before assembling and always replace its gasket.

Injector

It is not necessary and permitted to disassemble the fuel nozzle or the electromagnet.

Low pressure tubing

Figure 1



A Connector properly locked

B Connector released for removal-refitting

All connectors shall be in the blocking position (see Figure 1-A) with the clip (1).

To disconnect the low pressure system tubing, press on the clip (1) (as described in Figure 1-B) to free the connector.

After disconnecting, bring again the spring clip (1) in the blocking position (Figure 1-A) to avoid deformations.

When the low pressure system is restored, press the clip (1) (as described in Figure 1-B) and connect the union to its connector. Bring the clip (1) in the blocking position A to guarantee the connection between the tubing and its component.

The non-observance of the above mentioned connecting procedure may cause a sudden tubing disconnection during the vehicle starting or engine working, due to pressure.

High pressure tubing

Since this hydraulic system contains high pressures, observe the following norms to avoid any risks:

- ❑ Do not connect the high pressure tubing unions with a rough clamping;
- ❑ Do not disconnect the high pressure tubing while the engine is working;

Always replace each high pressure tubing after disassembling it once.

- ❑ Replace each fuel manifold after disassembling it once.

In case of clamping or loosening of the fixing connections, keep fuel manifolds, hydraulic accumulator (rail) and high pressure pump firmly fixed and the component-side hexagon firm, if there is enough space.

- ❑ Replace involved piping in case of drippings.

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ENGINE REMOVAL/REFITTING

Before performing removing/refitting operations, disconnect the battery cables and set the vehicle in safe and secure conditions.

Removal

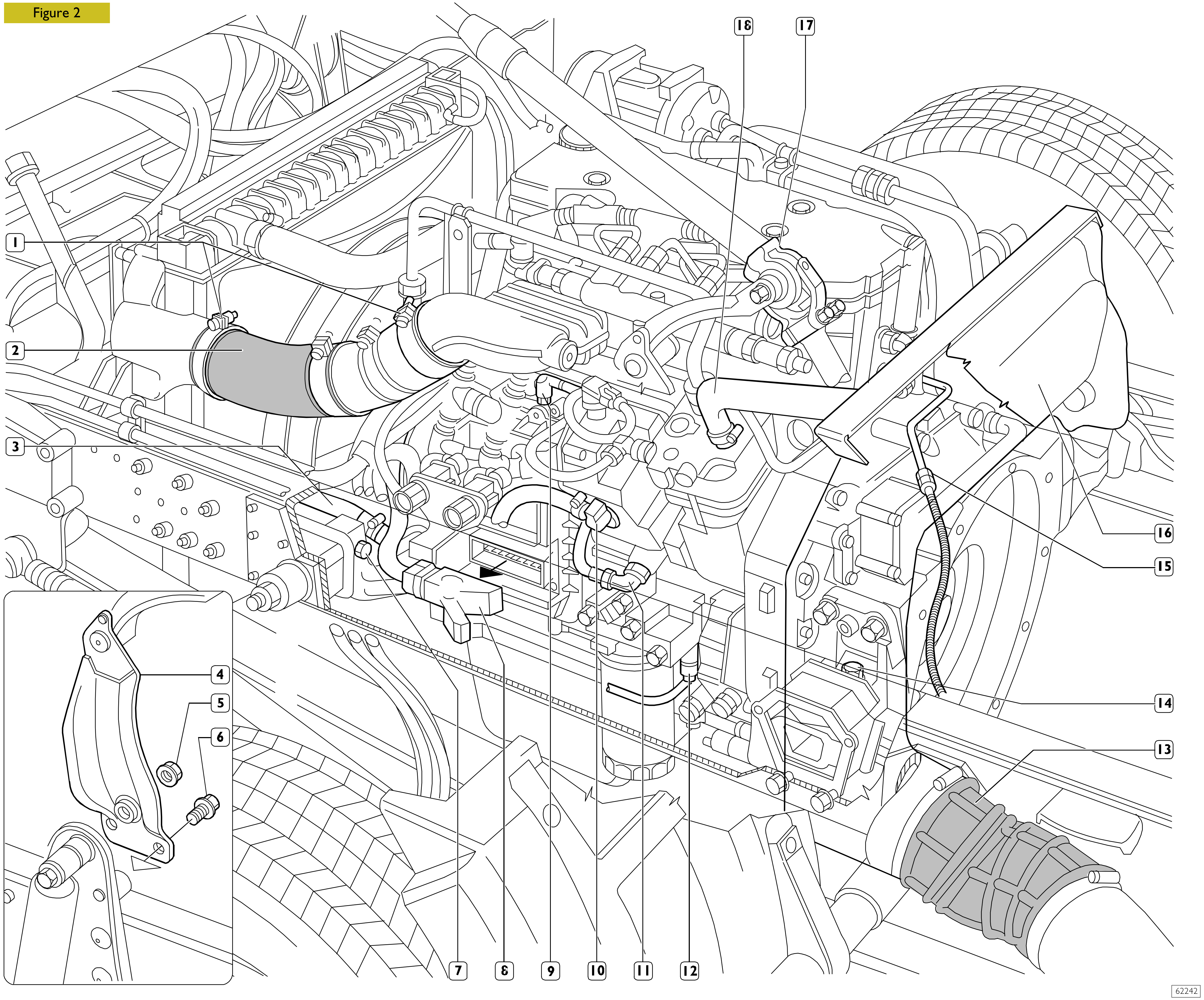
Lift the radiator grille and tilt the cab. Remove the gearbox as described in the relevant section and then proceed as follows:

- Drain engine coolant into a proper container.
- Drain power steering system oil into a proper container.

Working from the left side of the engine:

- Disconnect the pipes (18) from the turbosupercharger (13) and the air cleaner and the intake pipe from the turbine (on the right side).
- Loosen the relevant chassis fastening bolts to remove the intake duct (16) including the support.
- Disconnect the air duct (15).
- Loosen the fastening screws (6), the nut (5), remove the supporting bracket (4) and move the gearshift lever (17) to the right.
- Disconnect delivery (11) and return (10) pipe from the power steering pump.
- Loosen clamps (1) and remove the aftercooler pipe (2).
- Disconnect fuel delivery pipes (9) from the control unit and the return pipes (12) from the fuel filter support.
- Disconnect sump oil filling pipe (3).
- Disconnect the connector (8) from the control unit and also all engine connections arriving from chassis wiring.

Figure 2



Working from the right side of the engine:

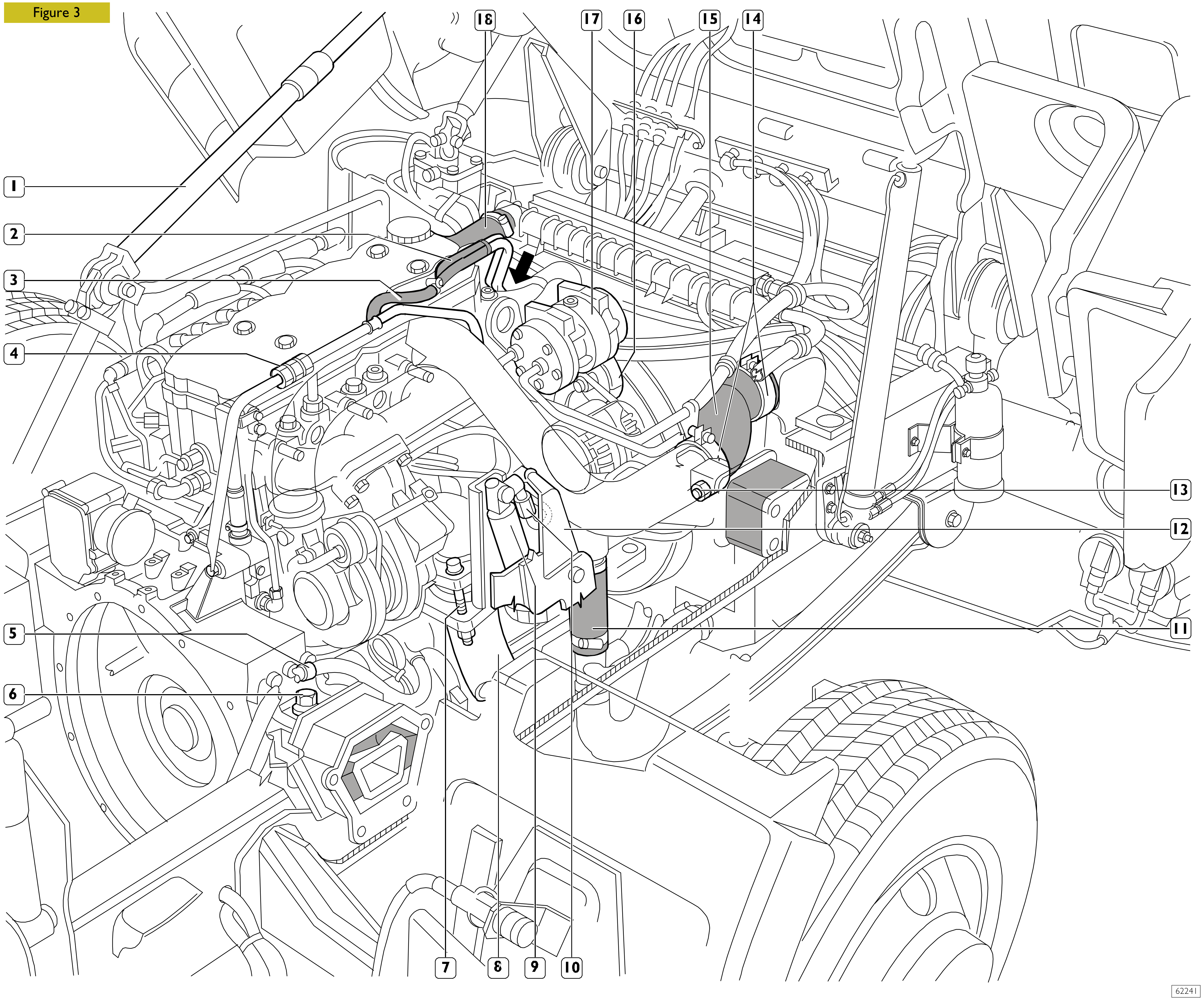
- ❑ Move the gearshift lever (1) to the left side of the vehicle.
- ❑ Loosen clamps (14) and remove the aftercooler pipe (15).
- ❑ Loosen the belt tensioner (16) and remove the belt.
- ❑ Loosen the fastening screws, remove conditioner compressor (17) and move it aside above the condenser. Secure it to prevent accidental falls during the following operations:
- ❑ Remove exhaust brake throttle valve (9) protection (12).
- ❑ Disconnect pipe (10), loosen the exhaust pipe (8) fastening screws (7) and remove the throttle valve (9).
- ❑ Loosen the silent-block fastening nut that secures the exhaust pipe (8) to the chassis and remove it.
- ❑ Disconnect the air duct (4).
- ❑ Loosen clamps from radiator and thermostat and disconnect the coolant pipe (18).

NOTE At refitting, take care not to reverse pipe (18) position since it could interfere with the fan.

- ❑ Disconnect the pipe (2) operating on the clamp that secures it to the head and release it from the retaining clamps.
- ❑ Disconnect the pipe (3) operating the clamp located in the point indicated with (→).
- ❑ Loosen the clamp and disconnect the coolant pipe (11).
- ❑ Disconnect alternator, starter and ground cable electrical connections.
- ❑ Remove the clamp (5) securing the wiring to the engine support bracket and disconnect all connections arriving from the chassis wiring
- ❑ Apply the lifting rig (99360595) to the engine and tension the engine using the proper equipment.
- ❑ Loosen the fastening bolts (7 and 14, Figure 2) and the fastening bolts (6 and 13, Figure 3). Take care to chassis wiring, lift the engine and at the same time, move it to the left towards the rear part, then take it out from the compartment.

NOTE According to the type of cab, engine removal could require to remove the rear cab coupling cross member.

Figure 3



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Refitting

To refit the engine reverse the procedure described for engine removal taking special care to the following indications:

- ❑ take care when refitting the engine into the engine compartment;
- ❑ check the conditions of coolant pipes or sleeves and air ducts, replace if damaged;
- ❑ check the elastic supports of engine and gearbox assemblies, replace if damaged;
- ❑ check that the exhaust pipe and its elastic fixing elements are not worn or about to deteriorate, replace if required;
- ❑ tighten screws or nuts to the specified torque;
- ❑ check carefully the connection between the low pressure fuel pipes and the relevant connectors as specified in paragraph "Main servicing operations to be performed on engine fitted on vehicle";
- ❑ fill the cooling system with coolant and bleed air as described in the relevant paragraphs;
- ❑ fill the power steering circuit and bleed air as described in the relevant paragraph;

Before reusing the power steering oil and the coolant check that they are free from impurities, otherwise use proper screen filters; for any topping up see the TOPPING UP table in section "GENERAL SPECIFICATIONS".

- ❑ check engine and gearbox oil level; for any topping up see the TOPPING UP table in section "GENERAL SPECIFICATIONS".

Checks and inspections

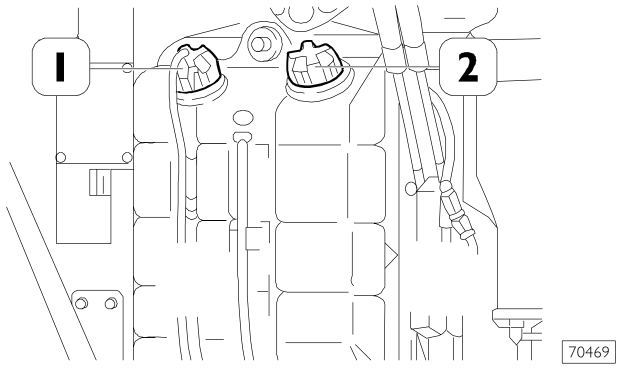
Start the engine and leave it running just above the idling speed, wait until the coolant reaches the temperature necessary to open the thermostat and then check:

- ❑ that there are no water leaks from the connecting sleeves of engine cooling circuit pipes and cab internal heating pipes, tighten the clamping collars if required;
- ❑ that there are no oil leaks between the cover and the cylinder head, between oil sump and engine block, between heat exchanger oil filter and the relevant housings and between the different pipes in the lubricating circuit;
- ❑ that there are no fuel leaks from the fuel pipes;
- ❑ that there are no air leaks from pneumatic pipes;
- ❑ check also proper operation of the warning lights set on the instrument panel and of the equipment disconnected when engine was removed.

Topping up the engine cooling system

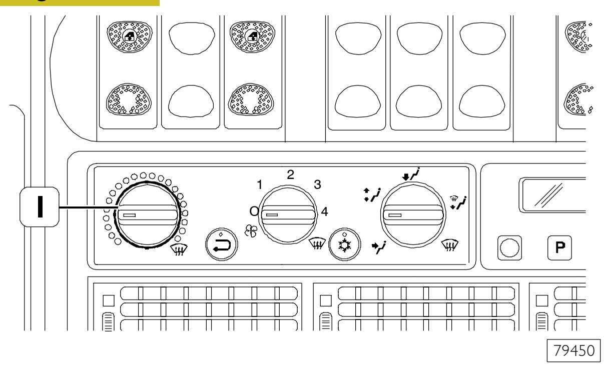
General indications

Figure 4



- ❑ Filling operations shall be performed with cold engine.
- ❑ Plug (1) is sealed and shall never be tampered.
  Use only plug (2) for draining out or filling operations.
- ❑ To prevent the formation of air locks in the system, fluid shall be poured very slowly (max. 8 litres per minute, as an indication).
- ❑ Antifreeze percentage in the coolant shall not exceed 50%.

Figure 5



- ❑ Open completely the heating fluid cock knob (1).
- ❑ Remove plug (2, Figure 4) and top up as previously described until filling the expansion tank.

Bleeding air from the cooling system

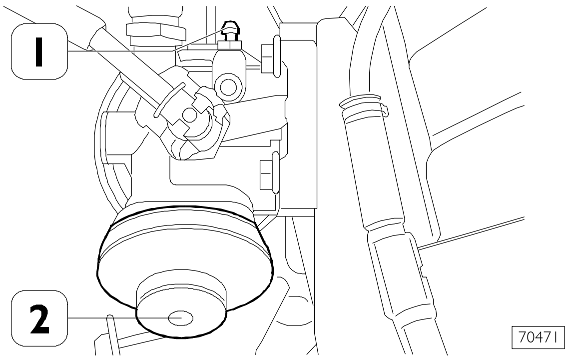
- Air bleeding from the cooling system shall be started immediately after the topping up operation.
- Start the engine and leave it running at idling speed for 5 minutes at least.
  After few seconds top up the coolant.
- Tighten plug 2, Figure 4, and run engine to high rpm to facilitate coolant heating until the thermostat opens.
  Note: to accelerate this operation, screen the radiator by placing cardboard between the radiator and the intercooler.
- Bring coolant temperature to approx. 90 °C (to guarantee thermostat opening) checking the onboard thermometer.
- When coolant reaches the required temperature, keep max. idle rpm for the time necessary to bleed air completely.
  This situation can be verified by checking the absence of foam or air bubbles in the expansion tank.
- The max. time required to obtain complete bleeding is approx. 15 minutes from thermostat opening.

Important notice

- Once plug (2, Figure 4) is closed and engine warming up begins, the plug must not be removed until engine is completely cold.
  As a consequence, any coolant topping up shall be only performed with completely cold engine.
  This to prevent the following:
  - personal burns;
  - engine damages since system pressurisation is obtained only with coolant heating from cold engine.

542011 Bleeding air from the fuel system

Figure 6



Air bleeding from the fuel system shall be performed as follows:

- fit a proper tube to the bleeder screw (1) to drain out fuel into a suitable container;
- loosen the screw (1);
- operate the priming pump (2) manual control until fuel flows from the bleeder screw (1) without air bubbles;
- retighten the screw (1);
- continue to operate the priming pump (2) manual control to idle stroke;
- start engine and run it idle for few minutes to eliminate any air residue.

Risk of fire: take the utmost care to retighten the bleeder screw to prevent dangerous fuel leaks.

501430 Bleeding air from the power steering system

Check oil level in the tank, top up if required.

Lift the front part of the vehicle, start the engine and run it idle for few minutes.

Check absence of oil leaks from the hydraulic circuit and check the oil level in the tank.

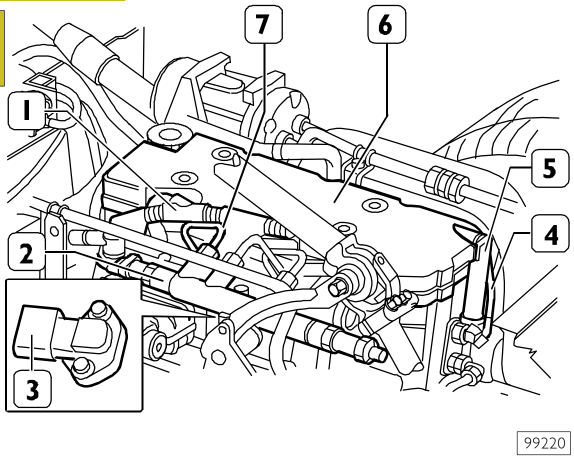
Turn slowly the steering wheel in both directions to bleed the air contained in the hydraulic system.

Recheck the oil level in the tank and top up if required.

INJECTOR REPLACEMENT

Removal

Figure 7

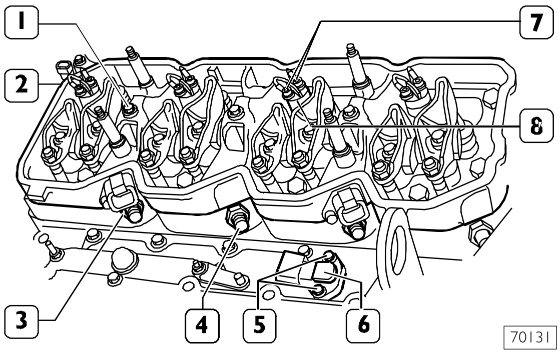


Set the vehicle in safe and secure conditions.

Disconnect the battery cables, lift the radiator grille, tilt the cab and proceed as follows:

- ❑ disconnect oil vapour pipes (4 and 5) from the tappet cover (6) and remove it;
- ❑ remove engine wiring clamps (1);
- ❑ disconnect engine wiring (1) from injector connectors, overpressure sensor and temperature/pressure sensor (3);
- ❑ disconnect pipes (7) from the rail (2) and from injector fuel manifolds.

Figure 8



Remove the nuts (7) and disconnect the electric cables from the injectors (8).

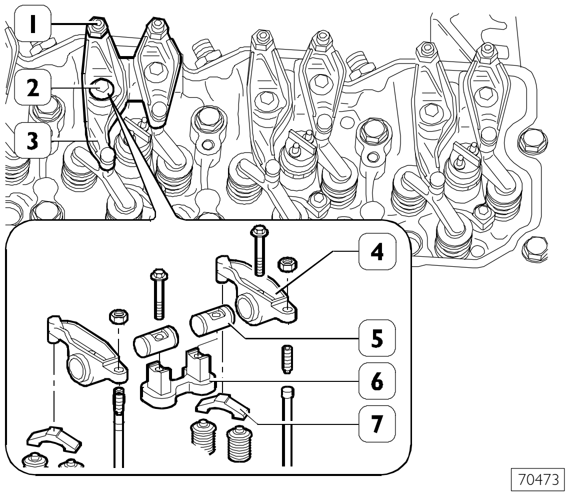
Remove the screws (1) and disconnect injector wiring support (2) including the seal.

Remove the screws (5) and disconnect the air temperature/pressure sensor (6).

Remove the nuts (3) and remove fuel manifolds (4).

NOTE Disassembled fuel manifolds (4) must not be used again, but however replaced with other new ones.

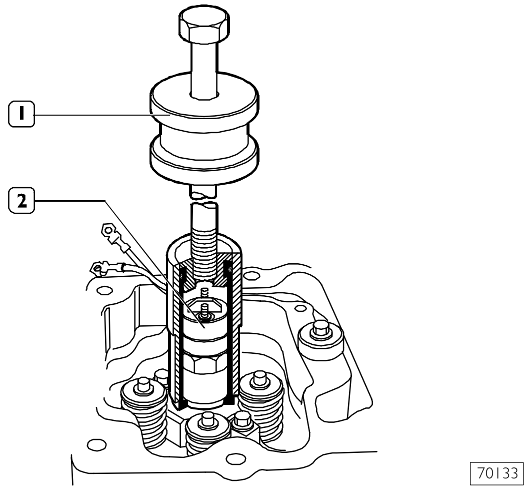
Figure 9



Loosen tappet adjustment fastening nuts (1) and unscrew the adjusters.

Remove the screws (2), remove the rocker assembly (3), consisting of: bracket (6), rockers (4), shafts (5) and remove jumpers (7) from valves.

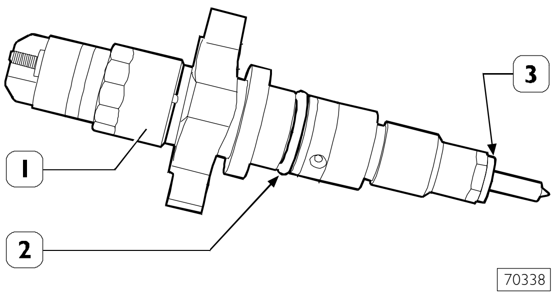
Figure 10



Remove injector fastening screws. Use tool 99342101 (1) to remove injectors (2) from the cylinder head.

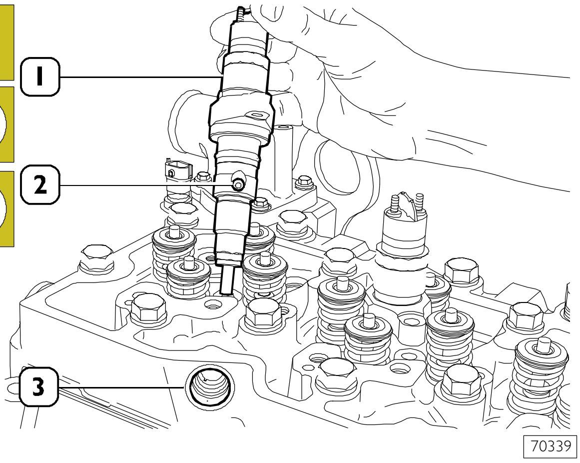
Refitting

Figure 11



Fit a new sealing ring (2) lubricated with vaseline and a new sealing washer (3) on the injector (1).

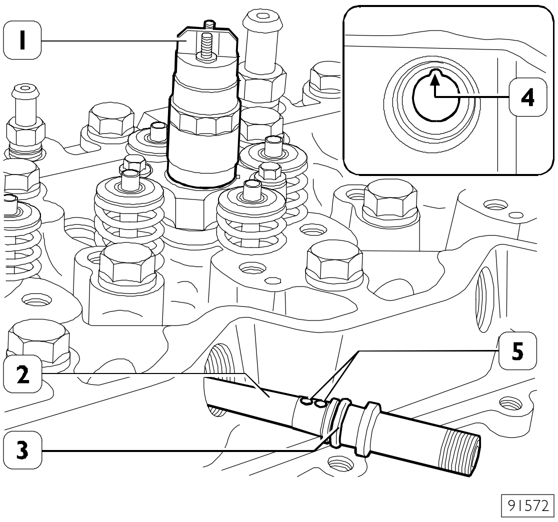
Figure 12



Fit injectors (1) into cylinder head seats directed with the fuel hole (2) facing the fuel manifold seat side (3).
Screw the fastening screws without tightening them.

NOTE Use tool 99342101 (Figure 10) to fit the injectors in place.

Figure 13



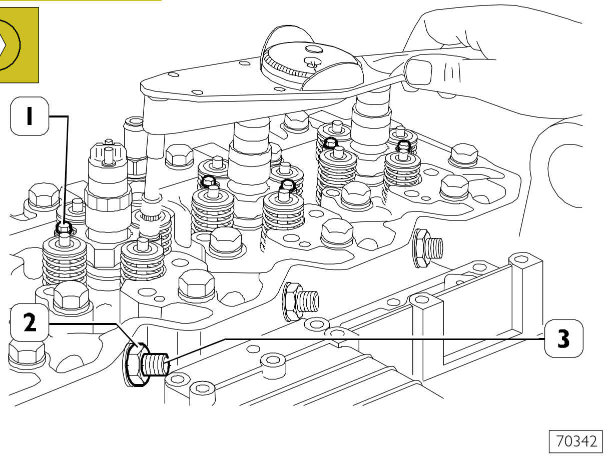
Fit a new sealing ring (3), lubricated with vaseline on the fuel manifold (2) and insert it into the cylinder head seat to make the position ball (5) coinciding with the relevant housing (4).

NOTE Disassembled fuel manifolds (2) must not be used again, but however replaced with other new ones.

Screw the fastening nuts without locking them.

During this operation, check that manifold (2, Figure 12) is properly fitted into injector (1) fuel hole (2, Figure 13).

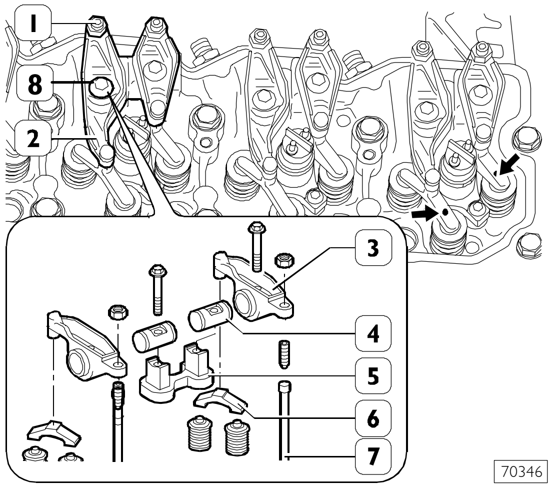
Figure 14



Use a dynamometric wrench to tighten gradually and alternately the injector fastening screws (1) to 8.5 ± 0.35 Nm torque.

Tighten fuel manifold (3) fastening nuts (2) to 50 Nm torque.

Figure 15



When refitting the rocker assembly (2), check that tappet adjusters (1) are loosen to prevent their balking on tappet rods (7). Refit jumpers (6) on valves.

Jumper marks (•) shall be directed towards the exhaust manifold side.

Refit the rocker assemblies (2), consisting of: bracket (5), rockers (3), shafts (4) and secure them to the cylinder head by tightening the fastening screws (8) to 36 Nm torque.

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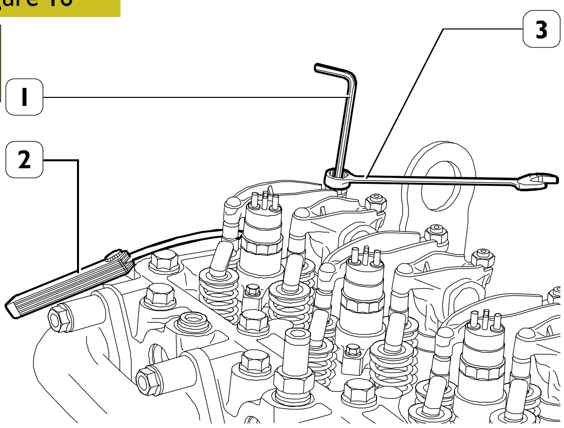
Figure 16



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Adjust clearance between rockers and valves using setscrew wrench (1), box wrench (3) and feeler gauge (2).

Working clearance shall be as follows:

- ± 0.05
- intake valves 0.25 ± 0.05 mm
- exhaust valves 0.51 ± 0.05 mm

To carry out rocker-valve clearance adjustment more quickly, proceed as follows:
rotate the output shaft, balance the valves of cylinder No. 1 and adjust the valves marked with an asterisk in the tables below:

four-cylinder engine

cylinder No.	1	2	3	4
intake	-	-	*	*
exhaust	-	*	-	*

Rotate the output shaft, balance the valves of cylinder No. 4 and adjust the valves marked with an asterisk in the table below:

cylinder No.	1	2	3	4
intake	*	*	-	-
exhaust	*	-	*	-

six-cylinder engine

cylinder No.	1	2	3	4	5	6
intake	-	-	*	-	*	*
exhaust	-	*	-	*	-	*

Rotate the output shaft, balance the valves of cylinder No. 6 and adjust the valves marked with an asterisk in the table below:

cylinder No.	1	2	3	4	5	6
intake	*	*	-	*	-	-
exhaust	*	-	*	-	*	-

Complete refitting by reversing the removal procedure observing the following indications:

- Tighten injector connector fastening screws to the specified torque;
- Refit high and low pressure pipes according to the procedures described in paragraph "Main servicing operations to be performed on engine fitted on vehicle";
- Fill the cooling system with coolant and bleed air as described in the relevant paragraphs.

Before reusing the coolant check absence of impurities, otherwise use proper screen filters; for any topping up see the TOPPING UP table in section "GENERAL SPECIFICATIONS".

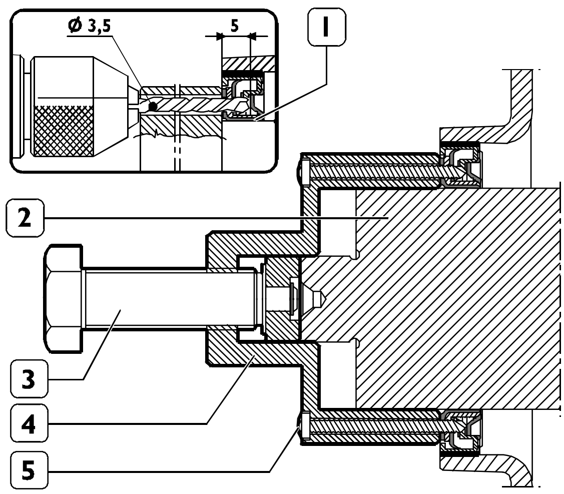
Checks and inspections

Start the engine and leave it running just above the idling speed, wait until the coolant reaches the temperature necessary to open the thermostat and then check:

- That there are no water leaks from the connecting sleeves of engine cooling circuit pipes and cab internal heating pipes, tighten the clamping collars if required.

REPLACEMENT OF ENGINE FRONT SHAFT COVER SEALING RING

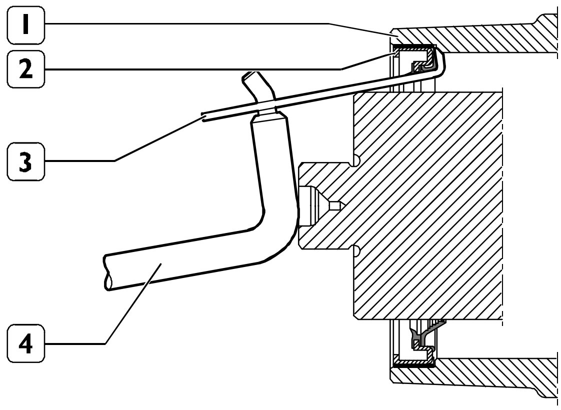
Figure 17



78256

Apply tool 99340055 (4) on the engine shaft front tang (2) and drill the inner sealing ring (1) with a drilling machine (Ø 3.5 mm) through the tool guide holes for a depth of 5 mm.Fasten the tool (4) to the ring (1) with the 6 provided screws and remove the ring by tightening the screw (3).

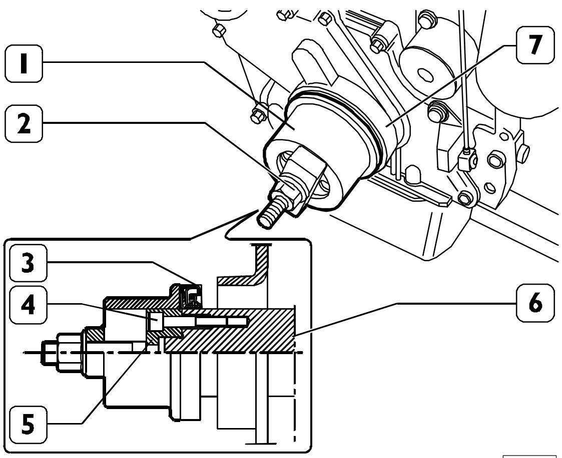
Figure 18



78257

Apply the appropriate tie rod (3) of tool 99363204 on the outer sealing ring (2) as illustrated in the figure and use lever (4) to remove the sealing ring from the front cover (1).

Figure 19

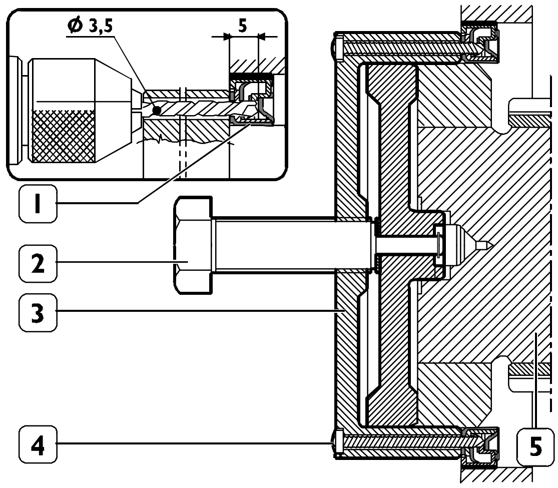


70225

Apply tool 99346252 part (5) to the front output shaft tang (6), secure it by screws (4) and fit the new sealing ring (3). Position part (1) on part (5), screw nut (2) until completing sealing ring (3) fitting into front cover (7).

REPLACEMENT OF FLYWHEEL CASE SEALING RING

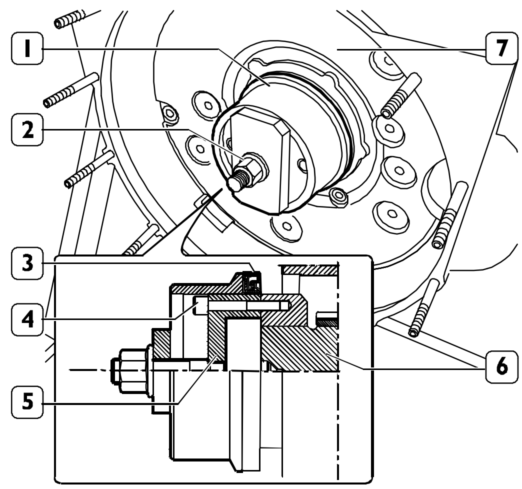
Figure 20



78258

Apply tool 99340056 on the engine shaft front tang (2) and drill the inner sealing ring (1) with a drilling machine (Ø 3.5 mm) through the tool guide holes for a depth of 5 mm.
Fasten the tool (3) to the ring (1) with the 6 provided screws and remove the ring by tightening the screw (2).
Remove the outer sealing ring as illustrated and described in Figure 18.

Figure 21



70216

Apply tool 99346252 part (5) to the rear output shaft tang (6), secure it by screws (4) and fit the new sealing ring (3).

Position part (1) on part (5), screw nut (2) until completing sealing ring (3) fitting into flywheel housing (7).

CYLINDER HEAD REMOVAL/REFITTING

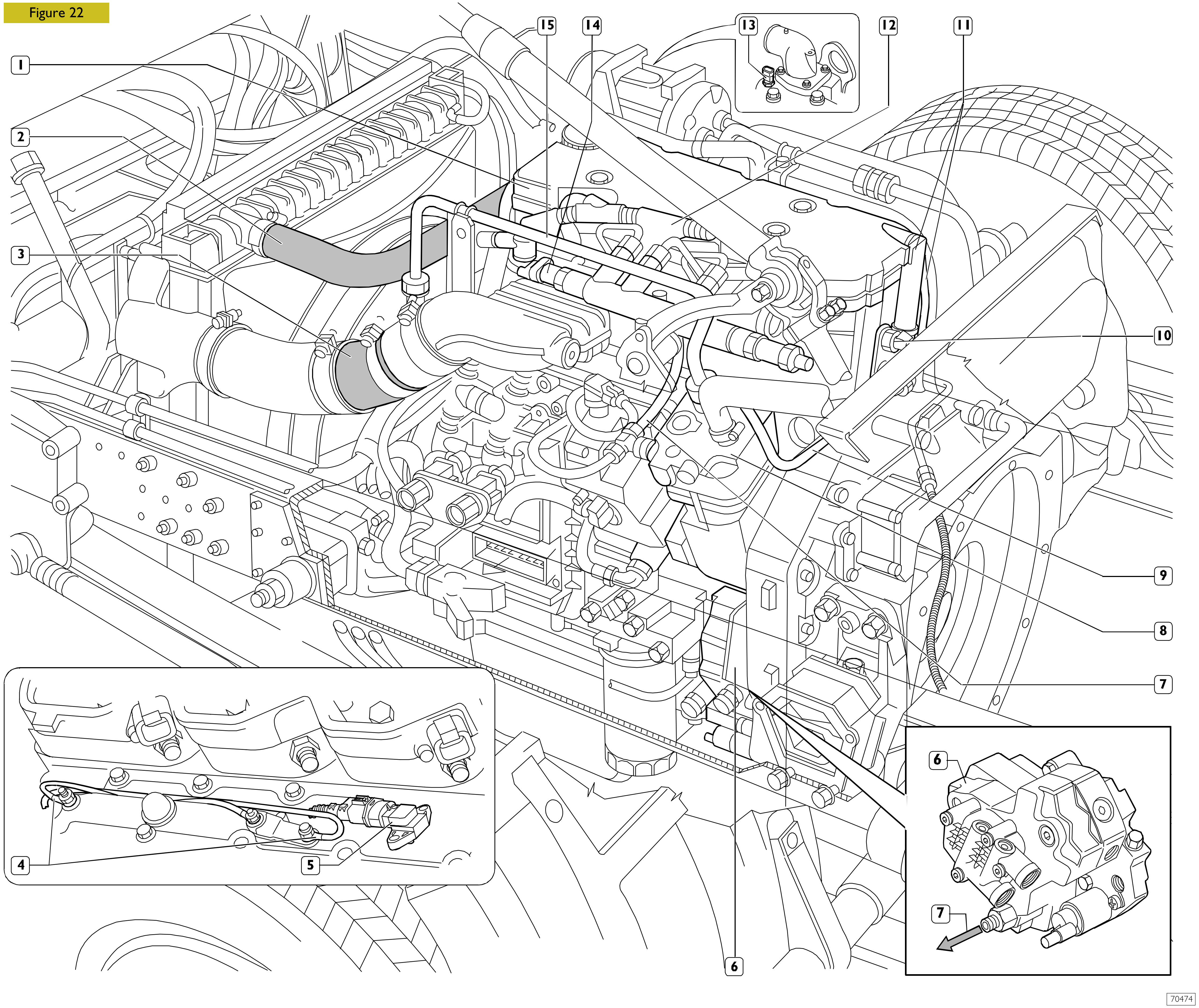
Removal

Before performing removing/refitting operations, disconnect the battery cables and set the vehicle in safe and secure conditions.

Lift the radiator grille, tilt the cab and then proceed as follows:

- drain coolant partially into a proper container;
- disconnect the coolant pipe (2) from the thermostat cover;
- disconnect the air duct (3) from the intake manifold;
- disconnect the following electrical connections:
  - (4) heater;
  - (12) injectors;
  - (13) water temperature sensor;
  - (5) air temperature/pressure sensor;
  - (14) air from rail pressure sensor;
- remove the air duct section (15) from the remaining pipe, from compressor (8) and from the supporting bracket;
- disconnect the coolant pipe (9) from the compressor (8);
- disconnect oil vapour bleeding pipes (11) from the tappet cover (1);
- disconnect fuel drain pipe (10) from pressure relief valve;
- disconnect the high pressure pipe (7) from the rail and from the high pressure pump (6).

Figure 22



- disconnect the air duct (9) from the turbosupercharger (3) and from the intercooler radiator (10);
- disconnect the coolant pipes (1);

For vehicles fitted with heating and ventilation unit:

- operate the automatic belt tensioner (11) to loosen compressor (13) belt (12) tension;
- remove the screws fastening compressor (13) to support and secure compressor (13) properly to prevent air-conditioning system gas pipe damaging;

For all vehicles:

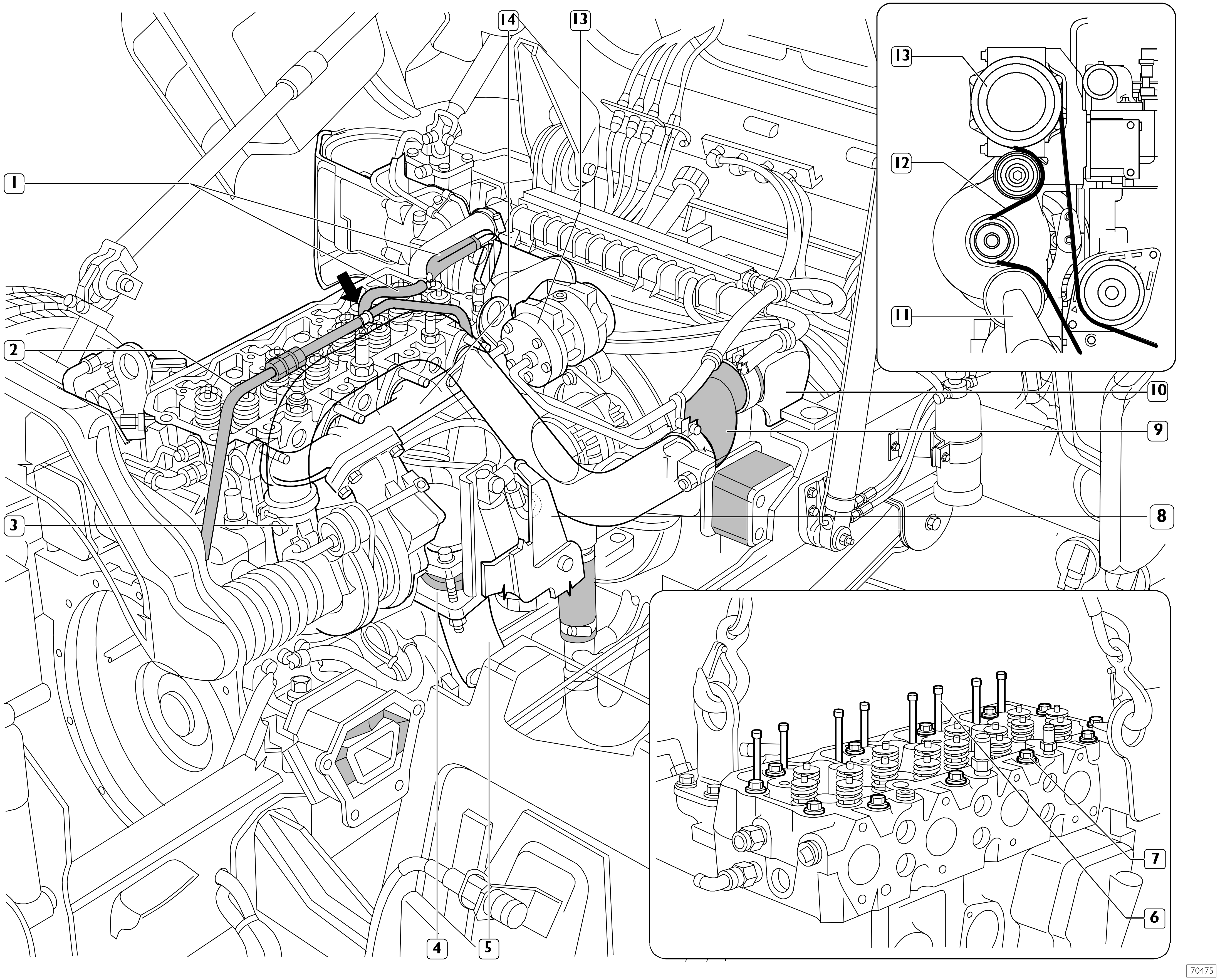
- remove the heat protection (8);
- remove from turbosupercharger (3): exhaust pipe (5) fastening screws, exhaust brake throttle valve (4) and secure it to the chassis;
- remove air duct (2) supporting bracket fastening screws;
- disconnect oil delivery and drain pipes from turbosupercharger (3);
- remove the screws fastening the exhaust manifold (14) to the cylinder head and disconnect it including the turbosupercharger (3).

NOTE Seal turbosupercharger air and oil inlet and outlet holes to prevent damages due to infiltration of foreign bodies.

- disconnect injectors as described in the relevant chapter;
- remove rocker control rods (6);
- remove cylinder head fastening screws (7).

NOTE Fit lifting rig 99360585 to cylinder head lifting bracket. Hook the lifting rig to the hoister and remove the cylinder head.

Figure 23



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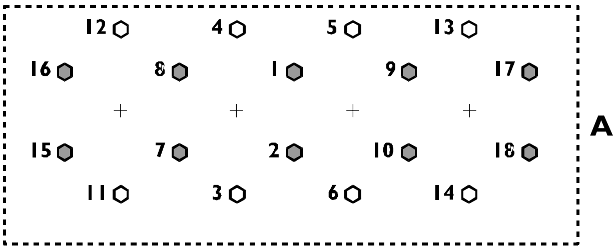
Refitting

For refitting, reverse the removal procedure observing the following indications:
cylinder head and engine block coupling surfaces shall be clean;
take care not to foul the cylinder head gasket.
Fit the cylinder head and tighten the screws in three successive stages following the sequence and the procedure shown in the figures below.

NOTE Tightening to angle shall be performed using tool 99395216.

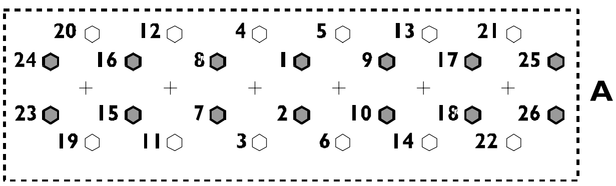
Figure 24



4-cylinder engine

70337

Figure 25



6-cylinder engine

70476

Cylinder head fastening screws tightening sequence:

- ❑ 1^{st} stage pre-tightening, with dynamometric wrench:
  • Screw 12x1.75x130 (⬡) 35 ± 5 Nm
  • Screw12x1.75 x 150 (⬢) 55 ± 5 Nm
  A = Front side
- ❑ 2^{nd} stage tightening with angle 90° ± 5°
- ❑ 3^{rd} stage tightening with angle 90° ± 5°

Refit injectors following the procedures described in the relevant paragraph.

Refit high and low pressure pipes according to the procedures described in paragraph "Main servicing operations to be performed on engine fitted on vehicle";

- ❑ check the conditions of coolant pipes or sleeves and air ducts, replace if damaged;
- ❑ tighten screws or nuts to the specified torque;
- ❑ fill the cooling system with coolant and bleed air as described in the relevant paragraphs.

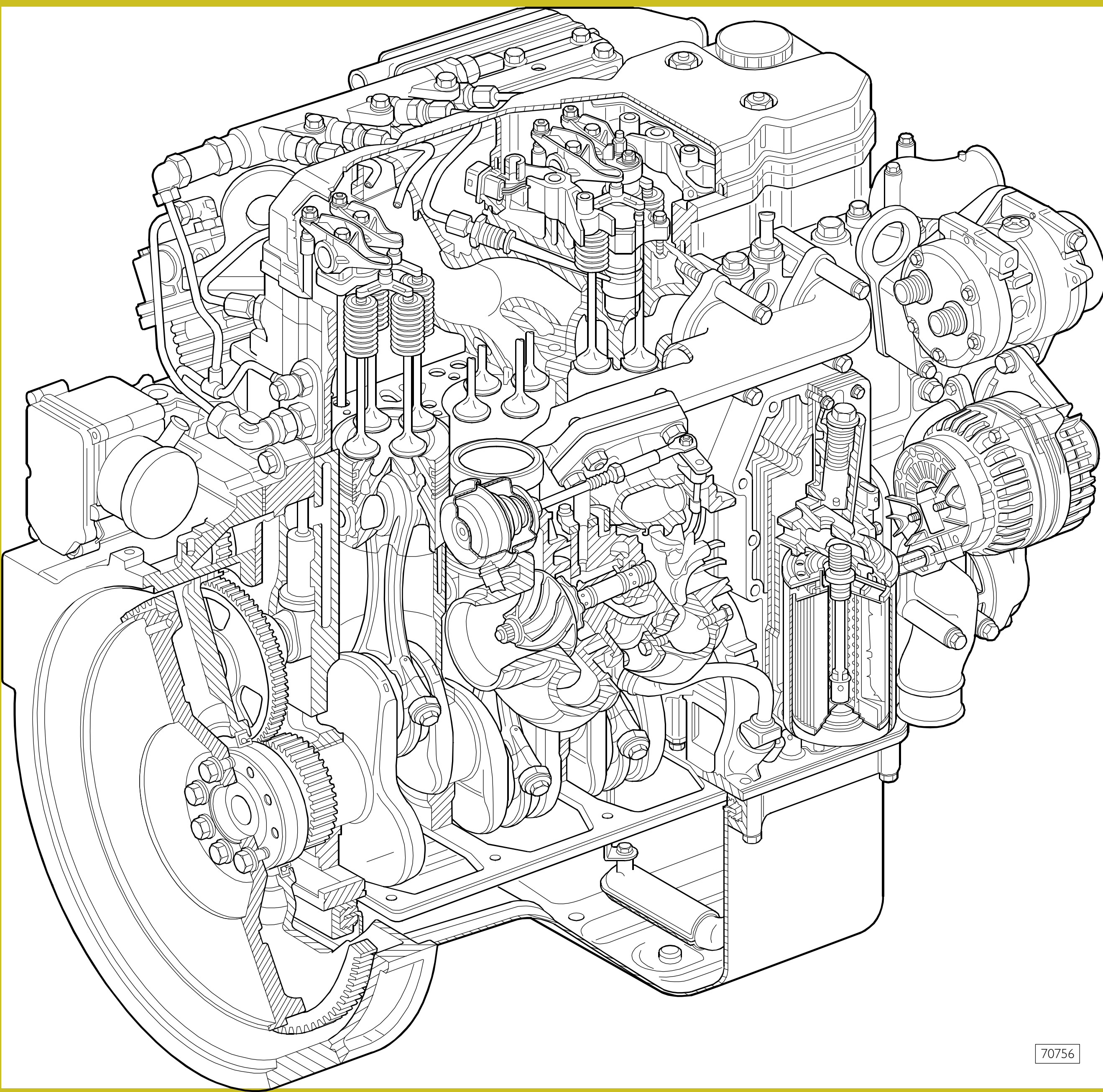
Before reusing the coolant check absence of impurities, otherwise use proper screen filters; for any topping up see the TOPPING UP table in section "GENERAL SPECIFICATIONS".

Checks and inspections

Start the engine and leave it running just above the idling speed, wait until the coolant reaches the temperature necessary to open the thermostat and then check:

- ❑ that there are no water leaks from the connecting sleeves of engine cooling circuit pipes and cab internal heating pipes, tighten the clamping collars if required;
- ❑ check carefully the connection between the low pressure fuel pipes and the relevant connectors as specified in paragraph "Main servicing operations to be performed on engine fitted on vehicle";
- ❑ that there are no oil leaks between the cover and the cylinder head, between oil sump and engine block, between heat exchanger oil filter and the relevant housings and between the different pipes in the lubricating circuit;
- ❑ that there are no fuel leaks from the fuel pipes;
- ❑ that there are no air leaks from pneumatic pipes;
- ❑ check also proper operation of the warning lights set on the instrument panel and of the equipment disconnected when engine was removed.

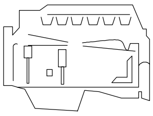
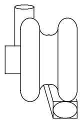
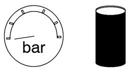
ENGINE F4 AE 0481



Engine F4 AE 0481

GENERAL SPECIFICATIONS

Type		F4AE0481D (.13)	F4AE0481C (.15)	F4AE0481A (.17)
Cycle		Four-stroke diesel engine		
Power		Supercharged with intercooler		
Injection		Direct		
Number of cylinders		4 in-line		
Bore	mm	102		
Stroke	mm	120		
Total displacement	cm^3	3900		
Compression ratio		17 : 1		
Max. output	kW (HP) rpm	95 (130) 2700	110 (150) 2700	125 (170) 2700
Max. torque	Nm (kgm) rpm	430 (43.9) 1200	490 (50) 1200	560 57.1 1200
Loadless engine idling	rpm	750		
Loadless engine peak rpm	rpm	3000		

<table>
<tr><td></td><td>Type</td><td></td><td colspan="2">F4AE0481D
(.13)</td><td colspan="2">F4AE0481C
(.15)</td><td colspan="2">F4AE0481A
(.17)</td></tr>
<tr><td></td><td>SUPERCHARGER</td><td></td><td colspan="6">With intercooler</td></tr>
<tr><td></td><td>turbosupercharger type</td><td></td><td colspan="6">GARRETT GT 22</td></tr>
<tr><td colspan="2">Turbosupercharger shaft radial backlash</td><td></td><td colspan="6">-</td></tr>
<tr><td colspan="2">Turbosupercharger shaft end play</td><td></td><td colspan="6">-</td></tr>
<tr><td colspan="2">Pressure relief valve min. opening stroke:</td><td>mm</td><td colspan="6">-</td></tr>
<tr><td colspan="2">Pressure relief valve max. opening stroke:</td><td>mm</td><td colspan="6">-</td></tr>
<tr><td colspan="2">Pressure corresponding to min. stroke:</td><td>bar</td><td colspan="6">-</td></tr>
<tr><td colspan="2">Pressure corresponding to max. stroke:</td><td>bar</td><td colspan="6">-</td></tr>
<tr><td></td><td>LUBRICATION</td><td></td><td colspan="6">Forced by gear pump , pressure relief valve,
oil filter</td></tr>
<tr><td></td><td>Oil pressure with
warm engine:
- idling
- peak rpm</td><td>

bar
bar</td><td colspan="6">

1.2
3.8</td></tr>
<tr><td>COOLING</td><td></td><td></td><td colspan="6">By centrifugal pump, regulating thermostat, radiator,
heat exchanger, intercooler</td></tr>
<tr><td></td><td>Water pump control</td><td></td><td colspan="6">Through belt</td></tr>
<tr><td></td><td>Thermostat
- opening start
- max. opening</td><td></td><td colspan="6">
81 ± 2 °C
96 °C</td></tr>
<tr><td> ACEA E3/E5
Urania LD5</td><td>FILLING
Total capacity
1st filling:</td><td>

litres
kg</td><td colspan="6">

-
-</td></tr>
<tr><td></td><td>- engine sump</td><td>
litres
kg</td><td colspan="3">Min. level.
5.3
4.8</td><td colspan="3">Max. level
8.3
7.5</td></tr>
<tr><td></td><td>engine sump + filter</td><td>
litres
kg</td><td colspan="3">
6.3
5.7</td><td colspan="3">
9.3
8.4</td></tr>
</table>

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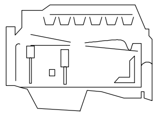
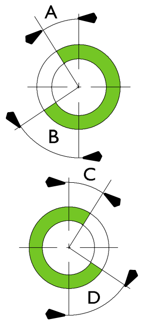
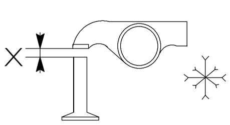
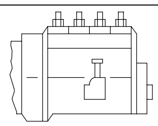
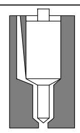
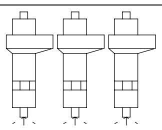
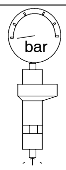
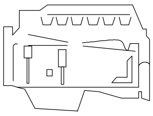
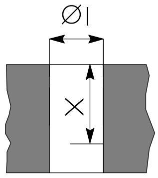
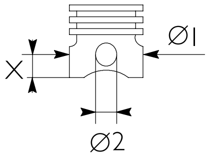
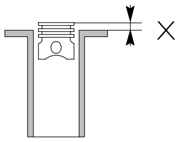
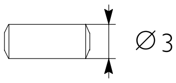
			F4AE0481D (.13)	F4AE0481C (.15)	F4AE0481A (.17)
	Type				
	**TIMING**				
	start before T.D.C. end after B.D.C.	A B		8.5° 8.5°	
	start before B.D.C. end after T.D.C.	D C		51° 12.5°	
	Checking timing				
	X	mm		-	
		mm		-	
	Checking operation				
	X	mm		0.20 to 0.30	
		mm		0.46 to 0.56	
	**FUEL FEED**				
	Injection Type:	Bosch		high pressure common rail EDC7 ECU	
	Nozzle type			Injectors	
	Injection sequence			1 - 3 - 4 - 2	
	Injection pressure	bar		250 - 1450	

CLEARANCE DATA

		F4AE0481D (.13)	F4AE0481C (.15)	F4AE0481A (.17)
	Type			
CYLINDER UNIT AND CRANKSHAFT COMPONENTS		mm		
	Cylinder barrels Ø1	102.009 to 102.031		
	Spare pistons type: Size X Outside diameter Ø 1 Pin housing Ø 2	60.5 101.731 to 101.749 40.010 to 40.016	60.5 101.781 to 101.799 40.008 to 40.014	
	Piston – cylinder barrels	0.116 to 0.134		
	Piston diameter Ø 1	0.5		
	Piston protrusion X	0.28 to 0.52		
	Piston pin Ø 3	39.9938 to 40.0002		
	Piston pin – pin housing	0.0098 to 0.0222	0.0078 to 0.0202	

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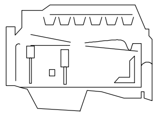
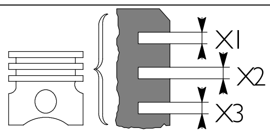
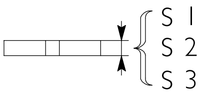
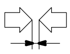
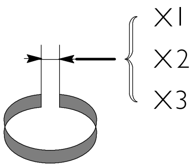
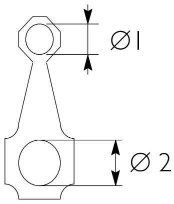
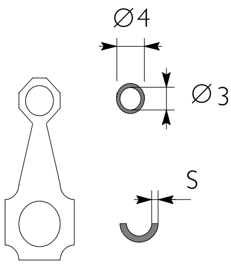
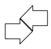
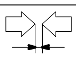
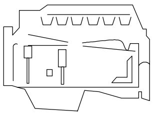
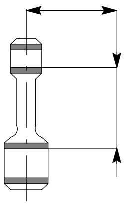
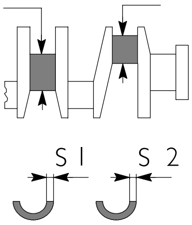
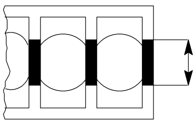
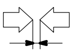
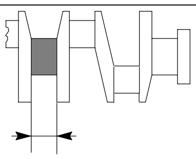
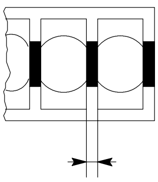
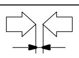
	Type		F4AE0481D (.13)	F4AE0481C (.15)	F4AE0481A (.17)
					
CYLINDER UNIT AND CRANKSHAFT COMPONENTS			mm		
	Split ring slots	X1* X 2 X 3	2.705 to 2.735 2.430 to 2.450 4.040 to 4.060	2.705 to 2.735 2.420 to 2.440 4.020 to 4.040	
	Split rings * measured on 99 mm Ø	S 1* S 2 S 3	2.560 to 2.605 2.350 to 2.380 3.975 to 4.000		
	Split rings - slots	1 2 3	0.100 to 0.175 0.050 to 0.100 0.040 to 0.085	0.100 to 0.175 0.040 to 0.90 0.020 to 0.065	
IVECO PARTS	Split rings		0.5		
	Split ring end opening in cylinder barrel:	X 1 X 2 X 3	0.30 to 0.40 0.60 to 0.80 0.25 to 0.55		
	Small end bush housing Big end bearing housing	Ø 1 Ø 2	42.987 to 43.013 72.987 to 73.013		
	Small end bush diameter Outside Inside Spare big end half bearings	Ø 4 Ø 3 S	43.279 to 43.553 40.019 to 40.033 1.955 to 1.968		
	Small end bush – housing		0.266 to 0.566		
	Piston pin – bush		0.0188 to 0.0392		
IVECO PARTS	Big end half bearings		0.250; 0.500		

	Type		F4AE0481D (.13)	F4AE0481C (.15)	F4AE0481A (.17)
CYLINDER UNIT AND CRANKSHAFT COMPONENTS			mm		
 X	Size	X	-		
	Max. tolerance on connecting rod axis alignment	—	-		
 ∅1 ∅2 S 1 S 2	Journals	∅ 1	82.99 to 83.01		
	Crankpins	∅ 2	68.997 to 69.013		
	Main half bearings	S 1	2.456 to 2.464		
	Big end half bearings	S 2	1.955 to 1.968		
	*provided as spare part				
 ∅ 3	Main bearings				
	No. 1 – 3 – 4 – 5	∅ 3	87.982 to 88.008		
	No. 2	∅ 3	87.982 to 88.008		
	Half bearings – Journals				
	No. 1 – 3 – 4 – 5		0.041 to 0.103		
	No. 2		0.041 to 0.103		
	Half bearings - Crankpins		0.033 to 0.041		
IVECO PARTS	Main half bearings Big end half bearings		0.250; 0.500		
 X 1	Shoulder journal	X 1	37.475 to 37.545		
 X 2	Shoulder main bearing	X 2	32.23		
	Shoulder half-rings	X 3	32.30		
	Output shaft shoulder		0.07		

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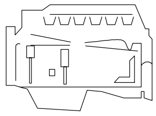
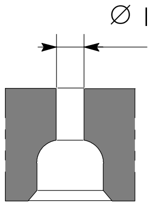
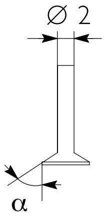
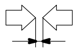
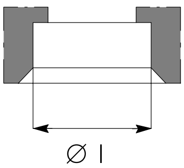
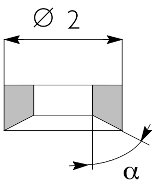
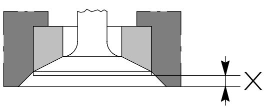
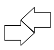
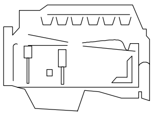
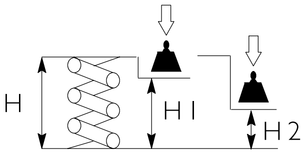
	Type		F4AE0481D (.13)	F4AE0481C (.15)	F4AE0481A (.17)
CYLINDER HEAD – TIMING SYSTEM			mm		
	Valve guide seats on cylinder head	Ø 1	7.042 to 7.062		
	Valves:	Ø 2 α Ø2 α	6.970 to 6.990 60° ± 0.25° 6.970 to 6.990 45° ± 0.25°		
	Valve stem and guide		0.052 to 0.092		
	Housing on head for valve seat:	Ø1 Ø1	34.837 to 34.863 34.837 to 34.863		
	Valve seat outside diameter; valve seat angle on cylinder head:	Ø 2 α Ø 2 α	34.917 to 34.931 60° 34.917 to 34.931 45°		
	Sinking	X X	0.59 to 1.11 0.96 to 1.48		
	Between valve seat and head		0.054 to 0.094 0.054 to 0.094		
IVECO PARTS	Valve seats		-		

<table>
<tr><td></td><td>Type</td><td></td><td>F4AE0481D
(.13)</td><td>F4AE0481C
(.15)</td><td>F4AE0481A
(.17)</td></tr>
<tr><td colspan="3">CYLINDER HEAD – TIMING SYSTEM</td><td colspan="3">mm</td></tr>
<tr><td></td><td>Valve spring height:

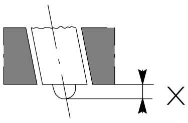
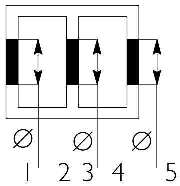
free spring

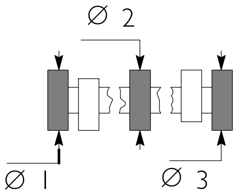
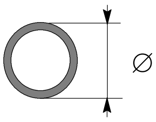
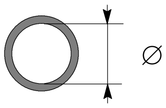
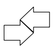
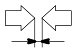
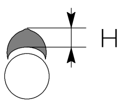
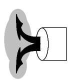
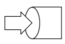
under a load equal to:
339.8 ± 19 N
741 ± 39 N</td><td>

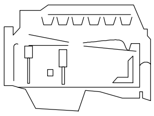
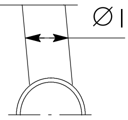
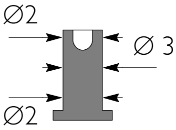
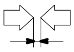
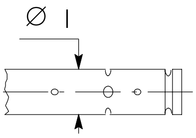
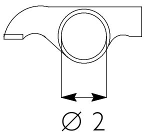
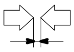
H

H1
H2</td><td colspan="3">

47.75

35.33
25.2</td></tr>
<tr><td></td><td>Injector protrusion</td><td>X</td><td colspan="3">Not adjustable</td></tr>
<tr><td></td><td>Camshaft bush
housings No. 1-5
Camshaft housings
No. 2-3-4</td><td></td><td colspan="3">59.222 to 59.248

59.222 to 59.248</td></tr>
<tr><td></td><td>Camshaft journals:
1 ⇒ 5 ∅ 1 - 2 - 3</td><td></td><td colspan="3">53.995 to 54.045</td></tr>
<tr><td></td><td>Camshaft bush outside
diameter: with 3.3 kN
load</td><td>∅</td><td colspan="3">59.222 to 59,248</td></tr>
<tr><td></td><td>Bush inside
diameter after driving</td><td>∅</td><td colspan="3">54.083 to 54.147</td></tr>
<tr><td></td><td>Bushes and housings
on block</td><td></td><td colspan="3">0.113 to 0.165</td></tr>
<tr><td></td><td>Bushes and journals</td><td></td><td colspan="3">0.038 to 0.152</td></tr>
<tr><td></td><td>Cam lift:

</td><td>
H
H</td><td colspan="3">
6.045
7.582</td></tr>
</table>

		F4AE0481D (.13)	F4AE0481C (.15)	F4AE0481A (.17)
	Type			
CYLINDER HEAD – TIMING SYSTEM		mm		
	Tappet cap housing on block Ø 1	16.000 to 16.030		
	Tappet cap outside diameter: Ø 2 Ø 3	15.924 to 15.954 15.960 to 15.975		
	Between tappets and housings	0.025 to 0.070		
IVECO PARTS	Tappets	-		
	Rocker shaft Ø 1	21.965 to 21.977		
	Rockers Ø 2	22.001 to 22.027		
	Between rockers and shaft	0.024 to 0.162		

TIGHTENING TORQUE

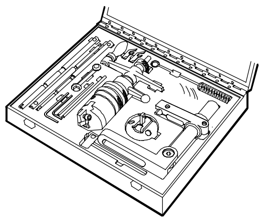
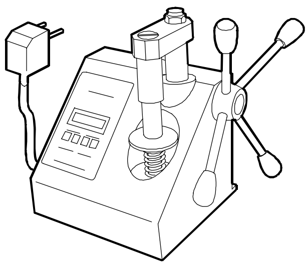
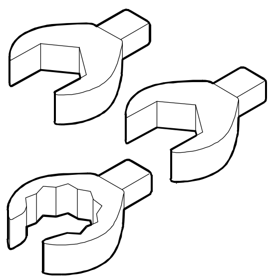
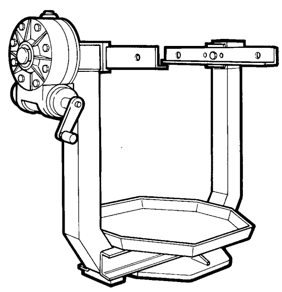
COMPONENT		TORQUE Nm	TORQUE kgm
Screw M8 for fastening cylinder barrel lubricating nozzles		15 ± 3	1.5 ± 0.3
Screw M12 for fastening output shaft caps	1st stage 2nd stage 3rd stage	50 ± 6 80 ± 6 90° ± 5°	5 ± 0.6 8 ± 0.6
Studs M6 for camshaft sensors		8 ± 2	0.8 ± 0.2
Studs M8 for feed pump		12 ± 2	1.2 ± 0.2
Screw M12 for fastening rear gear case Screw M10 for fastening rear gear case Screw M8 for fastening rear gear case		77 ± 12 47 ± 5 24 ± 4	7.7 ± 1.2 4.7 ± 0.5 2.4 ± 0.4
Nut M6 for fastening camshaft sensor		10 ± 2	1 ± 0.2
Screw M8 for fastening oil pump	1st stage 2nd stage	8 ± 1 24 ± 4	0.8 ± 0.1 2.4 ± 0.4
Screw M8 for fastening front cover		24 ± 4	2.4 ± 0.4
Screw M8 for fastening camshaft longitudinal retaining plate		24 ± 4	2.4 ± 0.4
Screw M8 for fastening camshaft gear		36 ± 4	3.6 ± 0.4
Screw M11 for fastening connecting rod caps	1st stage 2nd stage	60 ± 5 60° ± 5°	6 ± 0.5
Screw M10 for fastening crankcase plate		43 ± 5	4.3 ± 0.4
Nut M18 for fastening high pressure pump gear		105 ± 5	10.5 ± 0.5
Nuts M8 for fastening fuel pump		24 ± 4	2,4 ± 0,4
1/2 inch plug on cylinder head 1/4 inch plug on cylinder head 3/4 inch plug on cylinder head		24 ± 4 36 ± 5 12 ± 2	2.4 ± 0.4 3.6 ± 0.5 1.2 ± 0.2
Screw M6 for fastening injectors		8.5 ± 0.35	0.85 ± 0.035
Nut fastening for injector feed connector		50 ± 5	5 ± 0.5
Nut M6 for flame start grille on intake manifold		8 ± 2	0.8 ± 0.2
Screw M8 for fastening intake manifold		24 ± 4	2.4 ± 0.4
Screw M12 for fastening rear brackets for engine lifting		77 ± 12	7.7 ± 1.2
Screws M8 for fastening Common Rail		24 ± 4	2.4 ± 0.4
Connectors M14 for high pressure fuel pipes		20 ± 2	2 ± 0.2
Screw M12 (12 × 1.75 × 130) for fastening cylinder head Screw M12 (12 × 1.75 × 150) for fastening cylinder head	} 1st stage 2nd stage 3rd stage	35 ± 5 55 ± 5 90° ± 5° 90° ± 5°	3.5 ± 0.5 5.5 ± 0.5
Screw for fastening rocker bracket		36 ± 5	3.6 ± 0.5
Valve clearance adjusting nuts		24 ± 4	2.4 ± 0.4
Nuts M14 for fastening fuel pipes from high pressure pump to Common Rail		20 ± 2	2 ± 0.2
Screw M8 for fastening high pressure pipe connector		24 ± 4	2.4 ± 0.4
Screw M6 for fastening wiring bulkhead		10 ± 2	1 ± 0.2
Screw M8 for fastening electric wiring support for injector feed		24 ± 4	2.4 ± 0.4
Nuts for fastening wiring on each injector		1,5 ± 0,25	0.15 ± 0.025
Screw M12 for fastening fuel filter bracket		77 ± 8	7.7 ± 0.8
Screw M8 for fastening fuel filter holder		24 ± 4	2.4 ± 0.4
Fuel filter		contact + 3/4 turn	
Screw M22 for fastening oil pressure relief valve on oil filter support		80 ± 8	8 ± 0.8
Screw M8 for radiator seal and oil filter support		24 ± 4	2.4 ± 0.4
Oil filter		contact + 3/4 turn	

COMPONENT				TORQUE	
				Nm	kgm
11/8 inch connection on filter support for turbine lubrication				24 ± 4	2.4 ± 0.4
Nut M12 for fastening turbine lubrication pipe				10 ± 2	1 ± 0.2
Screw M10 for fastening engine coolant inlet connection				43 ± 6	4.3 ± 0.6
90° elbow fastening (if required) to engine coolant inlet connection				24 ± 4	2.4 ± 0.4
Pipe on cylinder head for compressor cooling				22 ± 2	2.2 ± 0.2
Screw M6 for fastening engine coolant drain connector				10 ± 2	1 ± 0.2
Pin fastening on engine block for exhaust manifold				10 ± 2	1 ± 0.2
Screw M10 for fastening exhaust manifold on cylinder head				53 ± 5	5.3 ± 0.5
Screw M12 for fastening damper adapter and damper on output shaft	1st stage 2nd stage			50 ± 5 90°	5 ± 0.5
Screw M10 for fastening pulley on output shaft				68 ± 7	6.8 ± 0.7
Screw M8 for fastening water pump				24 ± 4	2.4 ± 0.4
Screw M10 for fastening auxiliary component control belt tensioners				43 ± 6	4.3 ± 0.6
Screw M10 for fastening fixed pulleys for auxiliary component control belt				43 ± 6	4.3 ± 0.6
Screw M10 for fastening flywheel housing Screw M12 for fastening flywheel housing				85 ± 10 49 ± 5	8.5 ± 1 4.9 ± 0.5
Screw M6 for fastening heat exchanger for control unit Screw M8 for fastening heat exchanger for control unit				10 ± 2 24 ± 4	1 ± 0.2 2.4 ± 0.4
Connection M12 for fuel inlet-outlet on heat exchanger				12 ± 2	1.2 ± 0.2
Nut M8 for fastening valve cover				24 ± 4	2.4 ± 0.4
Screw M6 for fastening camshaft sensor				8 ± 2	0.8 ± 0.2
Screw M6 for fastening output shaft sensor				8 ± 2	0.8 ± 0.2
Screw M14 for fastening coolant temperature sensor				20 ± 3	2 ± 0.3
Screw M5 for fastening oil pressure/temperature sensor				6 ± 1	0.6 ± 0.1
Screw for fastening fuel pressure sensor				35 ± 5	3.5 ± 0.5
Screw M14 for fastening fuel temperature sensor				20 ± 3	2 ± 0.3
Screw for fastening air temperature/pressure sensor on intake manifold				6 ± 1	0.6 ± 0.1
Screw M12 for fastening engine oil level sensor				12 ± 2	1.2 ± 0.2
Turbine fixing to exhaust manifold	6-cyl.	pins nuts	M8 M8	7 ± 1 43 ± 6	0.7 ± 0.1 4.3 ± 0.6
	4-cyl.	pins nuts	M8 M8	7 ± 1 24 ± 4	0.7 ± 0.1 2.4 ± 0.4
Adapter M12 on turbine for lubricant oil pipes (inlet)				35 ± 5	3.5 ± 0.5
Pipe fixing on adapter M10 for turbine lubrication				35 ± 5	3.5 ± 0.5
Oil pipe fixing on adapter M10 for turbine lubrication to block				43 ± 6	4.3 ± 0.6
Oil drain pipe fixing M8 on turbine				24 ± 4	2.4 ± 0.4
Connector fixing M6 for oil return from cylinder head to flywheel housing				10 ± 2	1 ± 0.2
Screw M12 for fastening engine flywheel	1st stage 2nd stage			30 ± 4 60° ± 5°	3 ± 0.4
Screw M8 for fastening front bracket for engine lifting				24 ± 4	2.4 ± 0.4
Screw for fastening engine oil sump				24 ± 4	2.4 ± 0.4

AUXILIARY COMPONENTS

COMPONENT	TORQUE	
	Nm	kgm
Air compressor:		
5/8 nut for fastening control gear on compressor shaft	125 ± 19	12.5 ± 1.9
Nut M12 for fastening to flywheel housing	77 ± 12	7.7 ± 1.2
Alternator:		
Screw M10 for fastening bracket to water inlet connector	43 ± 6	4.3 ± 0.6
Nut M10 for fastening alternator	43 ± 6	4.3 ± 0.6
Ventilation and heating unit:		
Screw M10 for fastening bracket	43 ± 6	4.3 ± 0.6
Screw M10 for fastening compressor	24 ± 4	2.4 ± 0.4
Starter:		
Screw for fastening starter	43 ± 6	4.3 ± 0.6

TOOLS

TOOL No.		DEFINITION
99305018		Kit for valve seat regrinding
99305047		Spring load tester
99317915		Set of 3 insert wrenches 9x12 (14 - 17 - 19 mm) to be used with 99389829
99322205		Revolving stand for overhauling units (capacity 1000 daN, torque 120 daNm)

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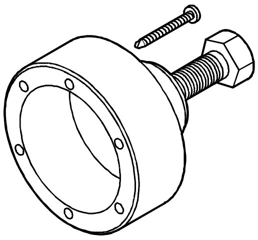
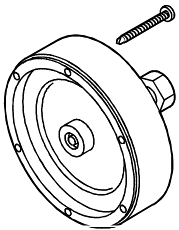
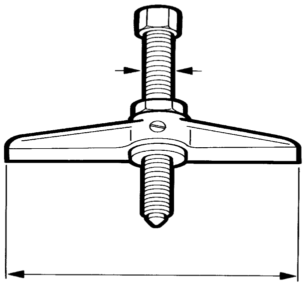
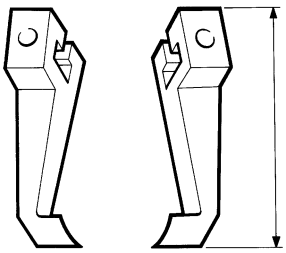
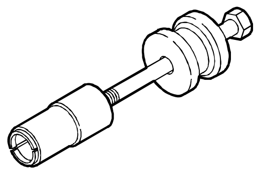
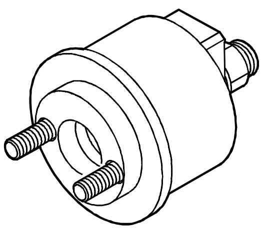
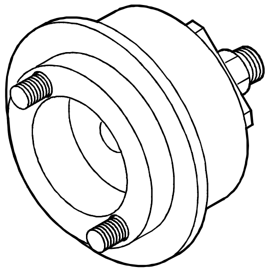
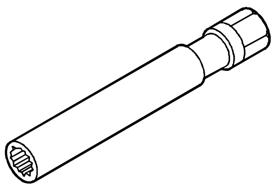
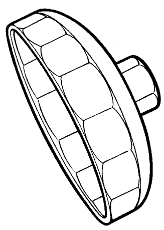
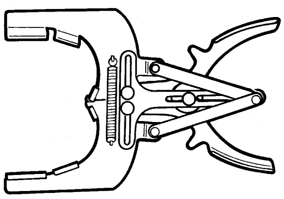
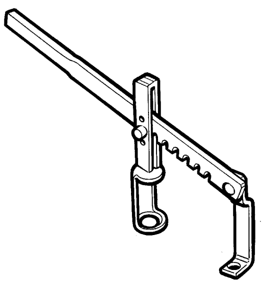
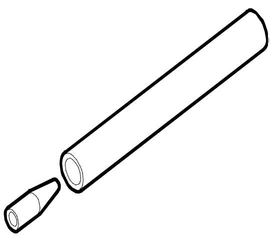
TOOLS

TOOL No.		DEFINITION
99340055		Tool to remove output shaft front gasket
99340056		Tool to remove output shaft rear gasket
99341001		Double acting puller
99341009		Pair of brackets
99342101		Tool to remove injectors
99346252		Key for front gasket assembly to engine shaft

TOOLS

TOOL No.		DEFINITION
99346253		Tool for fitting output shaft rear gasket
99355019		Wrench (10 mm) for hydraulic power steering pump retaining screw
99360076		Tool to remove oil filter (engine)
99360183		Pliers for removing/refitting piston rings (65 – 110 mm)
99360268		Tool for removing/refitting engine valves
99360292		Coupler for assembly on valve guide.

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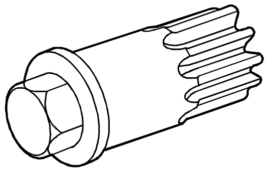
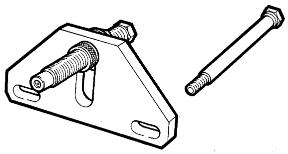
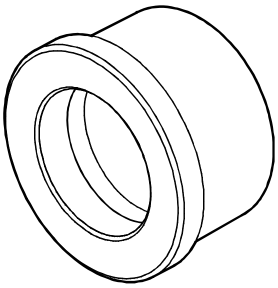
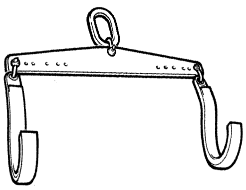
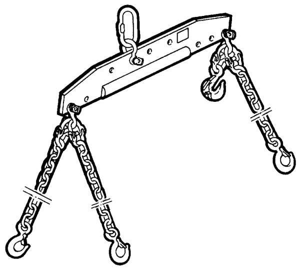
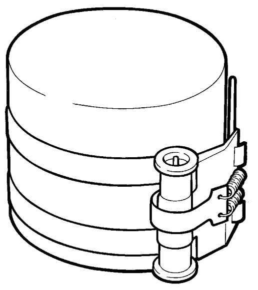
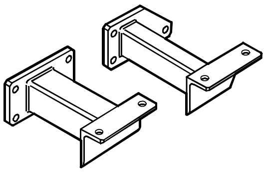
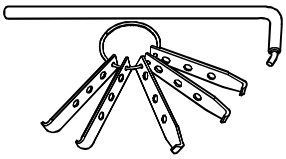
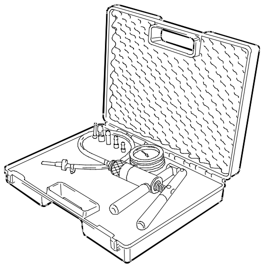
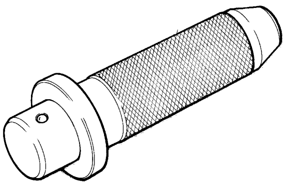
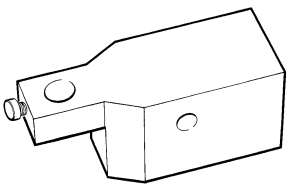
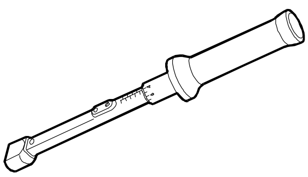
TOOLS

TOOL No.		DEFINITION
99360330		Tool for rotating the engine flywheel
99360351		Tool for stopping the engine flywheel
99360362		Beater for removing/refitting camshaft bushes (to be used with 99370006)
99360500		Tool for lifting the output shaft
99360595		Lifting rig for engine removal/refitting
99360605		Band for fitting piston into cylinder barrel (60 – 125 mm)

TOOLS

TOOL No.		DEFINITION
99361037		Brackets for fastening engine to revolving stand 99322205
99363204		Tool to remove gaskets
99367121		Manual pump for pressure and vacuum measurements
99370006		Handgrip for interchangeable beaters
99370415		Gauge base for different measurements (to be used with 99395603)
99389829		Joint torque wrench 9x12 - 50-60 Nm, to be used with 99317915

TOOLS

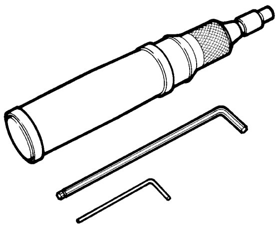
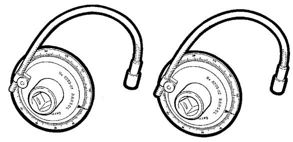
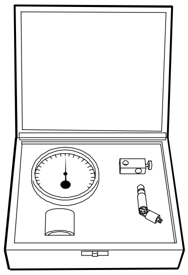
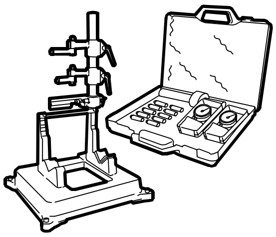
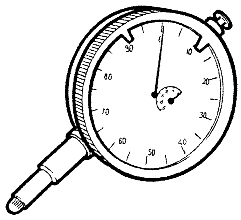
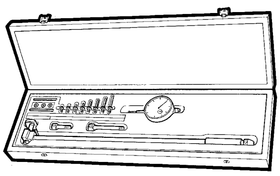
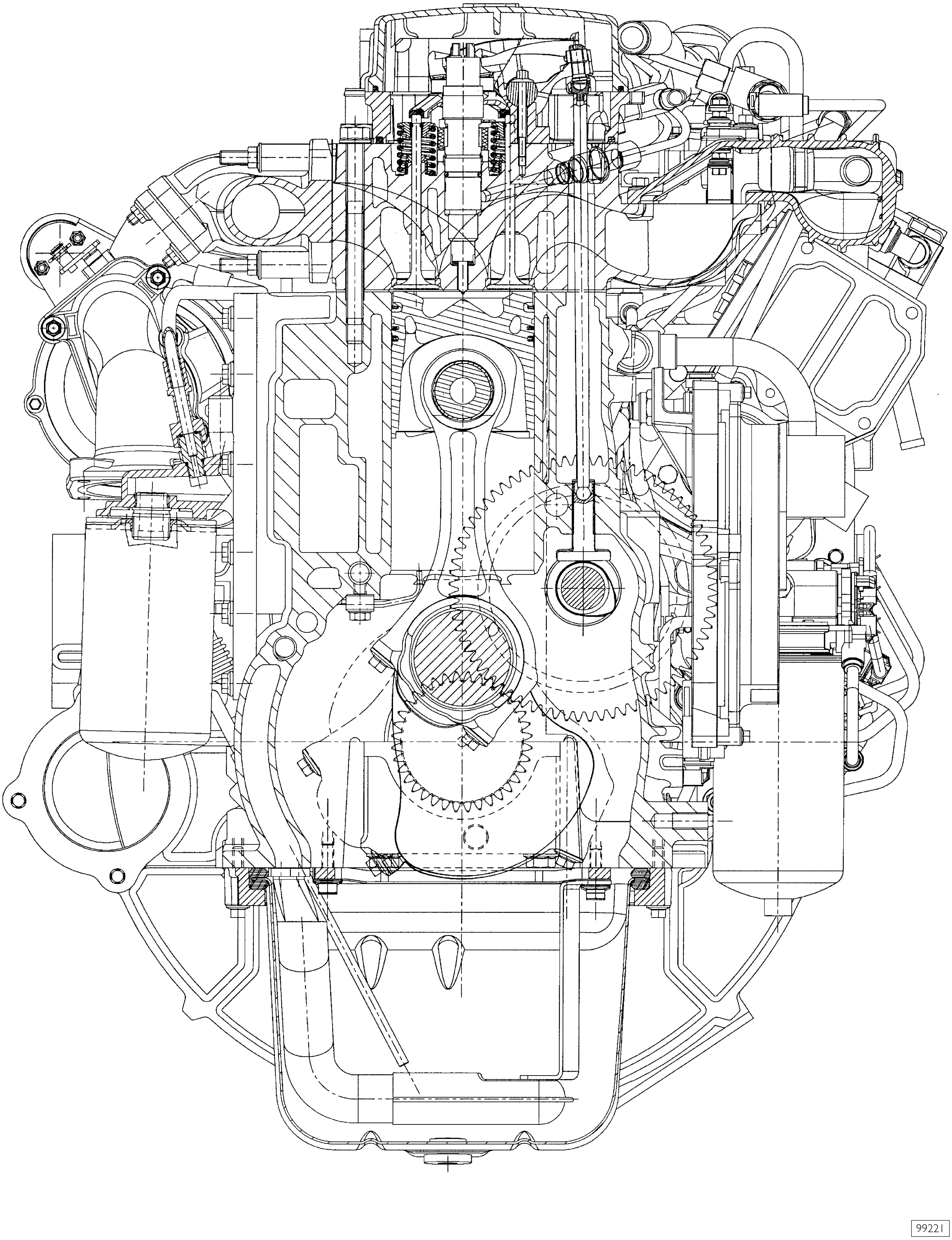
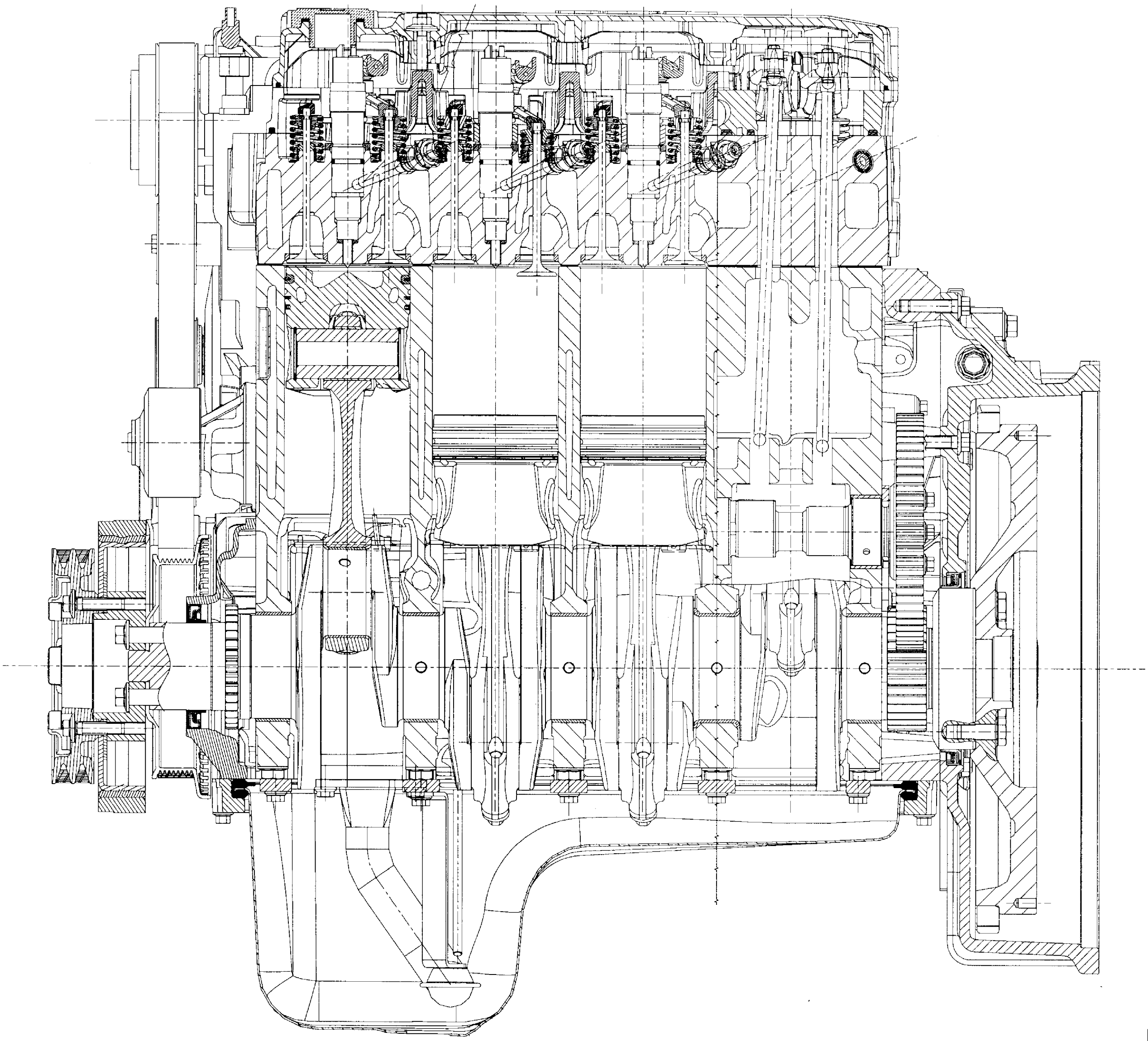
TOOL No.		DEFINITION
99389834		Torque screwdriver for injector solenoid valve connector stop nut setting
99395216		Pair of gauges with 1/2" and 3/4" square head for angle tightening
99395220		All-purpose goniometer/inclination indicator
99395363		Complete bush testing square
99395603		Dial gauge (0 – 5 mm)
99395687		Bore dial gauge

Figure 1



ENGINE F4AE0481 CROSS SECTION

Figure 2

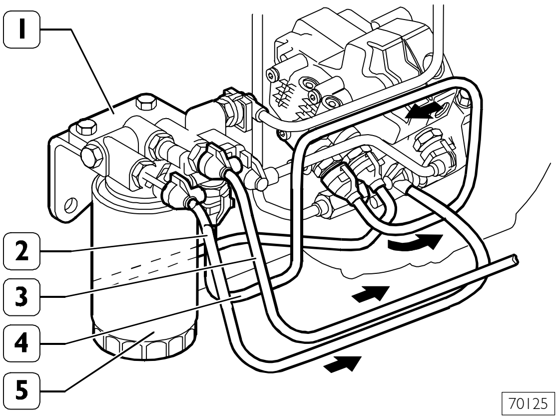


ENGINE F4AE0481 LONGITUDINAL SECTION

ENGINE OVERHAUL

540110 ENGINE REMOVAL AT THE BENCH

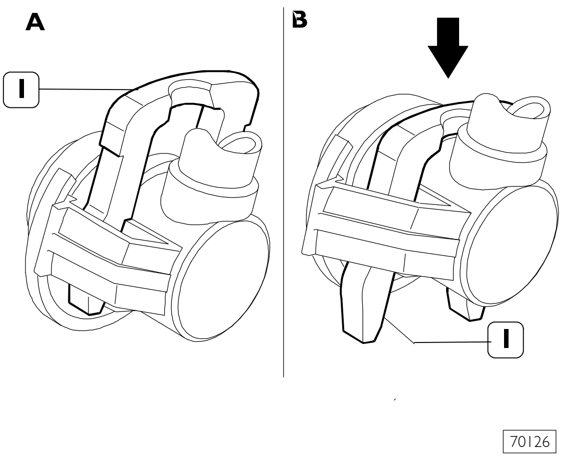
Figure 3



To apply to the engine block the brackets 99341009 for fastening the engine to the overhaul stand, proceed as follows (working from the left side of the engine):

- ❑ use tool 99360076 to remove the fuel filter (5) from the support (1);
- ❑ disconnect the low pressure fuel pipes (2 – 3 – 4) from the support (1);
- ❑ remove the support (1) bracket from the engine block.

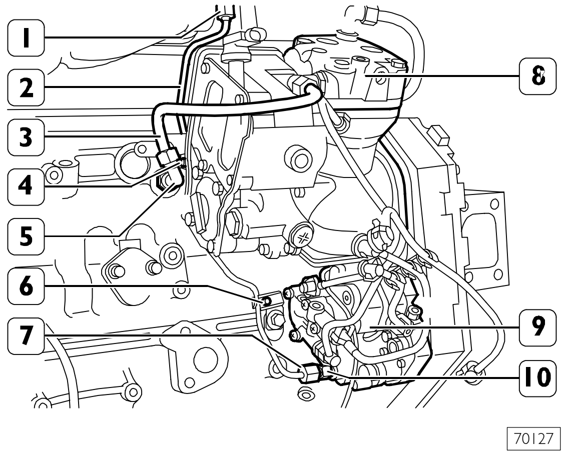
Figure 4



Press clamp (1), as shown in Figure **B,** to disconnect the low pressure fuel pipes (2 – 3 – 4, Figure 3) from the corresponding connections.

After disconnecting the pipe, reset the clamp (1) in locking position (Figure **A**) to prevent distortions.

Figure 5



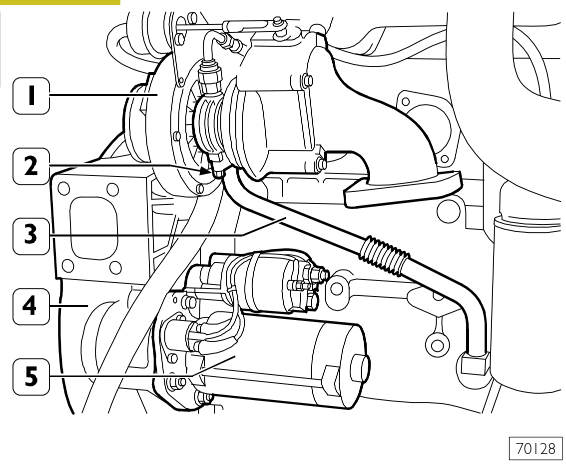
Disconnect the pipe (3) from the connection (4) and from supercharger (8).

Disconnect the fuel pipe (2) from the rail and from the high pressure pump (9), remove the fastening screws (4 and 6) and remove it from the engine block.

NOTE When releasing pipe (2) connection (7), use the proper wrench to avoid rotation of the high pressure pump (9) connection (10).

From the right side:

Figure 6



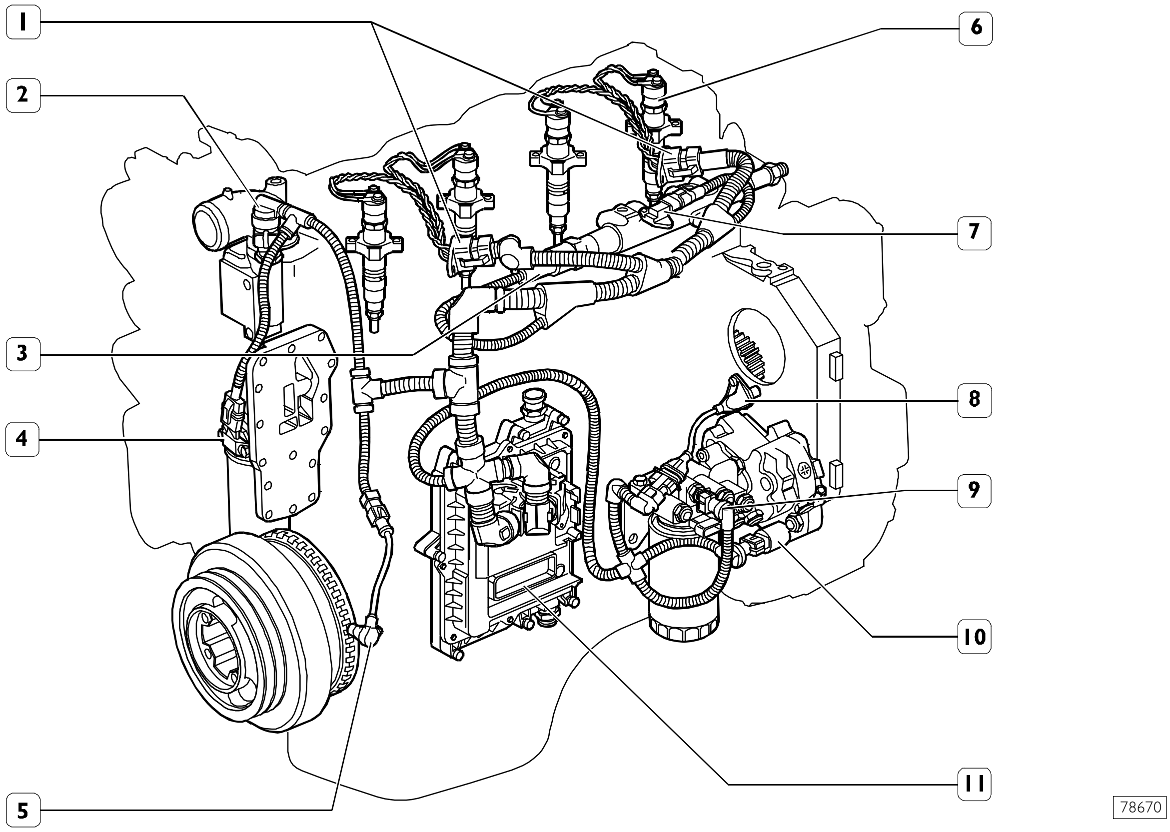
Remove the screws (2) and remove the oil pipe (3) from the supercharger pipe (1) and from the engine block.

Remove the starter (5) from the flywheel housing (4).

Apply brackets 99361037 to engine block and use them to secure the engine to the revolving stand 99322205. Remove sump cap and drain out oil.

Remove the fan from the output shaft pulley.

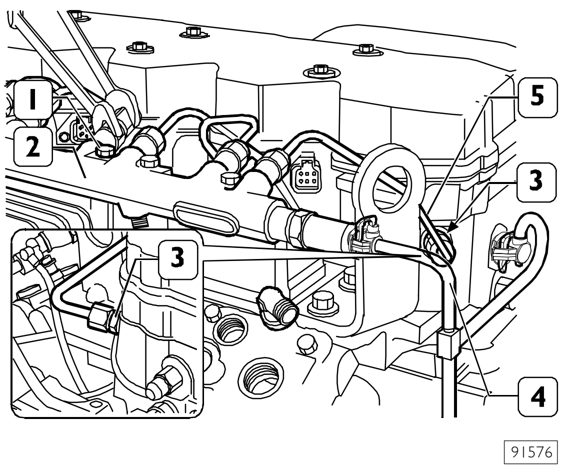
Figure 7



1. Injector connections - 2. Engine coolant temperature sensor - 3. Fuel pressure sensor - 4. Engine oil temperature and pressure sensor - 5. Output shaft sensor - 6. Injector - 7. Air temperature/pressure sensor - 8. Timing sensor - 9. Fuel heater and fuel temperature sensor - 10. Pressure limiter - 11. EDC7 ECU.

Disconnect the engine cable by disconnecting the connectors: (1) from injector wiring (6); (7) air pressure/temperature sensor; (3) fuel pressure sensor; (11) ECU; (10) high pressure pump sensor; (8) timing sensor; (2) engine coolant temperature sensor on thermostat; (5) engine speed sensor;

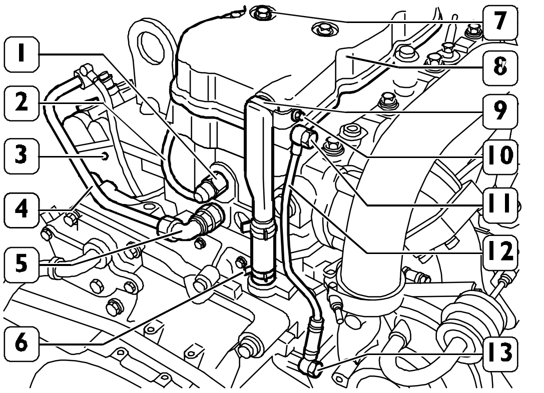
Figure 8



Disconnect from the rail (2): the fuel pipe (4) according to procedures described in figure (29). Disconnect fuel pipes (5) from rail (2) and injector manifolds (3).

Remove the screws (1) and disconnect the rail (2).

Figure 9



70130

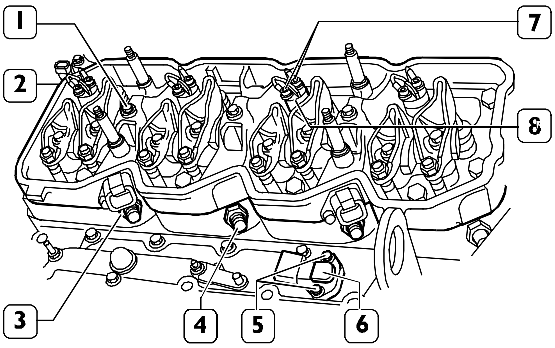
Disconnect pipe (2) from fuel return pressure limiter (1), as shown in Figure 4.

Disconnect pipe (4) from air compressor (3) and connection (5). Remove nut (10). Loosen clamp (6) and disconnect oil vapour pipe (9).

Remove connections (13-11) and disconnect pipe (12).

Remove nuts (7) and remove the tappet cover (8) including the gasket.

Figure 10



70131

Remove nuts (7) and disconnect the electrical cables from injectors (8).

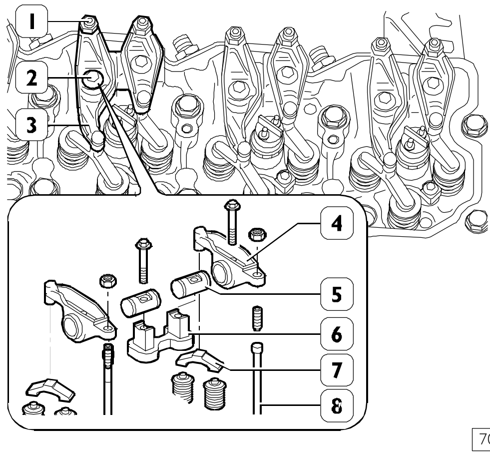
Remove screws (1) and disconnect injector wiring support (2) including the gasket.

Remove screws (5), disconnect air pressure/temperature sensor (6).

Remove nuts (3) and remove fuel manifolds (4).

NOTE Disassembled fuel manifolds (4) must not be used again, but however replaced with other new ones.

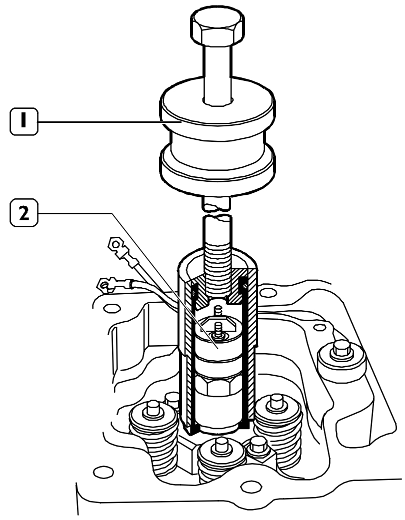
Figure 11



70132

Loosen tappet adjustment fastening nuts (1) and unscrew the adjusters.
Remove the screws (2), remove the rocker assembly (3), consisting of: bracket (6), rockers (4), shafts (5) and remove jumpers (7) from valves.
Remove rods (8).

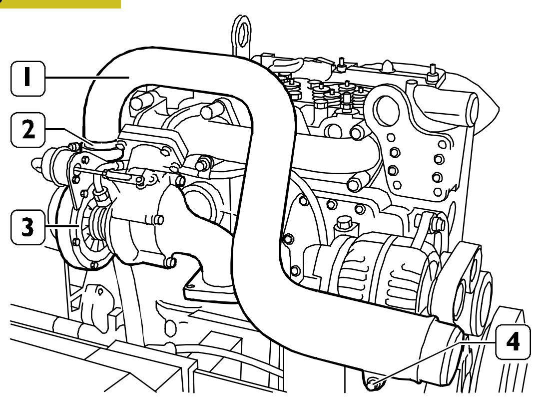
Figure 12



70133

Remove injector fastening screws. Use tool 99342101 (1) to remove injectors (2) from the cylinder head.

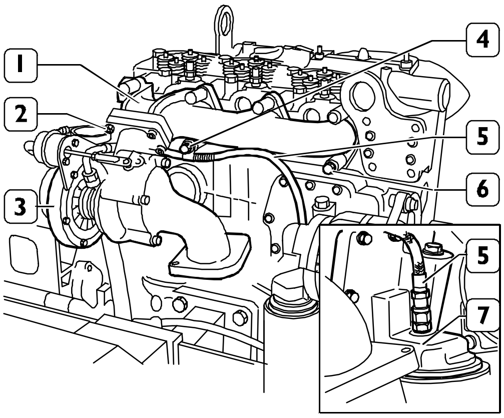
Figure 13



70134

Remove screw (4), loosen clamp (2) and disconnect air duct (1) from turbosupercharger (3).

Figure 14



70135

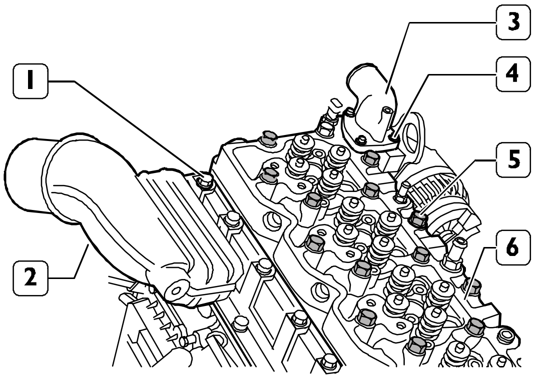
Remove the screw (4) fastening the oil pipe clamp (5) to the exhaust manifold (1).

Disconnect the oil pipe (5) from the heat exchanger/oil filter support (7).

Remove the nuts (2) and disconnect the turbosupercharger (3) from the exhaust manifold (1).

Remove the screws (6) and disconnect the exhaust manifold (1) from the cylinder head.

Figure 15



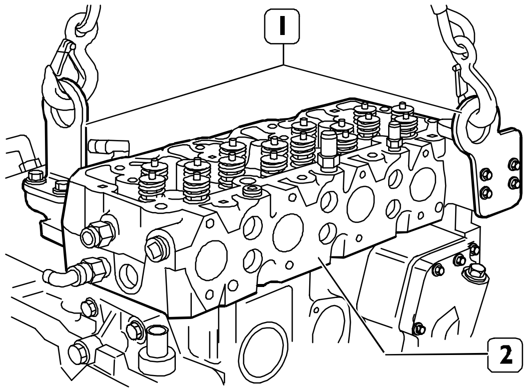
70136

Remove the screws (1) and disconnect the air duct (2) including the heater. Remove the screws (4), and take out the cover (3) and the thermostat set underneath.

Remove the cylinder head (6) fastening screws (5).

NOTE Pointed out external screws are shorter.

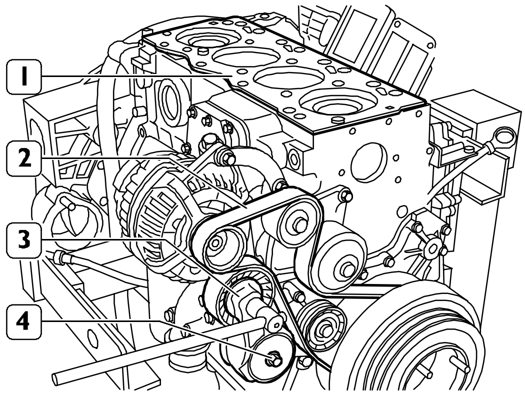
Figure 16



70137

Hook brackets (1) with metal ropes and remove cylinder head (2) from block using hoist.

Figure 17



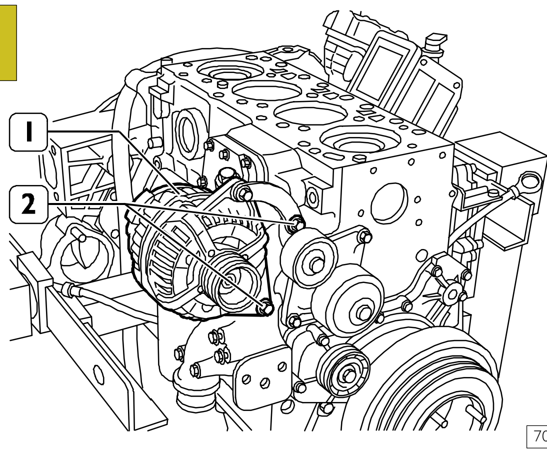
70138

Remove cylinder head gasket (1).

Use the proper wrench to operate the automatic belt tensioner (3) to loosen belt (2) tension and remove it;

Remove the screw (4) and the automatic belt tensioner (3).

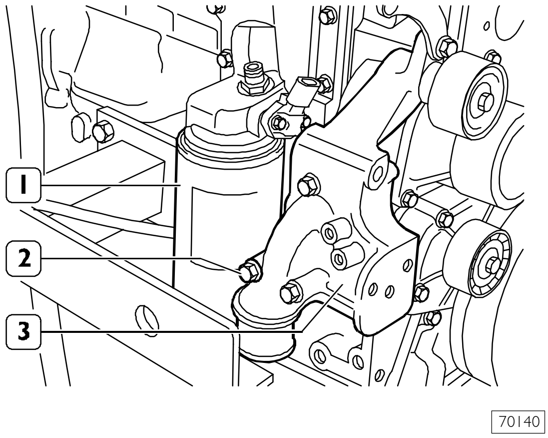
Figure 18



70139

Remove the screws (2) and disconnect the alternator (1).

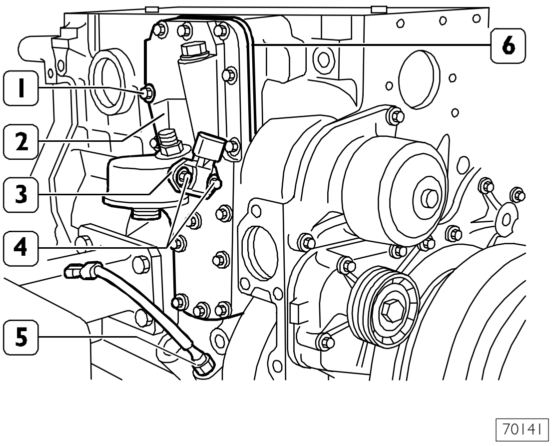
Figure 19



Remove the screws (2) and disconnect the alternator support (3).

Use tool 99360076 to remove the oil filter (1).

Figure 20

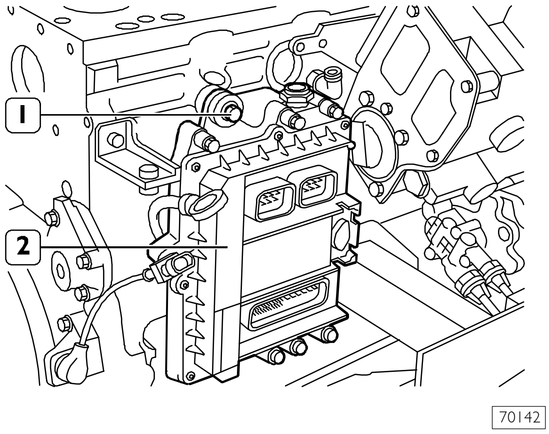


Remove the screws (4) and disconnect the oil temperature/pressure sensor (3).

Remove the screws (1) and then remove: heat exchanger/oil filter support (2), intermediate plate (6) and relevant gaskets.

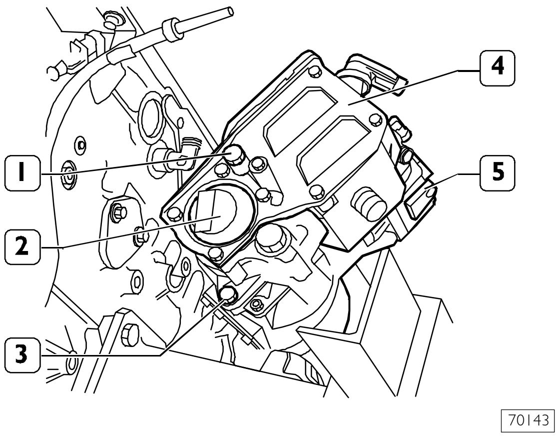
Remove the oil level sensor (5).

Figure 21



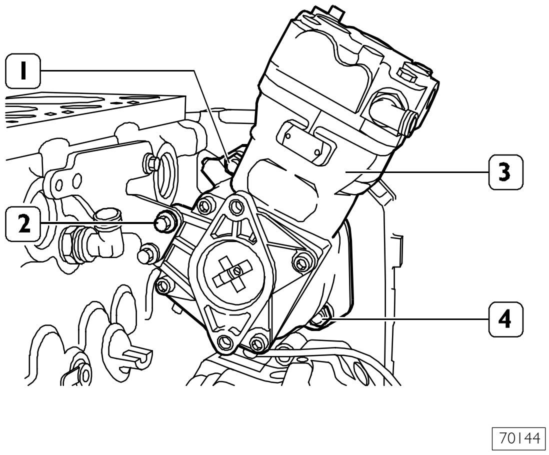
Remove the screws (1) and disconnect the ECU (2) including the heat exchanger.

Figure 22



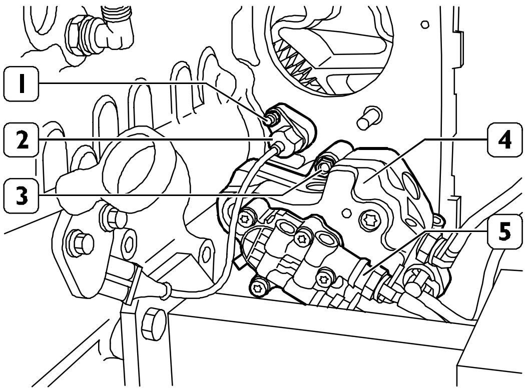
Use wrench 99355019 (1) to remove the screws (3) and disconnect the hydraulic power steering pump (2) including the oil tank (4) from the air compressor (5).

Figure 23



Remove the screws (2) and the nuts (1-4) and disconnect the air compressor (3).

Figure 24

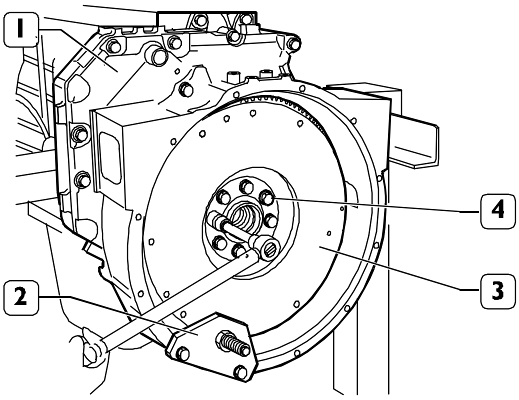


70145

Remove the nut (1) and disconnect the timing sensor (2).

Remove the nuts (3) and disconnect the high pressure pump (4) including the feed pump (5).

Figure 25

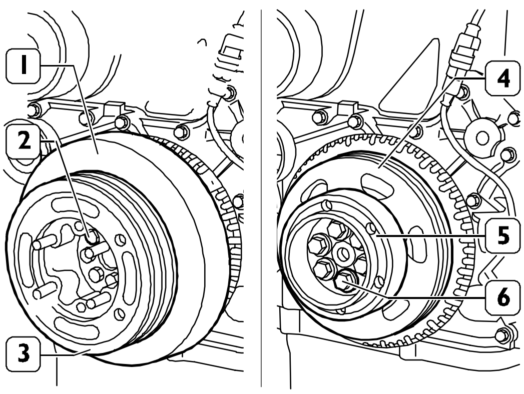


70146

Fit tool 99360351 (2) to the flywheel housing (1) to stop flywheel (3) rotation.

Loosen the screws (4).

Figure 26

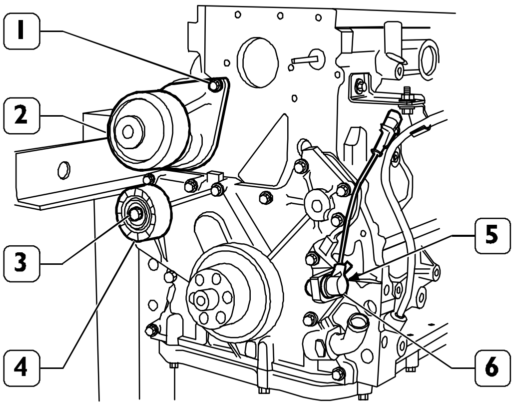


70340

Remove the screws (2) and remove the pulley (3) and the damper flywheel (1).

Remove the screws (6) and remove the hub (5) and the phonic wheel (4).

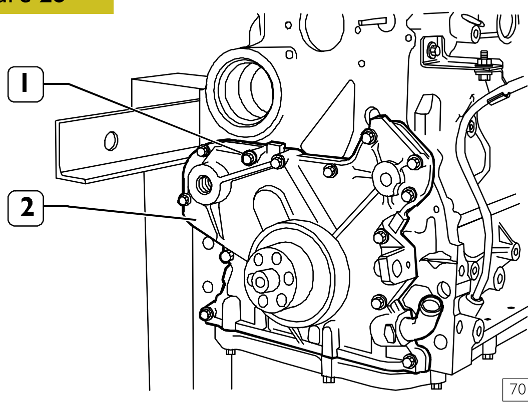
Figure 27



70148

Remove the screws (1) and disconnect the water pump (2).
Remove the screw (3) and the roller (4).
Remove the screw (5) and disconnect the engine speed sensor (6).

Figure 28

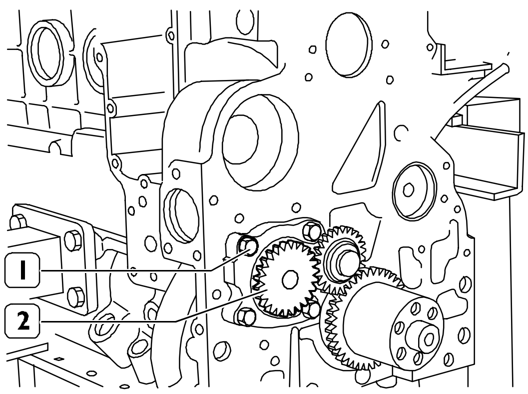


70149

Remove the screws (1) and take out the front cover (2).

NOTE Take note of screw (1) assembling positions since they have different lengths.

Figure 29

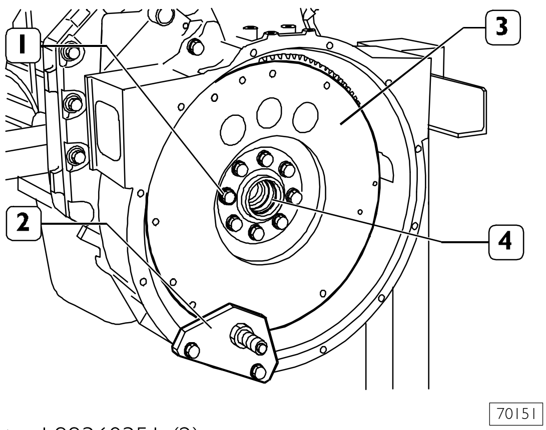


70150

Remove the screws (1) and disconnect the oil pump (2).

NOTE The oil pump (2) shall not be overhauled.

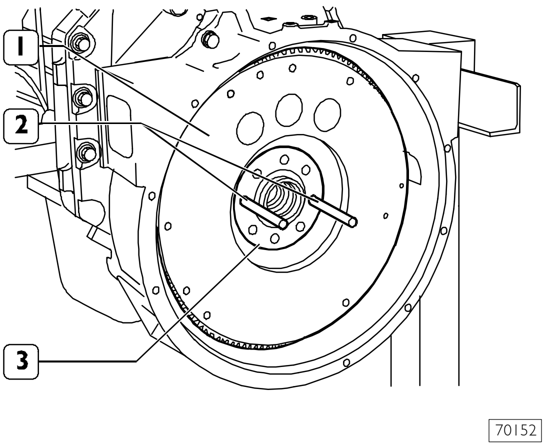
Figure 30



Remove tool 99360351 (2).

Remove the screws (1) fastening the engine flywheel (3) to the output shaft (4).

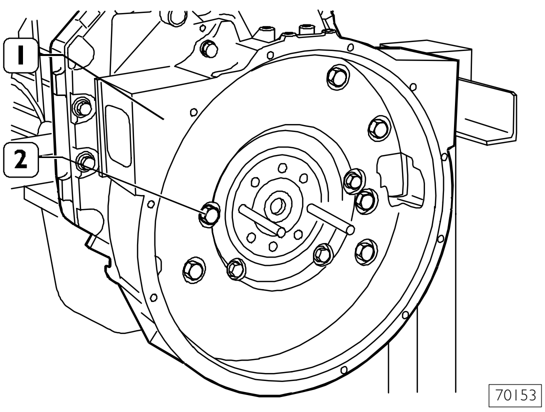
Figure 31



Screw two pins (2) having proper length into the output shaft (3) holes.

Withdraw the engine flywheel (1) to sling it with the hoist and put it into the proper container.

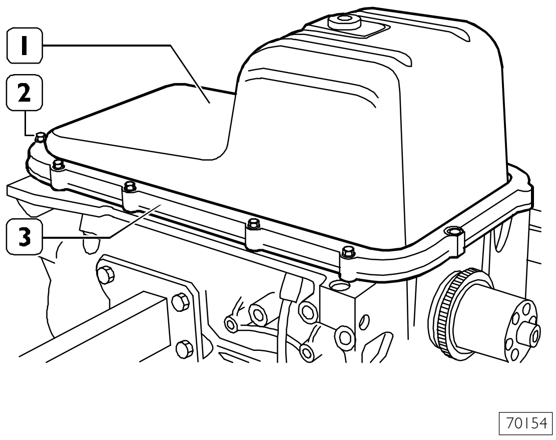
Figure 32



Remove the screws (1) and take out the rear cover (2).

NOTE Take note of screw (1) assembling positions since they have different sizes.

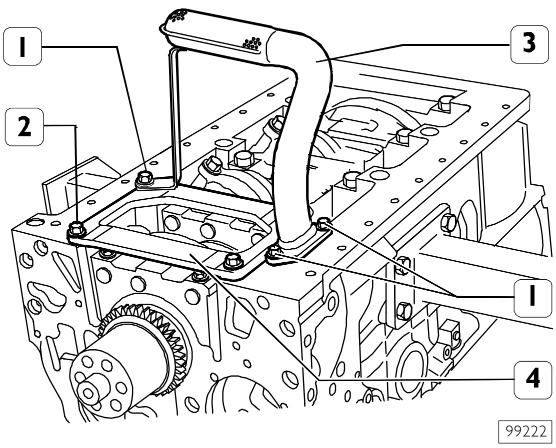
Figure 33



Overturn the engine.

Remove the screws (2), disassemble the plate (3) and disconnect the oil sump (1).

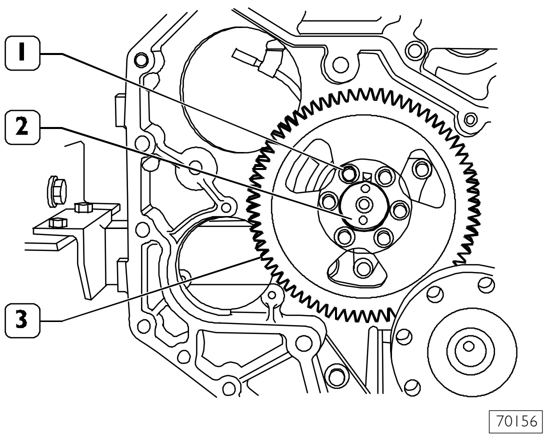
Figure 34



Remove the screws (1) and disassemble the oil suction rose pipe (3).

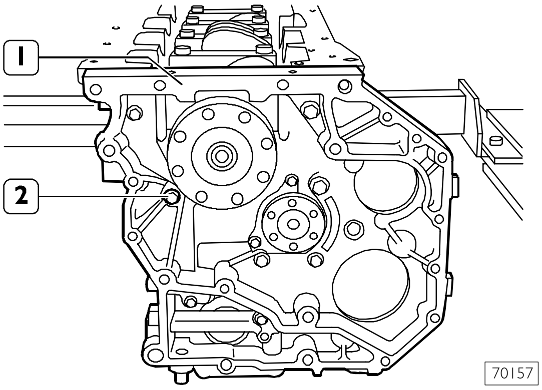
Remove the screws (2) and disassemble the stiffening plate (4).

Figure 35



Remove the screws (1) and remove the gear (3) from the camshaft (2).

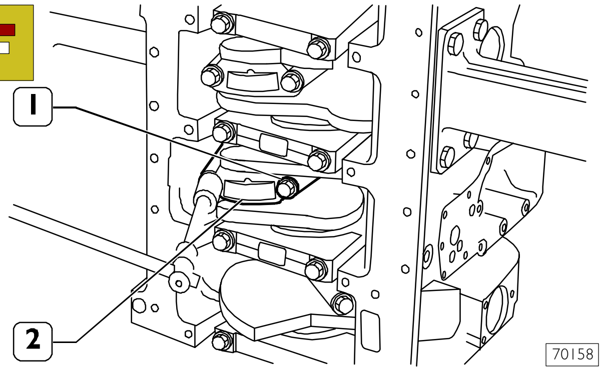
Figure 36



Remove the screws (2) and disconnect the timing gear case (1).

NOTE Take note of screw (2) assembling positions since they have different sizes.

Figure 37

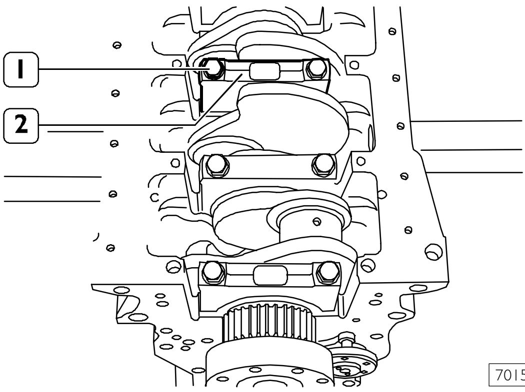


Remove the screws (1) fastening the connecting rod caps (2) and remove them.

Withdraw the pistons including the connecting rods from the top of the engine block.

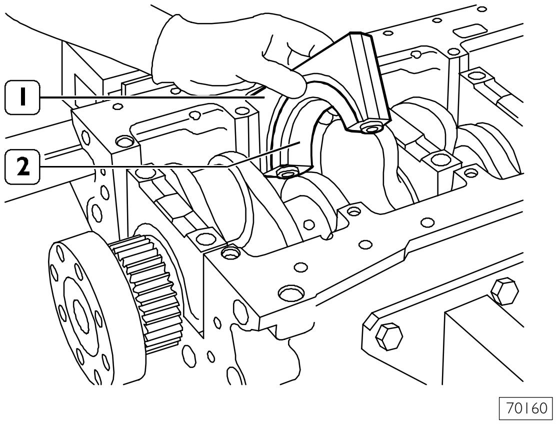
NOTE Keep the half-bearings into their housings since in case of use they shall be fitted in the same position found at removal.

Figure 38



Remove the screws (1) and the main bearing caps (2).

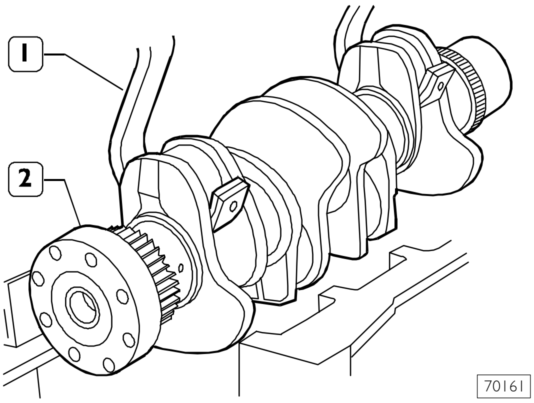
Figure 39



The second last main bearing cap (1) and the relevant support are fitted with shoulder half-bearing (2).

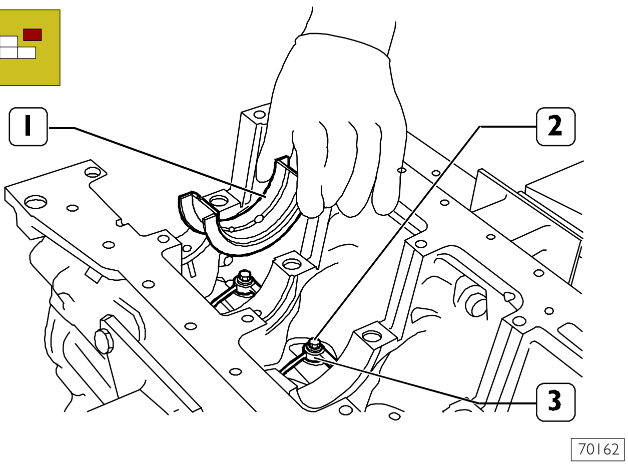
NOTE Take note of lower and upper half-bearing assembling positions since in case of reuse they shall be fitted in the same position found at removal.

Figure 40



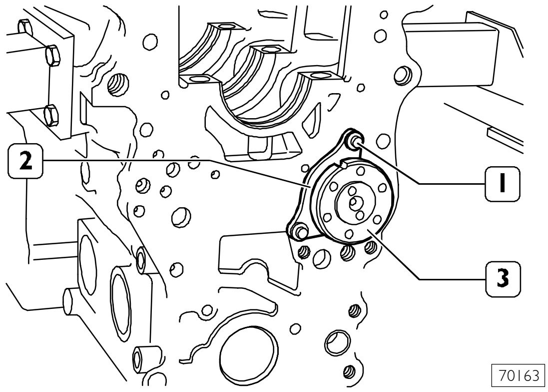
Use tool 99360500 (1) and hoist to remove the output shaft (2) from the block.

Figure 41



Remove the main half-bearings (1).
Remove the screws (2) and remove the oil nozzles (3).

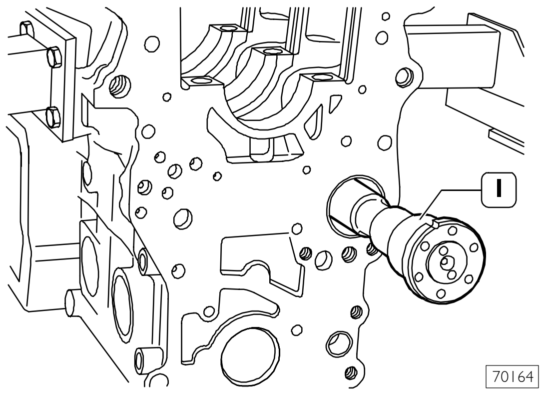
Figure 42



Remove the screws (1) and disconnect camshaft (3) retaining plate (2).

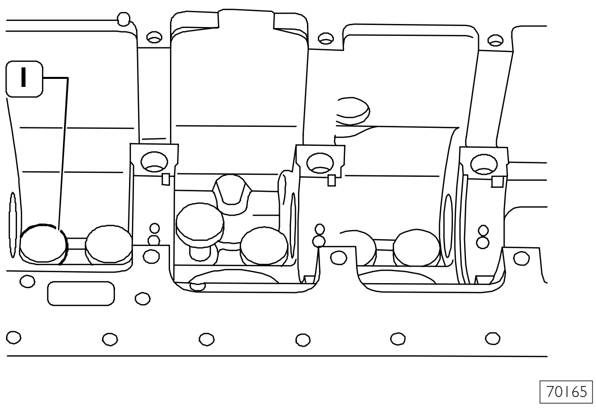
NOTE Take note of plate (2) assembling position.

Figure 43



Withdraw carefully the camshaft (1) from the engine block.

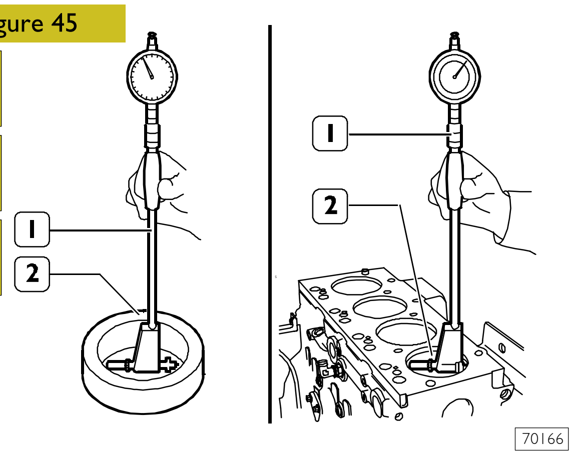
Figure 44



Withdraw the tappets (1) from the engine block.

REPAIR OPERATIONS
540410 CYLINDER UNIT
540420 Checks and measurements

Figure 45



Once engine is disassembled, clean accurately the cylinder-block assembly.

Use the proper rings to handle the cylinder unit.

The engine block shall not show cracks.

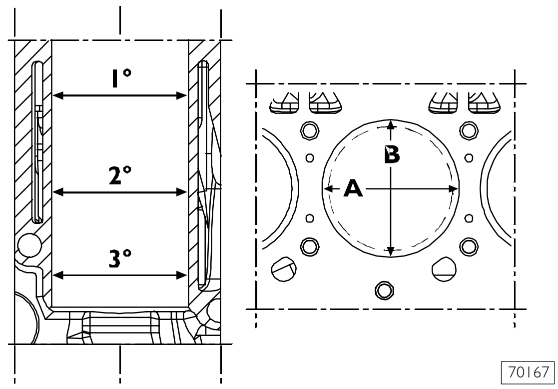
Check operating plug conditions and replace them in case of uncertain seal or if rusted.

Inspect cylinder barrel surfaces; they shall be free from seizing, scores, ovalisation, taper or excessive wear.

Inspection of cylinder barrel bore to check ovalisation, taper and wear shall be performed using the bore dial gauge 99395687 (1) fitted with the dial gauge previously set to zero on the ring gauge (2) of the cylinder barrel diameter.

NOTE Should the ring gauge be not available, use a micrometer for zero-setting.

Figure 46



Measurements shall be performed on each cylinder, at three different heights in the barrel and on two planes perpendicular with each other: one parallel to the longitudinal axis of the engine (A), and the other perpendicular (B). Maximum wear is usually found on plane (B) in correspondence with the first measurement.

Should ovalisation, taper or wear be found, bore and grind the cylinder barrels. Cylinder barrel regrinding shall be performed according to the spare piston diameter oversized by 0.5 mm and to the specified assembling clearance.

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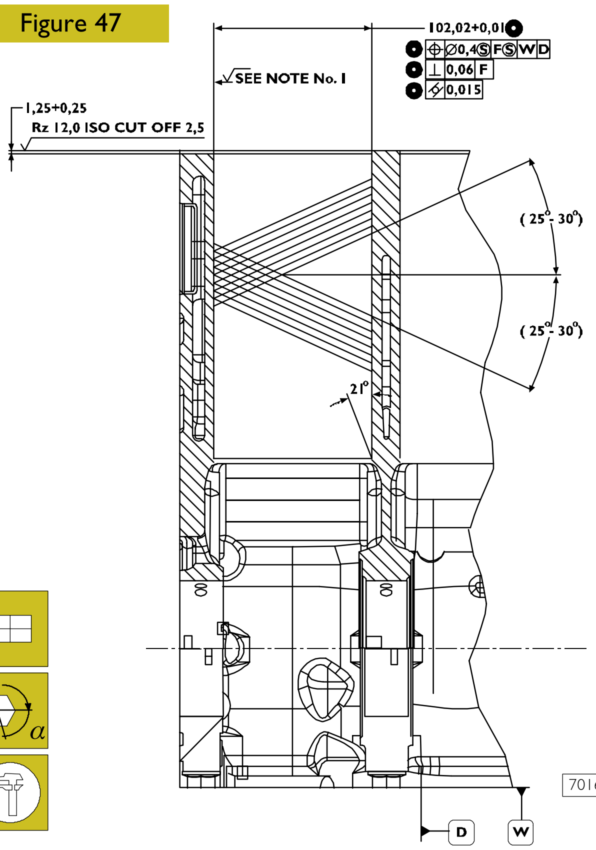
Figure 47



NOTE In case of regrinding, all barrels shall have the same oversize (0.5 mm).

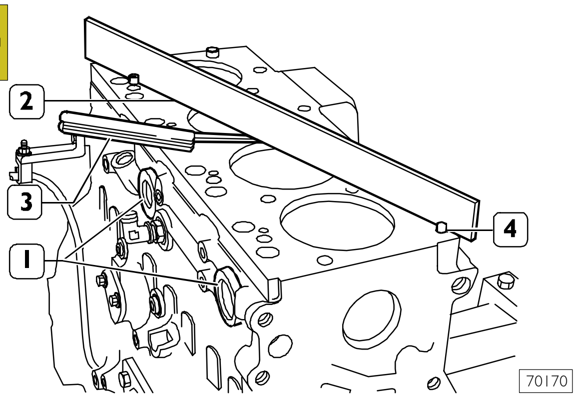
Check main bearing housings as follows:

- ❑ fit the main bearings caps on the supports without bearings;
- ❑ tighten the fastening screws to the specified torque;
- ❑ use the proper internal gauge to check whether the housing diameter is falling within the specified value.

Replace if higher value is found.

Checking head supporting surface on cylinder unit

Figure 48



Check absence of distortions on the head supporting surface on the cylinder unit.

This check can be performed after removing dowels (4), with a calibrated rule (2) and a feeler gauge (3).

After finding the distortion areas, level the surface using a grinder.

Planarity error shall not exceed 0.075 mm.

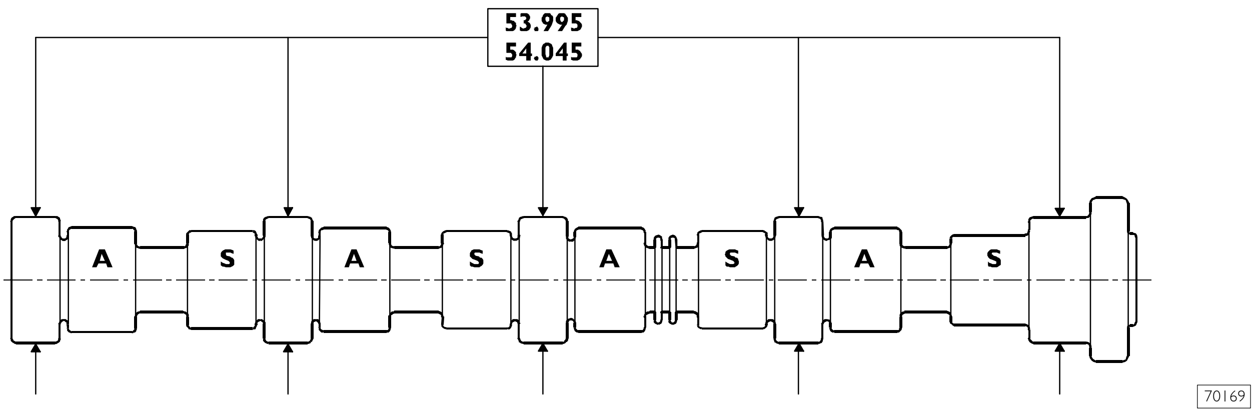
Block levelling shall be performed only after checking that piston protrusion from the cylinder barrel is not exceeding the specified value.

Check cylinder unit operating plug (1) conditions, replace them in case of uncertain seal or if rusted.

When levelling is completed, reset cylinder barrel chamfer as shown in the figure.

5412 TIMING SYSTEM
541210 Camshaft

Figure 49



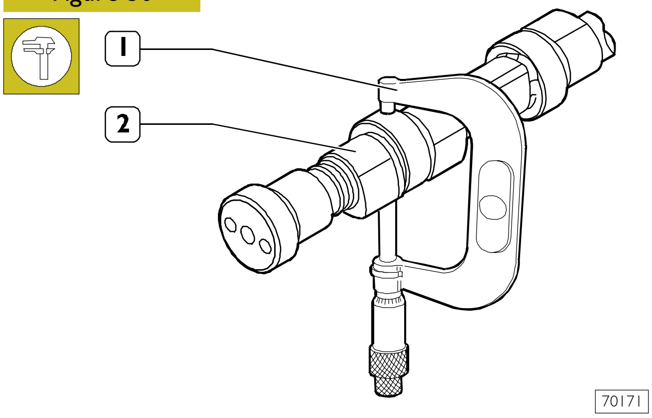
CAMSHAFT MAIN DATA
Specified data refer to pin standard diameter

Camshaft pin and cam surfaces shall be absolutely smooth; if they show any traces of seizing or scoring replace the camshaft and the bushes.

541211 Checking cam lift and pin alignment

Set the camshaft on the tailstock and using a 1/100 gauge set on the central support, check whether the alignment error is not exceeding 0.04 mm, otherwise replace the camshaft. Check cam lift; found values shall be: 6.045 mm for exhaust cams and 7.582 mm for intake cams, in case of different values replace the camshaft.

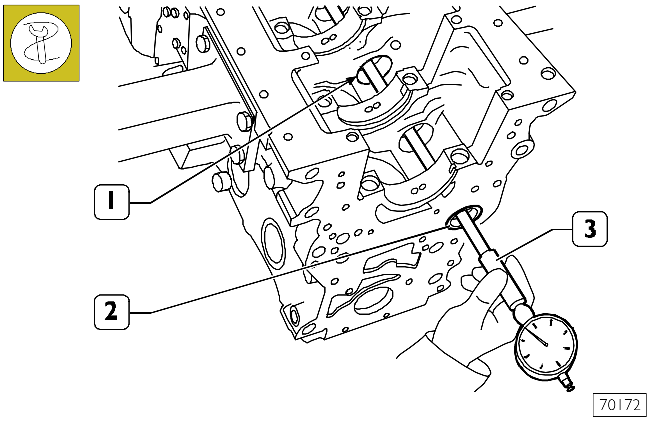
Figure 50



Check camshaft (2) pin diameter using micrometer (1) on two perpendicular axes.

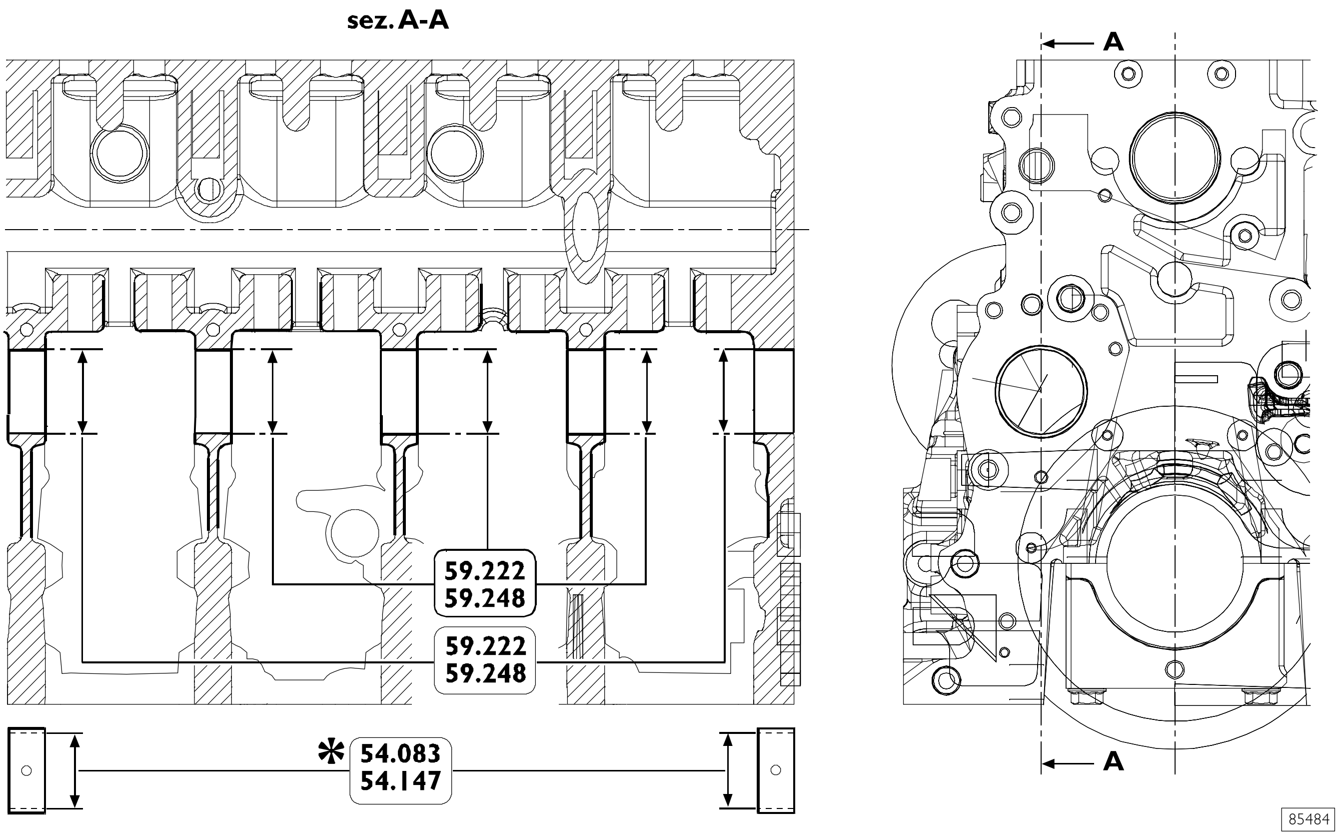
541213 BUSHES

Figure 51



Camshaft bushes (2) shall be pressed into their housings. Internal surfaces must not show seizing or wear.
Use bore dial gauge (3) to measure camshaft front and rear bush (2) and intermediate housing (1) diameter.
Measurements shall be performed on two perpendicular axes.

Figure 52

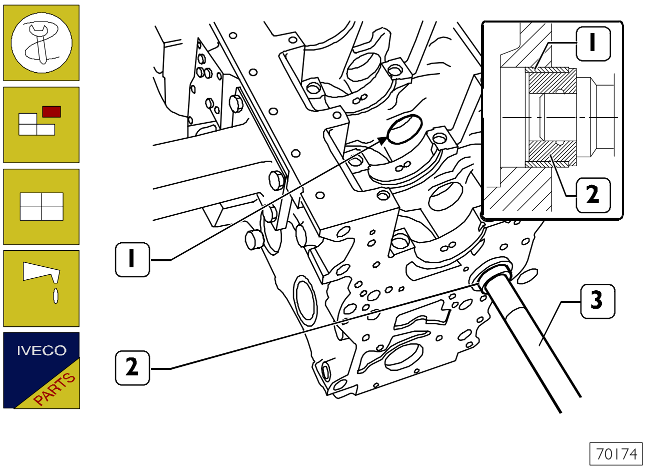


CAMSHAFT BUSH AND HOUSING MAIN DATA
* Value to be obtained after driving the bushes.

 Print 603.93.381

541213 Bush replacement

Figure 53

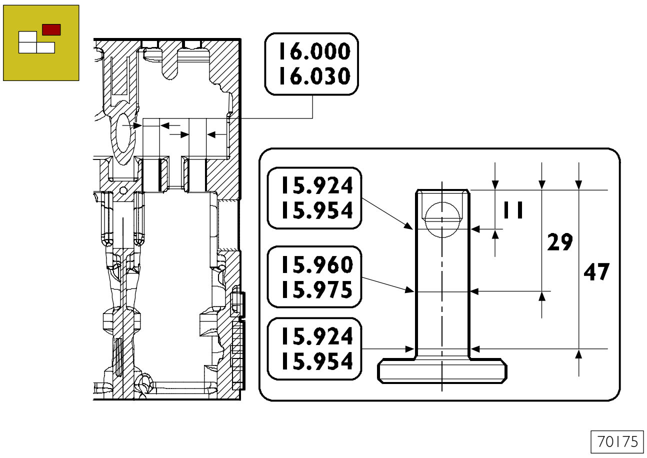


To replace front and rear bushes (1), remove and refit them using the beater 99360362 (2) and the handgrip 99370006 (3).

NOTE When refitting the bushes (1), direct them to make the lubricating holes (2) coincide with the holes on the block housings.

541224 Tappets

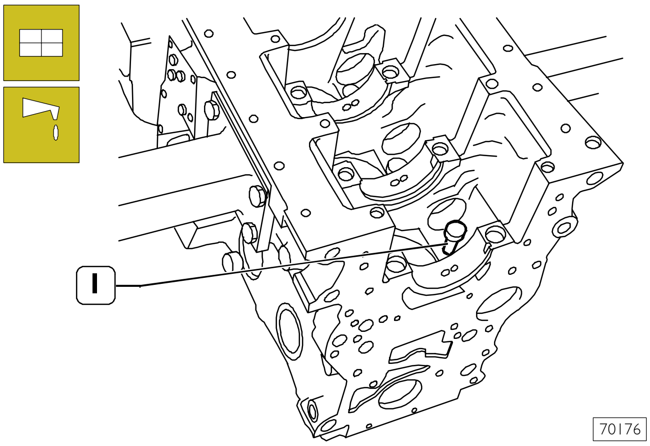
Figure 54



MAIN DATA CONCERNING THE TAPPETS AND THE RELEVANT HOUSINGS ON THE ENGINE BLOCK

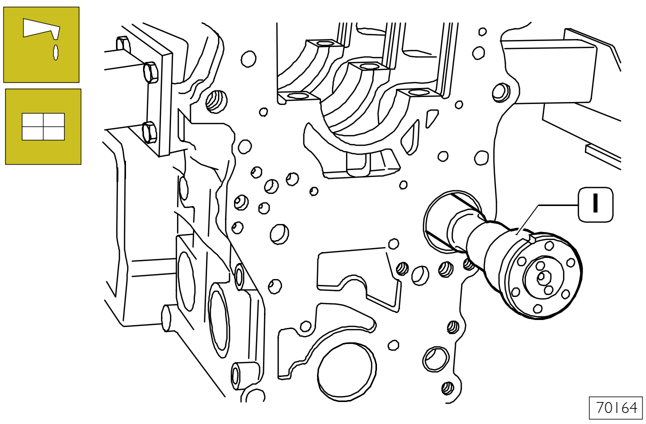
Fitting tappets – camshaft

Figure 55



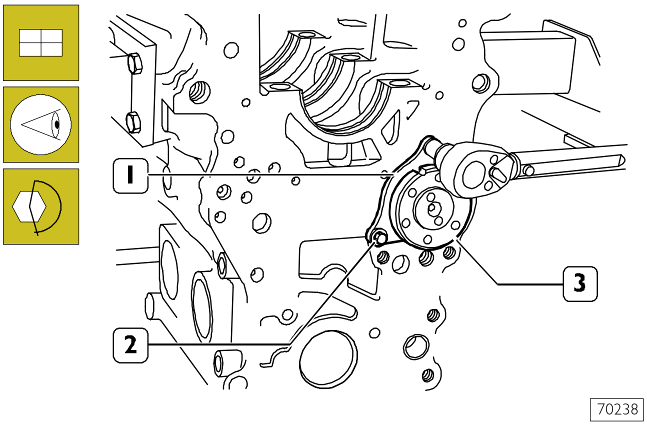
Lubricate the tappets (1) and fit them into the relevant housings on the engine block.

Figure 56



Lubricate the camshaft bushes and fit the camshaft (1) taking care not to damage the bushes or the housings.

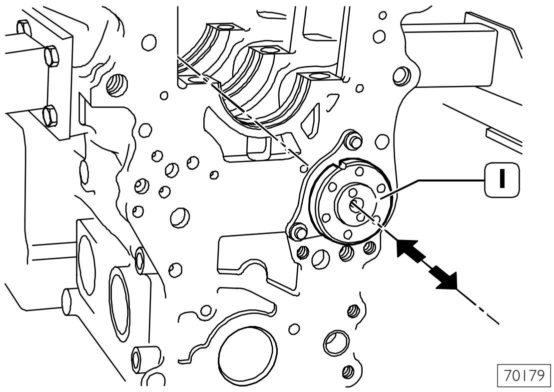
Figure 57



Set camshaft (3) retaining plate (1) with the slot facing the top of the engine block and the marking facing the operator, then tighten the screws (2) to the specified torque.

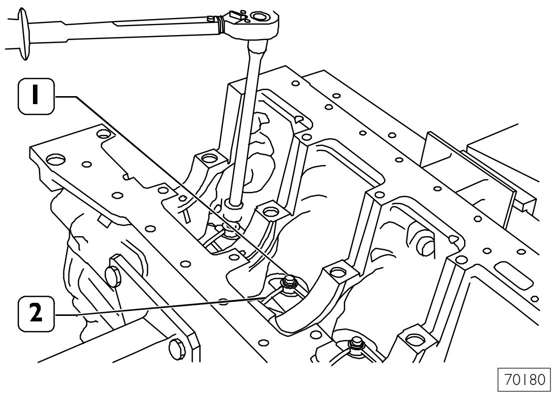
Print 603.93.381

Figure 58



Check camshaft end float (1).
It shall be 0.23 ± 0.13 mm.

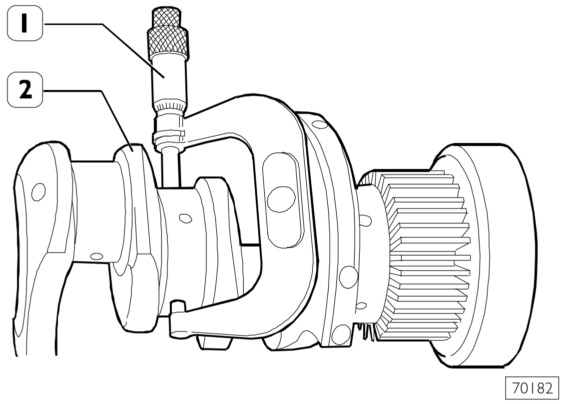
Figure 59



Fit nozzles (2) and tighten the fastening screws (1) to the specified torque.

5408 OUTPUT SHAFT
540810 Measuring journals and crankpins

Figure 60



Grind journals and crankpins if seizing, scoring or excessive ovalisation are found. Before grinding the pins (2) measure them with a micrometer (1) to decide the final diameter to which the pins are to be ground.

NOTE It is recommended to insert the found values in the proper table.
See Figure 61.

Undersize classes are:

Journals and crankpins shall always be ground to the same undersize class.
Journals and crankpins undersize shall be marked on the side of the crank arm No.1.
For undersized crankpins: letter M
For undersized journals: letter B
For undersized crankpins and journals: letters MB

Figure 61

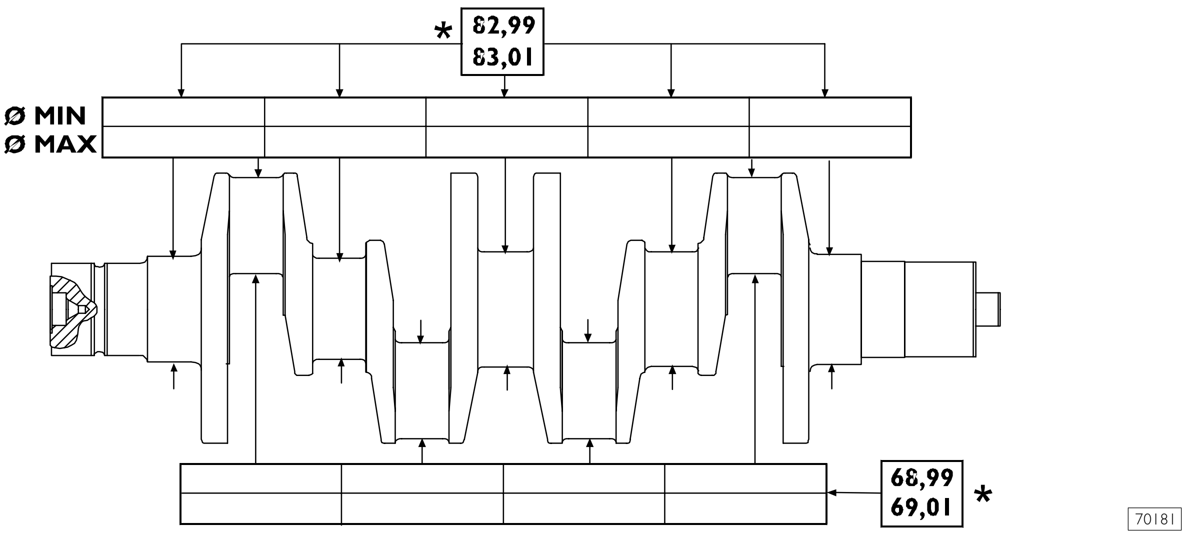
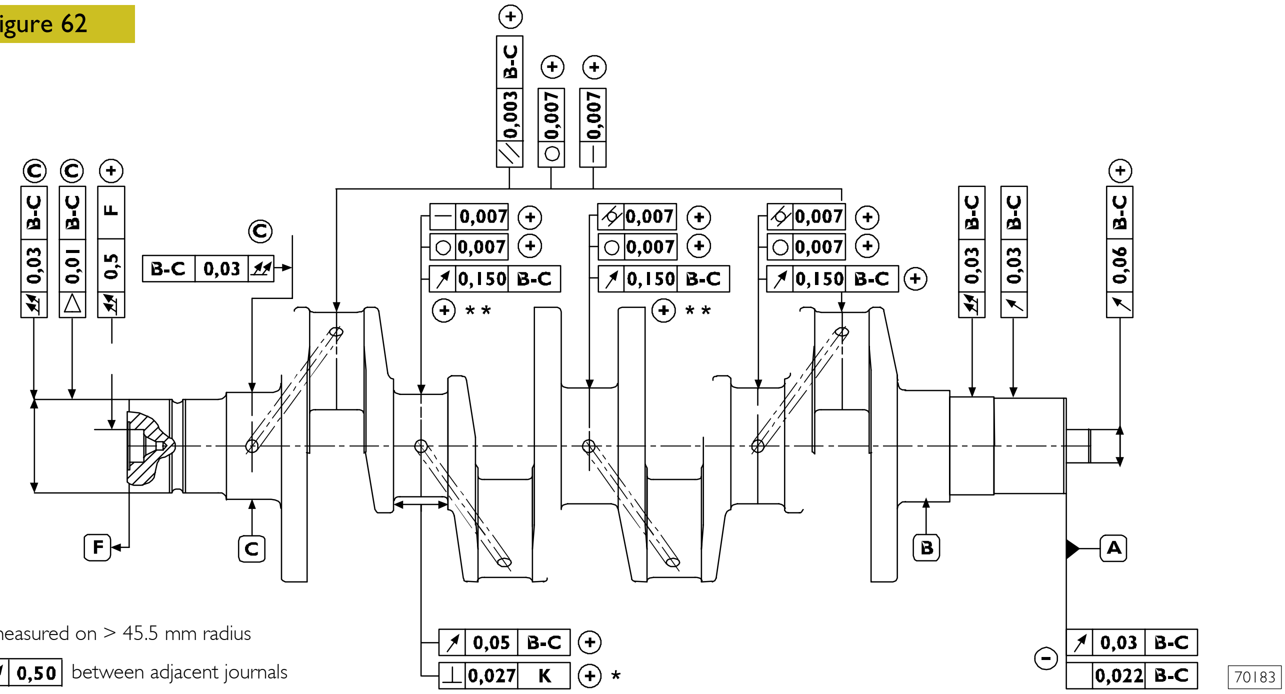


TABLE FOR VALUES RESULTING FROM ENGINE SHAFT MAIN JOURNAL AND CONNECTING ROD PIN MEASUREMENT
* nominal value

Figure 62



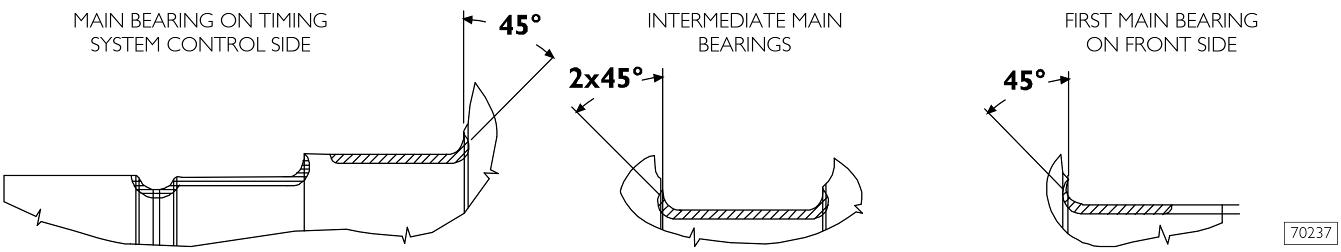
* measured on > 45.5 mm radius

** 0,50 between adjacent journals

OUTPUT SHAFT MAIN TOLERANCES

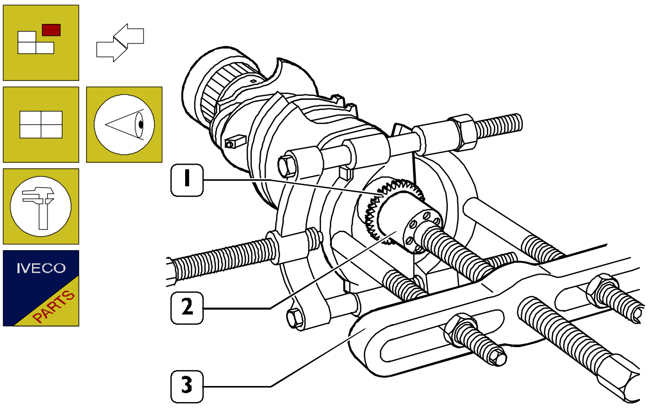
TOLERANCES	TOLERANCE CHARACTERISTIC	GRAPHIC SYMBOL
SHAPE	Roundness	○
	Cilindricity	/○/
DIRECTION	Parallelism	//
	Verticality	⊥
	Straightness	—
POSITION	Concentricity or coaxiality	⊚
OSCILLATION	Circular oscillation	↗
	Total oscillation	⇗⇗
	Taper	—▷—

LEVELS OF IMPORTANCE FOR PRODUCT CHARACTERISTICS	GRAPHIC SYMBOL
CRITICAL	©
IMPORTANT	⊕
SECONDARY	⊖



549215 Replacing oil pump control gear

Figure 63



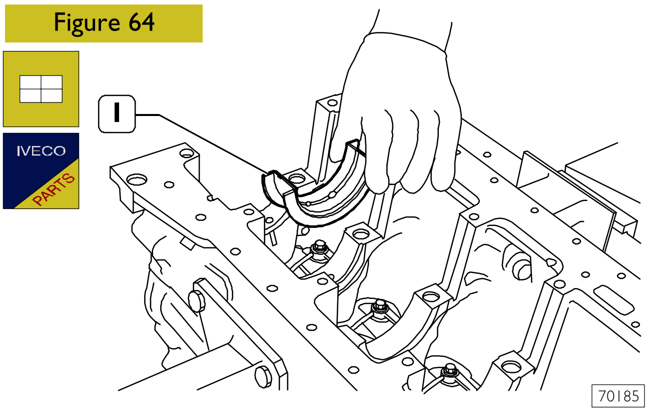
70184

Check that gear toothing (1) is not damaged or worn, otherwise remove it using the proper puller (3).

When fitting the new gear, heat it to 180 °C for 10 minutes in an oven and then key it to the output shaft.

Fitting main bearings

Figure 64



70185

NOTE Refit the main bearings that have not been replaced, in the same position found at removal.

Main bearings (1) are supplied spare with 0.250 – 0.500 mm undersize on the internal diameter.

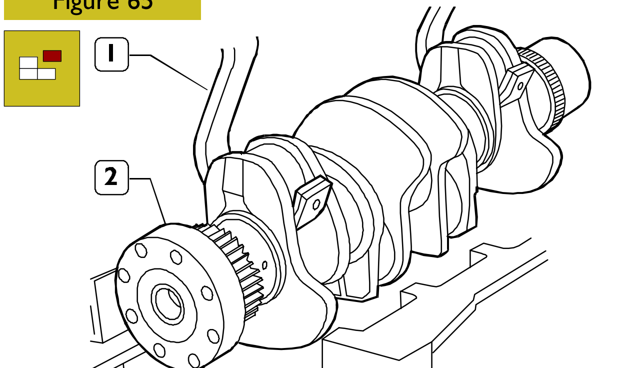
NOTE Do not try to adapt the bearings.

Clean accurately the main half bearings (1) having the lubricating hole and fit them into their housings.

The second last main half bearing (1) is fitted with shoulder half rings.

540811 Finding journal clearance

Figure 65

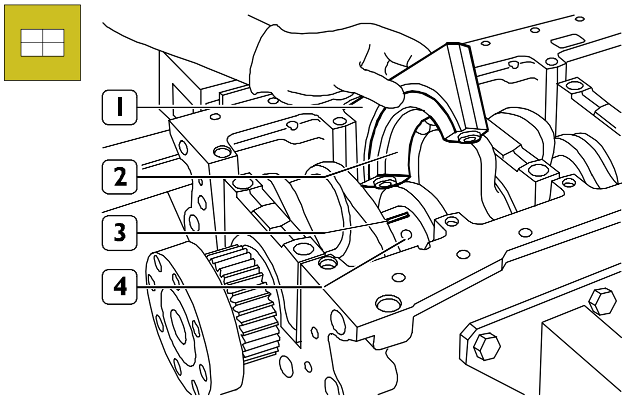


70161

Refit the output shaft (2).

Check the backlash between output shaft main journals and the relevant bearings as follows:

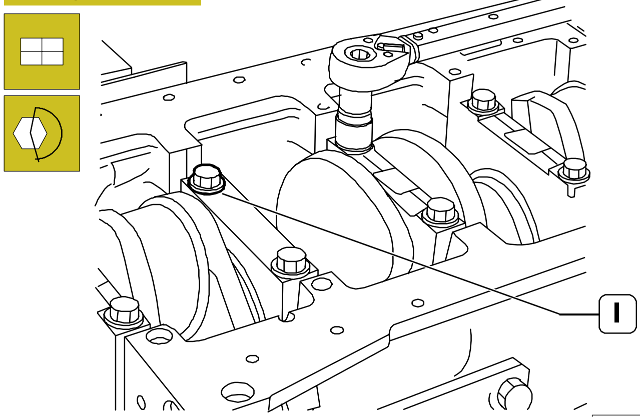
Figure 66



70186

- ❑ clean accurately the parts and remove any trace of oil;
- ❑ position a piece of calibrated wire (3) on the output shaft pins (4) so that it is parallel to the longitudinal axis;
- ❑ fit caps (1), including the half bearings (2) on the relevant supports.

Figure 67

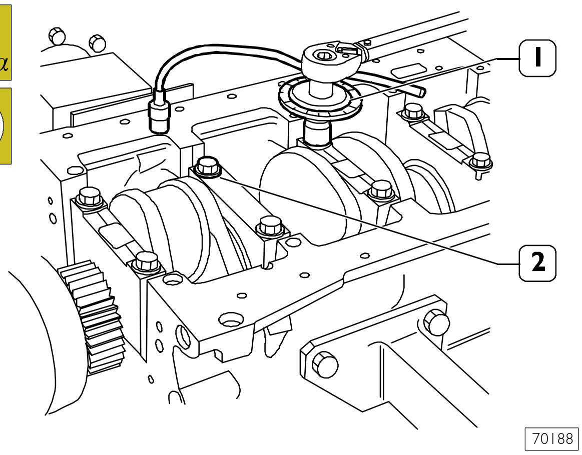


70187

Tighten the pre-lubricated screws (1) in the following three successive stages:

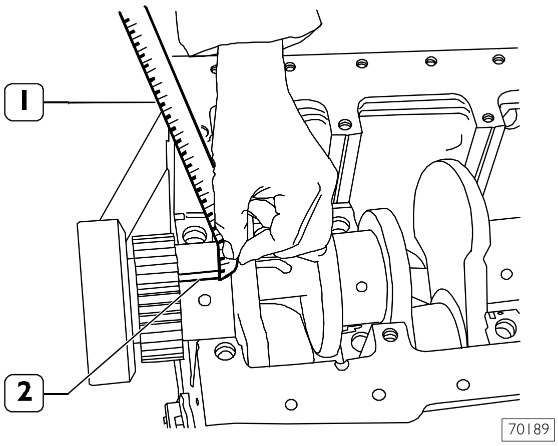
- ❑ 1st stage, with dynamometric wrench to 50 ± 6 Nm.
- ❑ 2nd stage, with dynamometric wrench to 80 ± 6 Nm.

Figure 68



❑ 3rd stage, with tool 99395216 (1) set as shown in the figure, tighten the screws (2) with 90° ± 5° angle.

Figure 69



❑ Remove caps from supports.

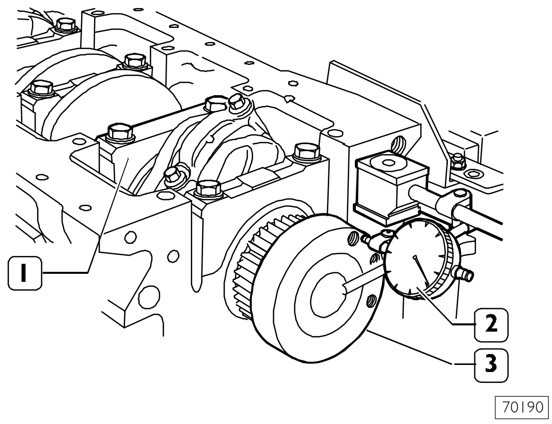
The backlash between the main bearings and the pins is found by comparing the width of the calibrated wire (2) at the narrowest point with the scale on the envelope (1) containing the calibrated wire.

The numbers on the scale indicate the backlash in mm.

Replace the half bearings and repeat the check if a different backlash value is found. Once the specified backlash is obtained, lubricate the main bearings and fit the supports by tightening the fastening screws as previously described.

Checking output shaft shoulder clearance

Figure 70

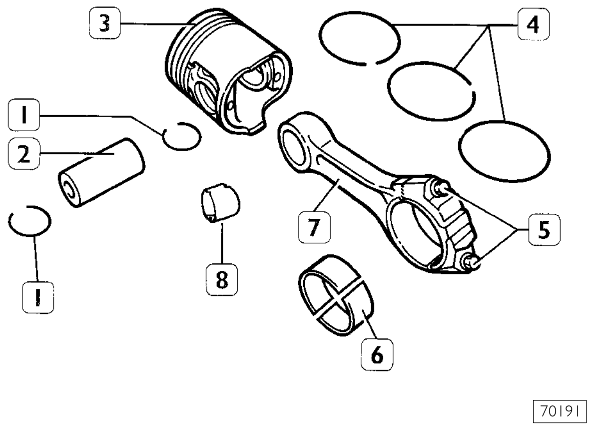


This check is performed by setting a magnetic-base dial gauge (2) on the output shaft (3) as shown in the figure, standard value is 0.068 to 0.41.

If higher value is found, replace main thrust half bearings of the second last rear support (1) and repeat the clearance check between output shaft pins and main half bearings.

540830 CONNECTING ROD – PISTON ASSEMBLY

Figure 71

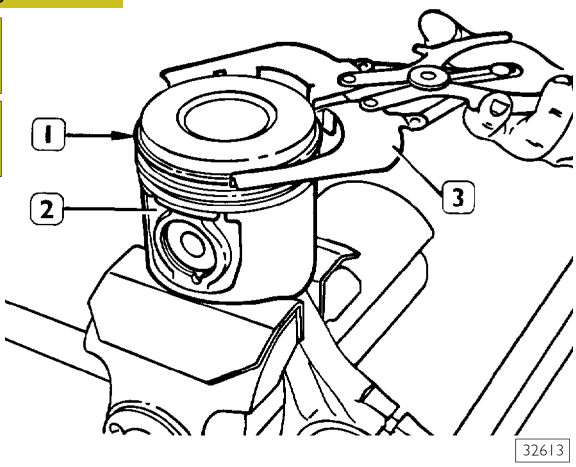


CONNECTING ROD – PISTON ASSEMBLY COMPONENTS

1. Stop rings - 2. Pin - 3. Piston - 4. Split rings - 5. Screws - 6. Half bearings - 7. Connecting rod - 8. Bush.

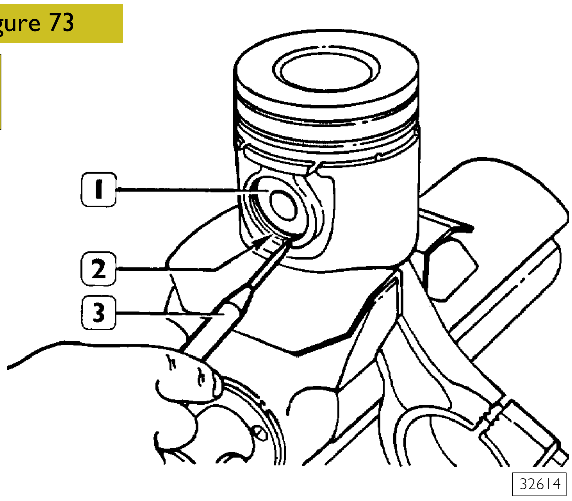
NOTE Pistons are supplied spare with 0.5 mm oversize.

Figure 72



Remove split rings (1) from piston (2) using pliers 99360183 (3).

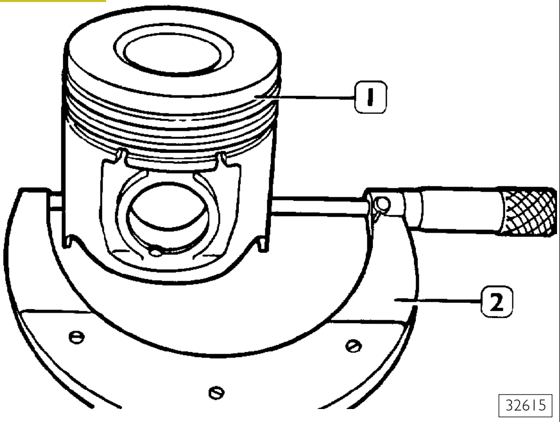
Figure 73



Piston pin (1) split rings (2) are removed using a scriber (3).

540840 Pistons
Measuring piston diameters

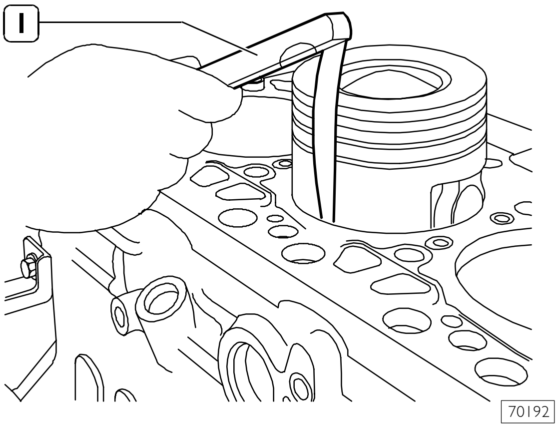
Figure 75



Using a micrometer (2), measure the diameter of the piston (1) to determine the assembly clearance.

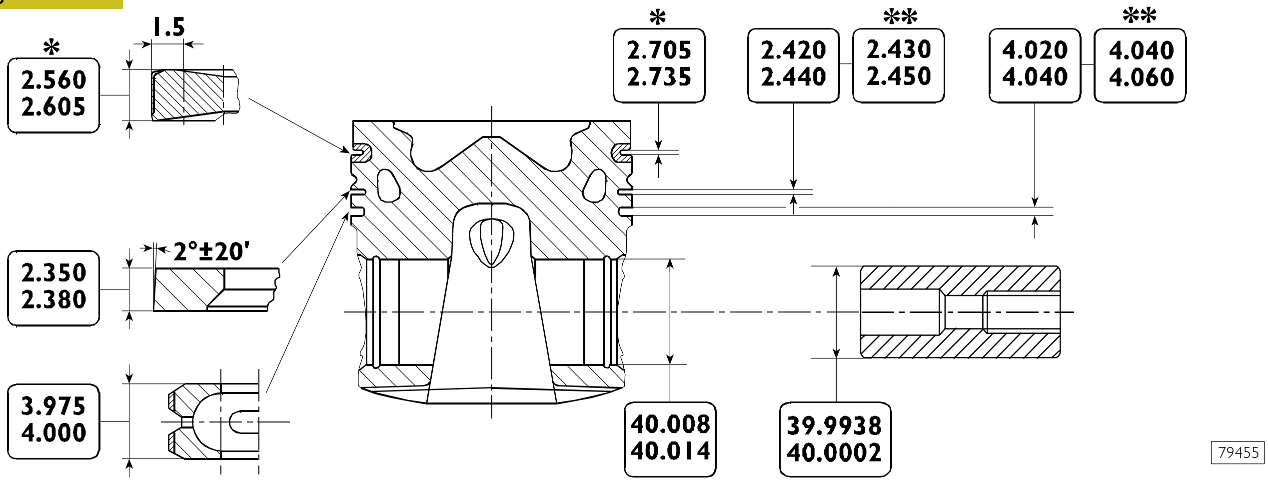
NOTE The diameter shall be measured at 12 mm from the piston skirt.

Figure 76



The clearance between the piston and the cylinder barrel can be checked also with a feeler gauge (1) as shown in the figure.

Figure 74

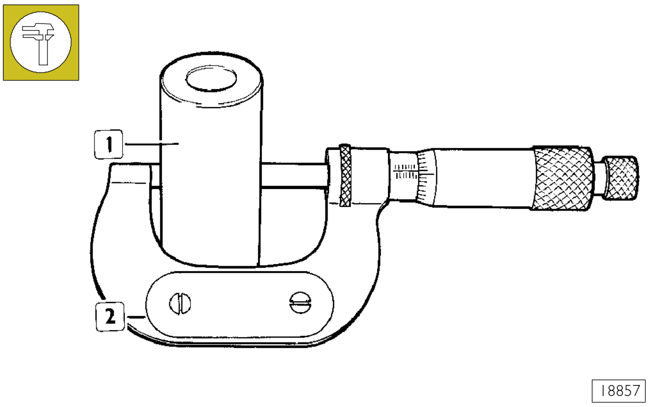


MAIN DATA CONCERNING PISTON, PINS AND SPLIT RINGS

* Value measured on 99 mm diameter
** Engine F4AE0481D

540841 Piston pins

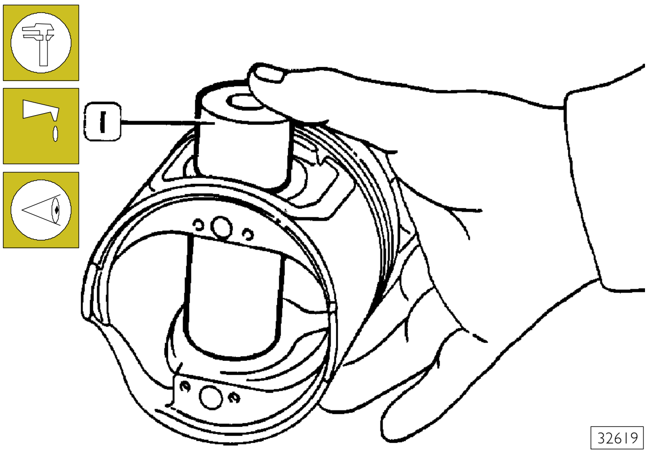
Figure 77



To measure the piston pin (1) diameter use the micrometer (2).

Conditions for proper pin-piston coupling

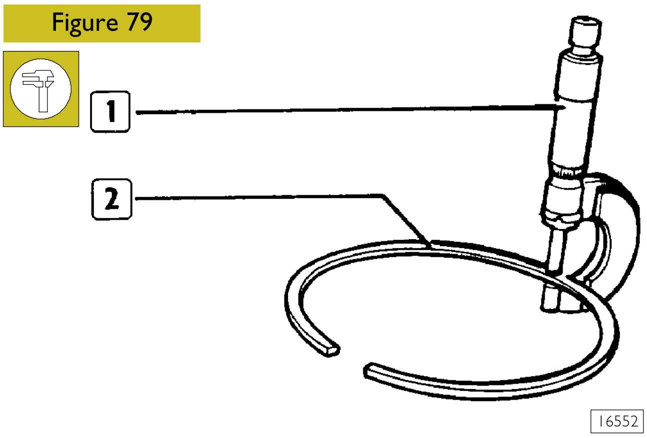
Figure 78



Lubricate the pin (1) and its seat on piston hubs with engine oil; the pin shall be fitted into the piston with a slight finger pressure and shall not be withdrawn by gravity.

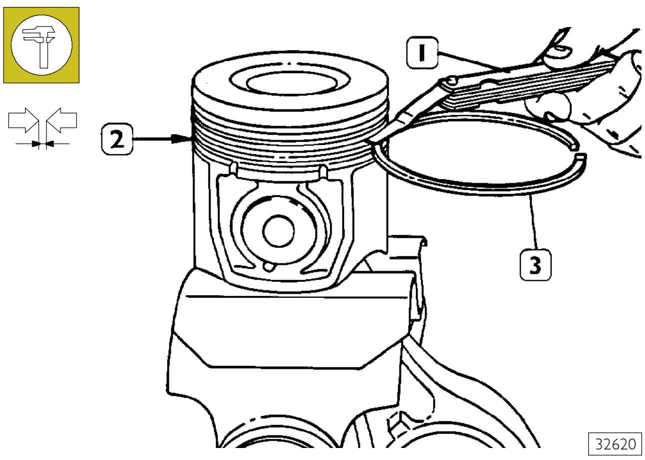
540842 Split rings

Figure 79



Use a micrometer (1) to check split ring (2) thickness.

Figure 80



Check the clearance between the sealing rings (3) of the 2nd and 3rd slot and the relevant housings on the piston (2), using a feeler gauge (1).

Figure 81

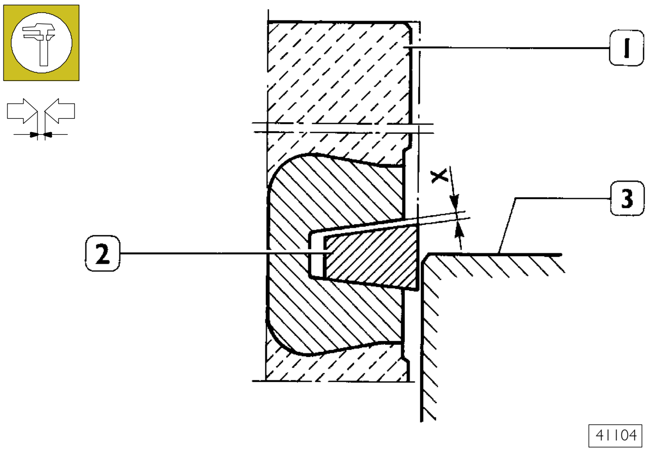
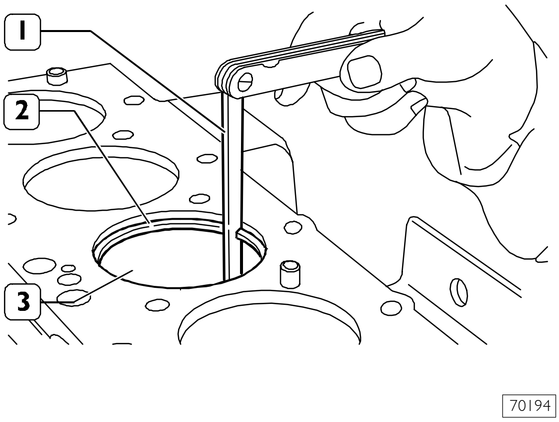


DIAGRAM FOR MEASURING THE CLEARANCE X BETWEEN THE FIRST PISTON SLOT AND THE TRAPEZOIDAL RING

Since the first sealing ring section is trapezoidal, the clearance between the slot and the ring shall be measured as follows: make the piston (1) protrude from the engine block so that the ring (2) protrudes half-way from the cylinder barrel (3).

In this position, use a feeler gauge to check the clearance (X) between ring and slot: found value shall be the specified one.

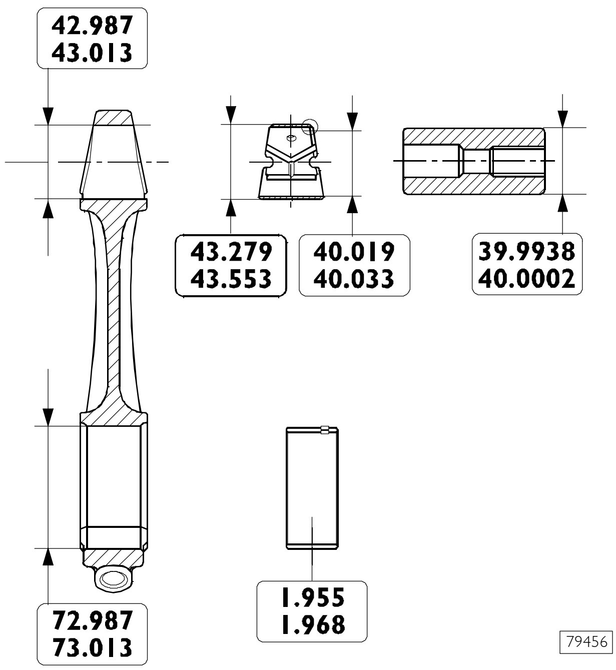
Figure 82



Use feeler gauge (1) to measure the clearance between the ends of the split rings (2) fitted into the cylinder barrel (3).

540830 Connecting rods

Figure 83



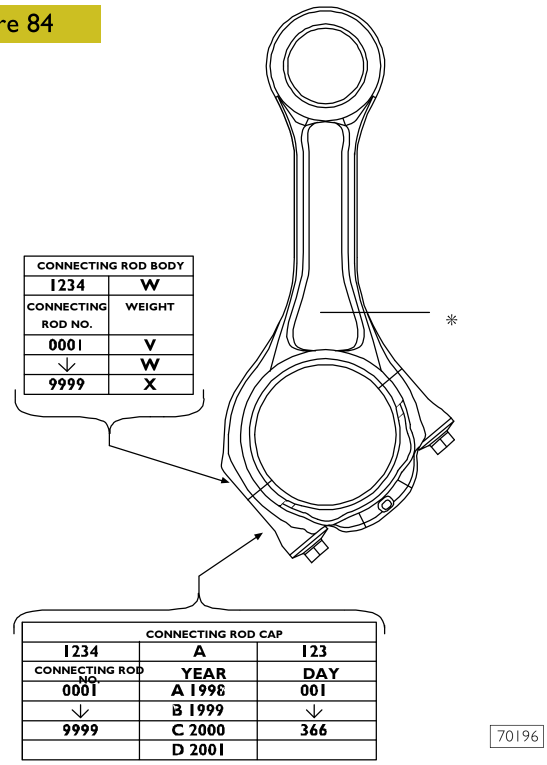
MAIN DATA FOR CONNECTING ROD, BUSH, PISTON PIN AND HALF BEARINGS

* Value for inside diameter to be obtained after driving in connecting rod small end and grinding.

** Value not measurable in released condition

To obtain best coupling the connecting rod-cap coupling surfaces are knurled.
It is therefore recommended to not remove knurling.

Figure 84



Every connecting rod is marked as follows:

- ❑ On body and cap with a number showing their coupling and the corresponding cylinder.
  In case of replacement it is therefore necessary to mark the new connecting rod with the same numbers of the replaced one.
- ❑ On body with a letter showing the weight of the connecting rod assembled at production:
  - V, 1820 to 1860 (yellow marking);
  - W, 1861 to 1900 (green marking);
  - X, 1901 to 1940 (blue marking);

Spare connecting rods are of the W class with green marking *.

Material removal is not allowed.

540834 Bushes

Check that the bush in the connecting rod small end is free from scoring or seizing and that it is not loosen. Otherwise replace.

Removal and refitting shall be performed using the proper beater.

When refitting take care to make coincide the oil holes set on the bush with those set on the connecting rod small end. Grind the bush to obtain the specified diameter.

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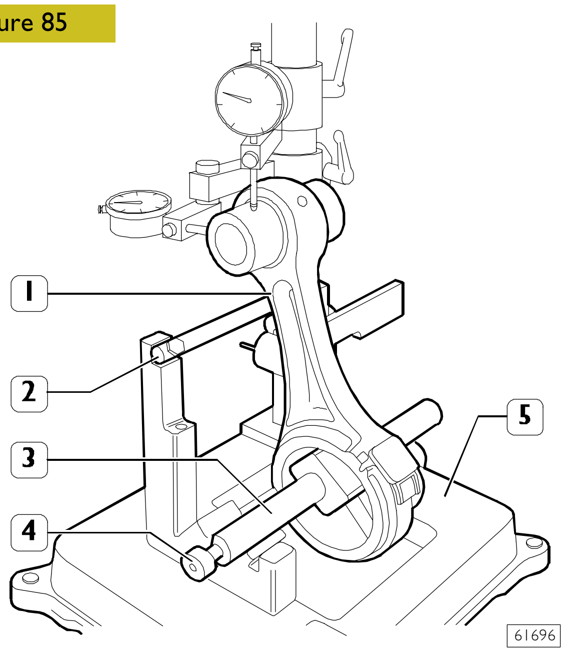
Checking connecting rods

Figure 85

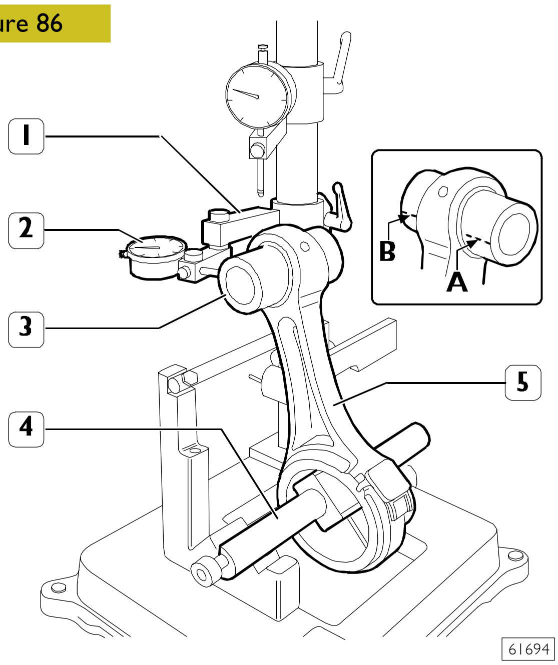


Check that the axes of the connecting rods (1) are parallel using tool 99395363 (5) as follows:

- ❑ fit the connecting rod (1) on tool 99395363 (5) spindle and lock it with screw (4);
- ❑ set the spindle (3) on V-blocks by resting the connecting rod (1) on the stop bar (2).

Checking torsion

Figure 86

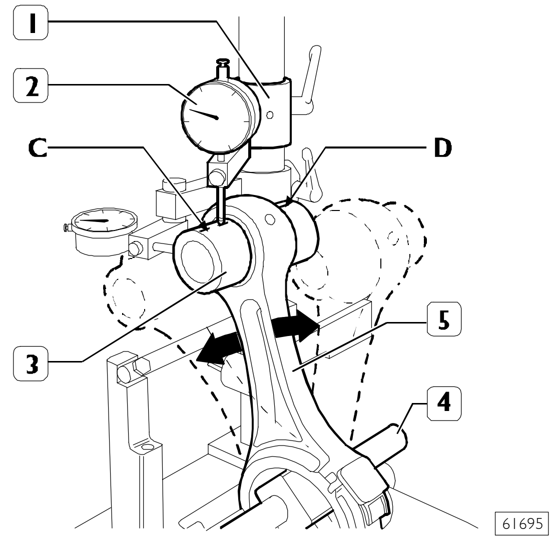


Check connecting rod (5) torsion by comparing two points (A and B) of pin (3) on the horizontal plane of the connecting rod axis.

Position the dial gauge (2) support (1) to obtain a preload of approx. 0.5 mm on the pin (3) in point A and then set the dial gauge (2) to zero. Move the spindle (4) with the connecting rod (5) and compare any deviation on the opposite side (B) of the pin (3): the difference between A and B shall not exceed 0.08 mm.

Checking bending

Figure 87



Check connecting rod (5) bending by comparing two points C and D of the pin (3) on the vertical plane of the connecting rod axis.

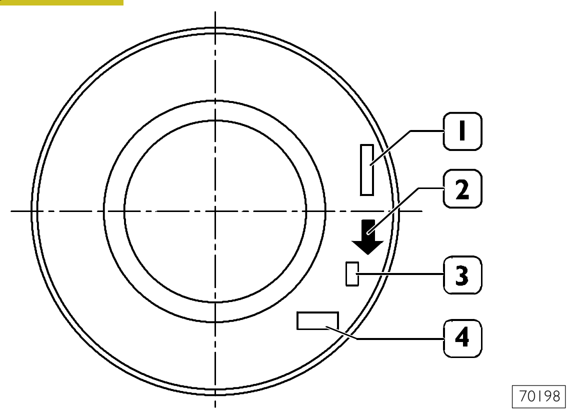
Position the vertical support (1) of the dial gauge (2) to rest the latter on pin (3), point C.

Move the connecting rod forwards and backwards to find pin top position, then in this condition reset the dial gauge (2).

Move the spindle with the connecting rod (5) and repeat the check of the top point on the opposite side D of the pin (3). The difference between point C and point D shall not exceed 0.08 mm.

Fitting connecting rod-piston assembly Connecting rod-piston coupling

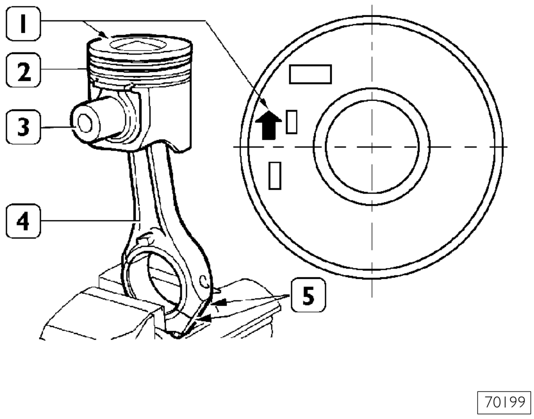
Figure 88



The piston crown is marked as follows:

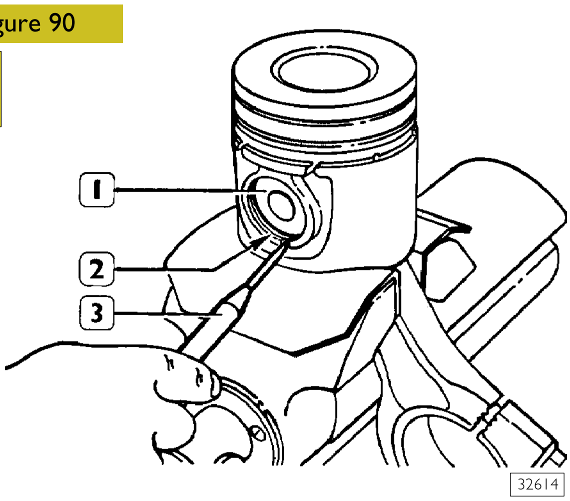
1. Part number and design modification number;
2. Arrow showing piston assembling direction into cylinder barrel, this arrow shall face the front key of the engine block;
3. Marking showing 1st slot insert testing;
4. Manufacturing date.

Figure 89



Connect piston (2) to connecting rod (4) with pin (3) so that the reference arrow (1) for fitting the piston (2) into the cylinder barrel and the numbers (5) marked on the connecting rod (5) are read as shown in the figure.

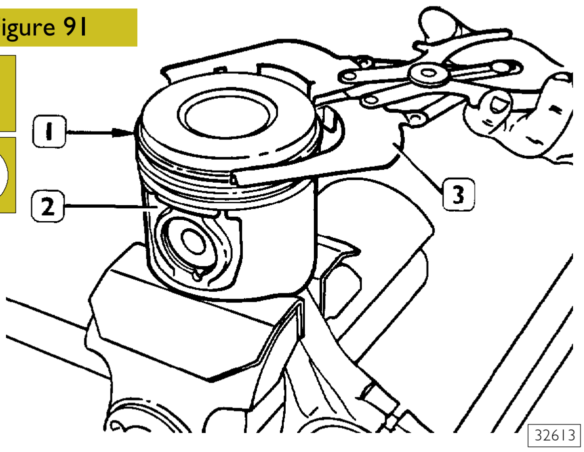
Figure 90



Position the piston (1) on the connecting rod according to the diagram shown in the figure, fit the pin (3) and stop it by the split rings (2).

Fitting split rings

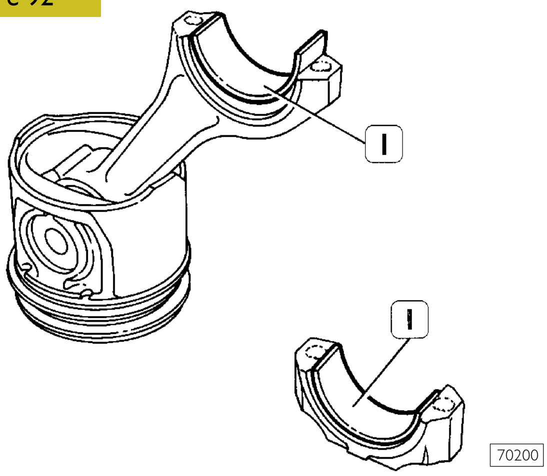
Figure 91



Use pliers 99360183 (3) to fit the split rings (1) on the piston (2).
Split rings shall be fitted with the marking "TOP" facing upwards and their openings shall be displaced with each other by 120°.

Split rings are supplied spare with the following sizes:
- standard, yellow marking;
- 0.5 mm oversize, yellow/green marking;

Figure 92

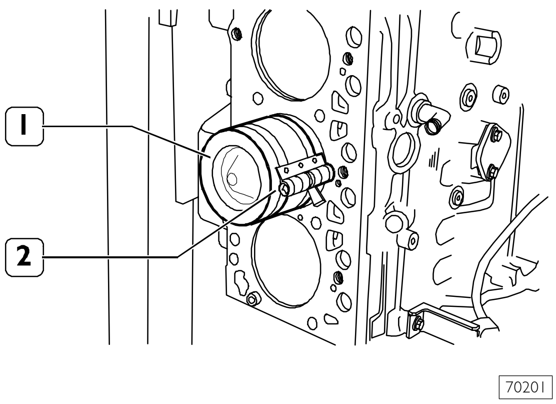


Fit half bearings (1) on connecting rod and cap.

NOTE Refit the main bearings that have not been replaced, in the same position found at removal. Do not try to adapt the half bearings.

Fitting connecting rod-piston assembly into cylinder barrels

Figure 93



Lubricate accurately the pistons, including the split rings and the cylinder barrel inside.
Use band 99360605 (2) to fit the connecting rod-piston assembly (1) into the cylinder barrels and check the following:

- ❑ the number of each connecting rod shall correspond to the cap coupling number.

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Figure 94

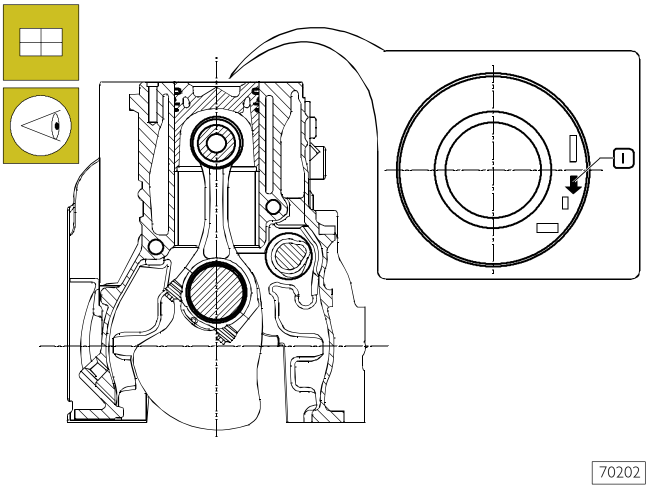
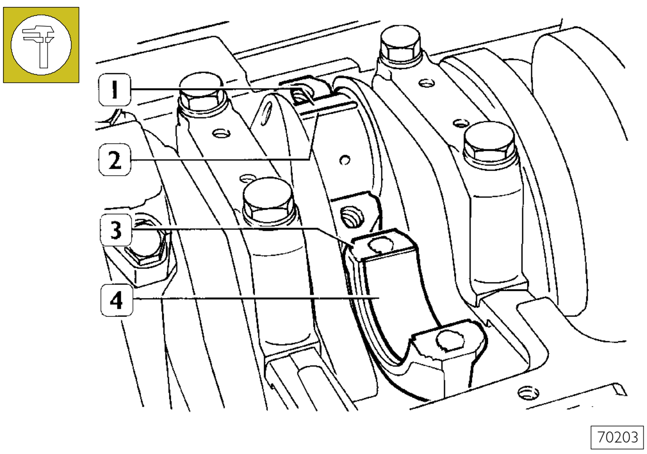


DIAGRAM FOR CONNECTING ROD-PISTON ASSEMBLY FITTING INTO BARREL

- Split ring openings shall be displaced with each other by 120°;
- connecting rod-piston assemblies shall have the same weight;
- the arrow marked on the piston crown shall be facing the front side of the engine block or the slot obtained on the piston skirt shall be corresponding to the oil nozzle position.

540831 Finding crankpin clearance

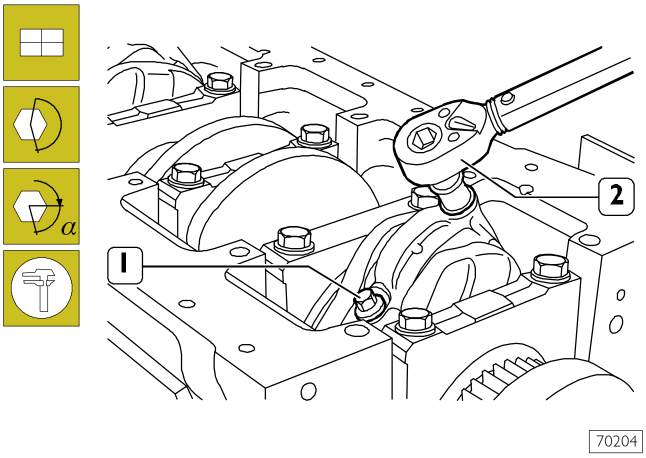
Figure 95



To measure the clearance proceed as follows:

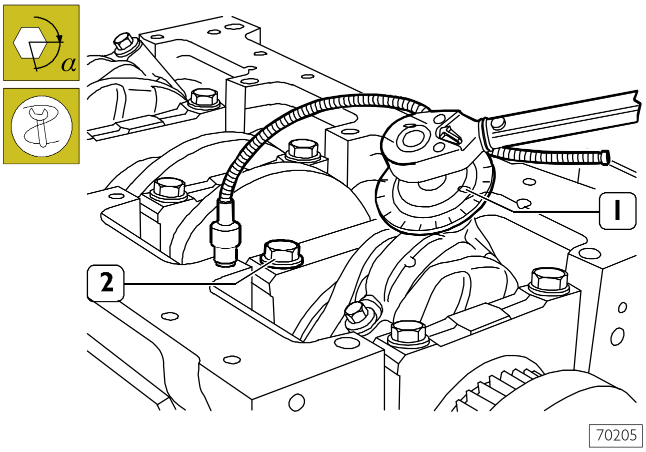
- clean the parts accurately and remove any trace of oil;
- set a piece of calibrated wire (2) on the output shaft pins (1);
- fit the connecting rod caps (3) with the relevant half bearings (4).

Figure 96



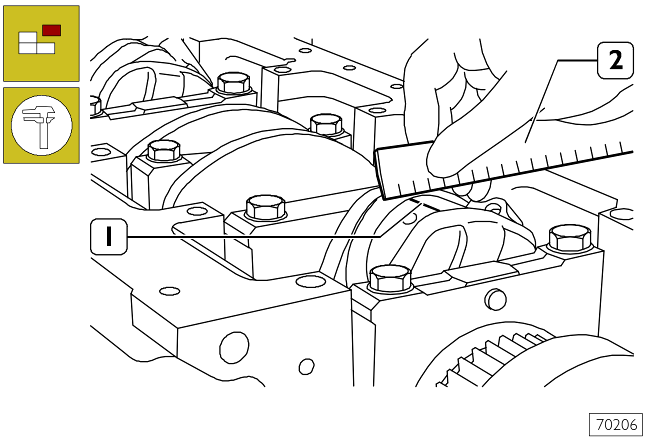
- Lubricate the screws (1) with engine oil and then tighten them to the specified torque using the dynamometric wrench (2).

Figure 97



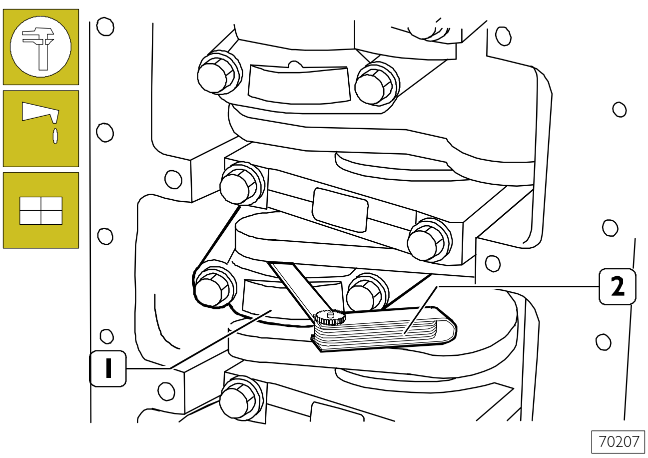
- Apply tool 99395216 (1) to the socket wrench and tighten screws (2) of 60°.

Figure 98



- Remove the cap and find the existing clearance by comparing the calibrated wire width (1) with the scale on the wire envelope (2).

Figure 99



If a different clearance value is found, replace the half bearings and repeat the check.

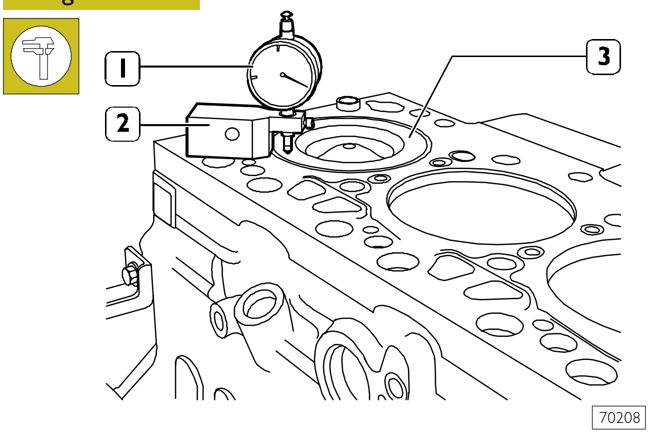
Once the specified clearance has been obtained, lubricate the main half bearings and fit them by tightening the connecting rod cap fastening screws to the specified torque.

> ⚠ Before the final fitting of the connecting rod cap fastening screws, check that their diameter measured at the centre of the thread length is not < 0.1 mm than the diameter measured at approx. 10 mm from screw end.

Check manually that the connecting rods (1) are sliding axially on the output shaft pins and that their end float, measured with feeler gauge (2) is 0.10 to 0.33 mm.

Checking piston protrusion

Figure 100

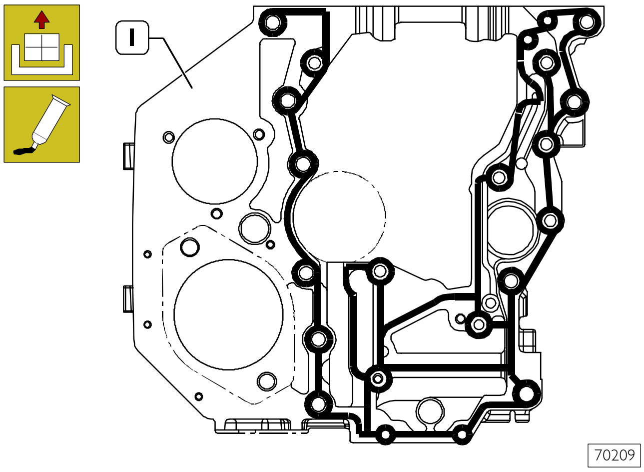


Once connecting rod-piston assemblies refitting is over, use dial gauge 99395603 (1) fitted with base 99370415 (2) to check piston (3) protrusion at T.D.C. with respect to the top of the engine block.

Protrusion shall be 0.28 to 0.52 mm.

Timing gear case

Figure 101



LOCTITE 5205 SEALANT APPLICATION AREAS

Clean accurately the timing gear case (1) and the engine block.

Perfect seal is only obtained by cleaning accurately the surface to seal.

Smear the case with LOCTITE 5205 to obtain a bead of few mm diameter.

It shall be uniform (no clots), without air bubbles, thin areas or discontinuities.

Any imperfection shall be corrected as soon as possible.

Avoid to use excess material to seal the joint.

Excessive sealant could come out from joint sides and cause lubricant passage clogging.

After applying the sealant, the joint shall be assembled immediately (max. 10 minutes).

Figure 102

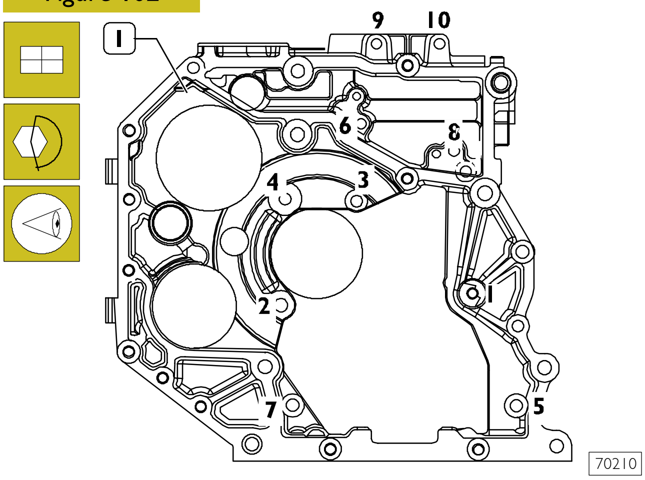


DIAGRAM FOR TIGHTENING THE REAR TIMING GEAR CASE FASTENING SCREWS

Refit the case (1) to the engine block.
Screw the fastening screws in the same position found at removal and tighten them to the following torque values in the sequence shown in the figure:

Screws M12	65 to 89 Nm
Screws M8	20 to 28 Nm
Screws M10	42 to 52 Nm

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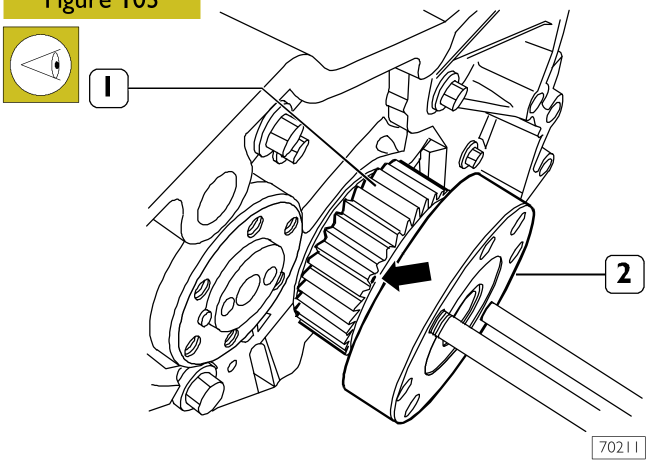
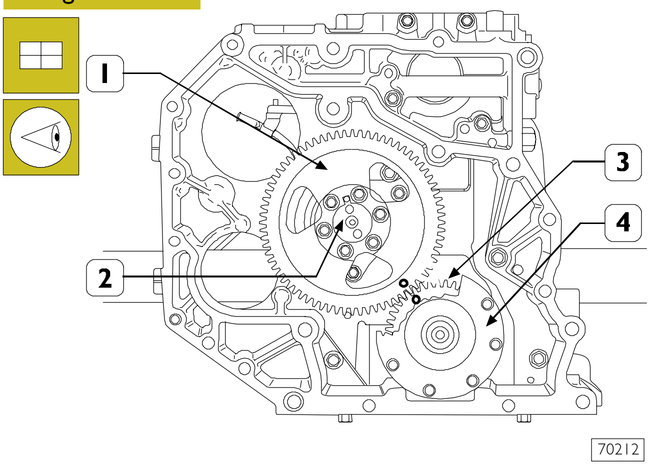
Timing

Figure 103



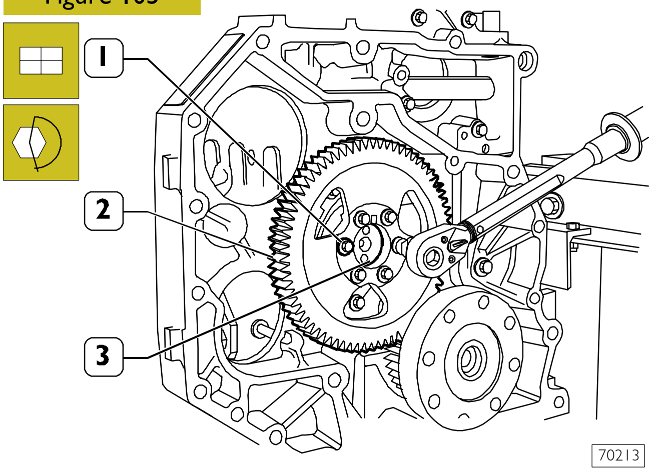
Use a felt pen to mark the driving gear (1) tooth fitted on the output shaft (2) having the mark (→) for timing on the side surface.

Figure 104



Direct the output shaft (4) and the camshaft (2) so that when fitting the driven gear (1) on the camshaft the marks on the gears (1 and 3) are coinciding.

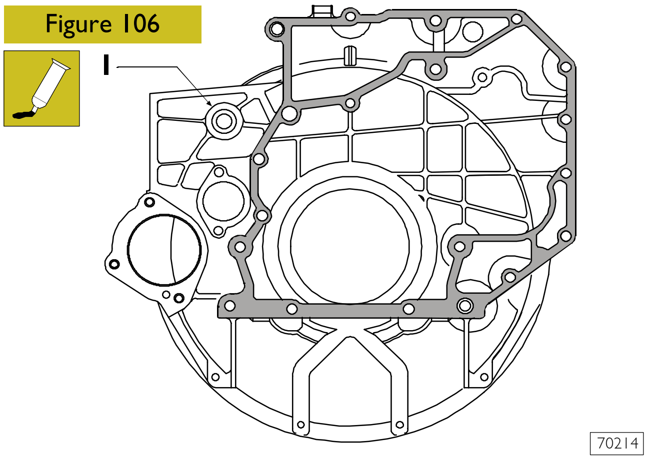
Figure 105



Tighten the screws (1) fastening gear (2) to camshaft (3) to the specified torque.

540460 Flywheel housing

Figure 106



LOCTITE 5205 SEALANT APPLICATION AREAS

Clean accurately the flywheel housing (1) and timing gear case coupling surfaces.

Perfect seal is only obtained by cleaning accurately the surface to seal.

Smear housing (1) with LOCTITE 5205 to obtain a bead of few mm diameter.

It shall be uniform (no clots), without air bubbles, thin areas or discontinuities.

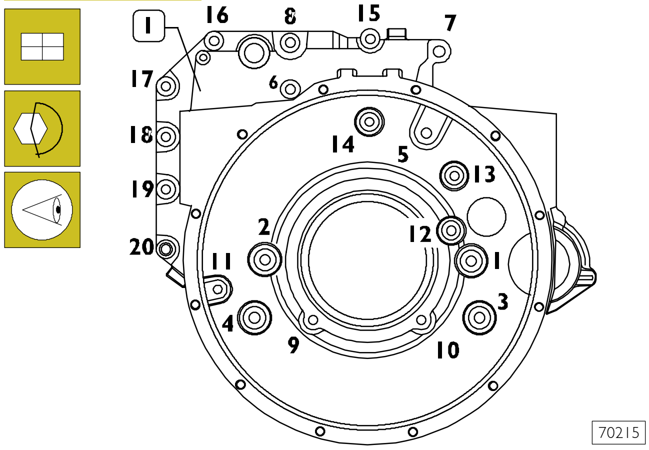
Any imperfection shall be corrected as soon as possible.

Avoid to use excess material to seal the joint.

Excessive sealant could come out from joint sides and cause lubricant passage clogging.

After applying the sealant, the joint shall be assembled immediately (max 10 – 20 minutes).

Figure 107

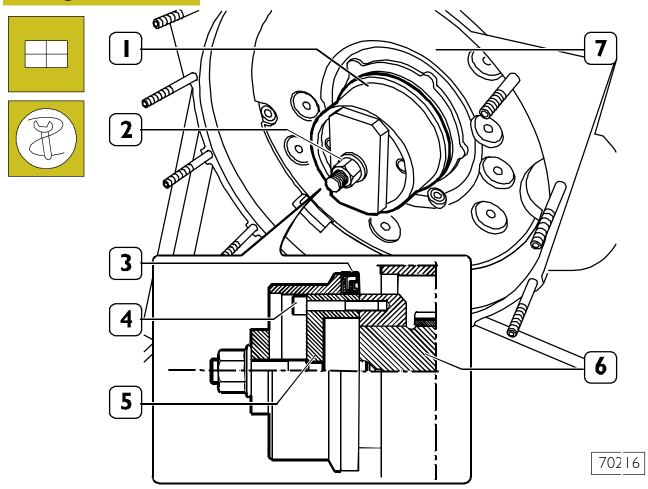


SEQUENCE FOR TIGHTENING THE FLYWHEEL HOUSING FASTENING SCREWS

Refit the housing (1) to the engine block and screw the fastening screws in the same position found at removal and tighten them to the following torque values in the sequence shown in the figure:

Screws M12 75 to 95 Nm
Screws M10 44 to 53 Nm

Figure 108

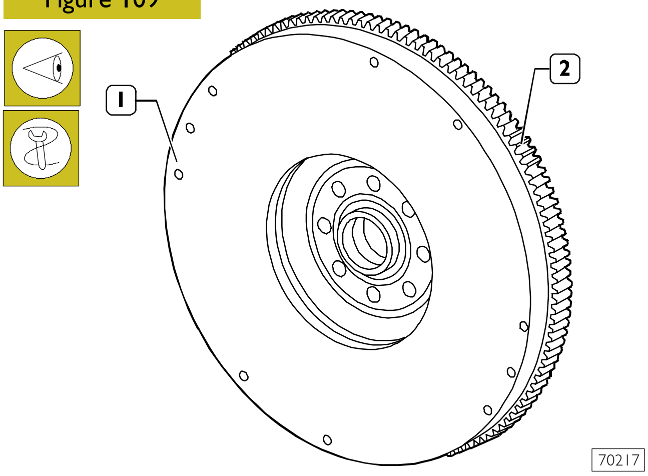


Apply tool 99346252 part (5) to the rear output shaft tang (6), secure it by screws (4) and fit the new sealing ring (3).

Position part (1) on part (5), screw nut (2) until completing sealing ring (3) fitting into flywheel housing (7).

540850 ENGINE FLYWHEEL

Figure 109



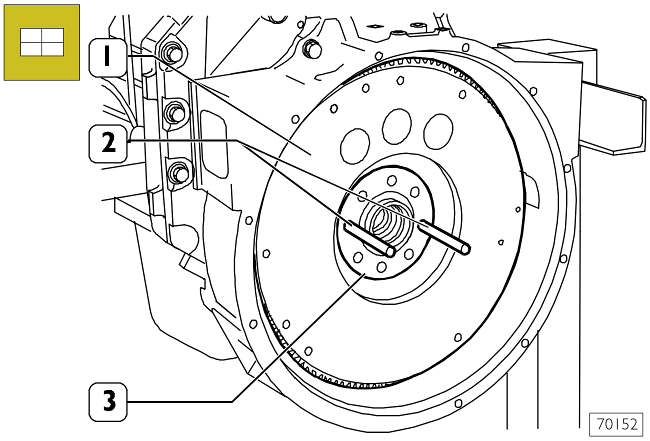
Check clutch plate supporting surface and turn it if scored.

NOTE Engine flywheel rated thickness is 49.6 ± 0.13 mm.

540853 Replacing engine flywheel ring gear

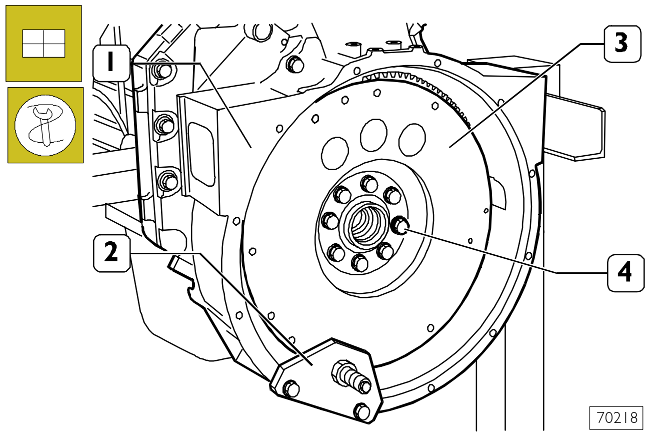
Check ring gear teeth (2), if breakage or excessive wear is found remove the ring gear from the engine flywheel (1, Figure 109) using a generic beater and fit the new one, previously heated to 150°C for 15 to 20 minutes. Chamfering on ring gear inside diameter shall be facing the engine flywheel.

Figure 110



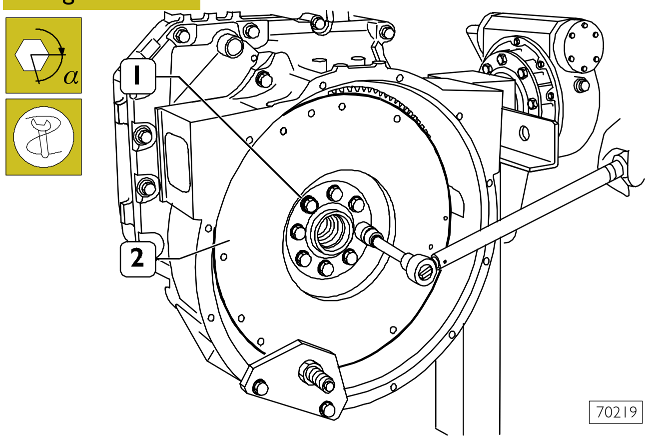
Screw two pins (2) having suitable length into shaft holes (3) and remove the engine flywheel (1) using proper sling and hoister.

Figure 111



Tighten the screws (4) fastening the engine flywheel (3) to the output shaft. Apply tool 99360351 (2) to the flywheel housing (1) to stop engine flywheel (3) rotation.

Figure 112

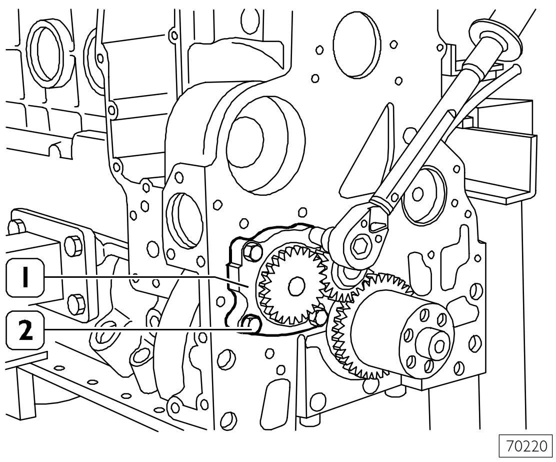


Tighten engine flywheel (2) fastening screws (1) in two stages:

- ❑ 1st stage, tightening to 30 – 4 Nm torque with dynamometric wrench;
- ❑ 2nd stage, tightening to 60° ± 5° angle.

NOTE Tightening to angle is performed using tool 99395216.

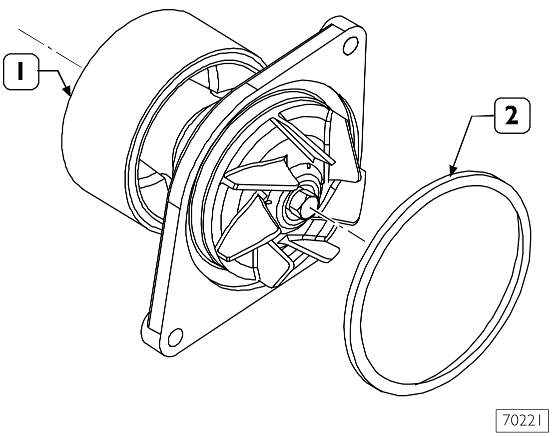
Figure 113



Fit the oil pump (1).

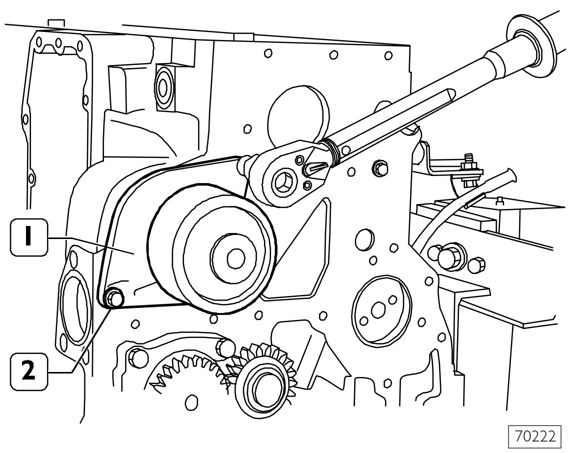
Tighten the fastening screws (2) to the specified torque.

Figure 114



Apply a new sealing ring (2) to the water pump (1).

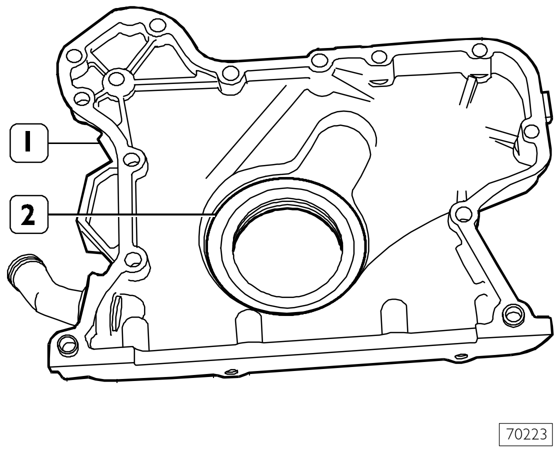
Figure 115



Fit the water pump (1).

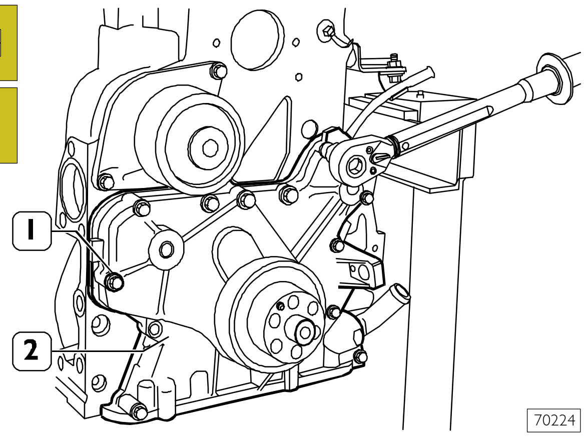
Tighten the screws (2) to the specified torque.

Figure 116



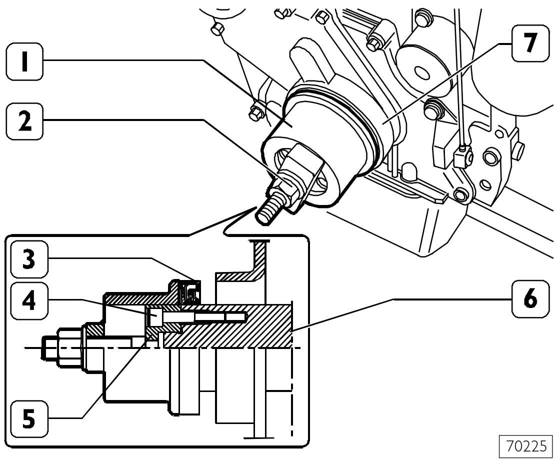
Remove the sealing ring (2) from the front cover (1), clean accurately the coupling surfaces and smear them with IVECO n. 2992595.

Figure 117



Clean accurately the front cover (2) surface and refit it. Tighten the screws (1) to the specified torque.

Figure 118



Apply tool 99346252 part (5) to the front output shaft tang (6), secure it by screws (4) and fit the new sealing ring (3). Position part (1) on part (5), screw nut (2) until completing sealing ring (3) fitting into front cover (7).

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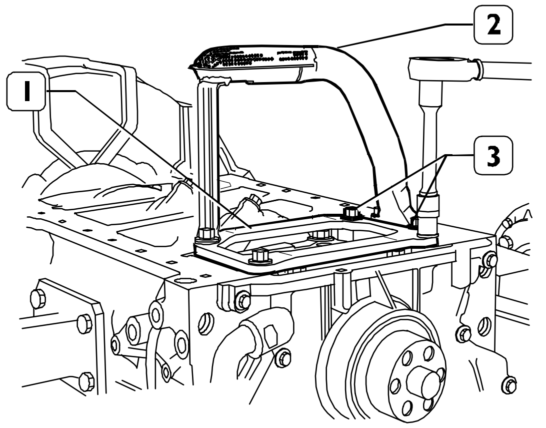
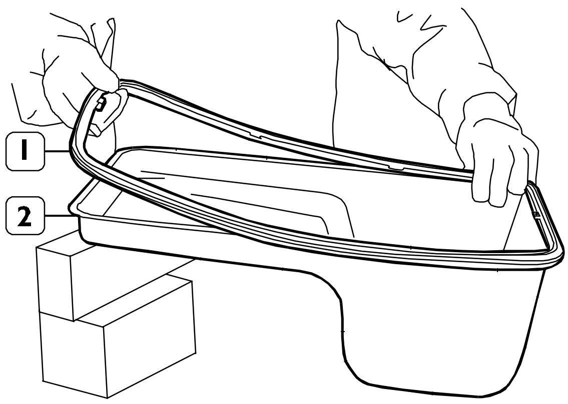
Figure 119



99223

Fit the plate (1), the rose pipe (2) and tighten the fastening screws (3) to the specified torque.

Figure 120

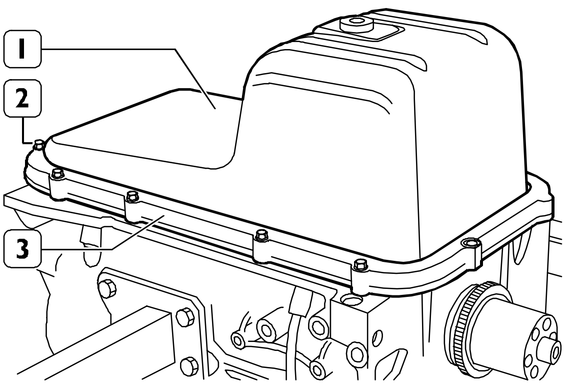


70227

Set the gasket (1) on the oil sump (2).

NOTE If not faulty the gasket can be reused.

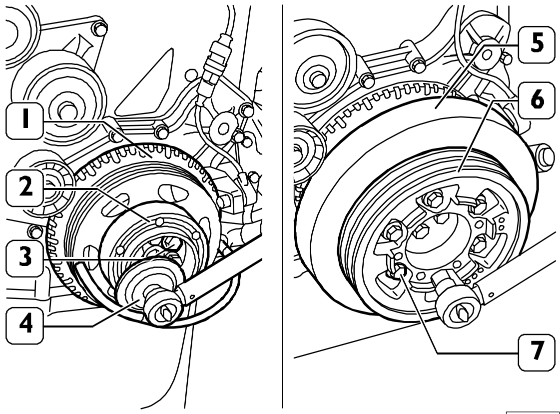
Figure 121



70154

Fit the oil sump (1) and apply the plate (3) to it.
Tighten the screws (2) to the specified torque.

Figure 122



70363

Fit the phonic wheel (1) and the hub (2) on the output shaft.

Tighten the fastening screws (3) in two stages:

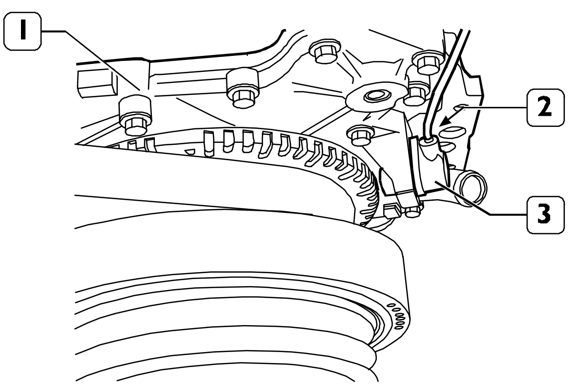
- 1st stage, tightening to 50 ± 5 Nm torque with dynamometric wrench;
- 2nd stage, tightening to 90° angle.

NOTE Tightening to angle is performed using tool 99395216 (4).

Fit the damper flywheel (5) and the pulley (6).

Tighten the fastening screws (7) to 68 ± 7 Nm torque.

Figure 123

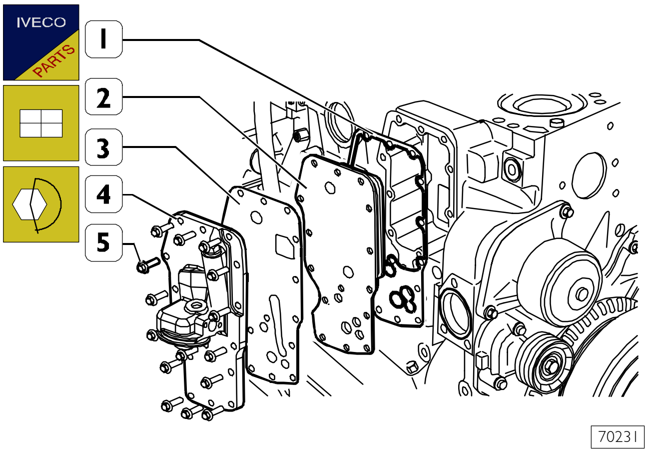


70230

Fit a new sealing ring on the speed sensor (3).

Fit the speed sensor (3) on the front cover (1) and tighten the screw (2) to the specified torque.

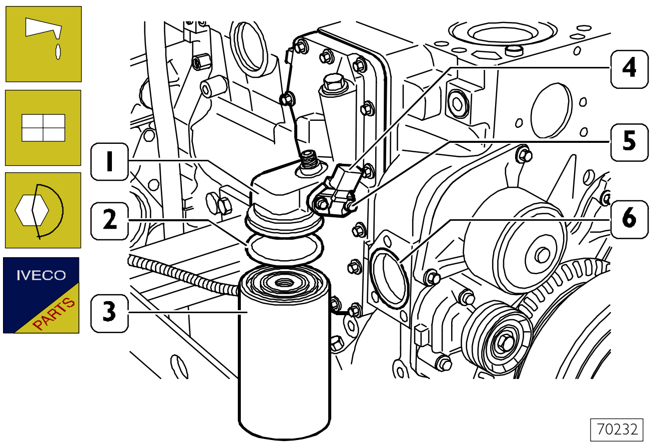
Figure 124



Fit on the engine block: a new gasket (1), the heat exchanger (2) a new gasket (3) and the oil filter support (4).

Tighten the screws (5) to the specified torque.

Figure 125



Lubricate the sealing ring (2) with engine oil and set it on the oil filter (3).

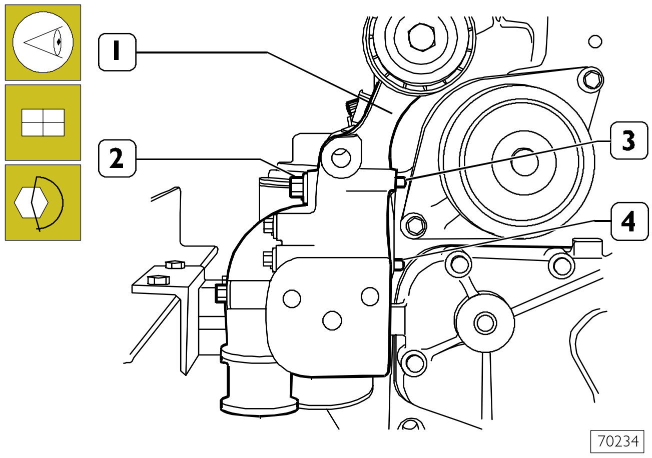
Screw manually to seat the oil filter (3) on the support connection (1) and then screw again the oil filter (3) by 3/4 turn.

Apply a new sealing ring on the oil temperature/pressure sensor (4) and fit it on the support (1).

Tighten the screws (5) to the specified torque.

Fit a new sealing ring (6) in the engine block seat.

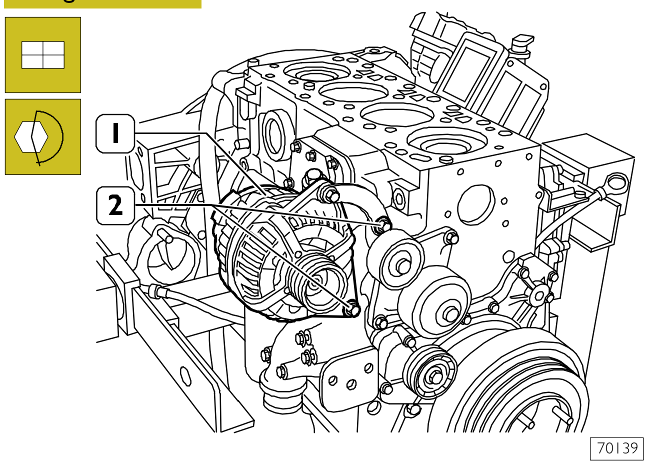
Figure 126



Position the alternator support (1) so that pins (3 and 4) are set against the engine block.

Tighten the screws (2) to the specified torque.

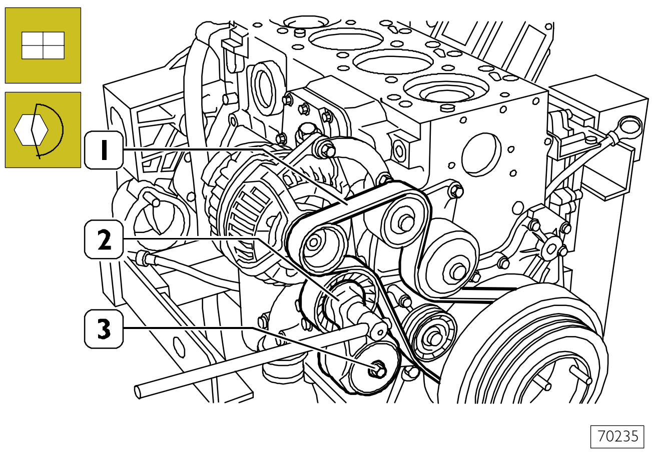
Figure 127



Refit the alternator (1).

Tighten the screw (2) to the specified torque.

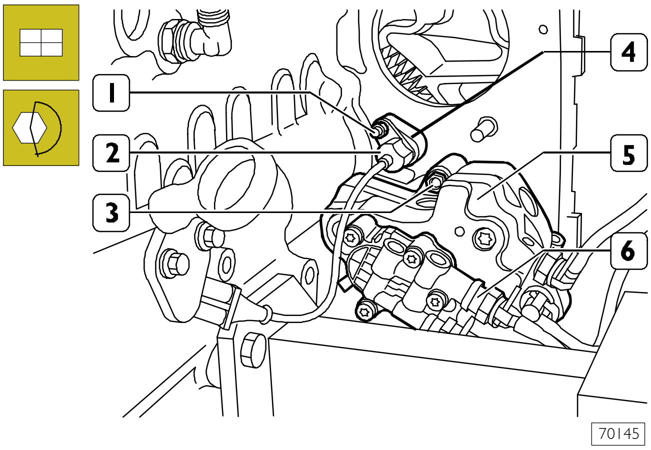
Figure 128



Refit the automatic belt tensioner (2).

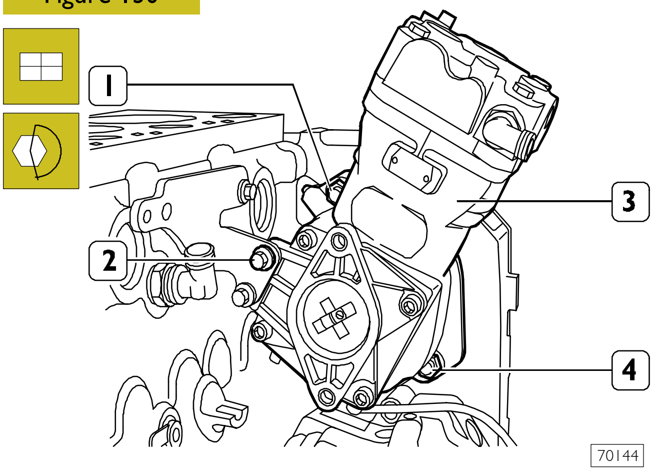
Tighten the screw (3) to the specified torque using the proper wrench, turn the automatic belt tensioner (2) to fit the belt (1) on pulleys and guide rollers.

Figure 129



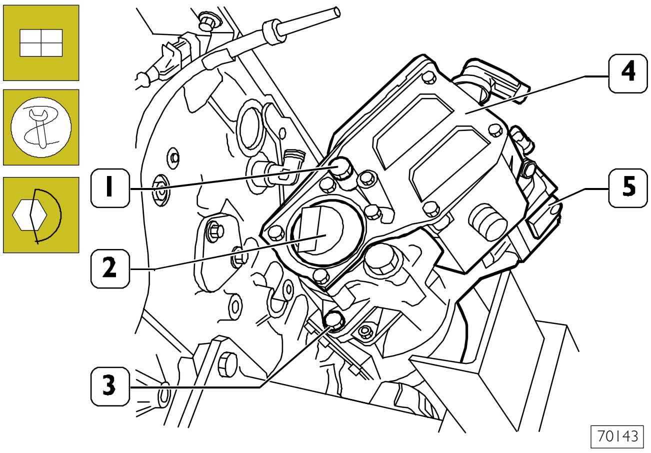
Refit the high pressure pump (4) including the feed pump (5) and tighten the nuts (3) to the specified torque. Fit the support (4) with a new sealing ring, the timing sensor (2) with a new sealing ring and tighten the relevant fastening nut (1) to the specified torque.

Figure 130



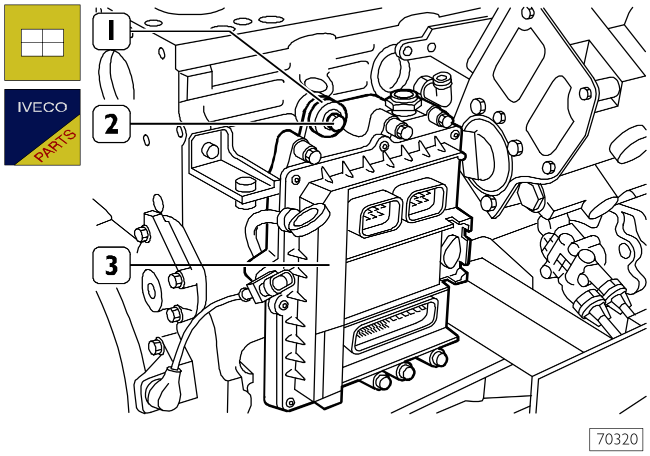
Refit the air compressor (3). Tighten the screws (2) and the nuts (1 and 4) to the specified torque.

Figure 131



Refit the hydraulic power steering pump (2) including the oil tank (4) to the air compressor (5).
Use wrench 99355019 to tighten the fastening screws (3) to the specified torque.

Figure 132

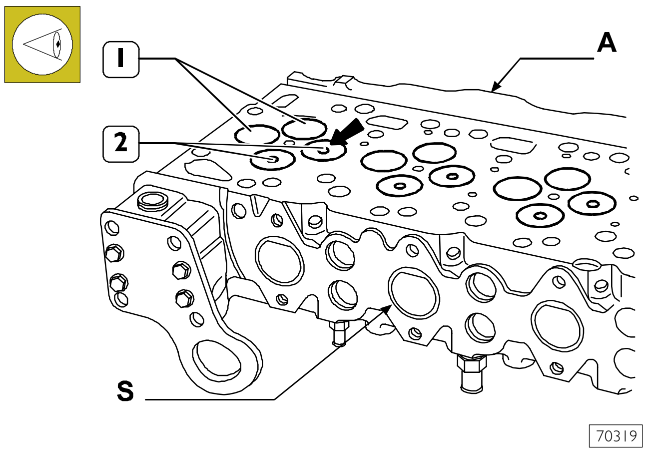


Refit the ECU (3) including the heat exchanger to the engine block and tighten the screws (2) to the specified torque.

NOTE Replace support elastic elements (1).

540610 CYLINDER HEAD
540662 Removing the valves

Figure 133



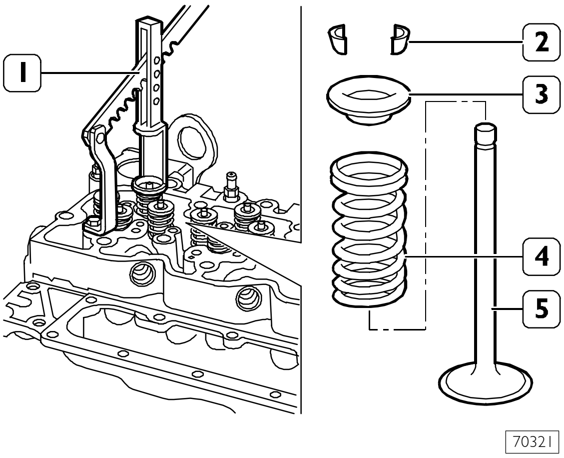
Intake (1) and exhaust (2) valves have heads with the same diameter.

The central notch (→) of the exhaust valve (2) head distinguishes it from the intake valve.

NOTE Should cylinder head valves be not replaced, number them before removing in order to refit them in the same position.

A = intake side – S = exhaust side

Figure 134

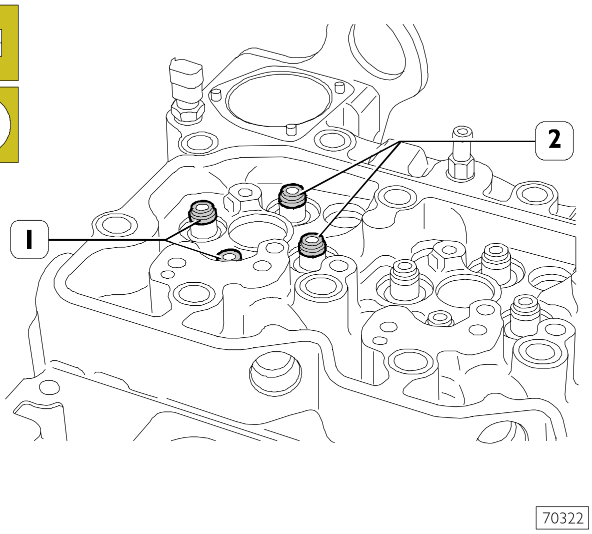


Valve removal shall be performed using tool 99360268 (1) and pressing the cap (3) so that when compressing the springs (4) the cotters (2) can be removed. Then remove the cap (3) and the springs (4).

Repeat this operation for all the valves.

Overturn the cylinder head and withdraw the valves (5).

Figure 135



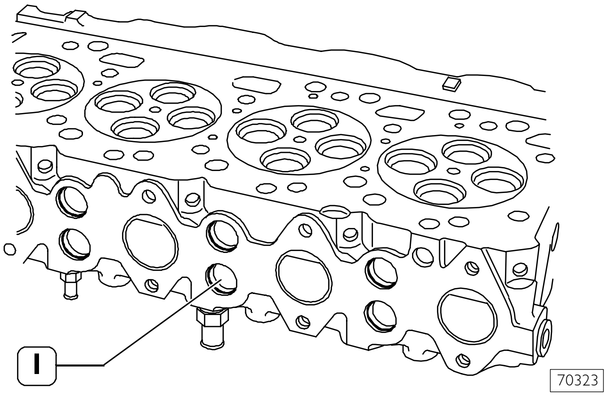
Remove the sealing rings (1 and 2) from the relevant valve guides.

NOTE Sealing rings (1) for intake valves are yellow.

Sealing rings (2) for exhaust valves are green.

Checking cylinder head wet seal

Figure 136



This check shall be performed using the proper tools.

Use a pump to fill with water heated to approx. 90°C and 2 to 3 bar pressure.

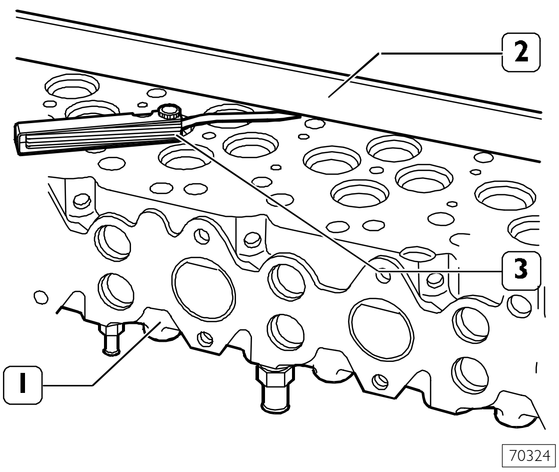
Replace the cup plugs (1) if leaks are found, use the proper beater for their removal/refitting.

NOTE Before refitting, smear the plug surfaces with water-repellent sealant.

Replace the cylinder head if leaks are found.

Checking cylinder head supporting surface

Figure 137

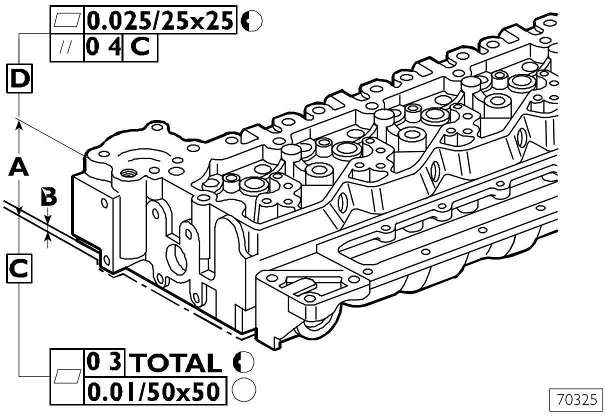


Use a rule (2) and a feeler gauge (3) to check the cylinder head (1) supporting surface.

Distortion found along the whole cylinder head shall not exceed 0.20 mm.

If higher values are found grind the cylinder head according to values and indications shown in the following figure.

Figure 138

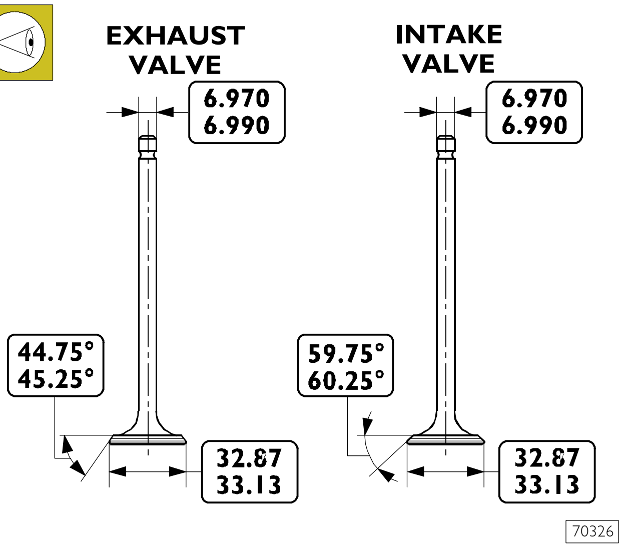


The rated thickness A for the cylinder head is 105 ± 0.25 mm, max. metal removal shall not exceed thickness B by 0.13 mm.

After grinding, check valve sinking. Regrind the valve seats, if required, to obtain the specified value.

540662 VALVES

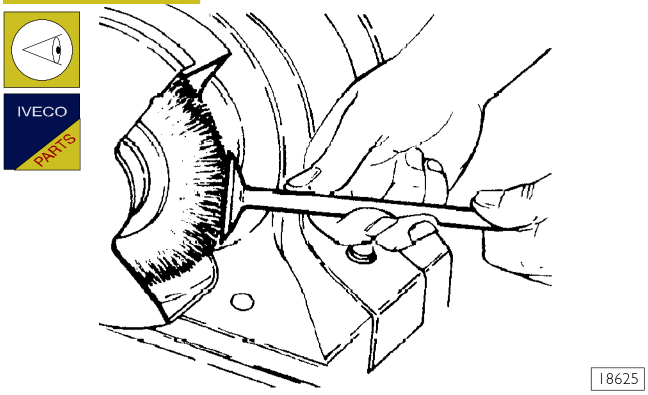
Figure 139



INTAKE AND EXHAUST VALVE MAIN DATA

Removing carbon deposits, checking and grinding valves

Figure 140

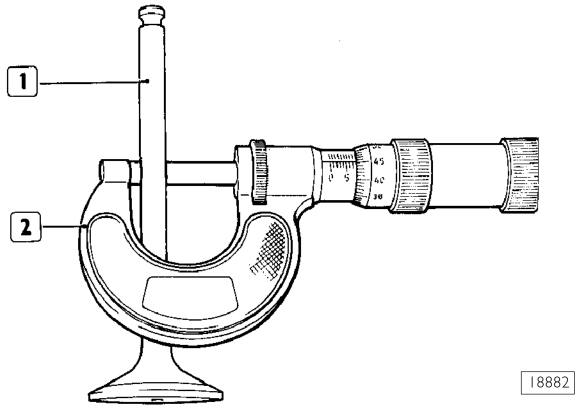


Remove carbon deposits from valves using the proper metal brush.

Check that the valves show no signs of seizing, scoring or cracking.

Regrind the valve seats, if required, using tool 99305018 and removing as less material as possible.

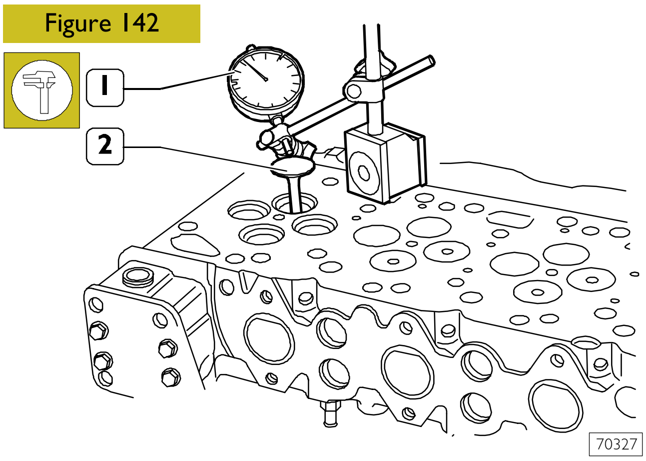
Figure 141



Check the valve stem (1) using a micrometer (2), it shall be 6.970 to 6.999.

Checking clearance between valve stem and valve guide and valve centering

Figure 142

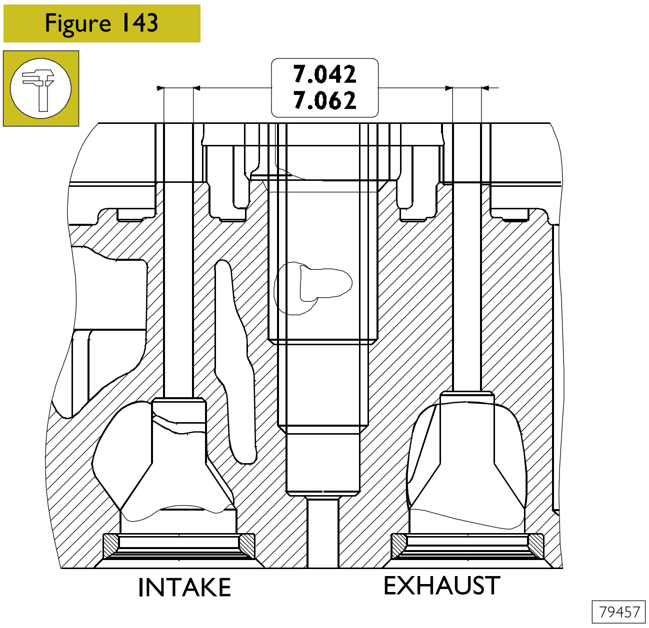


Use a magnetic base dial gauge (1) set as shown in the figure, the assembling clearance shall be 0.052 to 0.092 mm.

Turn the valve (2) and check that the centering error is not exceeding 0.03 mm.

540667 VALVE GUIDE

Figure 143

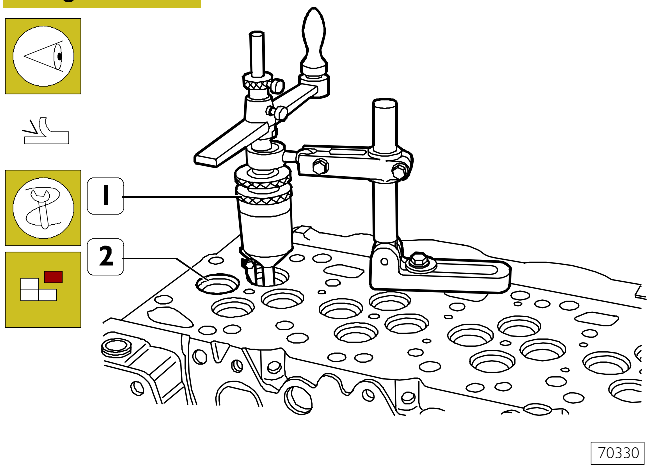


Use a bore dial gauge to measure the inside diameter of the valve guides, the read value shall comply with the value shown in the figure.

VALVE SEATS

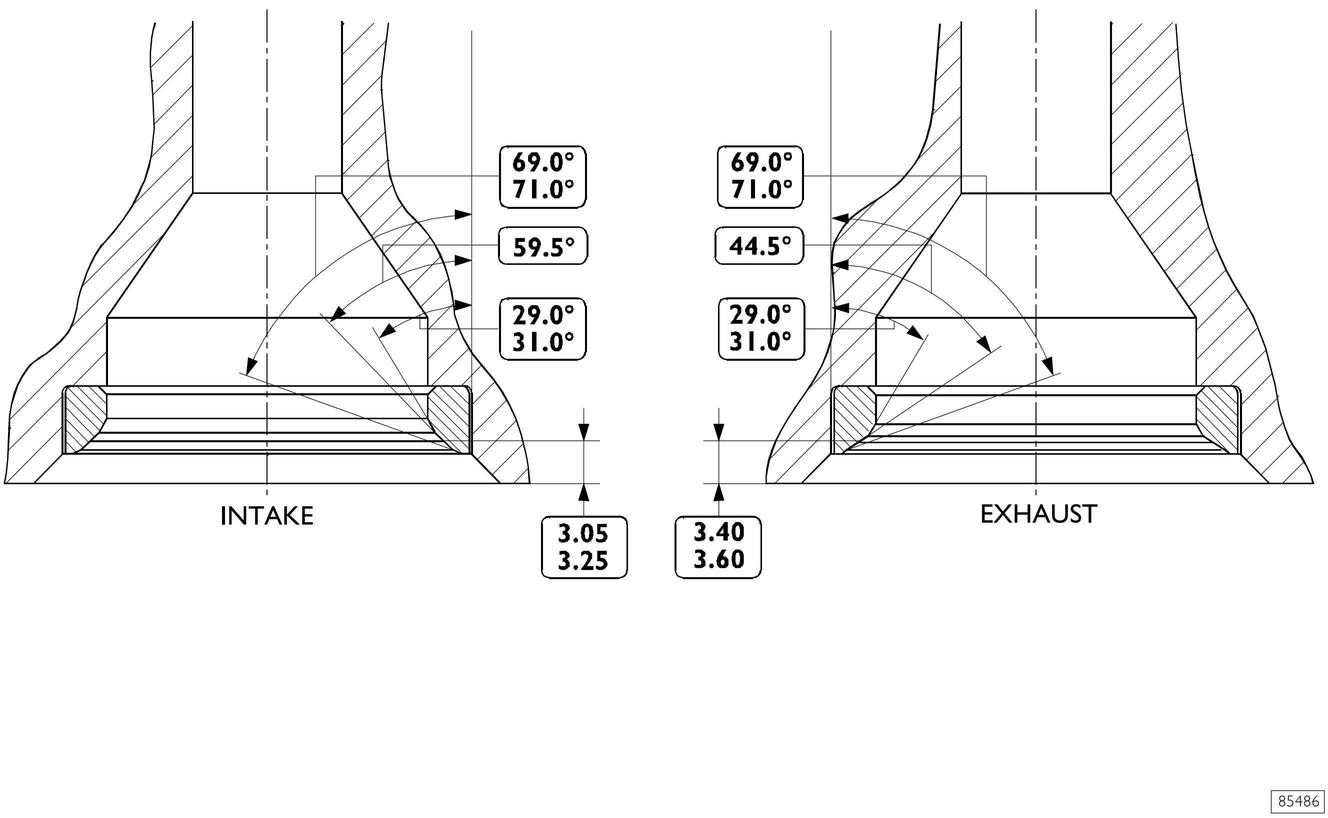
Regrinding – replacing the valve seats

Figure 144



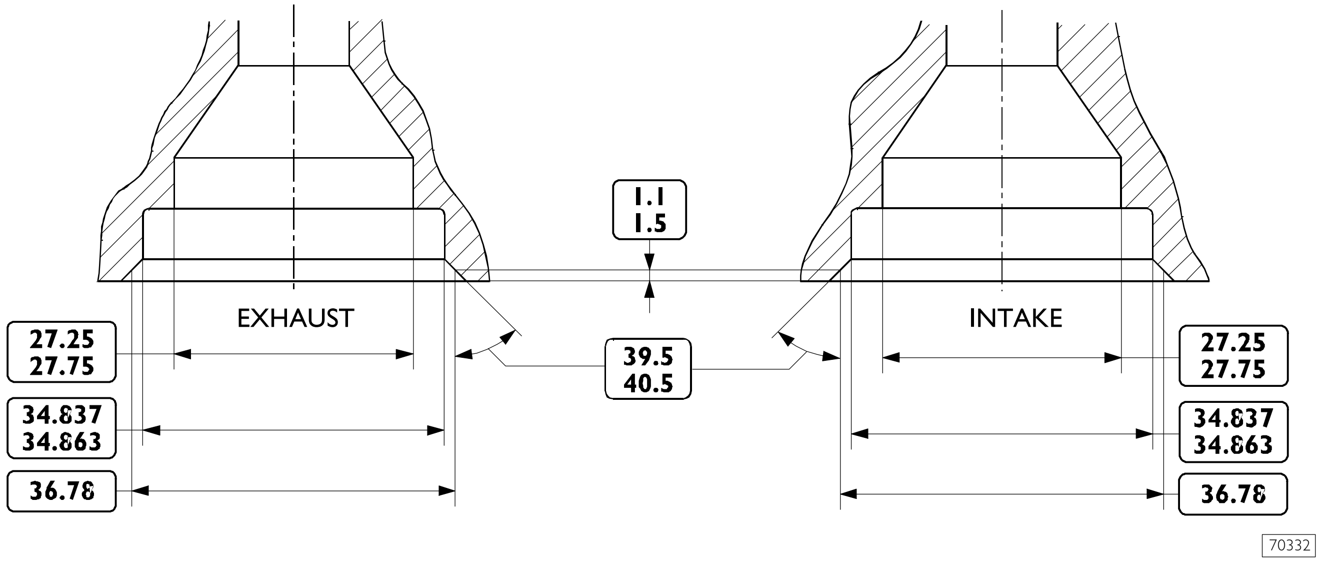
Check the valve seats (2). If slight scoring or burnout is found, regrind seats using tool 99305018 (1) according to the angle values shown in Figure 145.

Figure 145



VALVE SEAT MAIN DATA

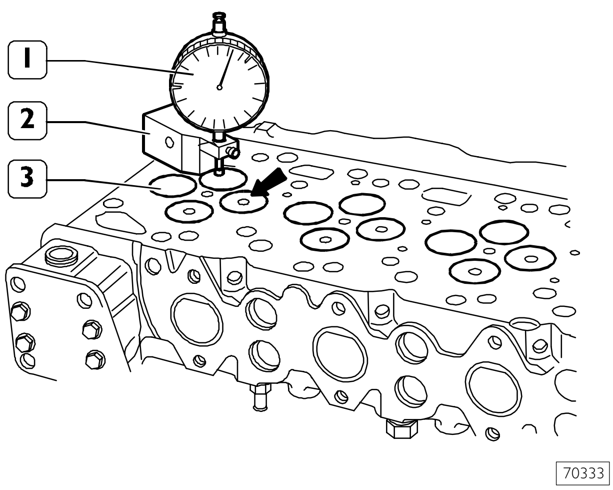
Figure 146



MAIN DATA CONCERNING THE SEATS ON THE CYLINDER HEAD

Should valve seats be not reset just by regrinding, replace them with the spare ones. Use tool 99305018 (Figure 144) to remove as much material as possible from the valve seats (take care not to damage the cylinder head) until they can be extracted from the cylinder head using a punch.

Figure 147



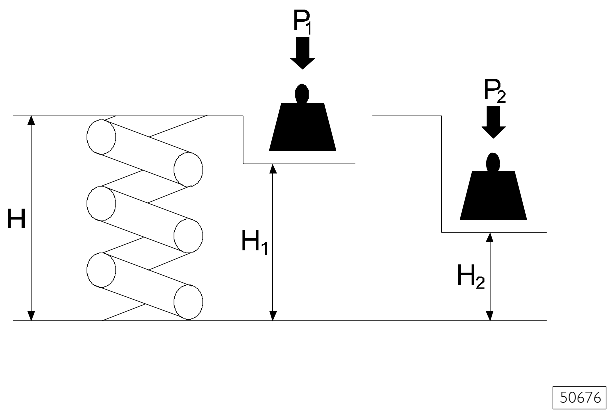
After regrinding, check that valve (3) sinking value is the specified one by using the base 99370415 (2) and the dial gauge 99395603 (1).

Heat the cylinder head to 80° - 100°C and using the proper beater, fit the new valve seats, previously cooled, into the cylinder head.

Use tool 99305018 to regrind the valve seats according to the values shown in Figure 145.

540665 VALVE SPRINGS

Figure 148



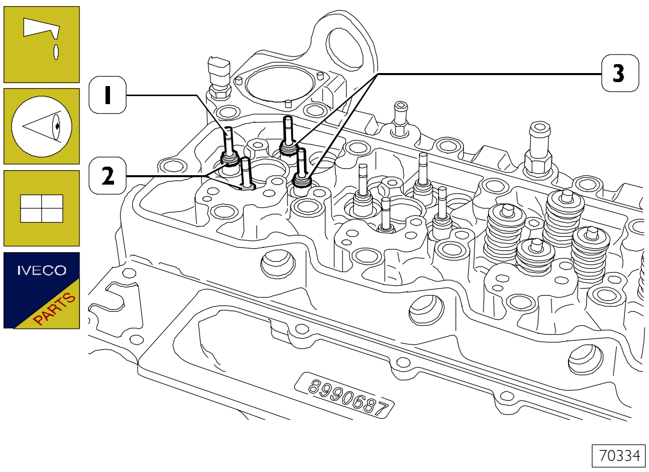
MAIN DATA TO CHECK INTAKE AND EXHAUST VALVE SPRINGS

Before refitting use tool 99305047 to check spring flexibility. Compare load and elastic deformation data with those of the new springs shown in the following table.

Height		Under a load of	
mm		N	
H	47.75		Free
H1	35.33	P1	339.8 ± 19 Nm
H2	25.2	P2	741 ± 39 Nm

FITTING CYLINDER HEAD

Figure 149

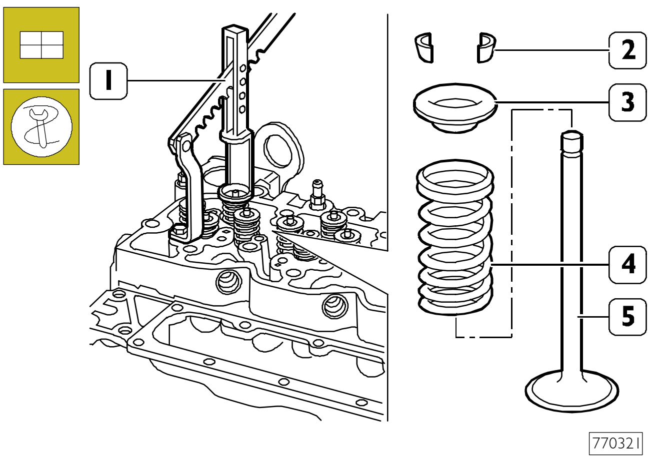


Lubricate the valve stems (1) and fit them into the relevant valve guides according to the position marked at removal.

Fit the sealing rings (2 and 3) on the valve guide.

NOTE Sealing rings (2) for intake valves are yellow and sealing rings (3) for exhaust valves are green.

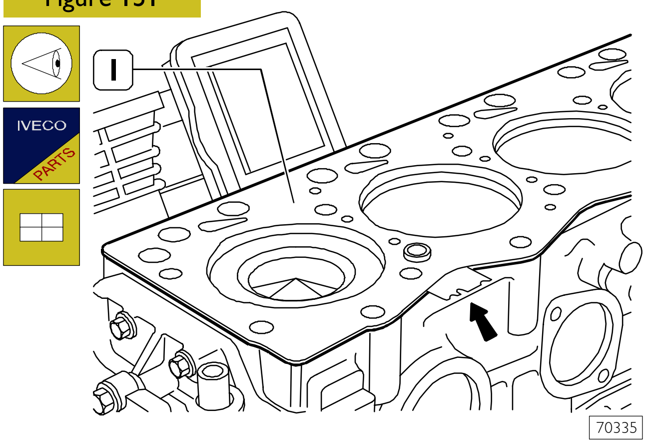
Figure 150



Position on the cylinder head: the spring (4), the upper cap (3); use tool 99360268 (1) to compress the spring (4) and lock the parts to the valve (5) by the cotters (2).

Refitting the cylinder head

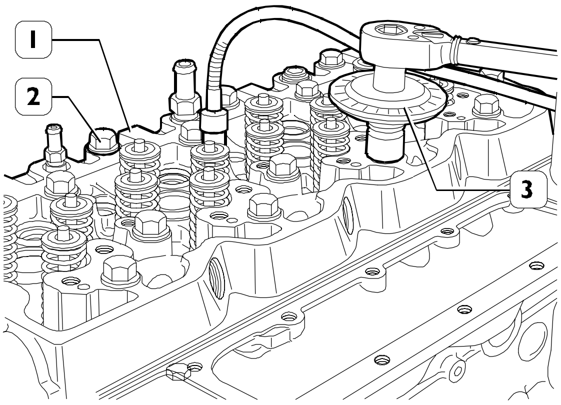
Figure 151



Check cleanness of cylinder head and engine block coupling surface.
Take care not to foul the cylinder head gasket.
Set the cylinder head gasket (1) with the marking "TOP" (1) facing the head.
The arrow shows the point where the gasket thickness is given.

NOTE Before reusing the cylinder head fastening screws check whether they are free from damages or distortions, otherwise replace.

Figure 152

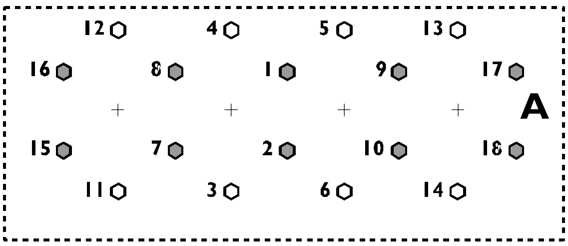


70336

Refit the cylinder head (1), tighten the screws (2) in three successive stages according to the sequence and procedure shown in the following figure.

Use tool 99395216 (3) to tighten to angle.

Figure 153



70337

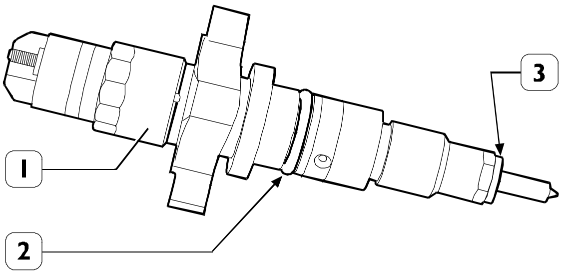
Cylinder head fastening screw tightening sequence:

- 1st stage pre-tightening, with dynamometric wrench:
  - Screw 12x1.75x130 ( ) 35 ± 5 Nm
  - Screw 12x1.75 x 150 ( ) 55 ± 5 Nm
- 2nd stage, tightening to 90° ± 5° angle
- 3rd stage, tightening to 90° ± 5° angle

A = front side

Assembling electro-injectors

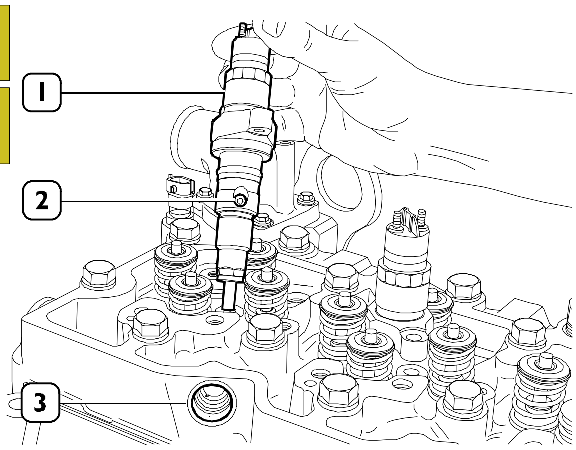
Figure 154



70338

Fit a new sealing ring (2) lubricated with vaseline and a new sealing washer (3) on injector (1).

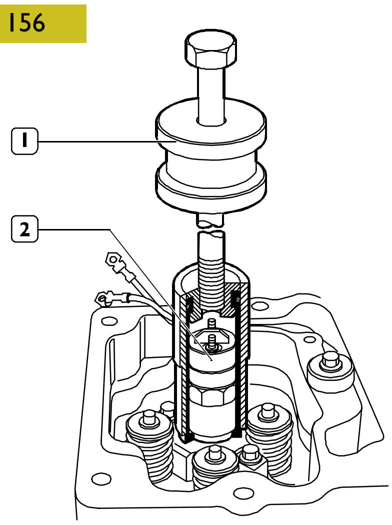
Figure 155



70339

Fit injectors (1) on the cylinder head seats, directed so that the fuel inlet hole (2) is facing the fuel manifold seat (3) side.

Figure 156

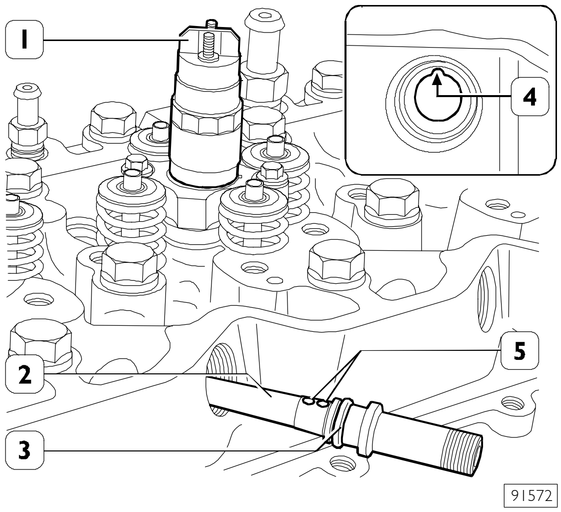


70133

Use tool 99342101 (1) to fit the injector (2) into its seat.

Screw injector fastening screws without tightening them.

Figure 157



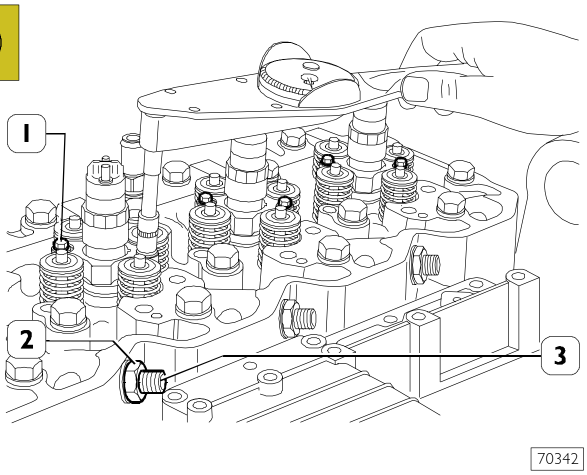
Fit a new sealing ring (3) lubricated with vaseline on the fuel manifold (2) and fit it into the cylinder head seat so that the positioning balls (5) coincide with the relevant housing (4).

NOTE Disassembled fuel manifolds (2) must not be used again, but however replaced with other new ones.

Screw the fastening nuts (2, Figure 158) without locking them.

During this operation, the injector (1) shall be moved so that the manifold (2) is properly inserted into the fuel inlet hole (2, Figure 155).

Figure 158

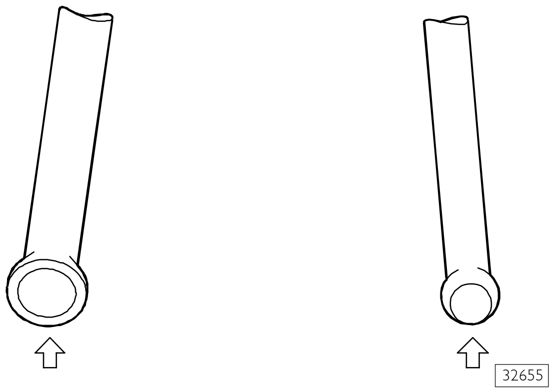


Use the dynamometric wrench to tighten gradually and alternately the injector fastening screws (1) to 8.5 ± 0.35 Nm torque.

Tighten the fuel manifold (3) fastening nuts (2) to 50 Nm torque.

541221 RODS

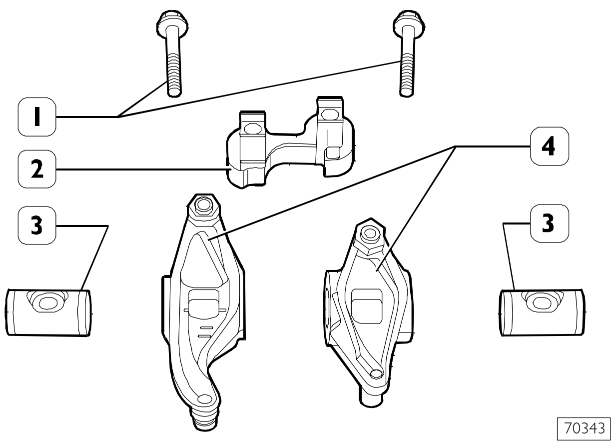
Figure 159



Rocker control rods shall not be distorted; the ball seats in touch with the rocker adjusting screw and with tappets (arrows) shall not show seizing or wear; otherwise replace them. Intake and exhaust valve control rods are identical and are therefore interchangeable.

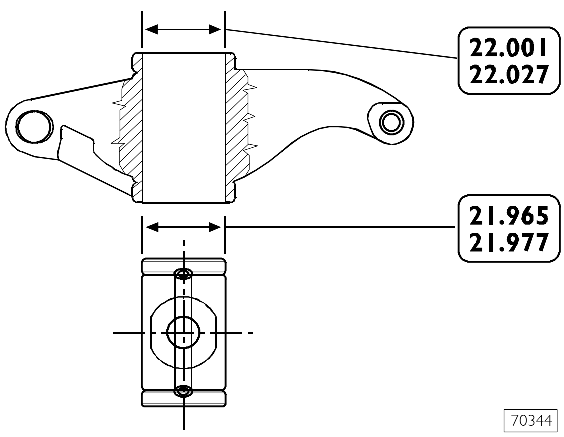
501230 Rocker assembly

Figure 160



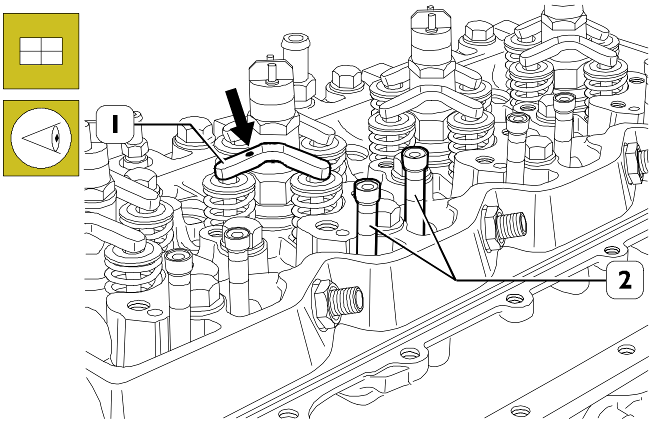
ROCKER ASSEMBLY COMPONENTS:
1. Screws - 2. Bracket - 3. Shafts - 4. Rockers.

Figure 161



SHAFT-ROCKER MAIN DATA
Check that shaft/rocker coupling surfaces are not showing excessive wear or damages.

Figure 162

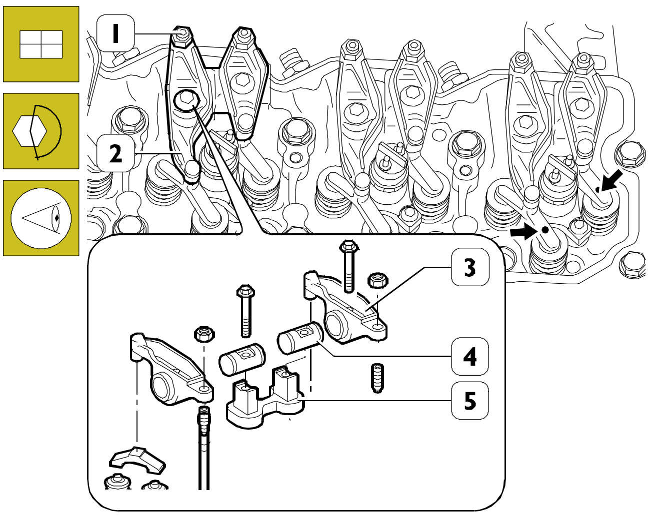


70345

Fit the rods (2).

Position jumpers (1) on valves with marks (→) facing the exhaust manifold.

Figure 163

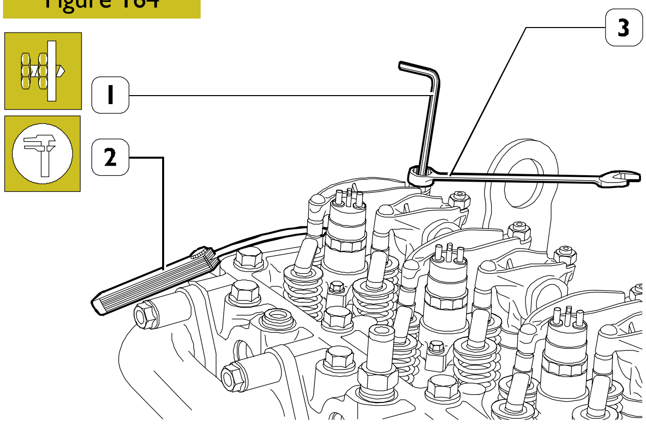


70346

Check that tappet adjusters (1) are loosen to prevent their balking on the rods (2, Figure 162) when refitting the rocker assembly.
Then refit the rocker assembly consisting of: bracket (5), rockers (3), shafts (4) and secure them to the cylinder head by tightening the fastening screws (2) to 36 Nm torque.

Adjusting tappet clearance

Figure 164



70520

Adjust clearance between rockers and valves using setscrew wrench (1), box wrench (3) and feeler gauge (2).
Working clearance shall be as follows:
- intake valves 0.25 ± 0.05 mm
- exhaust valves 0.51 ± 0.05 mm.

To carry out rocker-valve clearance adjustment more quickly, proceed as follows:
rotate the output shaft, balance the valves of cylinder No. 1 and adjust the valves marked with an asterisk in the tables below:

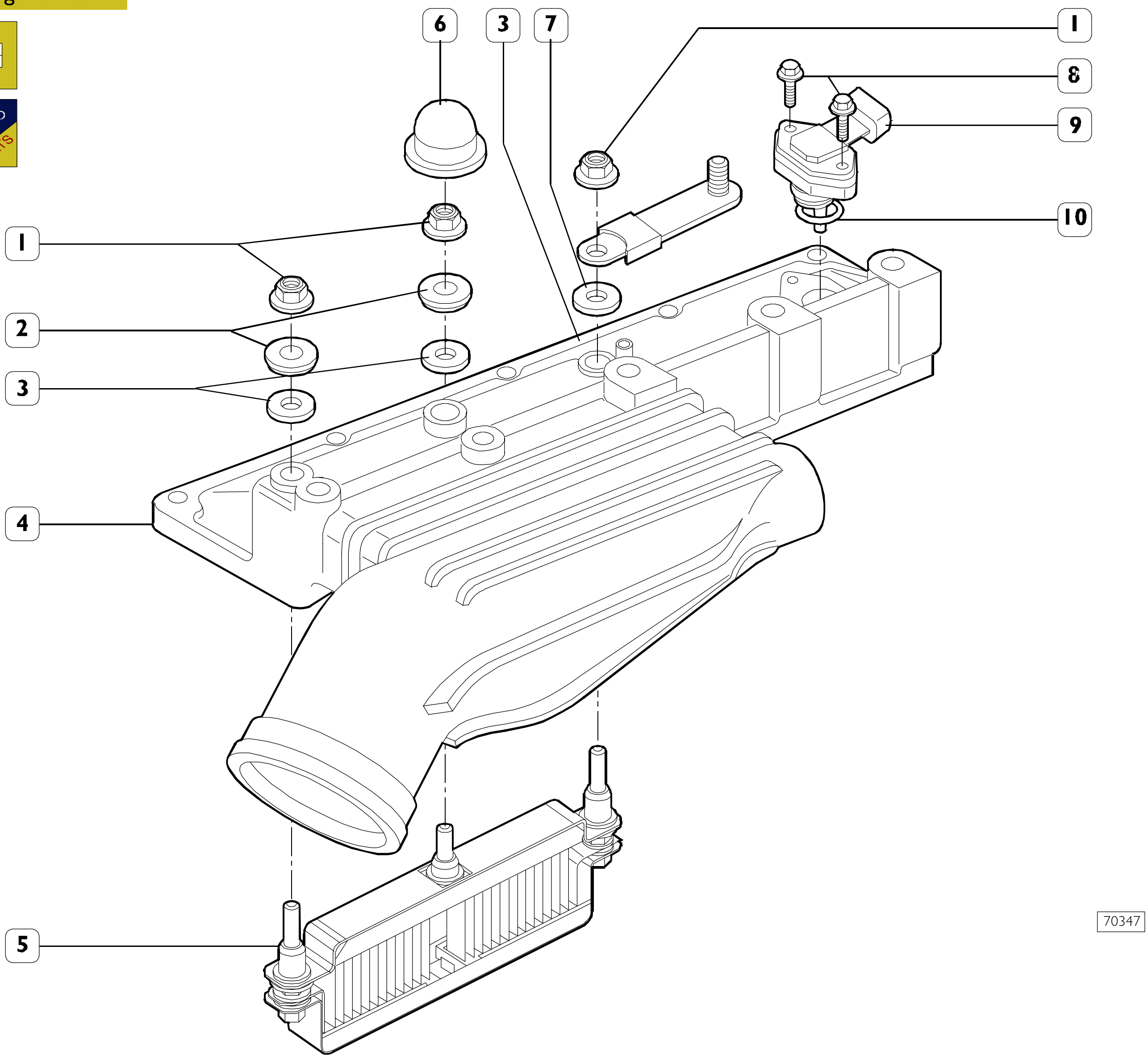
cylinder No.	1	2	3	4
intake	-	-	*	*
exhaust	-	*	-	*

Rotate the output shaft, balance the valves of cylinder No. 4 and adjust the valves marked with an asterisk in the table below:

cylinder No.	1	2	3	4
intake	*	*	-	-
exhaust	*	-	*	-

Intake manifold

Figure 165

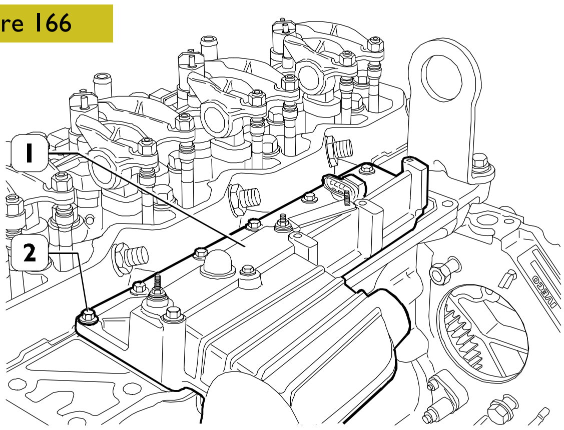


The intake manifold (4) houses the air heater (5) for cold starting. In case of failure it shall be replaced by removing the cap (6), the nuts (1), the sealing washers (2) and the washers (3). Fit the new heater (5) following the removal operations in reverse order.

The sealing washers (2) shall be replaced with new ones.
The nuts (1) shall be tightened to the specified torque.

Apply a new sealing ring (10) to the air temperature/pressure sensor and fit it on the intake manifold (4), tighten the screws (8) to the specified torque.

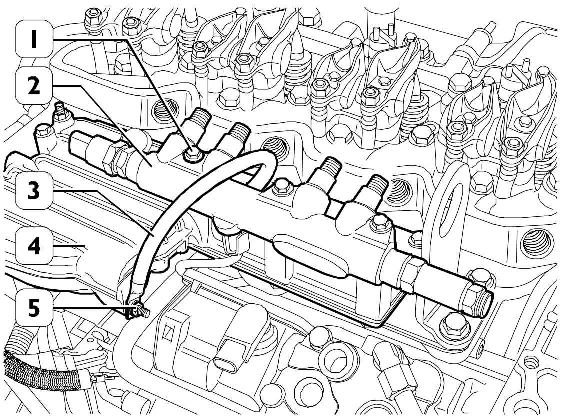
Figure 166



70348

Smear the intake manifold (1) coupling surface with IVECO n. 2992545 and fit it on the cylinder head.
Tighten the screws (2) to the specified torque.

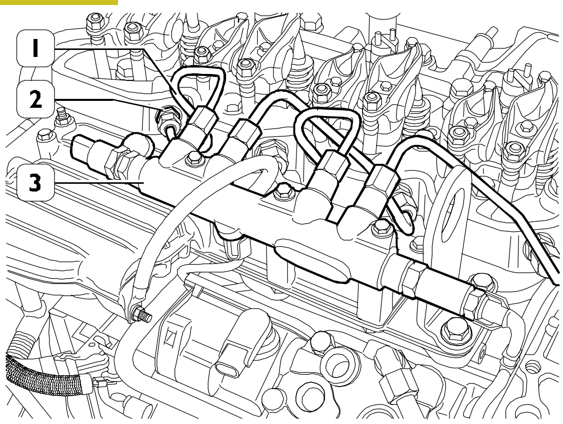
Figure 167



99224

Fit the rail (2) and tighten the screws (1) to the specified torque, connect the ground cable (3) to the intake manifold (4) and tighten the fastening nut (5) to the specified torque.

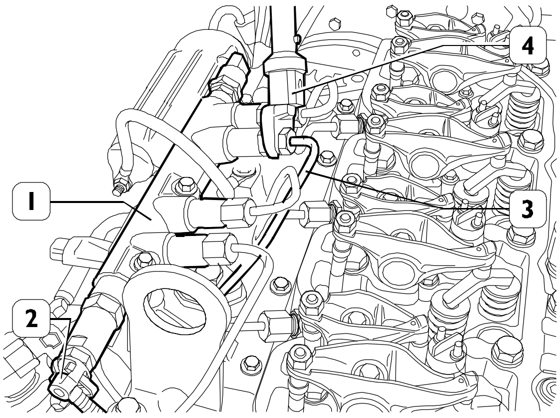
Figure 168



99225

Connect the fuel pipes (1) to rail (3) and injector manifolds (2).

Figure 169

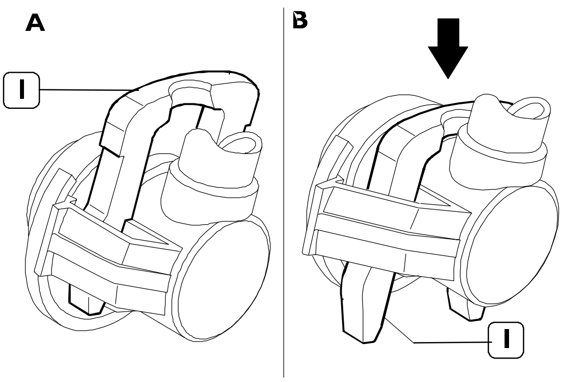


99226

Pipe (3) connections shall be tightened to 20 Nm torque, by using the proper torque wrench 99389829 (4) together with tool 99317915.

Connect the fuel pipe (2) to the rail (1) following the procedure shown in the following figure.

Figure 170



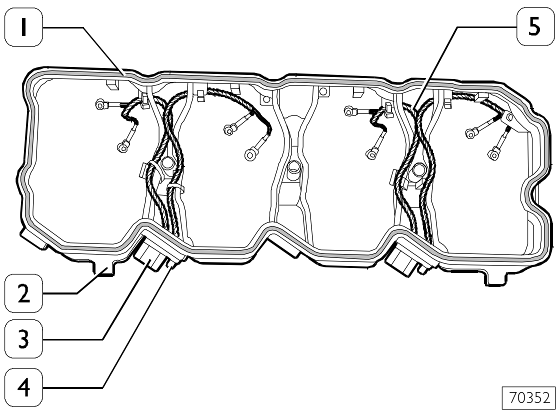
70126

Press the clamp (1) in arrow direction (Figure B) and connect the pipe to the rail (2, Figure 168), reset the clamp to the initial locking position "A".

NOTE Check proper fuel pipe connection.

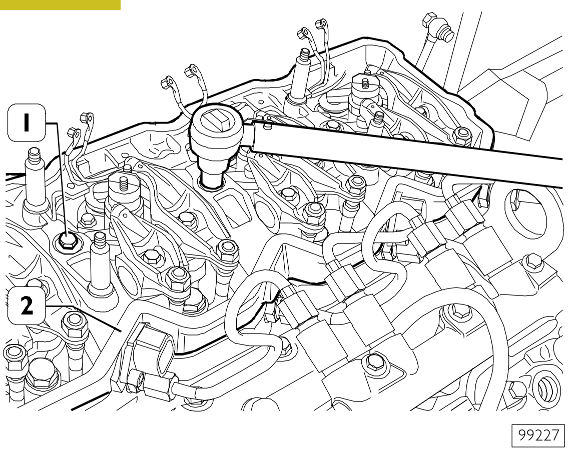
540634 Wiring support

Figure 171



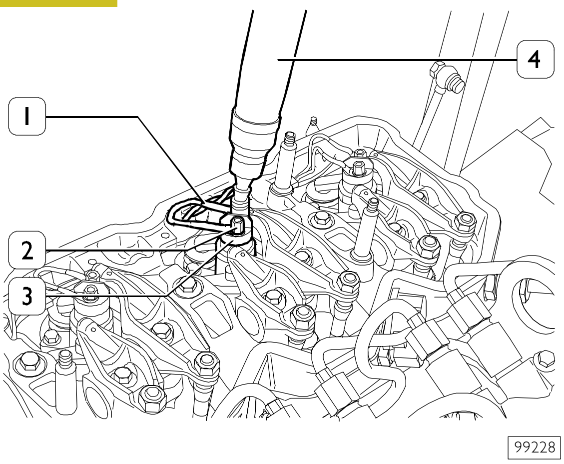
Check electrical cable (5) conditions, replace if damaged by cutting the support (2) clamps and removing the screws (5) that secure it to connections (3).
Fit a new gasket (1) on the support (2).

Figure 172



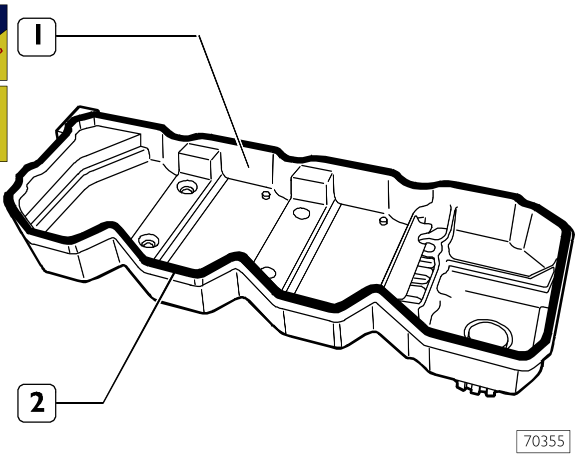
Fit the wiring support (2) and tighten the screws (1) to the specified torque.

Figure 173



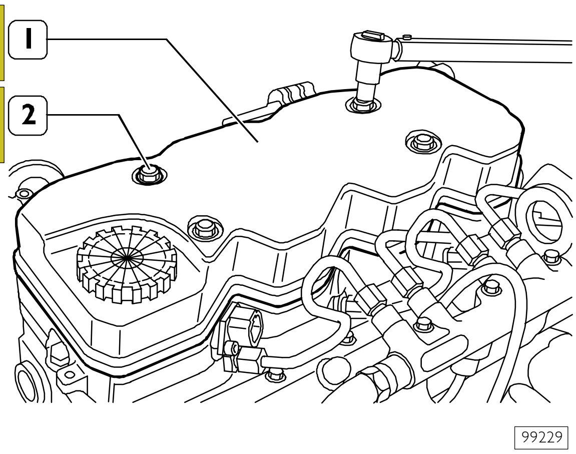
Connect the electrical cables (1) to the injectors (3) and use the dynamometric wrench 99389834 (4) to tighten the fastening nuts (2) to the specified torque.

Figure 174



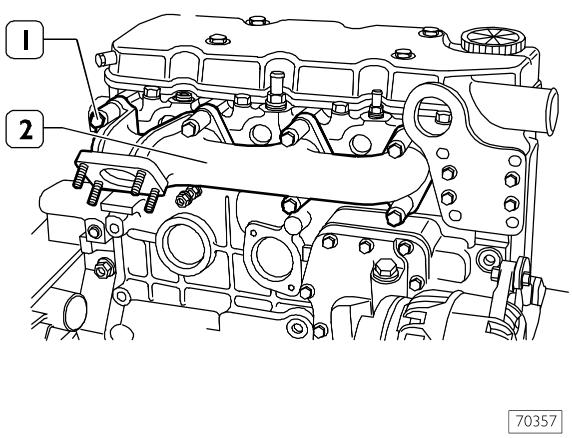
Fit a new gasket (2) on the tappet cover (1).

Figure 175



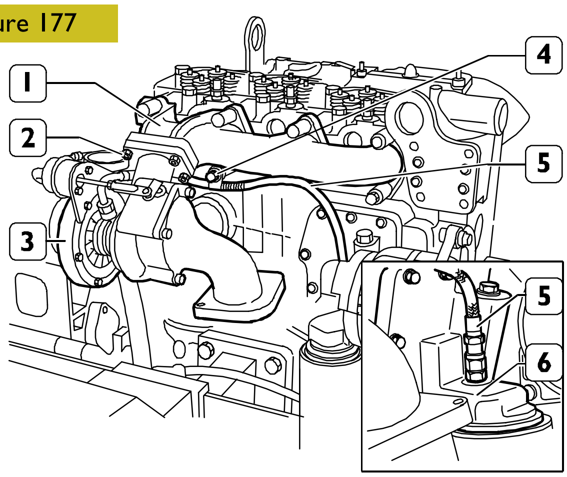
Fit the tappet cover (1) and tighten the nuts (2) to the specified torque.

Figure 176



Reconnect the exhaust manifold (2) with new gaskets. Tighten the fastening screws (1) to the specified torque.

Figure 177

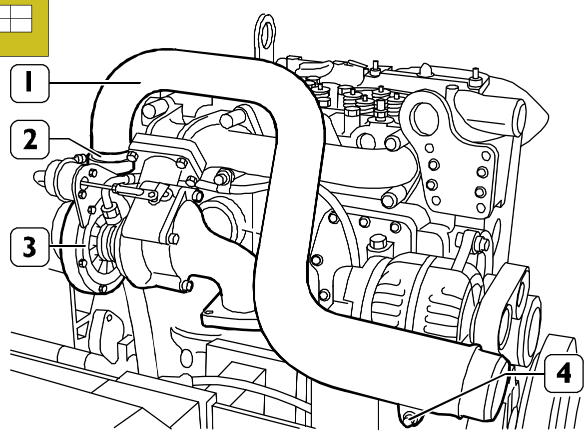


70358

Reconnect the turbosupercharger (3) with a new gasket to the exhaust manifold (1) and tighten the fastening nuts (2) to the specified torque.

Connect the oil pipe (5) to the heat exchanger support (6) and secure it to the exhaust manifold (1) by screw (4).

Figure 178

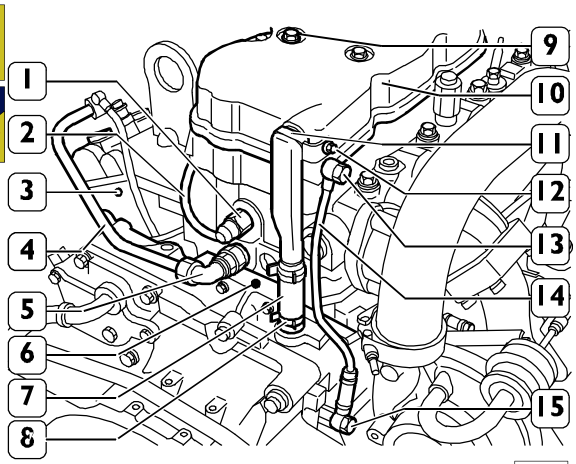


70134

Connect the air duct (1) to the turbosupercharger (3) and lock it by clamp (2).

Secure the air duct (1) to the alternator support by screws (4).

Figure 179



70360

Connect pipe (14) to tappet cover (19) and timing case (6) with connections (13-15) and new copper washers.

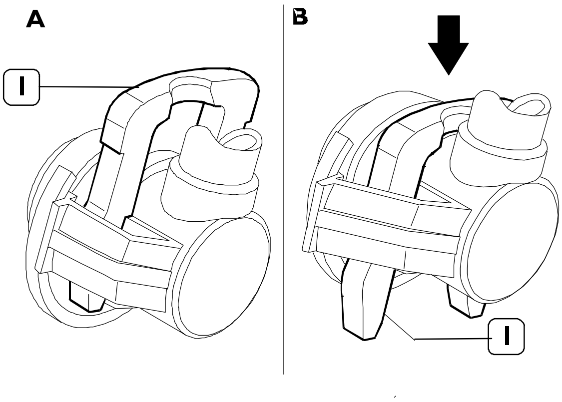
Connect pipe (7) to timing case (6) connection and lock it by the elastic clamp (8).

Fit a new sealing ring on pipe (11) connection and fit it on the tappet cover (10).

Secure the pipe (11) to the tappet cover (10) with the clip and the nut (12), connect pipe (4) to connection (5) and air compressor (3).

Connect the pipe (2) to the pressure limiter (1) as shown in the following figure.

Figure 180



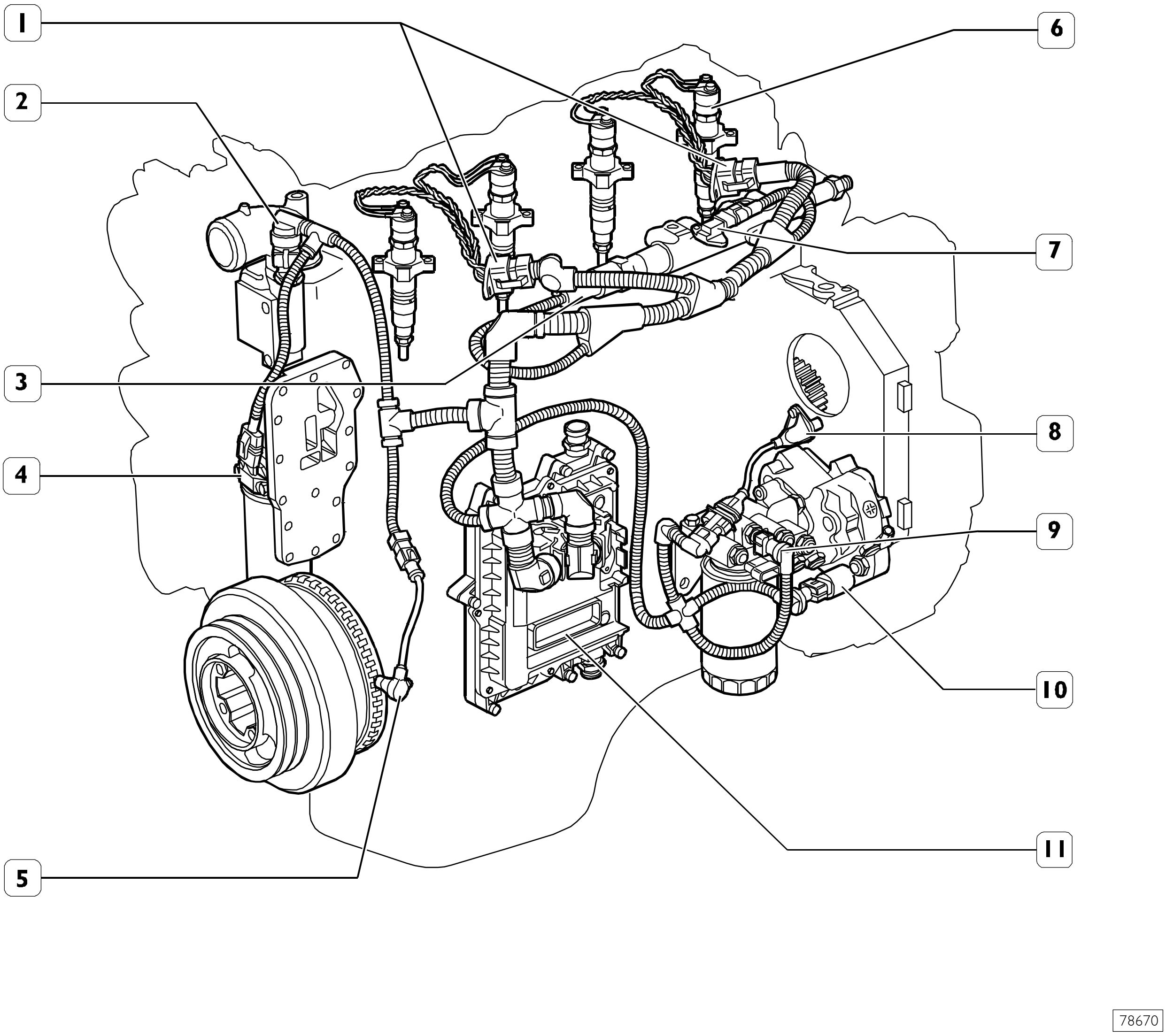
70126

Press the clamp (1) in arrow direction (Figure B) and connect the pipe.

Reset the clamp to the initial locking position A.

NOTE Check proper fuel pipe connection.

Figure 181

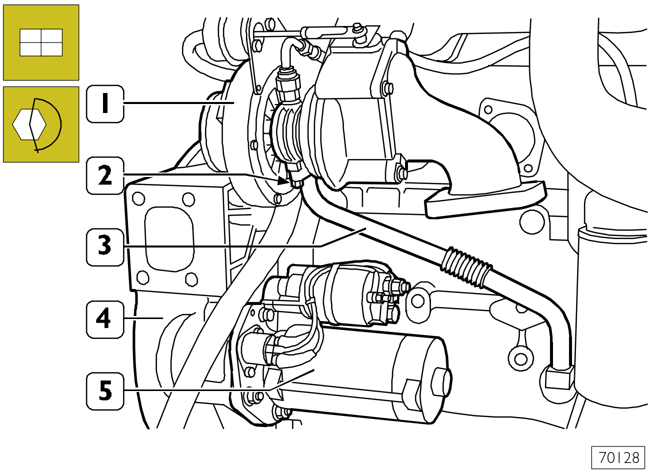


1. Injector connections - 2. Engine coolant temperature sensor - 3. Fuel pressure sensor - 4. Engine oil temperature and pressure sensor - 5. Output shaft sensor - 6. Injector - 7. Air temperature/pressure sensor - 8. Timing sensor - 9. Fuel heater and fuel temperature sensor - 10. Pressure regulator - 11. EDC7 control unit

Reconnect the engine cable by connecting injector wiring (6) connectors (1); (7) air pressure/temperature sensor; (3) rail pressure sensor; (3) control unit; (11) high pressure pump sensor; (8) timing sensor; (2) engine coolant temperature sensor on thermostat; (5) engine speed sensor.

Apply to engine lifting hooks the lifting rig 99360555, hook the latter to the hoister and remove the engine from the revolving stand. Remove the brackets 99361037.

Figure 182



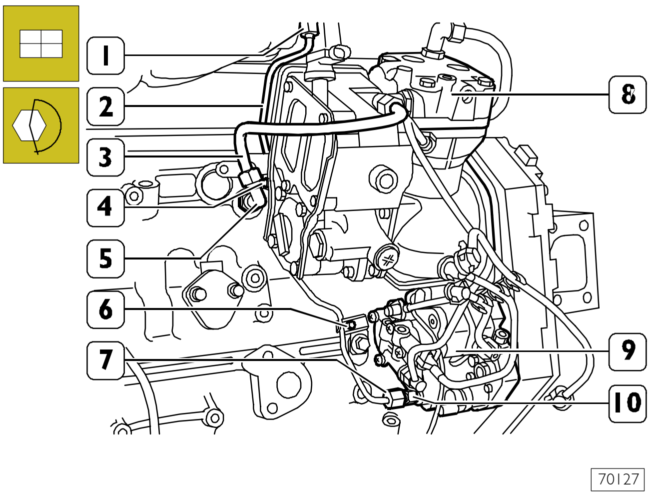
Complete engine refitting as follows:

Form the right side:

Refit the starter (5) to the flywheel housing (4) and tighten the fastening nuts to the specified torque.

Fit the oil pipe (3) with a new sealing ring into the engine block and secure it to the turbosupercharger (1) by the screws (2) tightened to the specified torque.

Figure 183

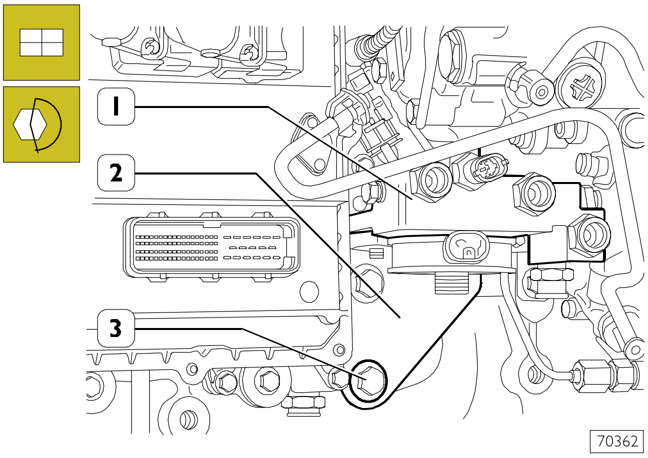


From the left side:

Connect the fuel pipe (2) to rail and to high pressure pump (9), secure it by screws (4 and 6) tightened to the specified torque.

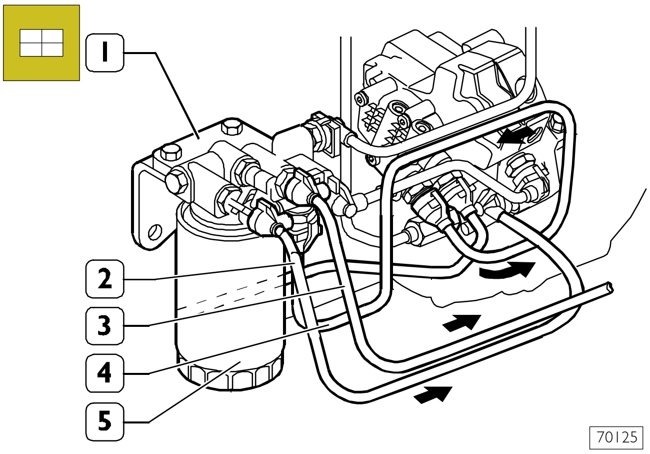
Pipe connections (2) shall be tightened to 20 Nm torque using the proper dynamometric wrench 99389834.
Connection (7) shall be tightened by holding at the same time the high pressure pump hexagon (10).
When removed pipe (2) shall always be replaced.
Connect pipe (3) to connection (4) and air compressor (8).

Figure 184



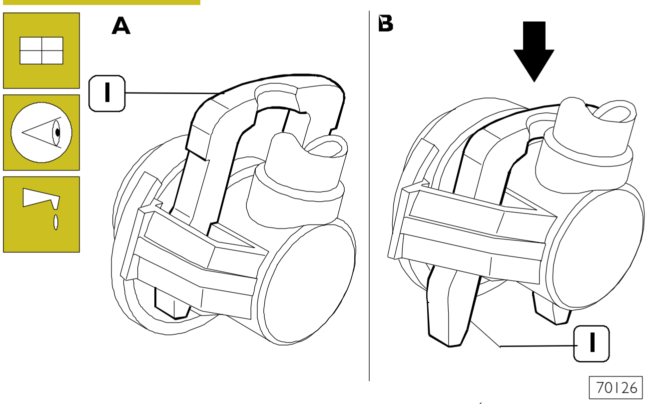
Refit the bracket (2) including the fuel filter support (1) to the engine block, tighten the screws (3) to the specified torque.

Figure 185



Screw manually the fuel filter to the support (1), screw the filter by 3/4 turn, connect the pipes (2-3-4) to the relevant support connections (1) as shown in the following figure.

Figure 186



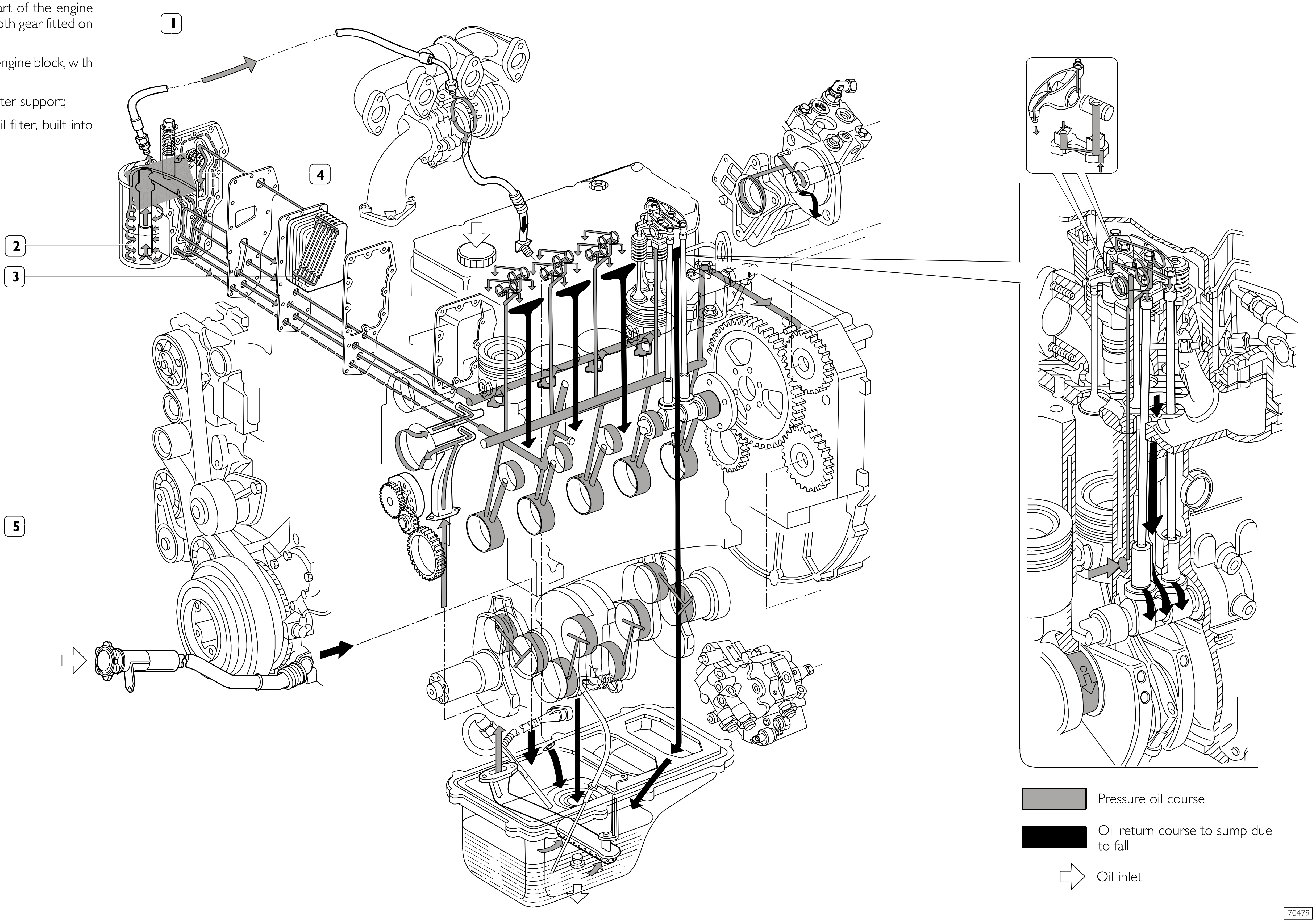
Press the clamp (1) as shown in figure B.
After disconnecting the pipe, reset the clamp (1) to the initial locking position A, to prevent deformations.
When refitting is over, fill engine with the prescribed lubricating oil in the specified quantity.

5450 LUBRICATION

Forced lubrication is implemented by the following components:

- rotor oil pump (5), set in the front part of the engine block and controlled by the straight-tooth gear fitted on the output shaft tang;
- water/oil heat exchanger (3) set in the engine block, with oil filter support;
- oil pressure relief valve (1) built into filter support;
- by-pass valve (4) to cut out clogged oil filter, built into filter support;
- cartridge oil filter (2).

Figure 187

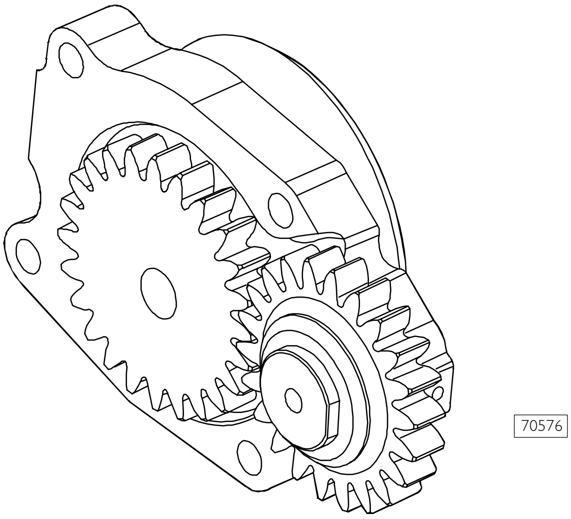


LUBRICATION SYSTEM LAYOUT

543010 OIL PUMP

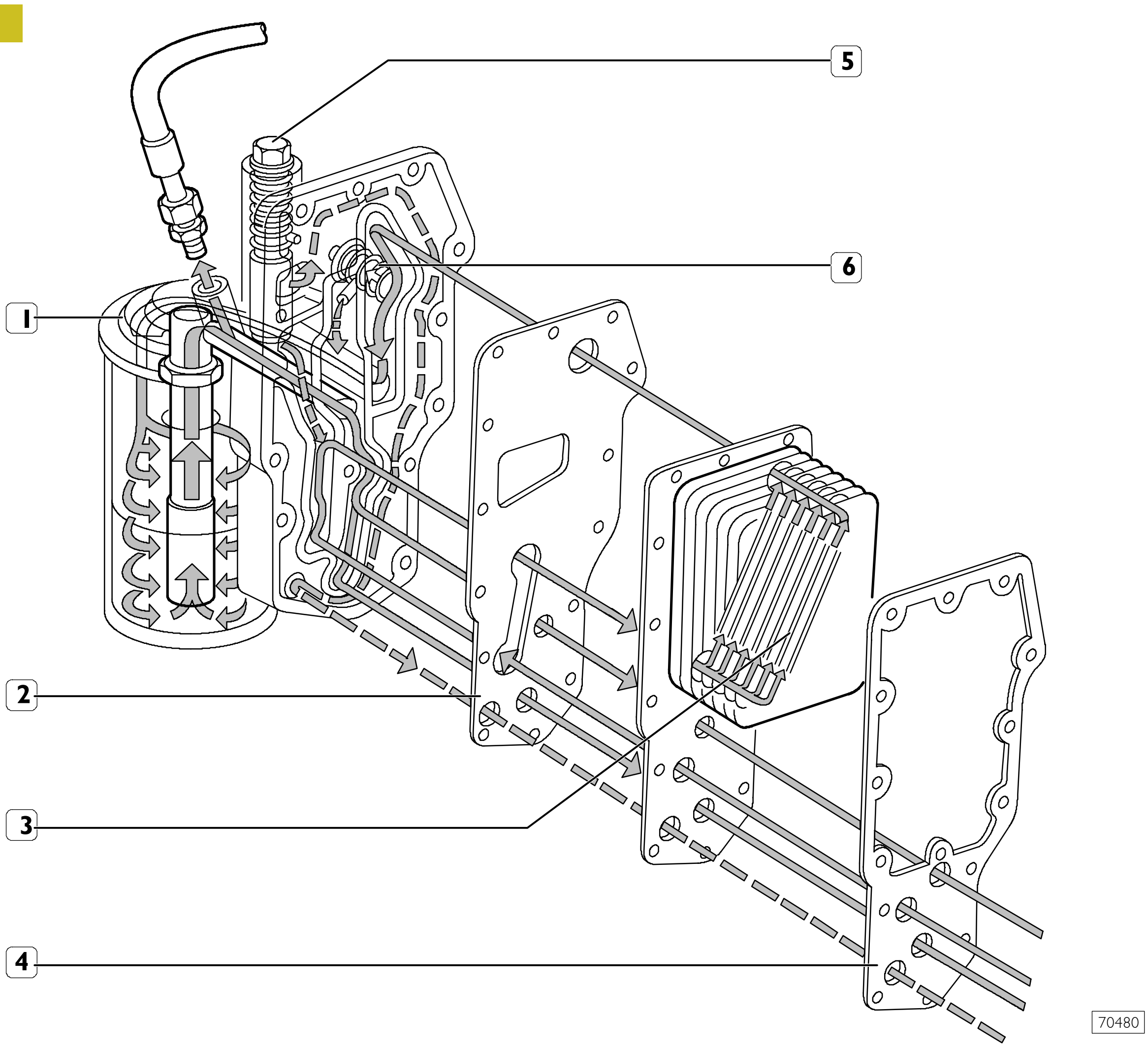
NOTE Since the oil pump cannot be overhauled, it shall be replaced when damaged.

Figure 188



543110 HEAT EXCHANGER

Figure 189



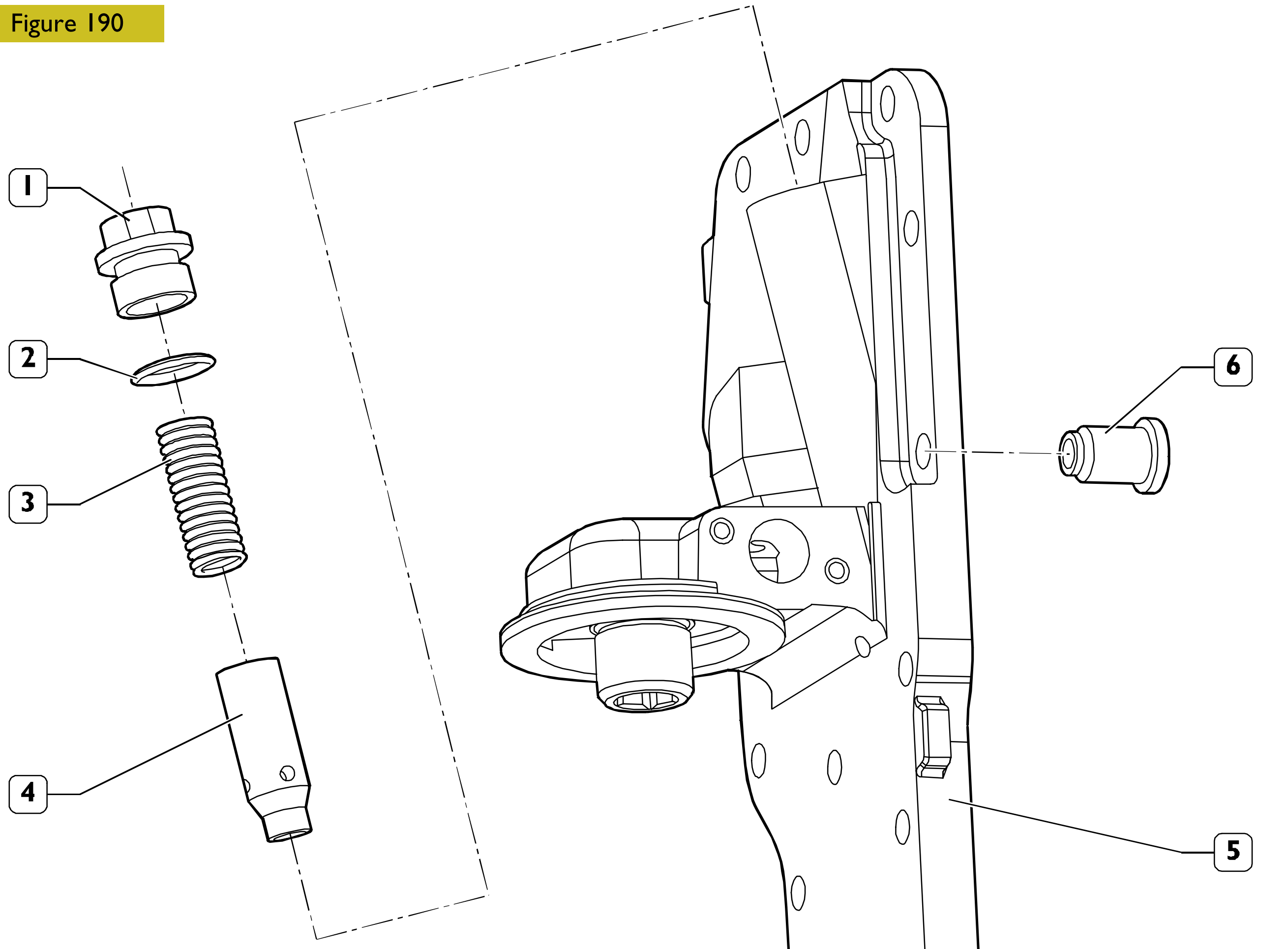
1. Heat exchanger body with filter support - 2. Internal gasket - 3. Water-oil heat exchanger - 4. Gasket between heat exchanger unit and engine block - 5. Oil pressure relief valve - 6. By-pass valve to cut out clogged oil filter.

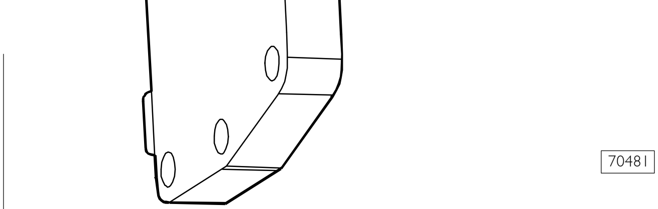
Clean accurately the heat exchanger components

Always replace the sealing gaskets.

543075 Oil pressure relief valve

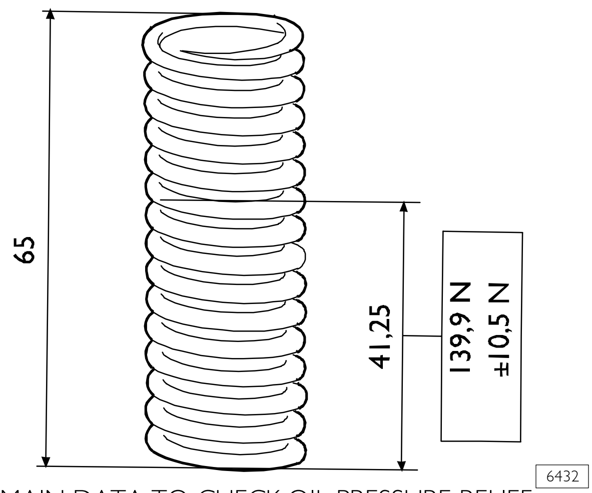
Figure 190





Loosen the plug (1), withdraw the spring (3) and the relief valve (4) from the support (5).
Check whether the valve (4) is not scored and is sliding smoothly into its seat. The spring (3) shall not be broken or yielded.
Pressure regulation at 100°C oil temperature:
- 1.2 bar min pressure;
- 3.8 bar max. pressure

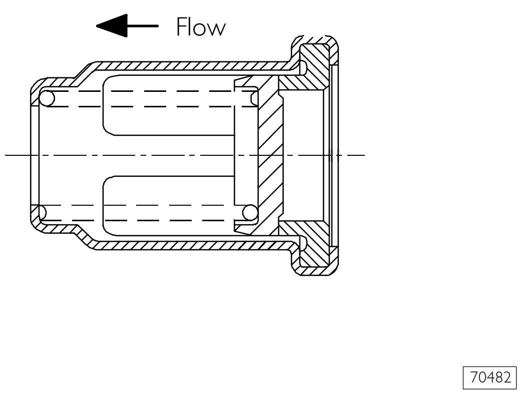
Figure 191



MAIN DATA TO CHECK OIL PRESSURE RELIEF VALVE SPRING

By-pass valve to cut out clogged oil filter.

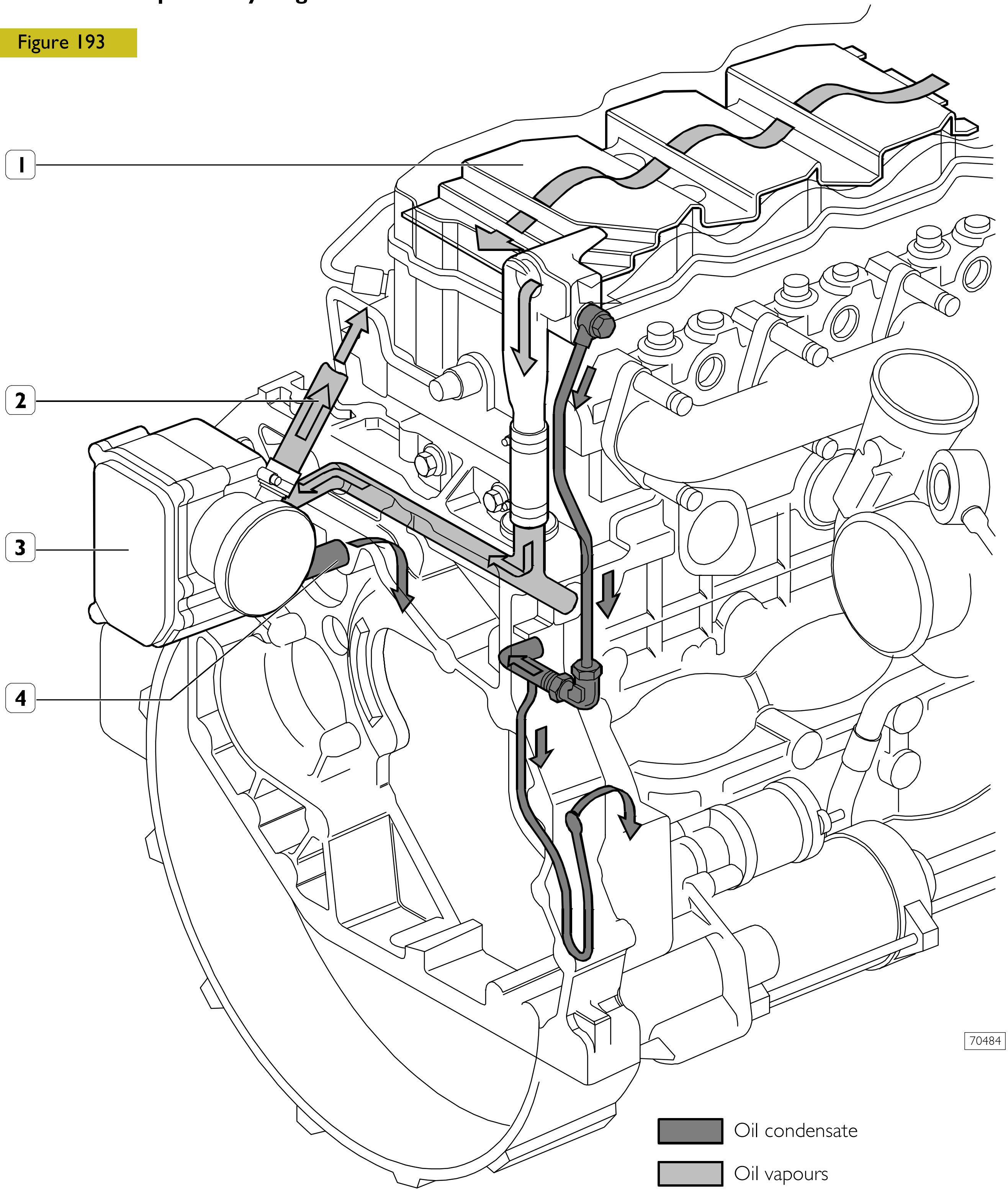
Figure 192



Max blow-by:
22 cm^3/1' at 0.8 bar pressure and 26.7°C temperature

540480 Oil vapour recycling

Figure 193



1. Pre-separator - 2. Exhaust to the outside (temporary) - 3. Filter - 4. Return to engine

The tappet cover houses the pre-separator (1), whose shape and position determines an increase in oil vapour outlet speed and condenses a part of vapours at the same time.

Condensate oil returns to the oil sump whereas the residual vapours are ducted, collected and filtered in the blow-by (3).

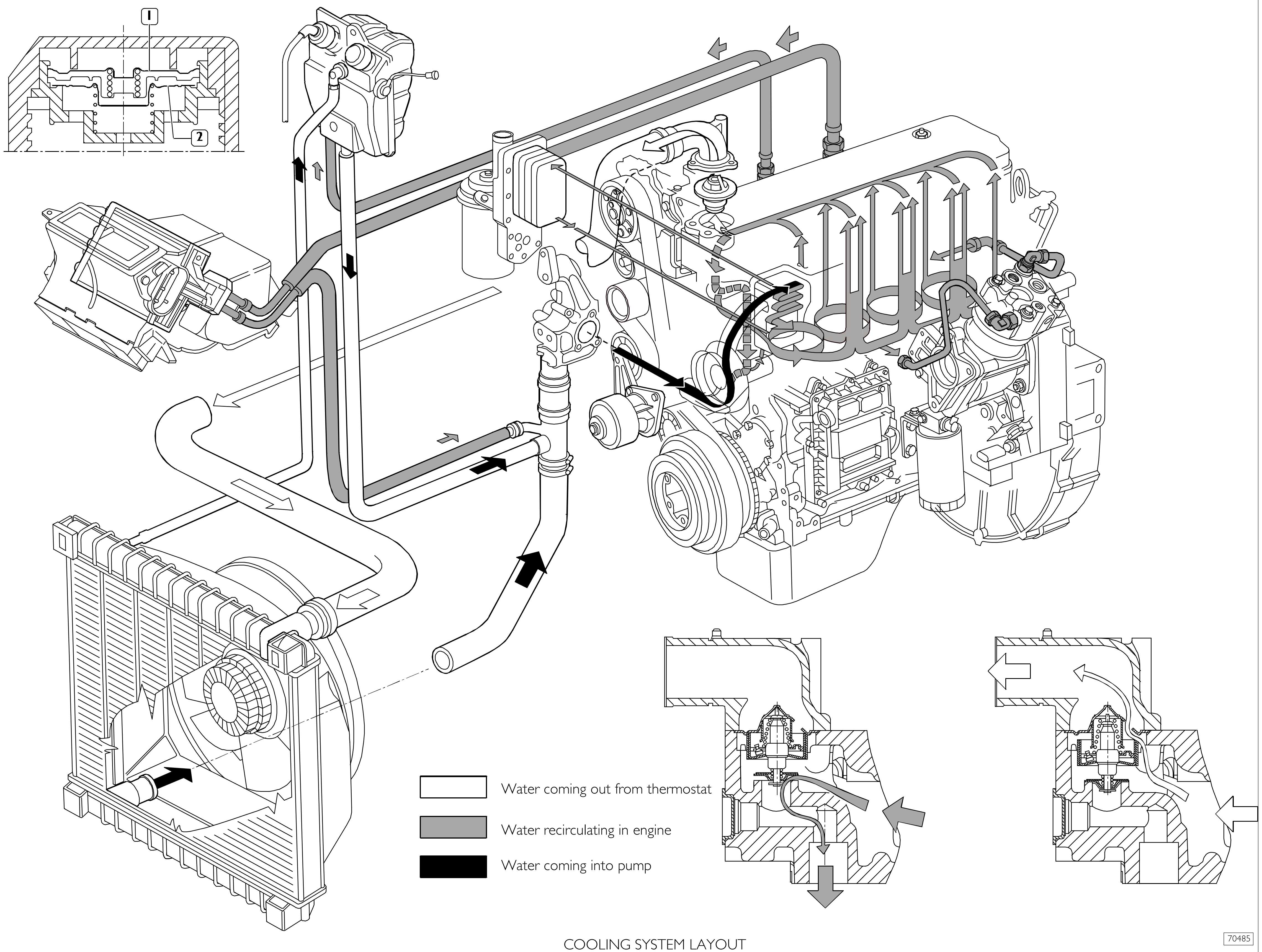
In the blow-by (3), part of the vapours condense and return to the oil sump whereas the remaining part is put into cycle again through pipe (2).

5432 COOLING SYSTEM

The closed loop cooling system by pump consists of the following components:

- expansion tank with plug, with two built-in valves: exhaust valve (2) and intake valve (1) to control system pressure;
- radiator, for dissipating the heat subtracted to engine by coolant;
- viscous fan;
- heat exchanger to cool the lubricating oil (see lubrication);
- centrifugal water pump set in the front part of the engine block;
- thermostat to control coolant circulation.

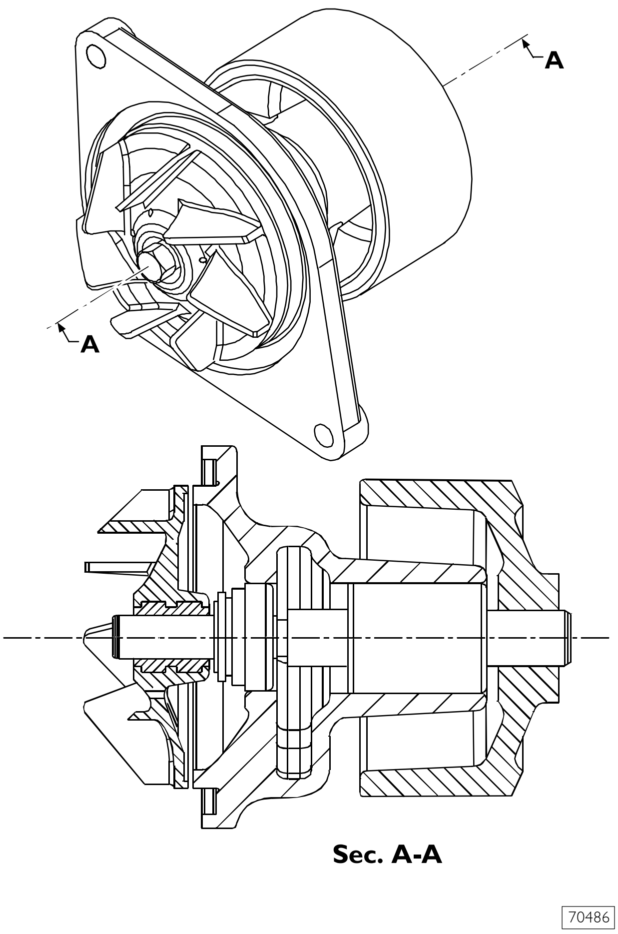
Figure 194



COOLING SYSTEM LAYOUT

543210 Water Pump

Figure 195

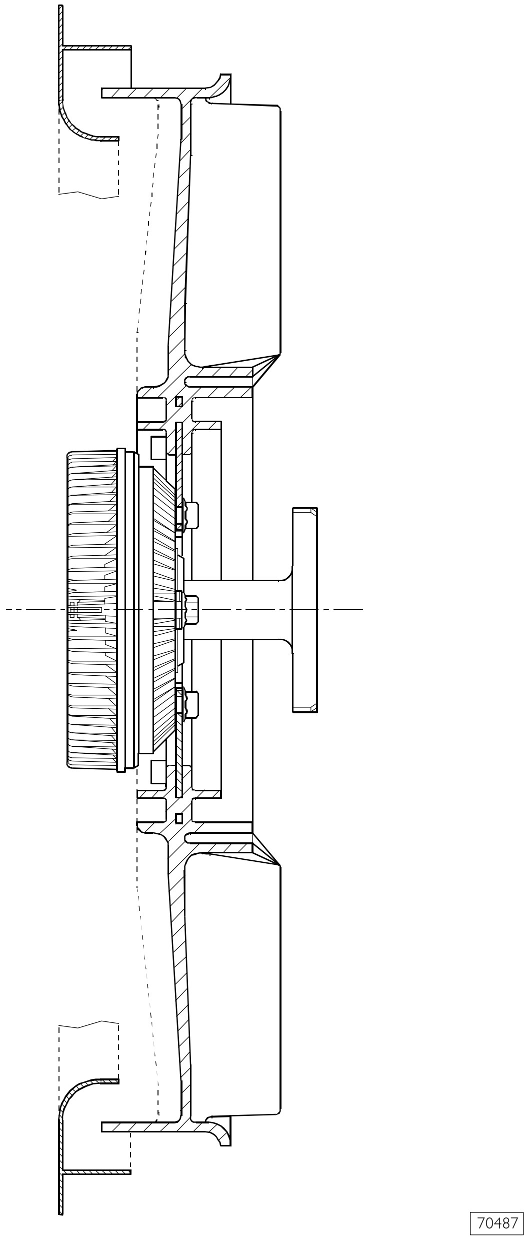


The water pump is located in a housing obtained in the engine block and is controlled by and a poly-V belt.

An automatic tensioner keeps the belt tension.

Viscous fan

Figure 196

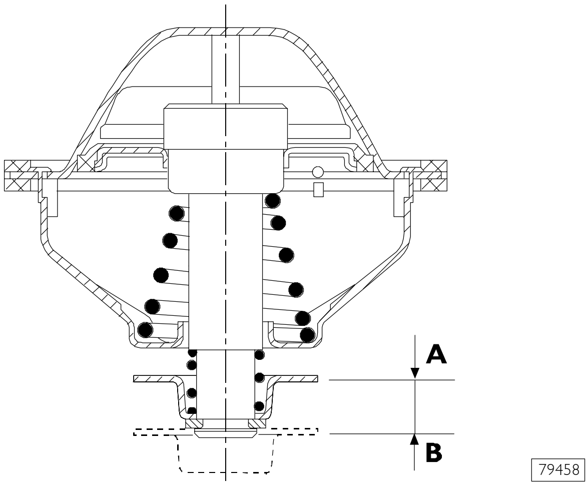


Characteristics:

Max control speed:	2700 rpm
Max fan speed:	2565 rpm ± 50 rpm
Operating temperature:	75°C± 4°C at 2160 rpm fan speed

543250 Thermostat

Figure 197



The thermostat (1) of the by-pass type is located in the cylinder head and doesn't need regulations.

Whenever doubts on its operation are present, replace it.

On the thermostat body are fitted the thermometric transmitter/switch and water temperature sensor.

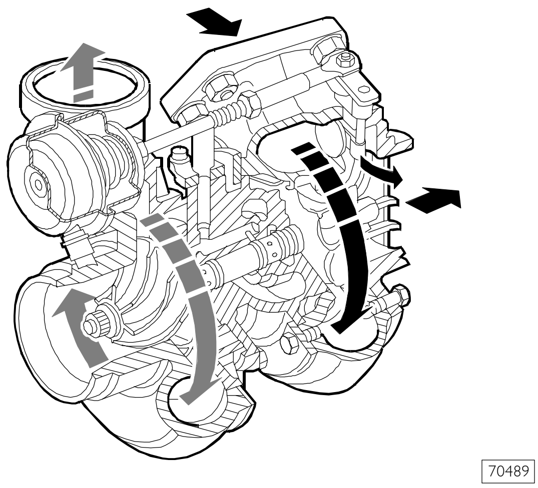
A= stroke beginning: 79.0 – 83.0 °C

B= stroke at 96 °C ≥ 7.5 mm

BOOSTER

542410 Turbosupercharger

Figure 198



Exhaust

Compressed air

TURBOSUPERCHARGER GARRETT

Booster pressure: 1.5 bar.
Actuator (WASTEGATE) opening start: 1600 rpm

Description

The booster system is composed of: air cleaner, turbosupercharger and intercooler.

The air cleaner is a dry type composed of a filtering cartridge that is periodically changeable.

The turbosupercharger has got the function of using the energy of engine exhaust gas in order to send pressure air to the cylinders.

It is essentially composed of:

- ❑ a main body where a shaft supported by bushes is located. At the ends of the bushes the turbine rotor and compressor rotor are fitted;
- ❑ a turbine body and a compressor body fitted on the end of the main body;
- ❑ a waste gate valve applied on the turbine body used for determining the portion of exhaust gases and sending a part of them directly to the exhaust pipe, when the booster pressure downstream the supercharger reaches the calibration value;
- ❑ the intercooler is composed of a radiator applied on the engine coolant radiator, and it is used for lowering the temperature of the air coming out from the turbosupercharger to send it to the cylinders.

Verifying an anomalous operation of the engine, due to the booster system, it is recommended, before performing controls on the turbosupercharger, to check the efficiency of the sealing gaskets and the fixing of the connection sleeves, making sure of clogging absence inside intake sleeves, air cleaner or inside radiators. If the turbosupercharger damage is due to a lack of lubrication, check that the oil circulation pipes are not broken or obstructed, in such case replace them or eliminate the trouble.

Bearing end play check

Position the tracer point of the magnetic-base dial gauge on the turbosupercharger shaft end and set to zero the dial gauge.

Move the turbosupercharger shaft axially and check that the clearance is not higher than the prescribed value.

Replace the turbosupercharger if a different value is found.

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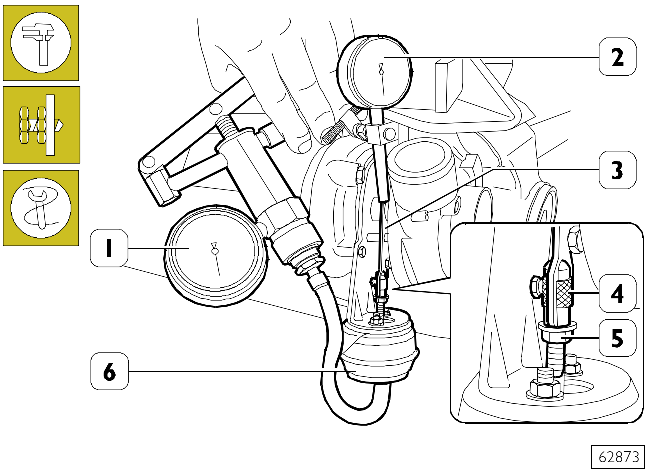
542418 TURBOSUPERCHARGER ACTUATOR

Check and adjustment

Figure 199



Cover the air, exhaust gas and lubrication oil inlets and outlets.

Carry out an accurate external cleaning of the turbosupercharger, using the anticorrosive and antioxidant solution and perform the check on the actuator (6).

Clamp the turbosupercharger in a vice.

Disconnect the pipe of the actuator (6) and apply to the actuator union, the pipe of pump 99367121 (1).

Apply the magnetic-base dial gauge (2) on the exhaust gas inlet flange in the turbine.

Position the tracer point of the gauge (2) on the tie rod (3) end and set to zero the gauge (2).

Through the pump (1) let in compressed air, in the actuator (6), at the prescribed pressure and make sure that such value is kept constant for the whole check time, otherwise replace the actuator (6).

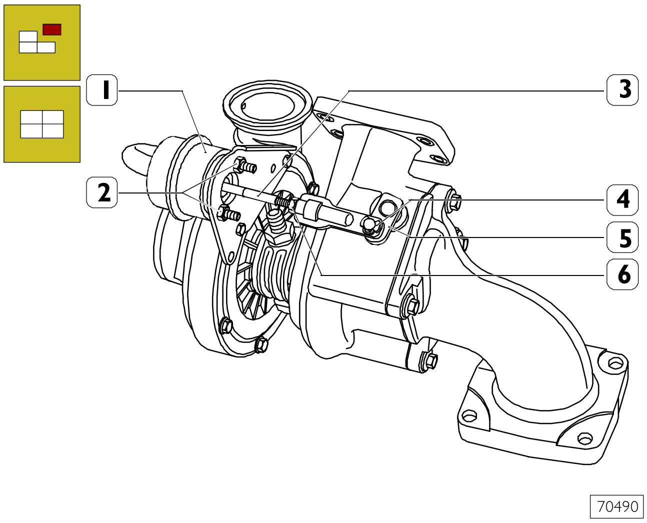
In the above-mentioned conditions, the tie rod must have carried out the prescribe stroke.

NOTE During the operation, beat slightly the actuator (6) in order to eliminate possible sticking of the actuator internal spring.

If a different value is found, loosen the nut (5) and operate properly the knurled ring nut (4).

Actuator replacement

Figure 200



Remove the elastic clip (4) and withdraw the tie rod (3) from the lever (5).

Remove the nuts (2) and remove the actuator (1) from the supporting bracket. Fit the new actuator following the removal operations in reverse order and fitting a new clip (4), tighten the nuts (2) to 5.6 – 6.8 Nm torque.

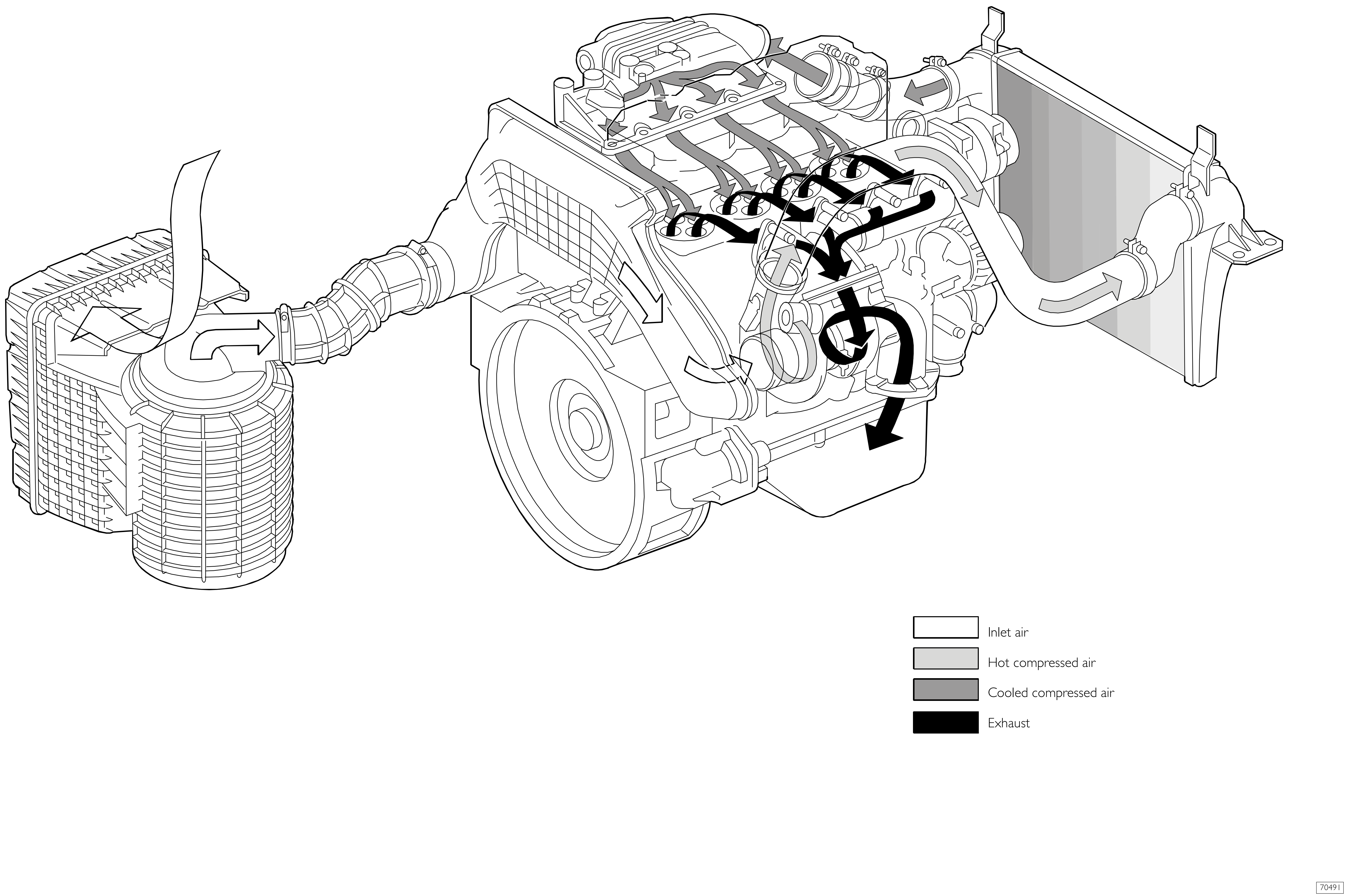
Check and adjust the actuator (1), if required, as described in the relevant chapter.

Then, paint the nut (6) with safety paint.

Before refitting the turbosupercharger on engine, fill the central body with engine oil.

TURBOSUPERCHARGER LAYOUT

Figure 201



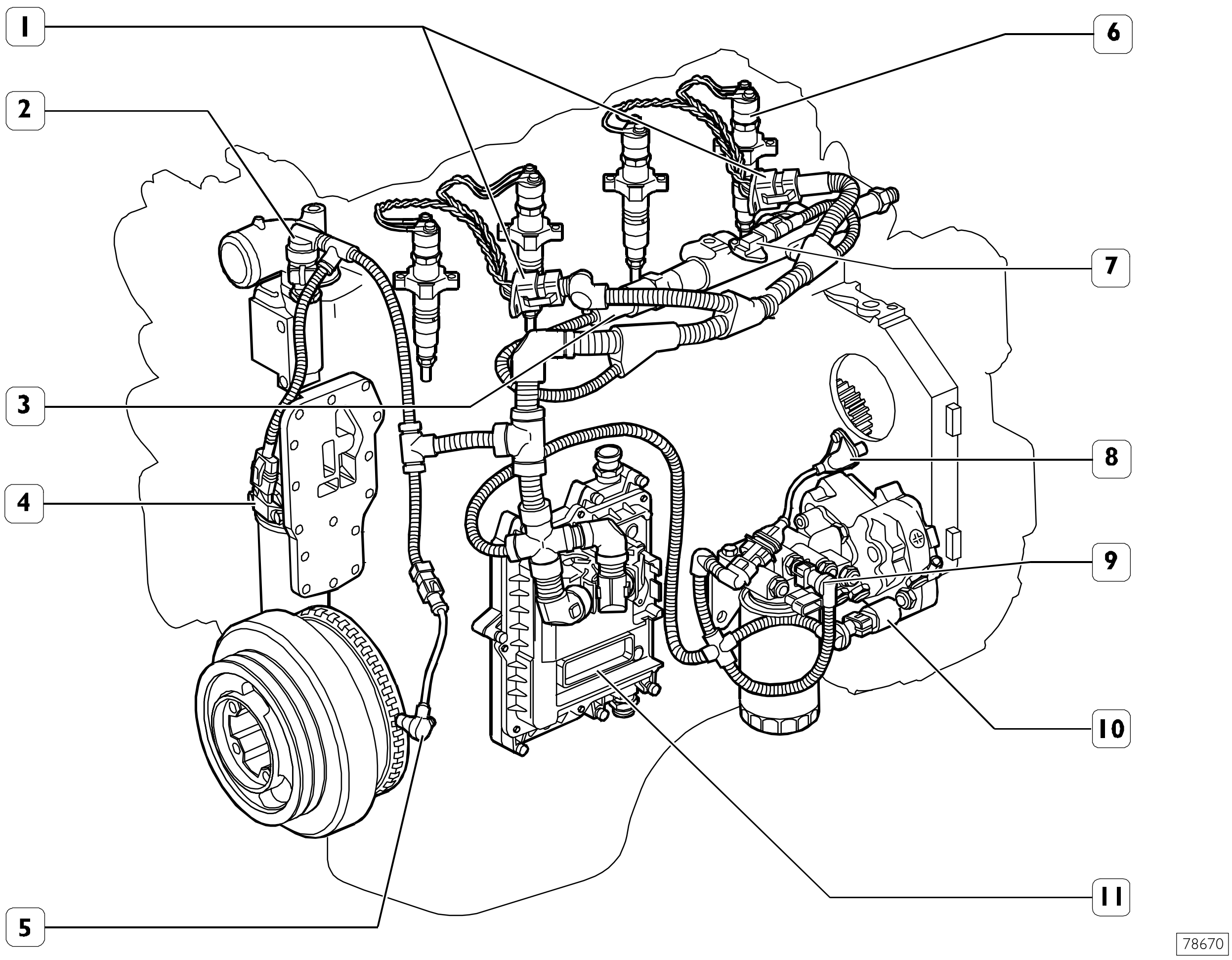
COMMON RAIL
General Specifications

In order to reduce PARTICULATES emissions, very high injection pressures are required.
The Common Rail system allows injecting the fuel up to pressures reaching 1350 bar, at the same time, the injection precision, obtained by the electronic system control, optimizes the engine performance, reducing emissions and consumption.

System description

Electric system

Figure 202



1. Injectors connections - 2. Fuel pressure sensor - 3. Engine coolant temperature sensor - 4. Engine oil temperature and pressure sensor - 5. Output shaft sensor - 6. Injector - 7. Air pressure/temperature sensor - 8. Camshaft sensor - 9. Fuel heater and fuel temperature sensor - 10. Pressure regulator - 11. EDC 7 control unit.

Through the sensors, present on the engine, the ECU controls the engine operation.

Air pressure/temperature sensor

It is a component integrating a temperature sensor and a pressure sensor.

Fitted on the intake manifold, it measures the max. inlet air capacity to calculate precisely the fuel quantity to inject at every cycle.

The outlet tension is proportional to the pressure or temperature obtained by the sensor.

Engine oil temperature and pressure sensor

Same as air pressure/temperature sensor, it is fitted on the engine oil filter, in a horizontal position.

It measures engine oil temperature and pressure.

Fuel pressure sensor

Assembled on a rail end, it measures the fuel pressure in the rail in order to determine the injection pressure.

The injection pressure value is used to control the pressure and to determine the electric injection control length.

Fuel temperature sensor

It is a sensor that is equal to the previous one.

It measures fuel temperature to provide the control unit with an index of the diesel fuel thermal state.

Coolant temperature sensor

It is a variable-resistance sensor suitable to measure the coolant temperature to provide the control unit with an index of the engine thermal state.

Output shaft sensor

It is an inductive sensor placed on the front engine part. Signals generated through the magnetic flow that is closed on the phonic wheel, change their frequencies depending on output shaft rotation speed.

Timing sensor

It is an inductive sensor placed on the engine rear left part. It generates signals obtained from magnetic flow lines that are closed through holes obtained on the keyed gear on the camshaft. The signal generated by this sensor is used by the ECU as injection phase signal.

Though being equal to the flywheel sensor, it is NOT interchangeable since it has a different outside shape.

System functionality

Self-diagnosis

The ECU self-diagnostic system checks signals coming from sensors by comparing them with threshold data.

IVECO Code recognition

The EDC7 control unit communicates with the Immobilizer control unit to obtain the startup consent.

Engine pre-heating resistance check

The pre-post heating is activated when even only one of the water, air or fuel temperature sensors signals a temperature that is less than 5 °C.

Phase recognition

By means of signals coming from camshaft sensor and flywheel sensor, the cylinder on which fuel must be injected is recognised upon startup.

Injection control

The control unit, depending on information coming from sensors, controls the pressure regulator, and changes pre-injection and main injection modes.

Closed-loop control for injection pressure

Depending on engine load, measured by processing signals coming from various sensors, the control unit controls the regulator in order to always have the optimum pressure.

Pilot and main injection spark advance control

The control unit, depending on signals coming from various sensors, computes the optimum injection point according to an internal mapping.

Idle speed control

The control unit processes signals coming from various sensors and adjusts the amount of injected fuel.
It controls the pressure regulator and changes the injection time of injectors.
Within certain thresholds, it also takes into account the battery voltage.

Maximum speed limiting

At 2700 rpm, the controlunit limits fuel flow-rate by reducing the injectors opening time.
Over 3000 rpm it deactivates the injectors.

Cut Off

Fuel cut off upon release is controlled by the control unit performing the following logics:

- ❏ it cuts off injectors supply;
- ❏ it re-activates the injectors shortly before idle speed is reached;
- ❏ it controls fuel pressure regulator.

Smoke control upon acceleration

With strong load requests, the control unit, depending on signals received by air inlet meter and engine speed sensor, controls the pressure regulator and changes the injectors actuation time, in order to avoid exhaust smokes.

Fuel temperature control

When the fuel temperature exceeds 75 °C (measured by the sensor placed on fuel filter) the control unit intervenes by reducing injection pressure.
If the temperature exceeds 90 °C, the power is reduced to 60%.

AC compressor engagement control

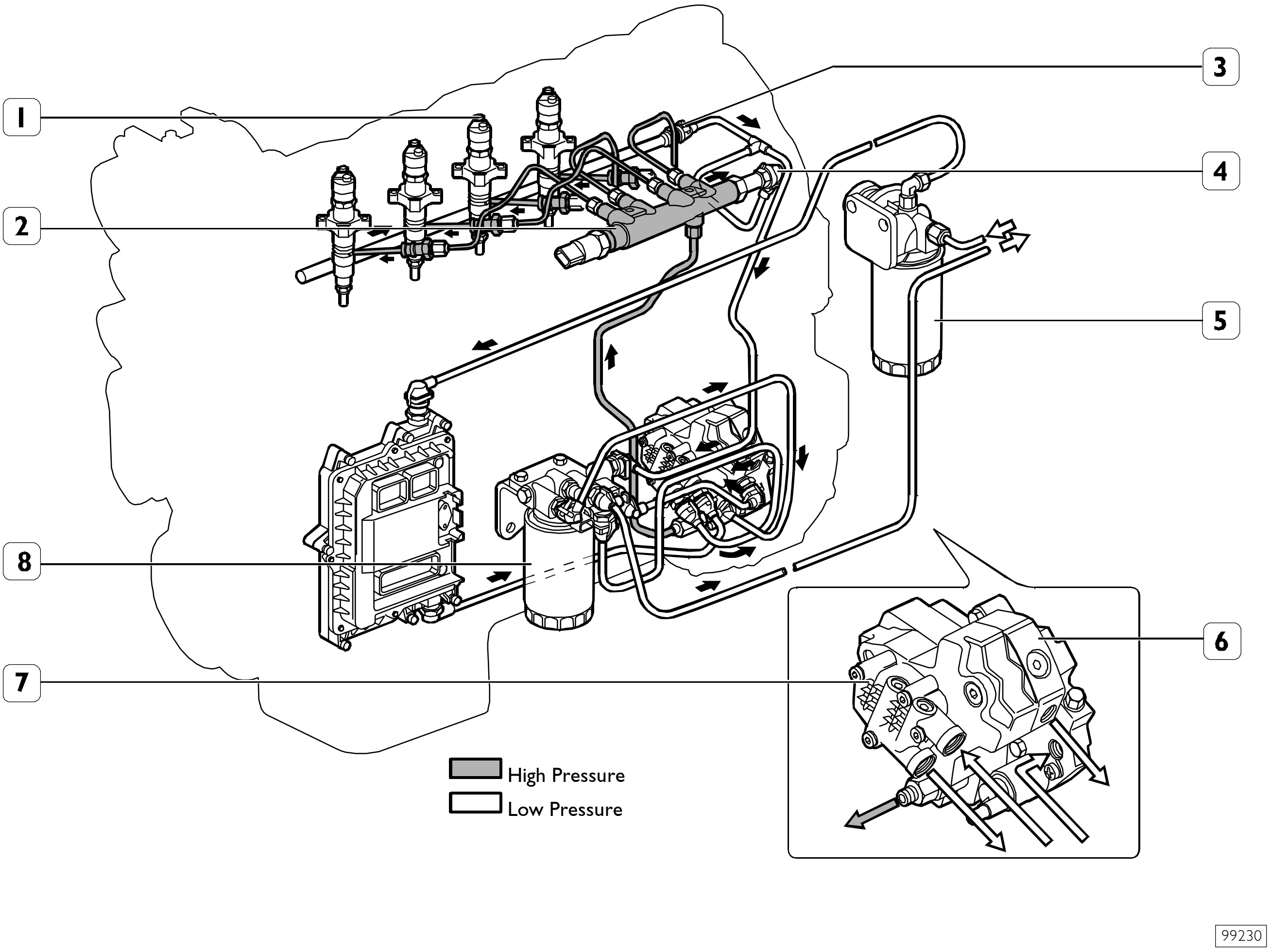
The control unit is able to drive engagement and disengagement of the electromagnetic compressor clutch depending on coolant temperature.
If the coolant temperature reaches about 105 °C, it disengages the clutch.

After Run

The control unit microprocessor allows storing certain EPROM data, among which failure memory and Immobilizer information, in order to make them available upon the following startup.

HYDRAULIC SYSTEM

Figure 203



1. Injector - 2. Common Rail - 3. Pressure limiter for fuel return - 4. Rail overpressure valve - 5. Prefilter assembled on chassis - 6. High-pressure pump - 7. Mechanical rotor pump - 8. Fuel filter.

The Common Rail system has a special pump that continuously keeps fuel at high pressure, independently from stroke and cylinder that has to receive the injection and accumulates fuel in a common duct for all injectors.

Therefore, fuel at the injection pressure computed by the ECU is always available at the injectors inlet.

When an injector solenoid valve is energised by the electronic control unit, the injection of fuel directly taken from rail takes place in the related cylinder.

The hydraulic system is implemented by a low-pressure circuit and a high-pressure circuit.

The high-pressure circuit is composed of the following pipings:

❑ piping connecting high-pressure pump outlet to rail;

❑ pipings supplying injectors from rail.

The low-pressure circuit is composed of the following pipings:

❑ fuel suction piping from tank to prefilter;

❑ pipings supplying the mechanical supply pump through the control unit heat exchanger, manual priming pump and prefilter;

❑ pipings supplying the high-pressure pump through the fuel filter.

The fuel draining circuit from rail and from injectors and the high-pressure pump cooling circuit complete the system.

HYDRAULIC SYSTEM LAYOUT

This Common Rail injection system, with CP3 pump, is mostly different from the one adopted on the Daily range with CP1 pump due to the different pressure regulator position and due to the gear supply pump.

The pressure regulator, placed upstream of the high-pressure pump, adjusts the fuel flow that is necessary on the low-pressure system. Afterwards, the high-pressure pump takes care of supplying the rail properly. This arrangement, by pressurising the necessary fuel only, improves the energetic efficiency and limits fuel heating in the system.

Function of the pressure relief valve (2), assembled on the high-pressure pump, is keeping the pressure, at the pressure regulator inlet, constant at 5 bars, independently from the efficiency of the fuel filter and of the system set upstream.

The pressure relief valve (2) intervention brings about a fuel flow increase in the high-pressure pump cooling circuit, through inlet and drain piping (16) from piping (8).

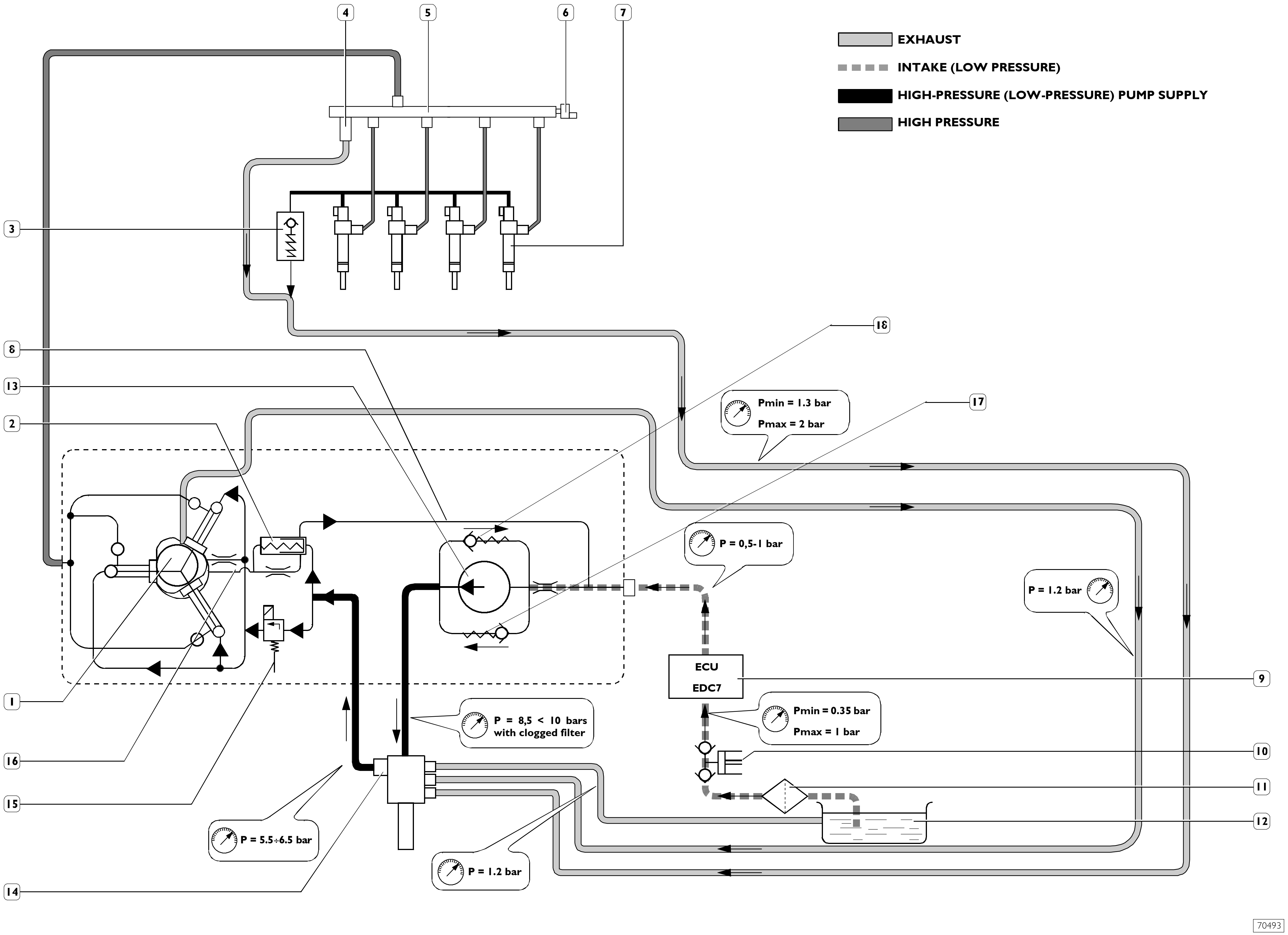
The pressure relief valve housed on the cylinder head, assembled on injector return (3), limits the fuel return flow from injectors at a pressure of 1.3 to 2 bars.

Two by-pass valves are placed in parallel with the mechanical supply pump.

The by-pass valve (18) allows fuel to flow from mechanical pump outlet to its inlet, when the fuel filter inlet pressure exceeds the allowed threshold value.

The by-pass valve (17) allows filling the supply system through the manual priming pump (10).

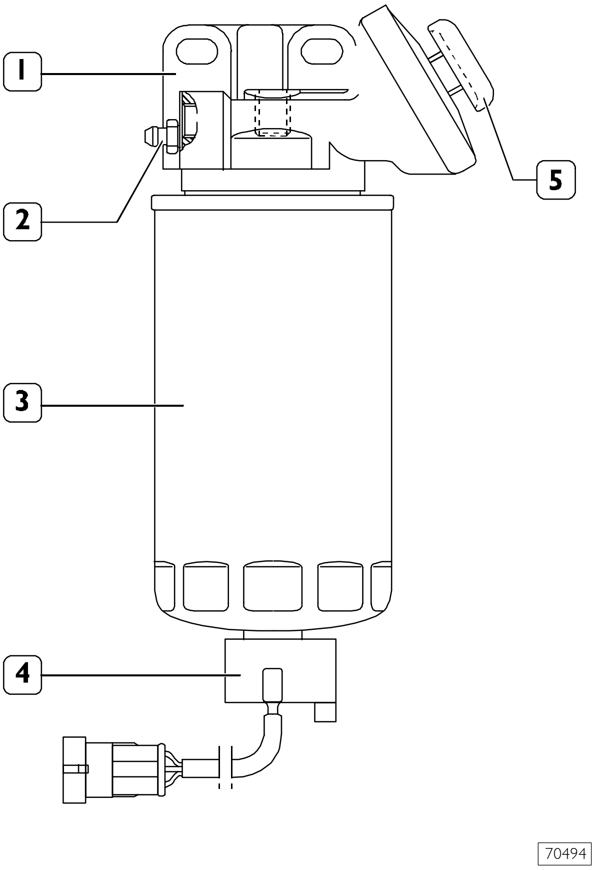
Figure 204



1. High-pressure pump. – 2. Pressure relief valve on high-pressure pump, 5 bars. – 3. Pressure relief valve assembled on fuel return from injectors, 1.3 to 2 bars. – 4. Rail overpressure valve. – 5. Common Rail. – 6. Pressure sensor. – 7. Injector. – 8. Return piping. – 9. Control unit heat exchanger. – 10. Mechanical priming pump. – 11. Prefilter assembled on chassis. – 12. Fuel tank. – 13. Mechanical supply pump. – 14. Fuel filter. – 15. Pressure regulator. – 16. High-pressure pump cooling piping. – 17. By-pass valve. – 18. By-pass valve.

FUEL PREFILTER

Figure 205



The fuel filter is of the high water separation type, is assembled on the right side of the vehicle chassis, and has the sensor (4) for detecting water in fuel placed on the cartridge (3) base.

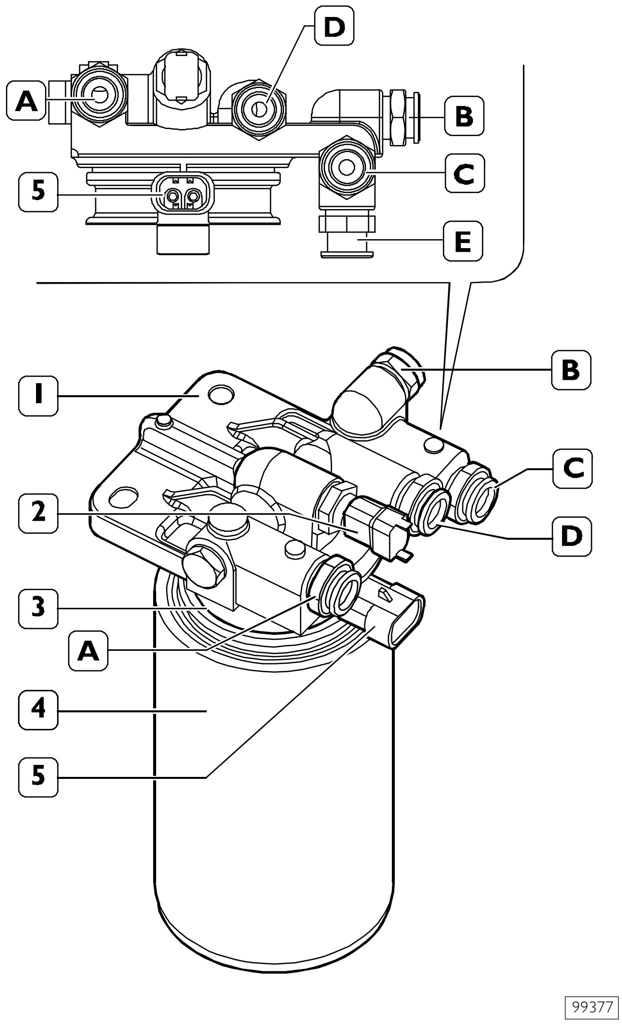
Manual priming pump (5) and air bleeding screw (2) from system are placed on filter support.

The presence of condensate into filter is signalled by sensor (4) when a warning light on the instrument panel is lit.

> If the warning light is on, it is necessary to immediately operate to remove its cause; the common rail system components are quickly damaged by the presence of water or impurities in the fuel.

FUEL FILTER

Figure 206



1. Fuel filter support - 2. Fuel temperature sensor - 3. Electric fuel heater - 4. Fuel filter - 5. Heater connector.

A. Outlet connection to high-pressure pump
B. Inlet connection for fuel discharge from common rail
C. Outlet connection for fuel discharge to the tank
D. Inlet connection from fuel pump
E. Discharge connection from high-pressure pump

It is placed on engine block in the circuit between supply pump and high-pressure pump (CP3).

Cartridge filtering degree: 4 microns, Pressure delta 2 bars.

The following are placed on the support: fuel temperature sensor and heater resistances.

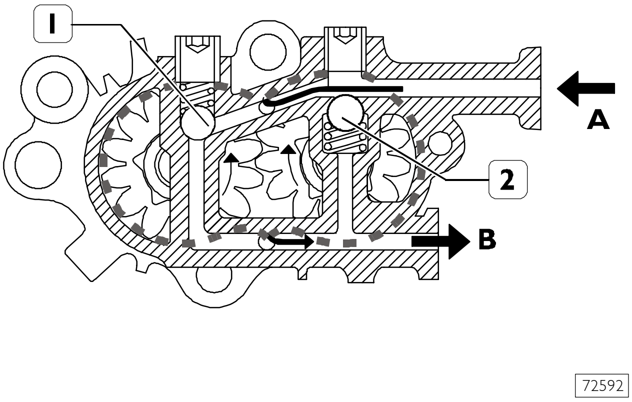
Fuel temperature, signalled by the related sensor to EDC7 control unit, allows a very accurate computation of the fuel flow-rate to be injected into the cylinders.

MECHANICAL SUPPLY PUMP

Gear pump, fitted on the rear side of the high pressure pump and used to supply it.
It is controlled by high pressure pump shaft

Normal operating conditions

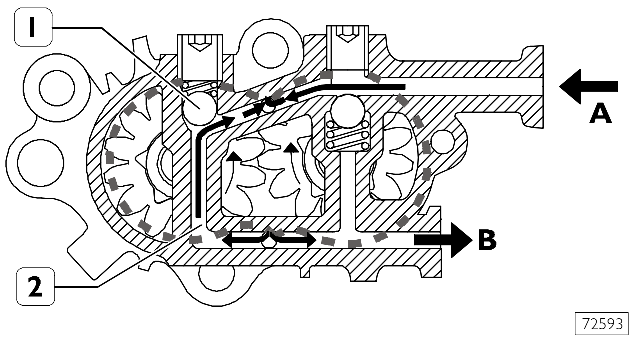
Figure 207



A Fuel inlet from tank, B fuel outlet to filter, 1-2 by-pass valves in close position

Overpressure condition at outlet

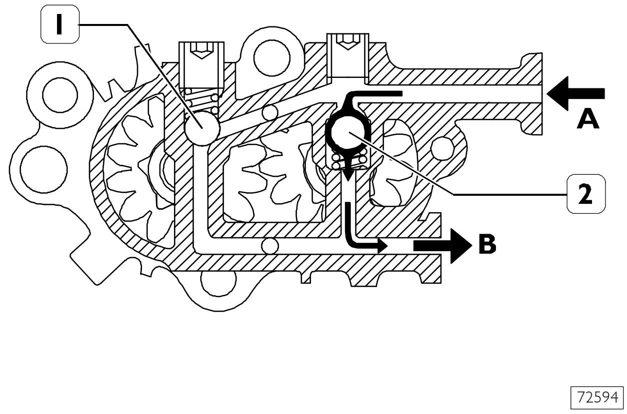
Figure 208



The by-pass valve (1) cuts in when overpressure is generated at outlet B. The existing pressure, overcoming valve spring (1) elastic strength, makes inlet and outlet communicating through duct (2).

Drain conditions

Figure 209



The by-pass valve (2) cuts in when, with engine off, the fuel system shall be filled through the priming pump. In this situation the by-pass valve (1) stays closed whereas by-pass valve (2) opens due to inlet pressure, and fuel is drained out through **B**.

NOTE The mechanical supply pump cannot be replaced individually, therefore it cannot be removed from the high pressure pump.

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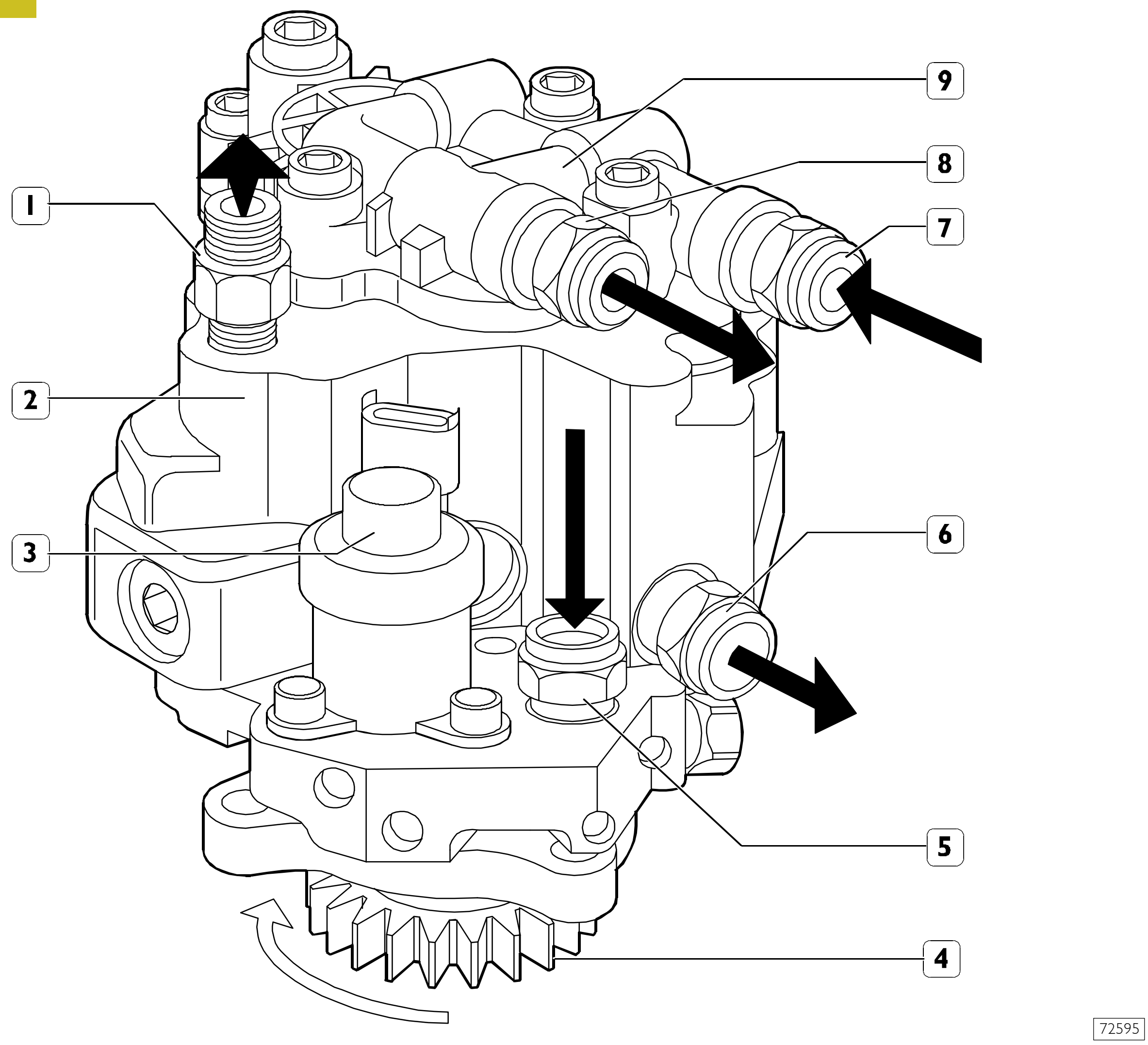
CP3 HIGH-PRESSURE PUMP

Pump with 3 radial pistons controlled by the timing gear, without needing any setting. On the rear side of the high pressure pump is fitted the mechanical supply pump controlled by the high pressure pump shaft.

The following work must be carried out on the feed pump / high-pressure pump assembly:

- ❑ replacing the drive gear;
- ❑ replacing the pressure regulator.

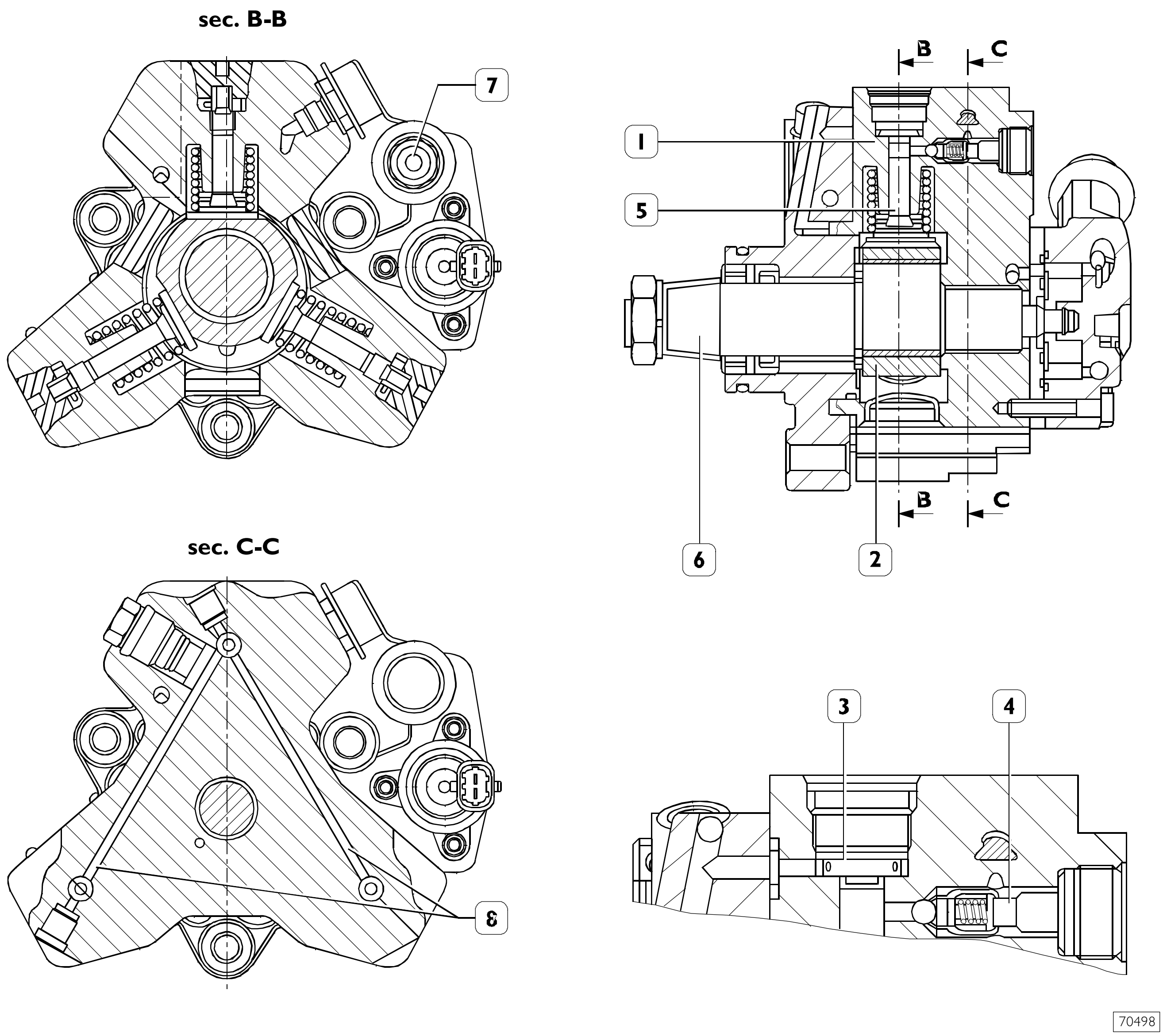
Figure 210



1. Fuel outlet fitting to rail - 2. High-pressure pump - 3. Pressure regulator - 4. Control gear - 5. Fuel inlet fitting from filter - 6. Fuel outlet fitting to filter support - 7. Fuel inlet fitting from control unit heat exchanger - 8. Fuel outlet fitting from supply pump to filter - 9.Mechanical supply pump

HIGH-PRESSURE PUMP - INSIDE STRUCTURE

Figure 211



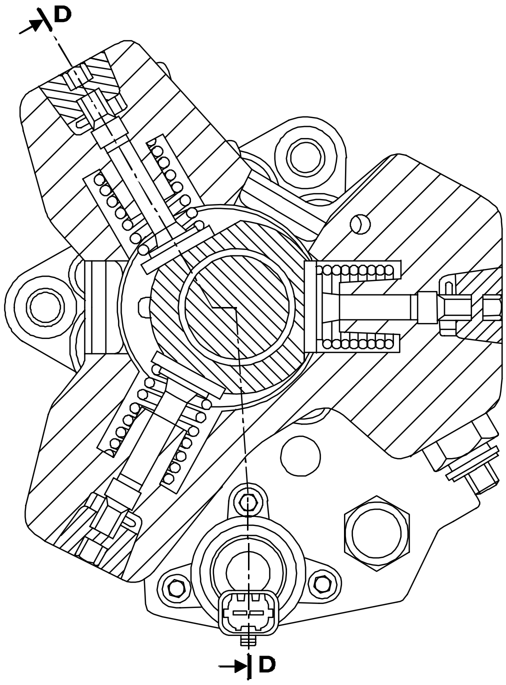
1. Cylinder. – 2. Three-lobe element. – 3. Cap intake valve. – 4. Ball delivery valve. – 5. Piston. – 6- Pump shaft. – 7. Low-pressure fuel inlet. – 8. Pumping elements supplying fuel ducts.

Every pumping unit is composed of:

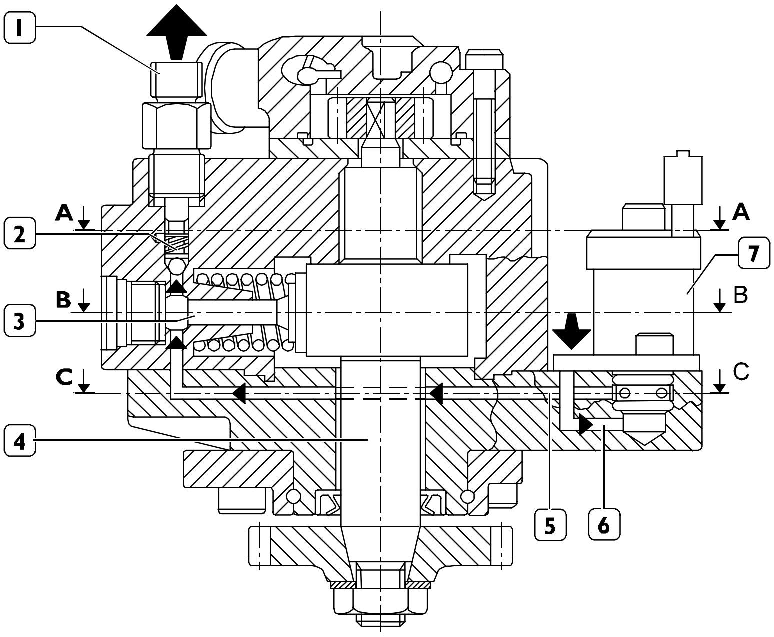
- a piston (5) actuated by a three-lobe element (2) floating on the pump shaft (6). The element (2), being **floating** on a misaligned part of the shaft (6), when the shaft rotates, does not rotate therewith but is only translated in a circular movement along a wider radius, with the resulting alternate actuation of the three pumping elements;
- cap intake valve (3);
- ball delivery valve (4).

Operating principle

Figure 212



Sec. B – B



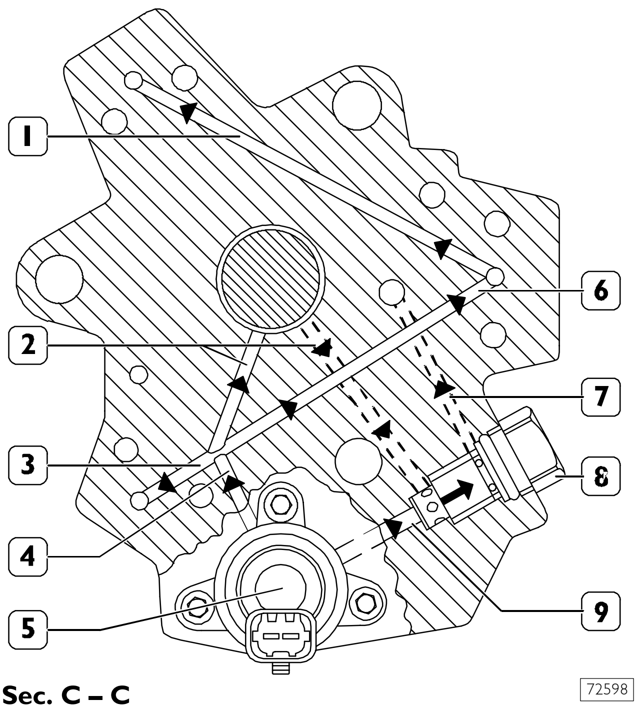
Sec. D – D

72597

1. Fuel outlet fitting to rail - 2. Delivery valve to rail - 3. Pumping element - 4. Pump shaft - 5. Pumping element supply duct - 6. Pressure regulator supply duct - 7. Pressure regulator

Pumping element (3) is oriented to pump shaft (4) cam. During intake, the pumping element is supplied through supply duct (5). The fuel amount to be sent to the pumping element is set by the pressure regulator (7). The pressure regulator meters fuel flow to pumping element according to the PWM signal received from ECU. During pumping element compression stage, fuel reaches the pressure required to open the delivery valve to common rail (2) and to feed it through outlet (1).

Figure 213



Sec. C – C

1. Pumping element inlet - 2. Pump lubrication ducts - 3. Pumping element inlet - 4. Main pumping element supply duct - 5. Pressure regulator - 6. Pumping element inlet - 7. Regulator exhaust duct - 8. 5 bar pressure relief valve - 9. Fuel drain from regulator inlet

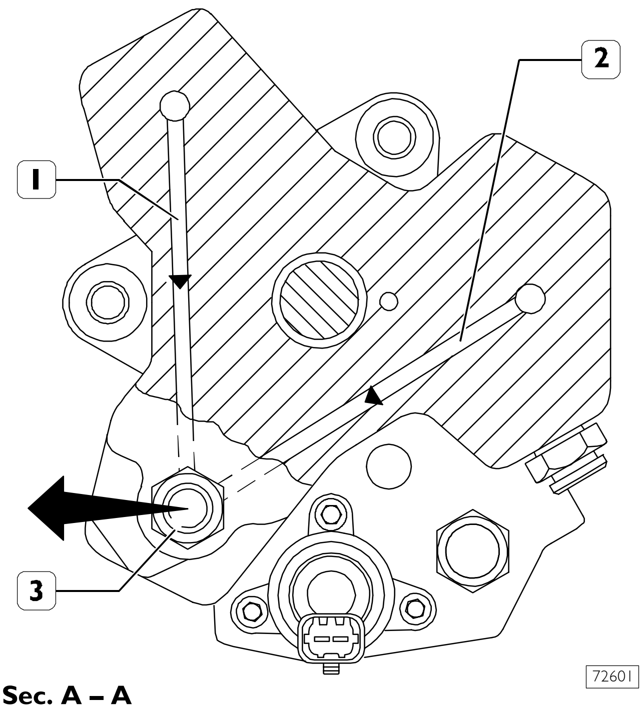
Figure 213 shows low pressure fuel paths inside the path and highlights: main pumping element supply duct (4), pumping element supply ducts (1 – 3 – 6), pump lubrication ducts (2), pressure regulator (5), 5 bar pressure relief valve (8) and fuel drain duct (7).

Pump shaft is lubricated by fuel through delivery and return ducts (2).

Pressure regulator (5) establishes the fuel amount to send to pumping elements; excess fuel is drained out through duct (9).

5 bar pressure relief valve acts as fuel exhaust manifold and keeps 5 bar constant pressure at regulator inlet.

Figure 214



Sec. A – A

1. Fuel outlet duct - 2. Fuel outlet duct - 3. Fuel outlet from pump with high pressure pipe fitting for common rail

Figure 214 shows high pressure fuel flow through pumping element outlet ducts.

Operation

The cylinder is filled through the cap intake valve only if the supply pressure is suitable to open the delivery valves set on the pumping elements (about 2 bars).

The amount of fuel supplying the high-pressure pump is metered by the pressure regulator, placed on the low-pressure system; the pressure regulator is controlled by the EDC7 control unit through a PWM signal.

When fuel is sent to a pumping element, the related piston is moving downwards (suction stroke). When the piston stroke is reversed, the intake valve closes and the remaining fuel in the pumping element chamber, not being able to come out, is compressed above the supply pressure value existing in the rail.

The thereby-generated pressure makes the exhaust valve open and the compressed fuel reaches the high-pressure circuit.

The pumping element compresses the fuel till the top dead center (delivery stroke) is reached. Afterwards, the pressure decreases till the exhaust valve is closed.

The pumping element piston goes back towards the bottom dead center and the remaining fuel is decompressed.

When the pumping element chamber pressure becomes less than the supply pressure, the intake valve is again opened and the cycle is repeated.

The delivery valves must always be free in their movements, free from impurities and oxidation.

The rail delivery pressure is modulated between 250 and 1350 bars by the electronic control unit, through the pressure regulator solenoid valve.

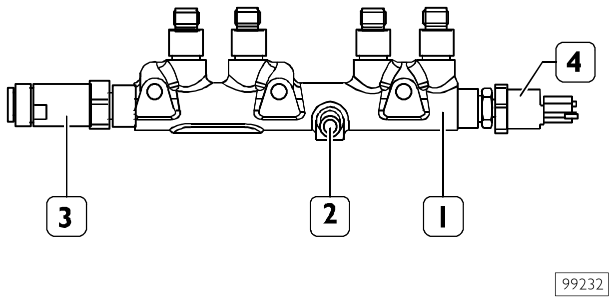
The pump is lubricated and cooled by the fuel.

The radialjet pump disconnection – reconnection time on the engine is highly reduced in comparison with traditional injection pumps, because it does not require setting.

If the pipe between fuel filter and high-pressure pump is to be removed-refitted, be sure that hands and components are absolutely clean.

RAIL

Figure 215



1. Rail. – 2. Fuel inlet from high-pressure pump. – 4. Pressure sensor. – 3. Overpressure valve.

The rail volume is of reduced sizes to allow a quick pressurisation at startup, at idle and in case of high flow-rates.

It anyway has enough volume as to minimise use of plenum chambers caused by injectors openings and closings and by the high-pressure pump operation. This function is further enabled by a calibrated hole being set downstream of the high-pressure pump.

A fuel pressure sensor (4) is screwed to the rail. The signal sent by this sensor to the electronic control unit is a feed-back information, depending on which the rail pressure value is checked and, if necessary, corrected.

DOUBLE STAGE OVERPRESSURE VALVE

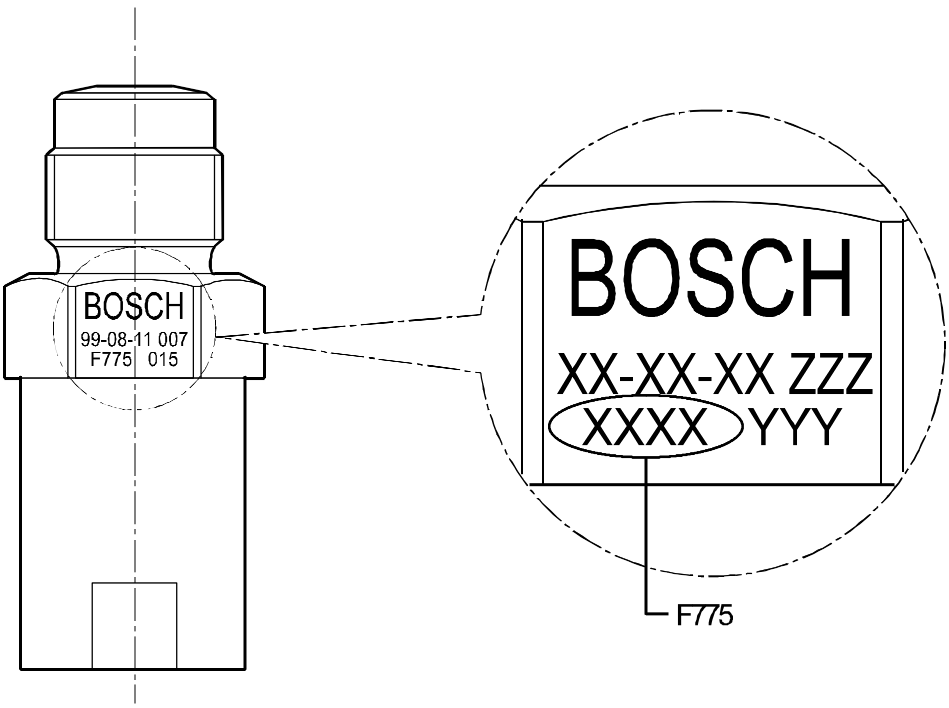
Once the valve has been mounted at one rail end, the valve task is to protect system components in the case where a fault in either rail pressure sensor or pump pressure regulator CP3 causes pressure excessive increment in high pressure system.

The valve is of a definitely mechanical type and has double operation threshold: 1750 bar and about 800 bar.

When pressure in the rail reaches 1750 bar, the valve first operates as a single stage valve to cause fuel to be drained away and pressure to be consequently decreased to safety values, then it mechanically regulates pressure in the rail to about 800 bar.

This valve enables to have the engine operated for long time with limited performance and inhibits fuel excessive overheating, so preserving the pipings returning from the tank.

Figure 216



91577

INJECTOR

The injector is similar as construction to the traditional ones, apart from the absence of plunger return springs.

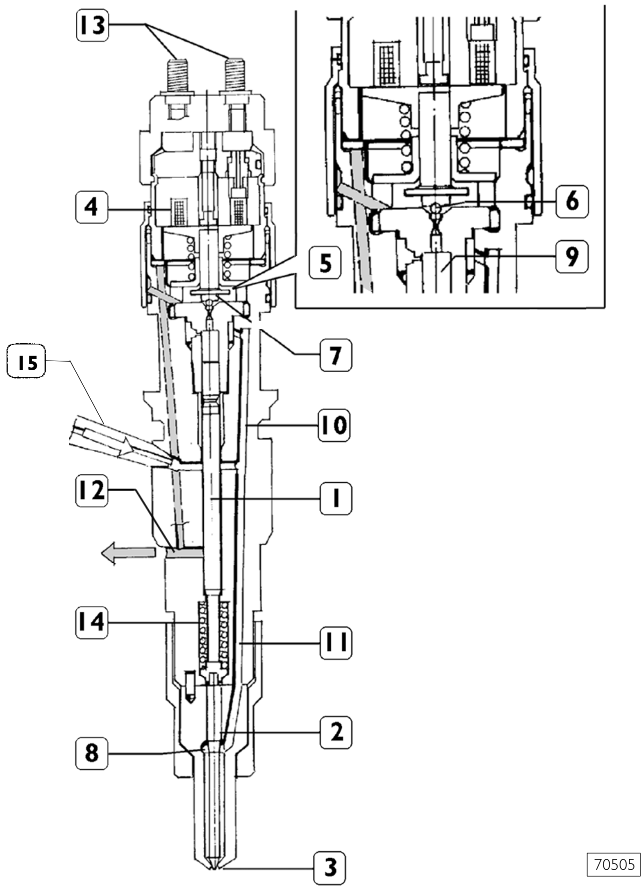
The injector can be deemed as composed of two parts:

- actuator – spray nozzle composed of pressure rod (1), plunger (2) and nozzle (3);
- control solenoid valve composed of coil (4) and pilot valve (5).

The solenoid valve controls spray nozzle plunger lift.

Injector in rest position

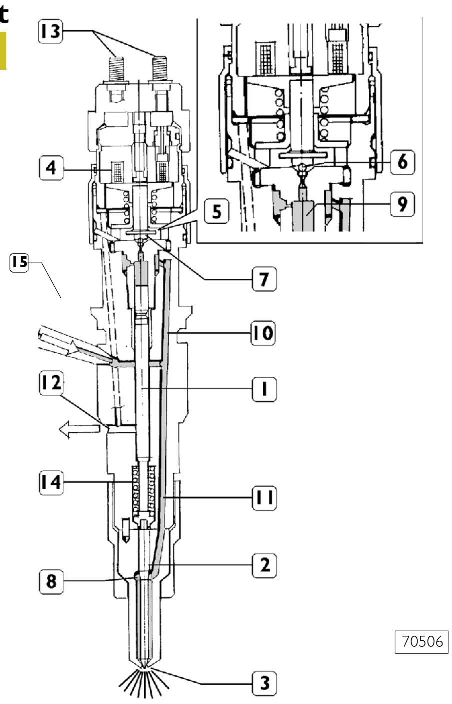
Figure 217



1. Pressure rod – 2. Plunger – 3. Nozzle – 4. Coil – 5. Pilot valve – 6. Ball shutter – 7. Control area – 8. Pressure chamber – 9. Control volume – 10. Control duct – 11. Supply duct – 12. Control fuel outlet – 13. Electric connection – 14. Spring – 15. High-pressure fuel inlet.

Injection start

Figure 218



When coil (4) is energised, it makes shutter (6) move upwards. The control volume (9) fuel flows towards flow duct (12) making a pressure drop occur in control volume (9). Simultaneously the fuel pressure into pressure chamber (8) makes plunger (2) lift, with following fuel injection into the cylinder.

Injection end

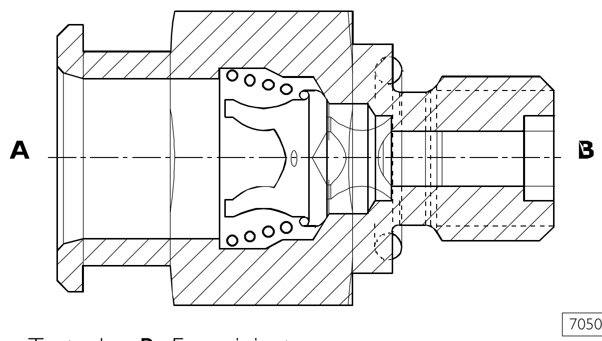
When coil (4) is de-energised, shutter (6) goes back to its closing position, in order to re-create such a force balance as to make plunger (2) go back to its closing position and end the injection.

NOTE The injector cannot be overhauled and therefore it must not be disassembled.

PRESSURE LIMITER FOR FUEL RETURN

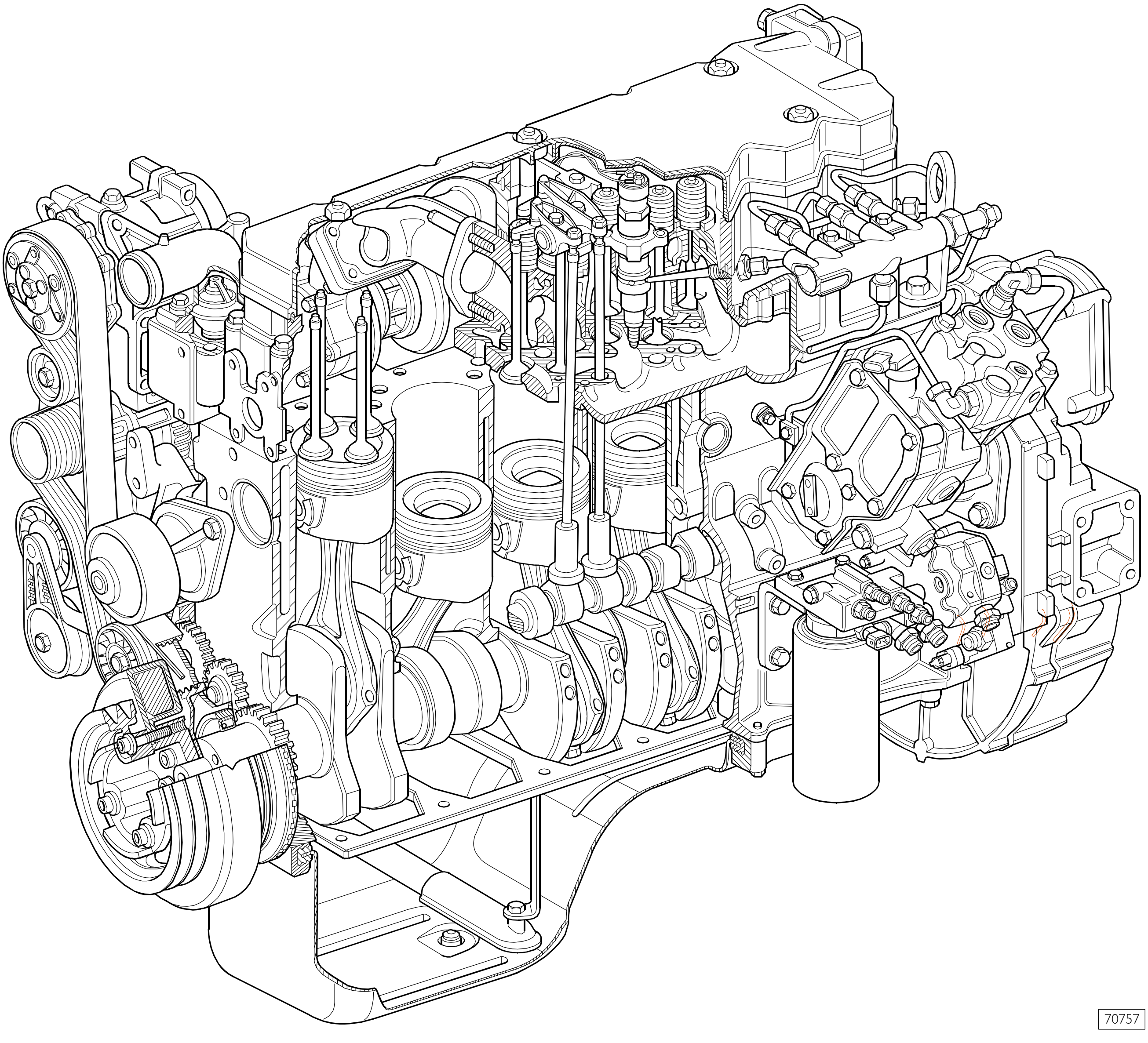
It is housed on the rear cylinder head part, and adjusts the pressure of fuel returning from injectors at a pressure included between 1.3 to 2 bars. By guaranteeing this pressure to the return fuel, the fuel vapours formation inside injectors is avoided, optimising fuel spraying and combustion.

Figure 219



A To tank – **B** From injectors

ENGINE F4 AE 0681

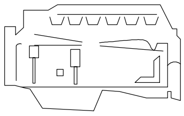
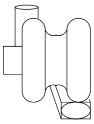
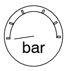
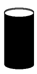


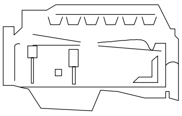
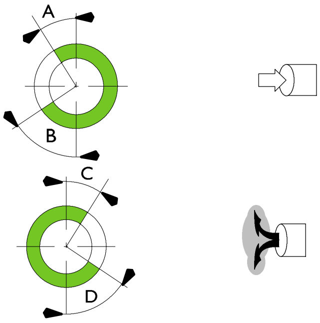
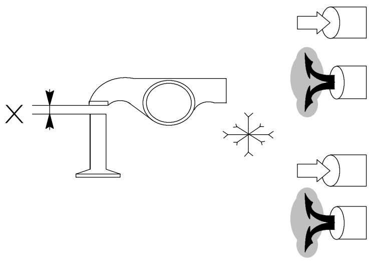
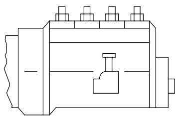
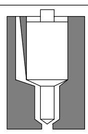
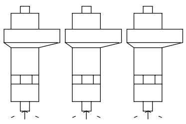
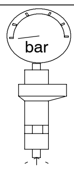
Engine F4 AE 0681

Page

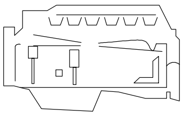
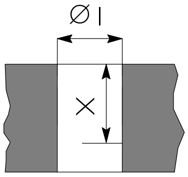
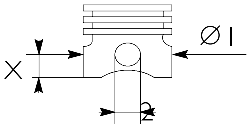
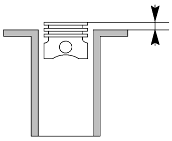
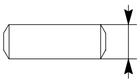
GENERAL SPECIFICATIONS

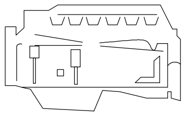
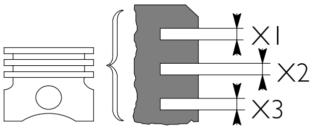
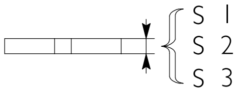
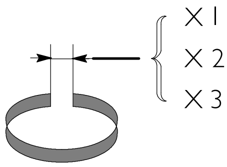
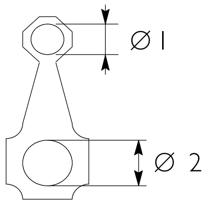
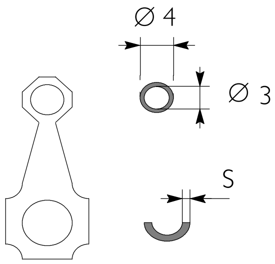
	Type		**F4 AE 0681E (.18)**	**F4 AE 0681D (.21)**
	Cycle		Four-stroke diesel engine	
	Power		Supercharged with intercooler	
	Injection		Direct	
	Number of cylinders		6 in-line	
Ø	Bore	mm	102	
	Stroke	mm	120	
+ + +.. =	Total displacement cm^3		5900	
ρ	Compression ratio		17 : 1	
	Max. output	kW (HP) rpm	132 (180) 2700	154 (210) 2700
	Max. torque	Nm (kgm) rpm	570 (58) 1200 to 2100	680 (69) 1200 to 2100
	Loadless engine idling	rpm	650	
	Loadless engine peak	rpm	3000	

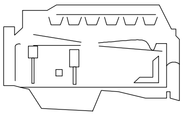
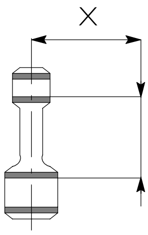
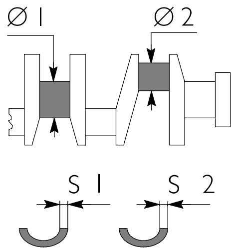
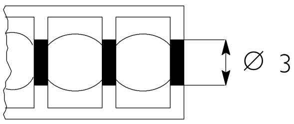
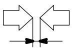
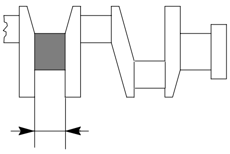
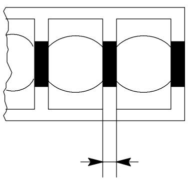
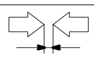
	Type	**F4 AE 0681E (.18)**	**F4 AE 0681D (.21)**
	SUPERCHARGING	With intercooler	
	Turbosupercharger type	Borg Warner Turbo Systems K27.2	
Turbosupercharger shaft radial backlash		-	
Turbosupercharger shaft end play		-	
Pressure relief valve min. opening stroke:	mm	-	
Pressure relief valve max. opening stroke:	mm	-	
Pressure corresponding to min. stroke:	bar	-	
Pressure corresponding to max. stroke:	bar	-	
 	LUBRICATION	Forced by gear pump , pressure relief valve, oil filter	
	Oil pressure with warm engine:		
	- idling bar	1.2	
	- peak rpm bar	3.8	
COOLING		By centrifugal pump, regulating thermostat, radiator, heat exchanger, intercooler	
	Water pump control	Through belt	
	Thermostat		
	- start of opening	81 ± 2 °C	
	- maximum opening	96 °C	
	FILLING		
	Total capacity		
	1st filling:		
	liters	-	
	kg	-	
 ACEA E3/E5 Urania LD		Min. level	Max. level
	- engine sump		
	liters	8	10.8
	kg	7.2	9.7
	- engine sump + filter		
	liters	9	11..8
	kg	8.1	10.6

	Type	F4 AE 0681E (.18)	F4 AE 0681D (.21)
	Type	F4 AE 0681E (.18)	F4 AE 0681D (.21)
	**TIMING** start before T.D.C. A end after B.D.C. B start before T.D.C. D end after B.D.C. C	8,5° 8.5° 51° 12.5°	
	Checking timing X { mm mm Checking operation X { mm mm	- - 0.20 to 0.30 0.45 to 0.55	
	**FUEL FEED** Injection Type: Bosch	high pressure common rail EDC7 ECU	
	Nozzle type	Injectors	
	Injection sequence	1 - 5 - 3 - 6 - 2 - 4	
	Injection sequence bar Injection pressure bar	250 - 1450 -	

ASSEMBLY DATA – CLEARANCES

	Type	**F4 AE 0681E (.18)**	**F4 AE 0681D (.21)**
CYLINDER UNIT AND CRANKSHAFT COMPONENTS		mm	
	Cylinder barrels: Ø 1 Measuring height X	102.009 to 102.031	
	Spare pistons: type: Size X Outside diameter Ø 1 Pin housing Ø 2	MAHLE MONDIAL S.p.A. 60.5 101.721 to 101.739 40.010 to 40.016	
	Piston – cylinder barrels	0.260 to 0.300	
IVECO PARTS	Piston diameter Ø 1	0.5	
	Piston protrusion X	0.28 to 0.52	
	Piston pin Ø 3	39.9938 to 40.0002	
	Piston pin – pin housing	0.0098 to 0.0222	

	Type	F4 AE 0681E (.18)	F4 AE 0681D (.21)
CYLINDER UNIT AND CRANKSHAFT COMPONENTS		mm	
	Split ring slots X 1* X 2 X 3 * measured on 99 mm Ø	2.705 to 2.735 2.430 to 2.450 4.040 to 4.060	
	Split rings S 1* S 2 S 3 * measured on 99 mm Ø	2.560 to 2.605 2.350 to 2,380 3.975 to 4.000	
	Split rings - slots 1 2 3	0.100 to 0.175 0.050 to 0.100 0.040 to 0.085	
IVECO PARTS >	Split rings	0.5	
	Split ring end opening in cylinder barrel: X 1 X 2 X 3	0.30 to 0.40 0.60 to 0.80 0.25 to 0.55	
	Small end bush housing Ø 1 Big and bearing housing Ø 2	42.987 to 43.013 72.987 to 73.013	
	Small end bush diameter Outside Ø 4 Inside Ø 3 Spare big end half bearings S	43.279 to 43.553 40.019 to 40.033 1.955 to 1.968	
	Small end bush – housing	0.266 to 0.566	
	Piston pin - bush	0.0188 to 0.0392	
IVECO PARTS >	Big end half bearings	-	

	Type	F4 AE 0681E (.18)	F4 AE 0681D (.21)
CYLINDER UNIT AND CRANKSHAFT COMPONENTS		mm	
	Size X Max. tolerance on connecting rod axis alignment	- -	
	Journals Ø 1 Crankpins Ø 2 Main half bearings S 1 Big end half bearings S 2 *provided as spare part	82.99 to 83.013 68.987 to 69.013 2.456 to 2.464 1.955 to 1.968	
	Main bearings No. 1 – 3 – 4 – 5 – 6 – 7 Ø 3 No. 2 Ø 3	87.982 to 88.008 87.982 to 88.008	
	Half bearings – Journals No. 1 – 3 – 4 – 5 – 6 – 7 No. 2	0.041 to 0.103 0.041 to 0.103	
	Half bearings - Crankpins	0.033 to 0.041	
IVECO PARTS 	Main half bearings Big end half bearings	0.250 to 0.500	
 X 1	Shoulder journal X 1	37.475 to 37.545	
 X 2	Shoulder main bearing X 2	32.23	
	Shoulder half-rings X 3	32.30	
	Output shaft shoulder	0.07	

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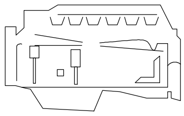
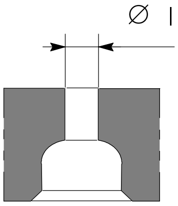
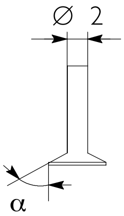
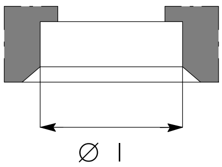
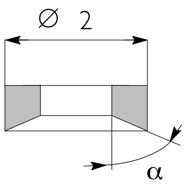
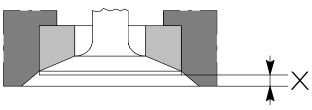
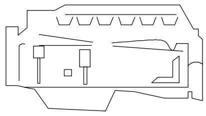
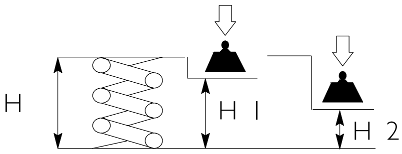
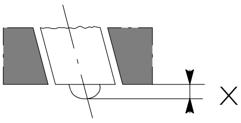
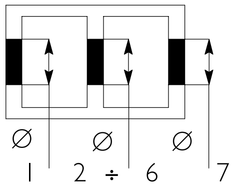
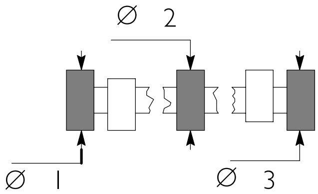
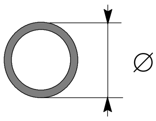
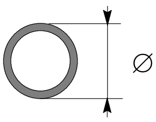
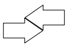
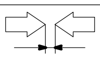
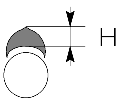
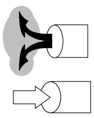
	Type	F4AE0681E (.18)	F4AE0681D (.21)
	Type	F4AE0681E (.18)	F4AE0681D (.21)
CYLINDER HEAD – TIMING SYSTEM		mm	
	Valve guide seats on cylinder head Ø 1	7.042 to 7.062	
	Valves: Ø 2 α Ø 2 α	6.970 to 6.990 60° ± 0.25° 6.970 to 6.990 45° ± 0.25°	
	Valve stem and guide	0.052 to 0.092	
	Housing on head for valve seat Ø1 Ø1	34.837 to 34.863 34.837 to 34.863	
	Valve seat outside diameter; valve seat angle on cylinder head: Ø 2 α Ø 2 α	34.917 to 34.931 60° 34.917 to 34.931 45°	
	Sinking X X	0.59 to 1.11 0.96 to 1.48	
	Between valve seat and head	0.054 to 0.094 0.054 to 0.094	
IVECO PARTS	Valve seats	-	

	Type	**F4AE0681E (.18)**	**F4AE0681D (.21)**
CYLINDER HEAD – TIMING SYSTEM		mm	
	Valve spring height: free spring H under a load equal to: 339.8 ± 19 N H1 741 ± 39 N H2	47.75 35.33 25.2	
	Injector protrusion X	not adjustable	
	Camshaft bush housings No. 1-7 Camshaft housings No. 2-3-4-5-6	59.222 to 59.248 59.222 to 59.248	
	Camshaft journals: 1 ⇒ 7 ∅ 1 – 2 – 3	53.995 to 54.045	
	Camshaft bush outside diameter: with 3.3 kN load ∅	59.222 to 59.248	
	Bush inside diameter after driving ∅	54.083 to 54.147	
	Bushes and housings on block	0.113 to 0.165	
	Bushes and journals	0.038 to 0.152	
	Cam lift:  H H	6.045 7.582	

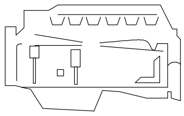
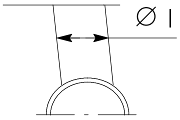
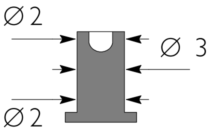
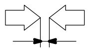
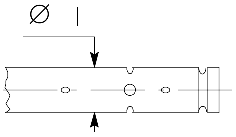
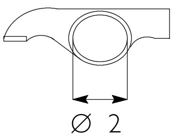
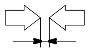
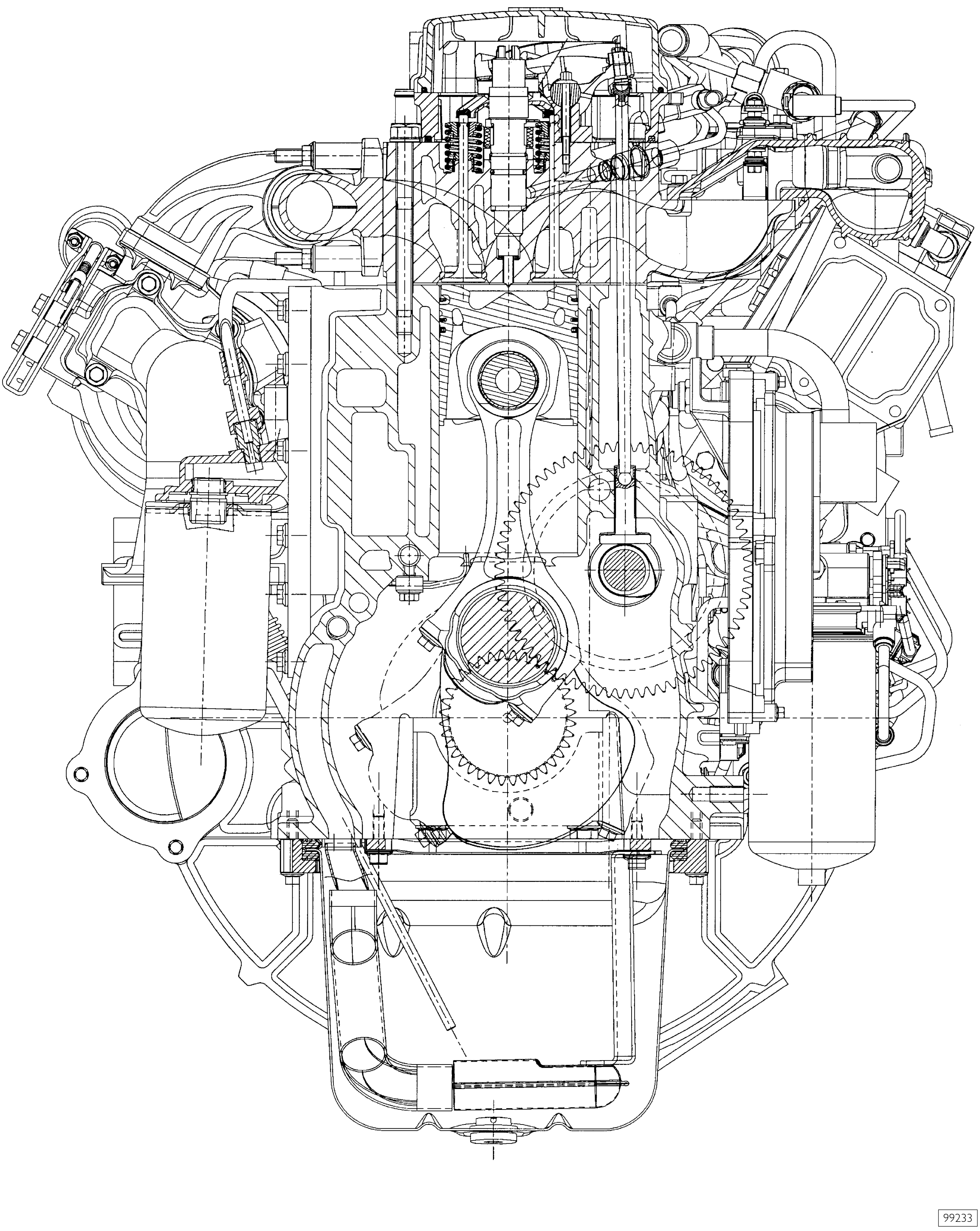
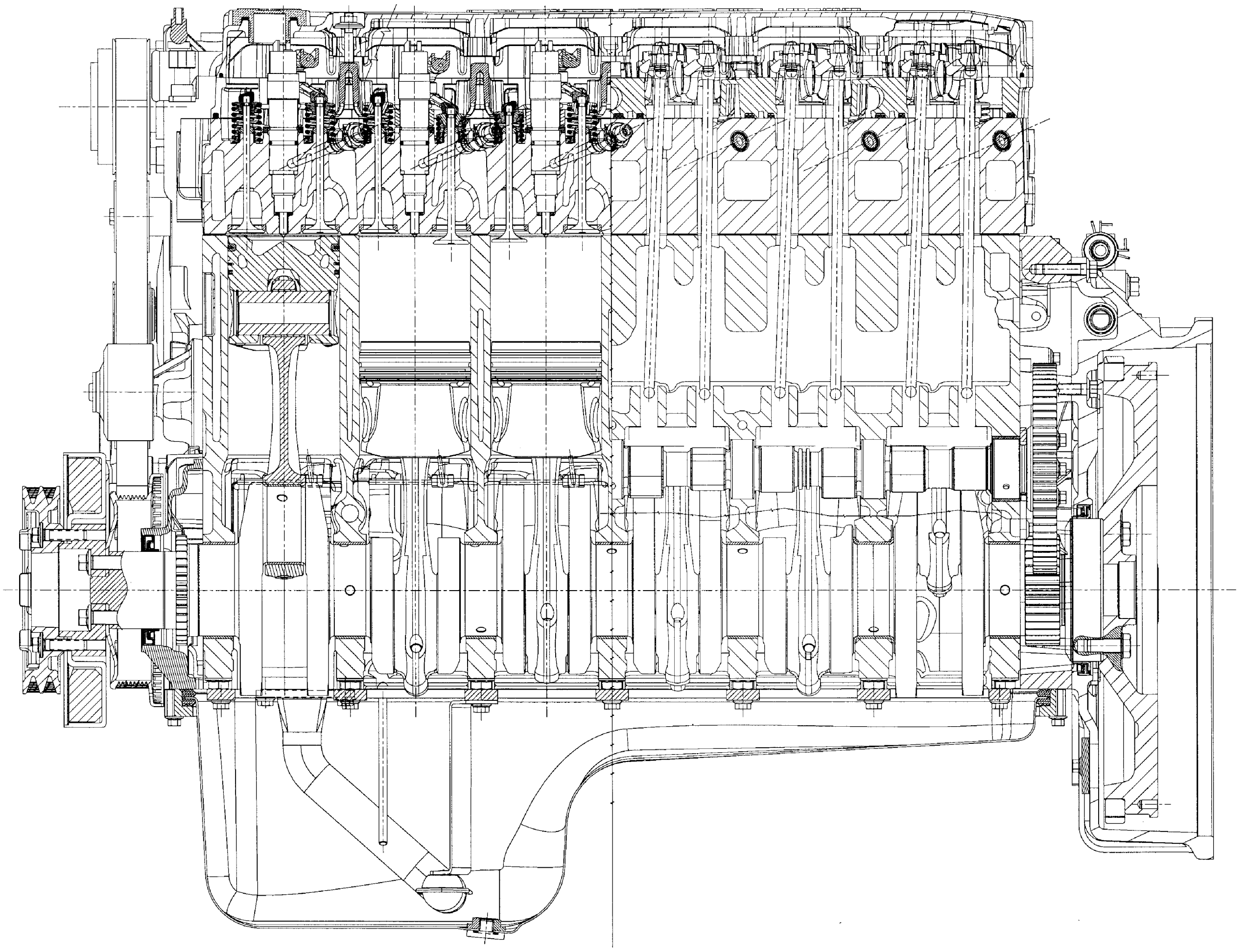
	Type	**F4AE0681E (.18)**	**F4AE0681D (.21)**
CYLINDER HEAD – TIMING SYSTEM		mm	
	Tappet cap housing on block Ø 1	16.000 to 16.030	
	Tappet cap outside diameter: Ø 2 Ø 3	15.924 to 15.954 15.960 to 15.975	
	Between tappets and housings	0.025 to 0.070	
IVECO PARTS	Tappets	-	
	Rocker shaft Ø 1	21.965 to 21.977	
	Rockers Ø 2	22.001 to 22.027	
	Between rockers and shaft	0.024 to 0.162	

Figure 1



ENGINE F4AE0681 CROSS SECTION

Figure 2



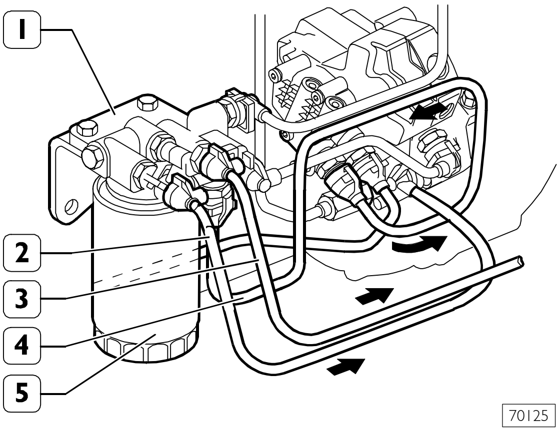
ENGINE F4AE0681 LONGITUDINAL SECTION

ENGINE F4AE0681 OVERHAUL

NOTE It is different from engine F4AE0481 overhaul as regards what is stated below.

540110 Engine removal at the bench

Figure 3

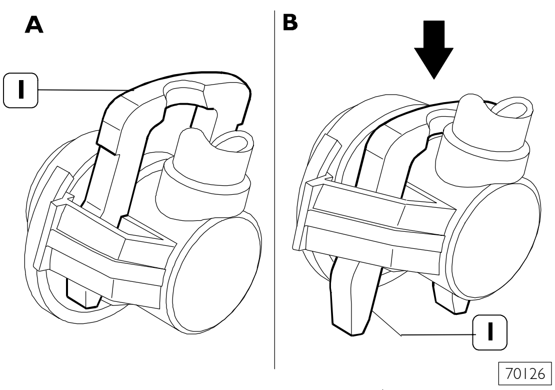


Apply to engine block brackets 99341009 securing engine to overhaul stand 99322205.

In order to apply a bracket to left engine side, it is necessary to:

- ❑ with tool 99360076, disassemble fuel filter (5) from support (1);
- ❑ disconnect low-pressure fuel pipings (2-3-4) from support (1);
- ❑ detach support bearing bracket (1) from block.

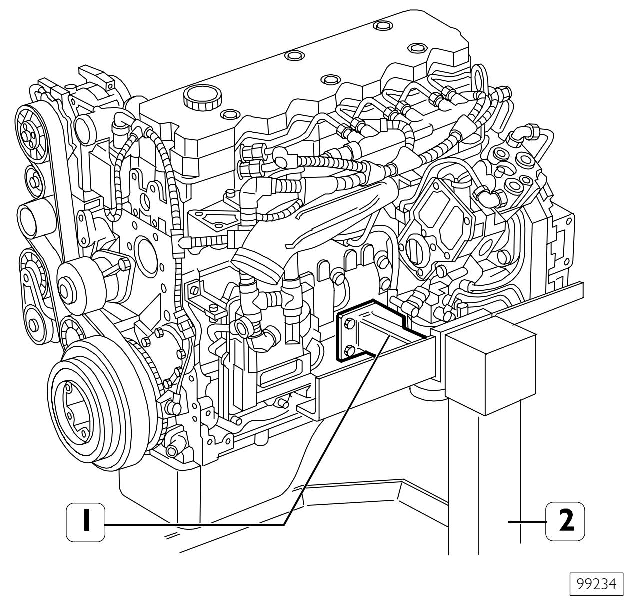
Figure 4



In order to disconnect low-pressure fuel pipings (2 – 3 – 4. Figure 3) from related connection fittings, it is necessary to press clip (1) as shown in figure **B**.

After having disconnected the piping, take back clip (1) to its locking position, figure **A**, to avoid possible distortions of the clip.

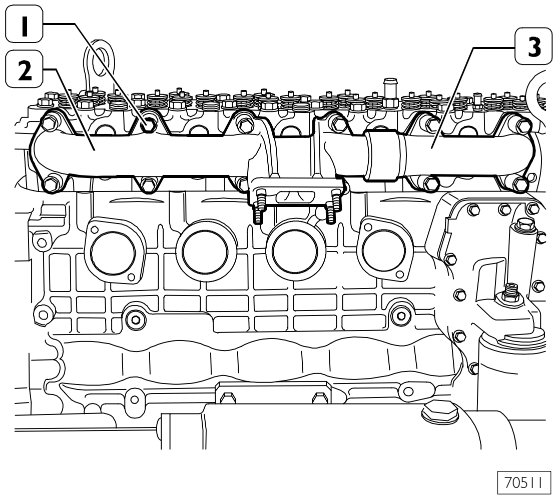
Figure 5



Assemble brackets 99341009 (1) to engine block and secure them to overhaul stand 99322225 (2).

Proceed then to overhaul the engine complying, unless otherwise stated, with what is described for four-cylinder engine F4AE0481.

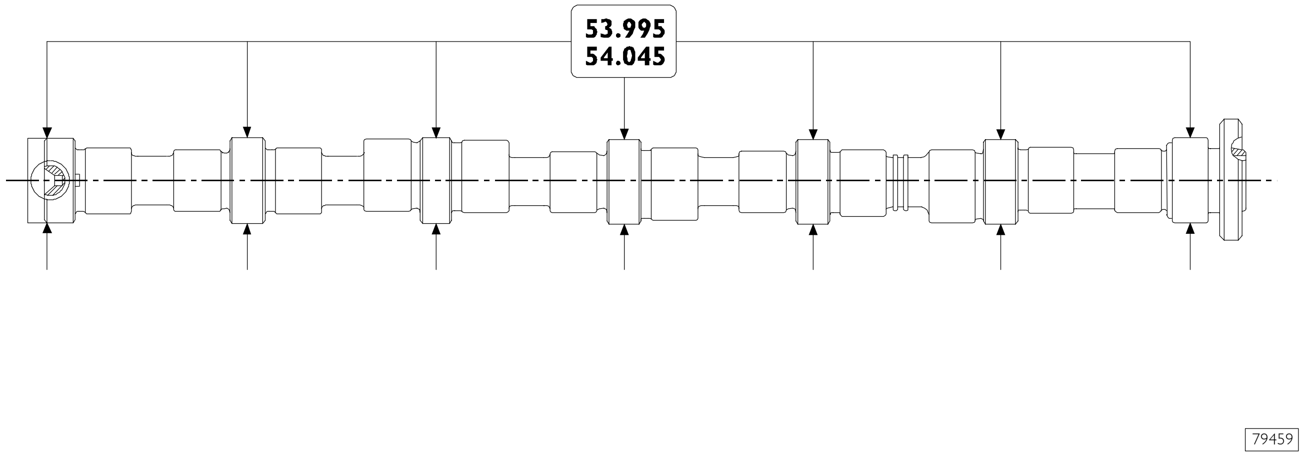
Figure 6



Remove fastening screws (1) and disconnect exhaust manifold into two sections (2-3) with related gaskets.

5412 TIMING SYSTEM
541210 Camshaft

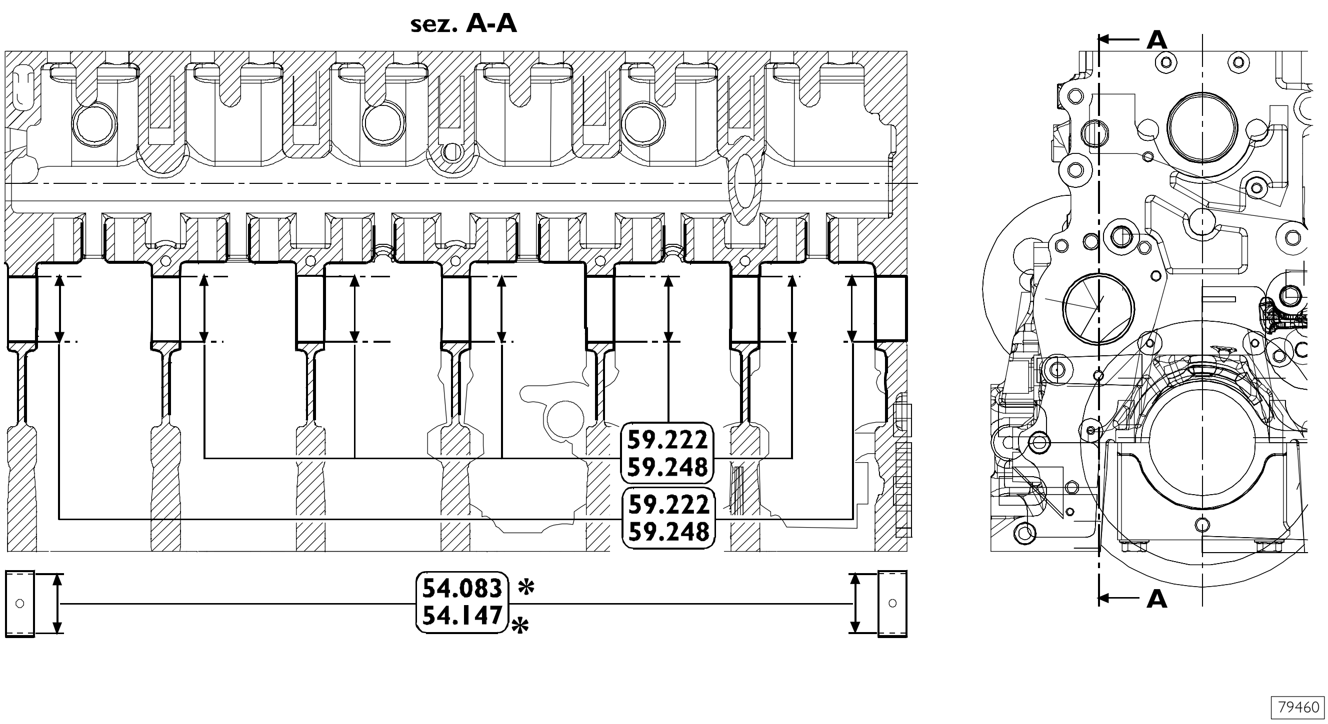
Figure 7



MAIN DATA ABOUT CAMSHAFT PINS

BUSHES

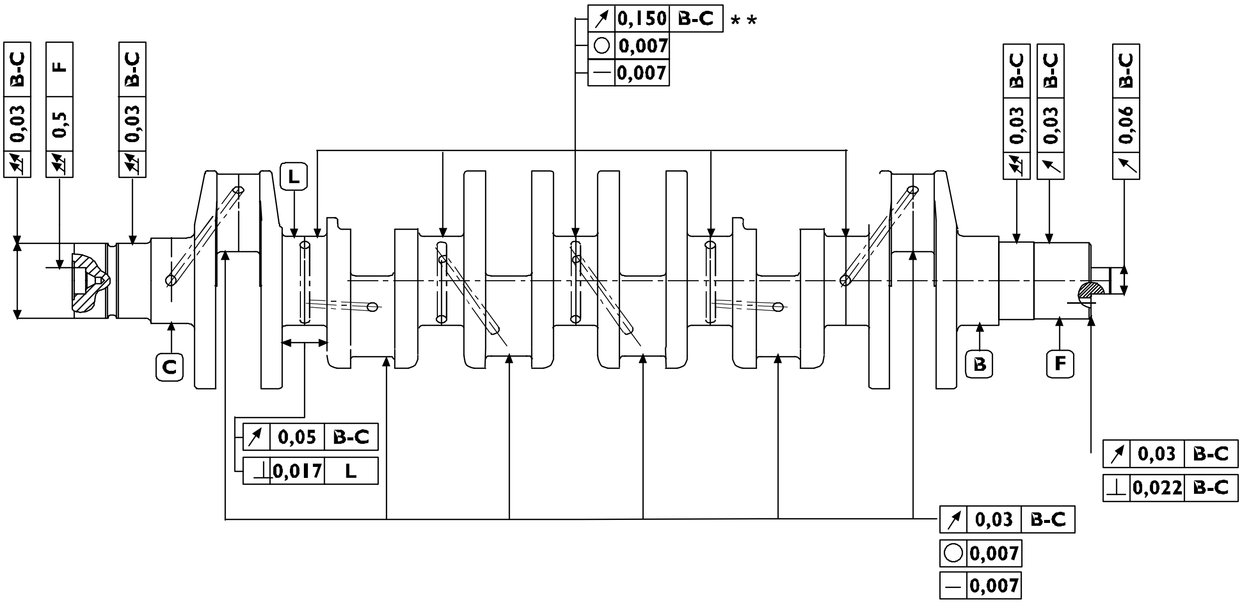
Figure 8



MAIN DATA ABOUT CAMSHAFT BUSHES AND RELATED HOUSINGS

*Height to be obtained after driving the bushes.

Figure 9



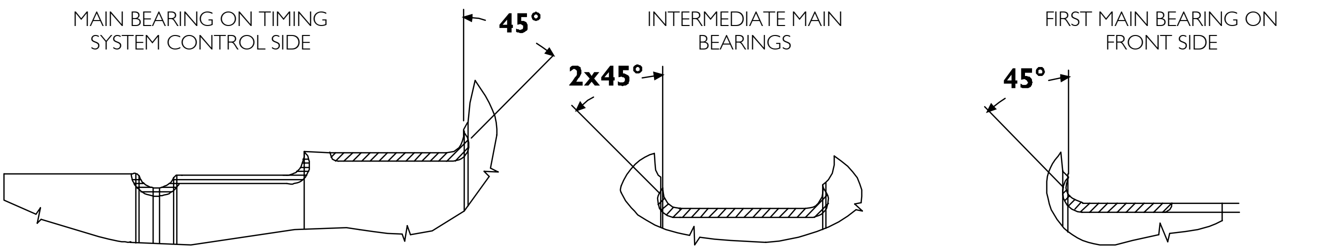
70577

* Measured on a radius greater than 45.5 mm

** 0.500 between adjacent main journals

MAIN OUTPUT SHAFT TOLERANCES

Figure 10



70237

TOLERANCES	TOLERANCE CHARACTERISTIC	GRAPHIC SYMBOL
SHAPE	Roundness	○
	Cilindricity	/○/
DIRECTION	Parallelism	//
	Verticality	⊥
	Straightness	—
POSITION	Concentricity or coaxiality	◎
OSCILLATION	Circular oscillation	↗
	Total oscillation	⇗
	Taper	—▷

LEVELS OF IMPORTANCE FOR PRODUCT CHARACTERISTICS	GRAPHIC SYMBOL
CRITICAL	©
IMPORTANT	⊕
SECONDARY	⊖

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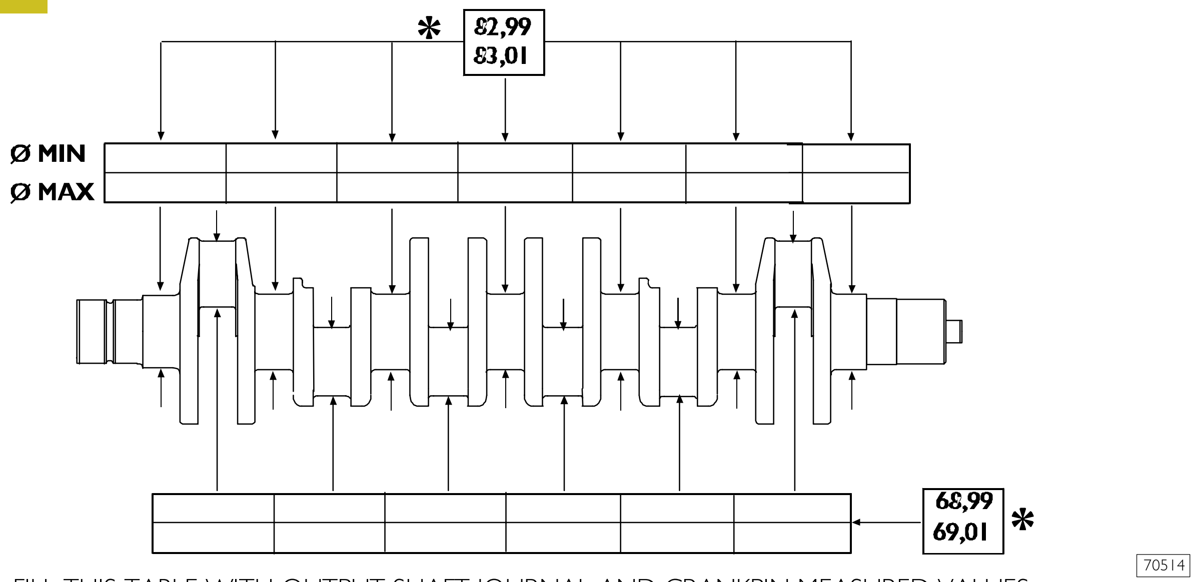
Figure 11

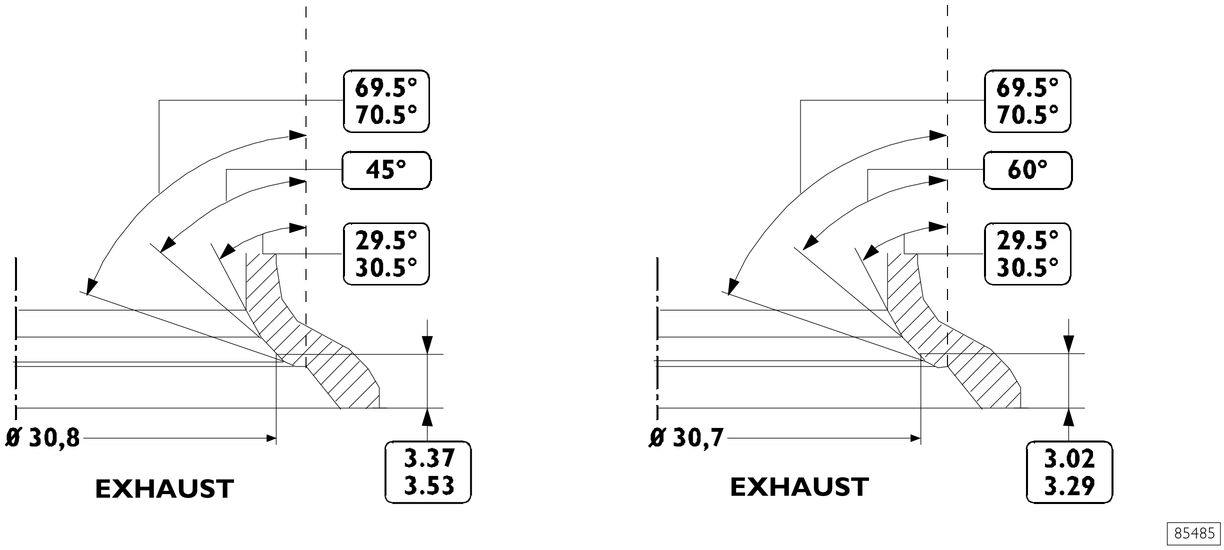


FILL THIS TABLE WITH OUTPUT SHAFT JOURNAL AND CRANKPIN MEASURED VALUES

*Nominal value

5406 CYLINDER HEAD VALVE SEATS

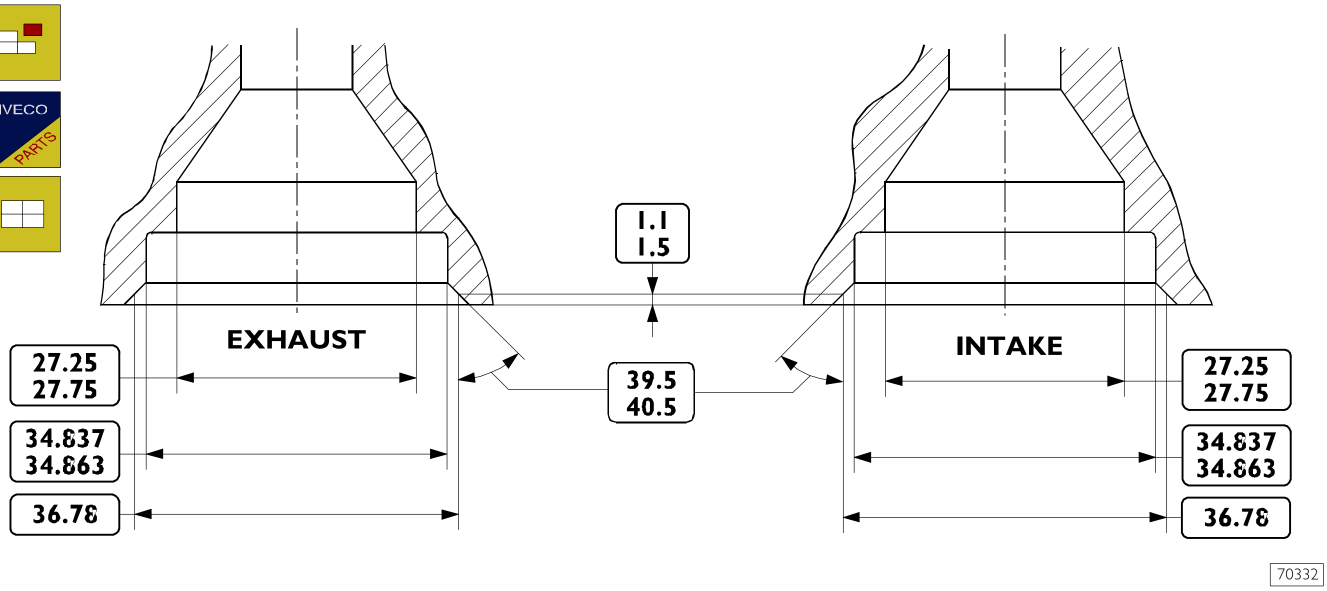
Figure 12



MAIN DATA ABOUT ENGINE VALVE SEATS

Valve seats are obtained by melting on cylinder head and machined.

Figure 13



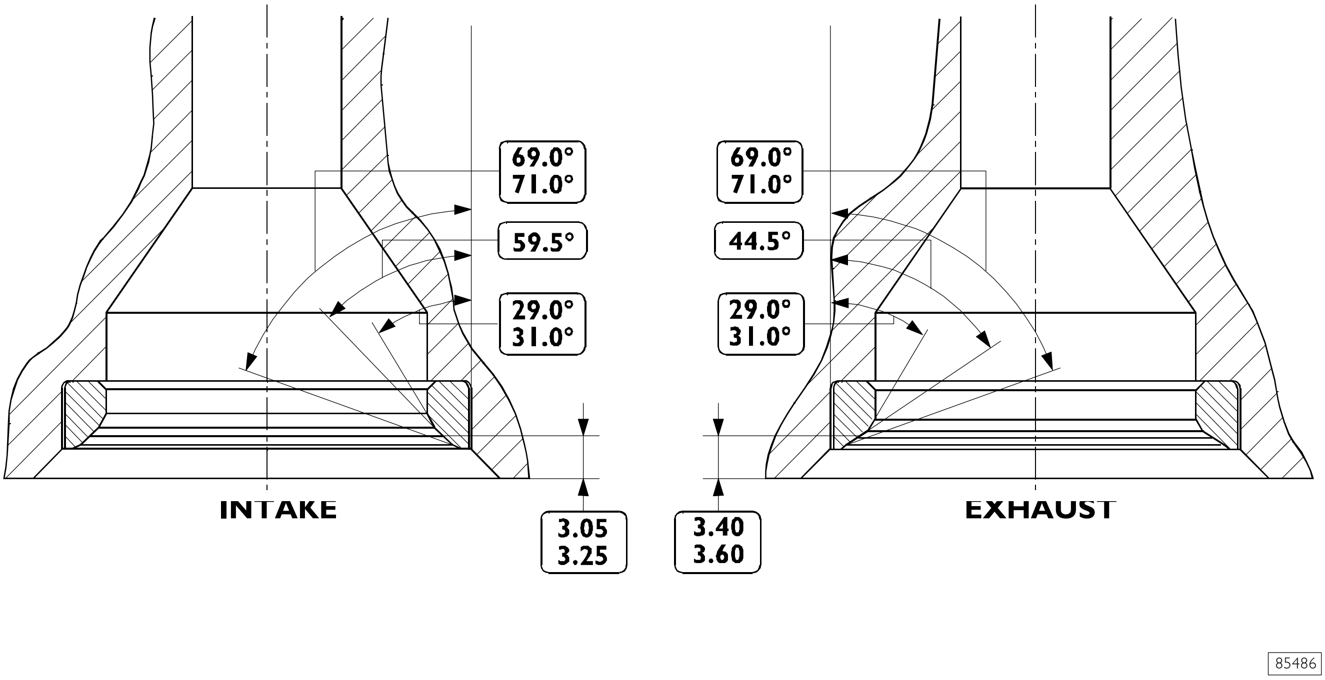
If valve seats cannot be restored just by regrinding, it is possible to assemble the spare inserts provided.

In this case, it is necessary to obtain seats into the cylinder head sized as shown in the figure and to assemble the valve seats.

In order to assemble the valve seats into the cylinder head, it is necessary to heat the cylinder head to 80° to 100°C and, through a suitable beater, to assemble the new, previously cooled valve seats (2) into the head.

Then, with tool 99305018, adjust valve seats according to the values shown in Figure 14.

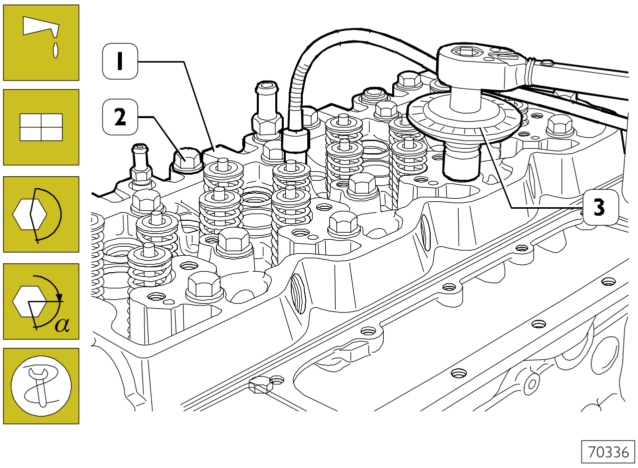
Figure 14



VALVE SEAT MAIN DATA

Cylinder head fastening screw tightening

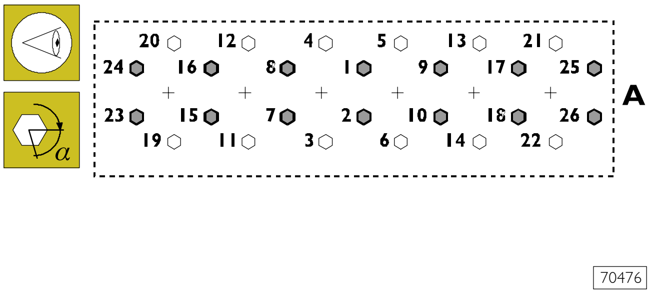
Figure 15



Assemble cylinder head (1), tighten the screws (2) in three following steps, following order and mode shown in the figure below.

NOTE The angle tightening is carried out through tool 99395216 (3).

Figure 16

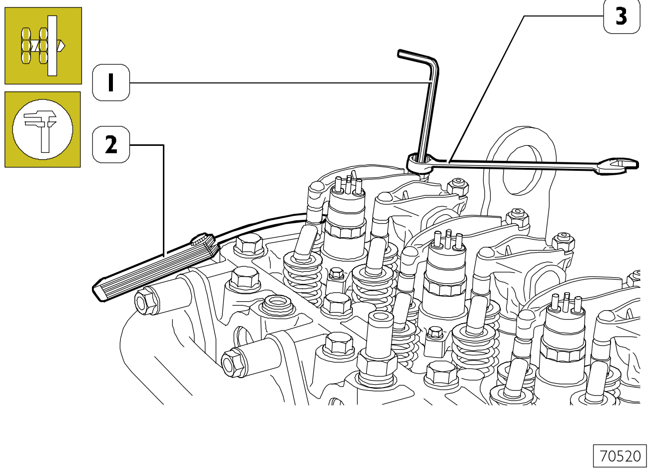


Tightening order layout for cylinder head fastening screws:

- ❑ 1st step pre-tightening with dynamometric wrench:
  - • Screw 12x1.75x130 (○) 35 ± 5 Nm
  - • Screw 12x1.75 x 150 (●) 55 ± 5 Nm
- ❑ 2nd step tightening with a 90° ± 5° angle
- ❑ 3rd step tightening with a 90° ± 5° angle

A = Front side

Figure 17



Adjust the clearance between rocker arms and valves through setscrew wrench (1), box wrench (3) and feeler gauge (2).

The operating clearance is:
- ± 0.05
- intake valves 0.25 ± 0.05 mm
- exhaust valve 0.51 ± 0.05 mm

In order to more quickly perform the operating clearance adjustment for rocker arms – valves, proceed as follows:

rotate the drive shaft, balance cylinder 1 valves and adjust the valves marked by the asterisk as shown in the table:

cylinder n.	1	2	3	4	5	6
intake	-	-	*	-	*	*
exhaust	-	*	-	*	-	*

Rotate the drive shaft, balance cylinder 6 valves and adjust the valves marked by the asterisk as shown in the table:

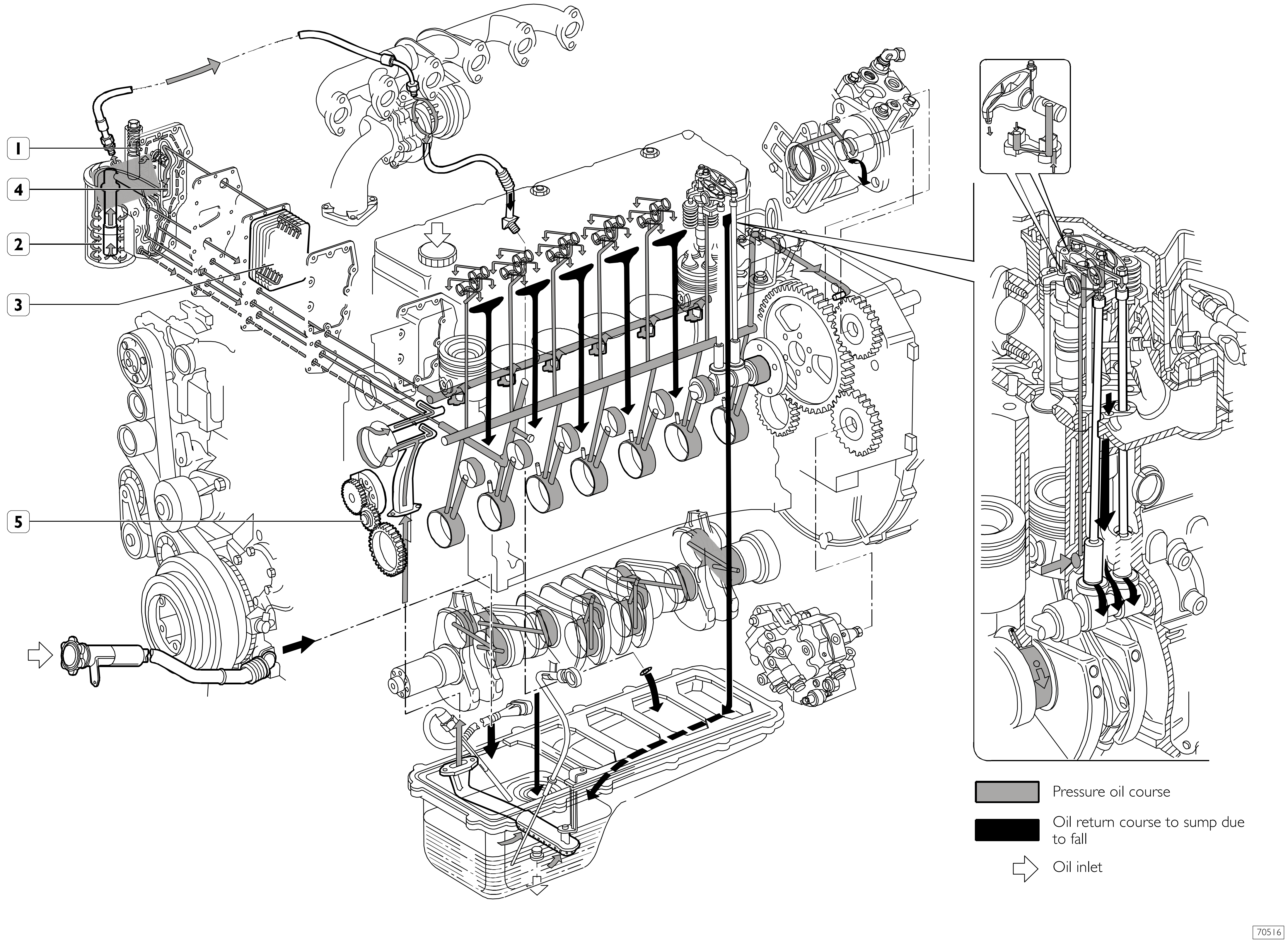
cylinder n.	1	2	3	4	5	6
intake	*	*	-	*	-	-
exhaust	*	-	*	-	*	-

5450 LUBRICATION

The forced-circulation lubrication is carried out by the following components:

- rotor oil pump (5), housed in the front block part, controlled by the straight-tooth gear keyed to the output shaft tang;
- water/oil heat exchanger (3), housed in engine block, with oil filter support;
- oil pressure relief valve (1) embedded into filter support;
- by-pass valve (4) to cut off clogged oil filter, embedded into filter support;
- cartridge oil filter (2).

Figure 18



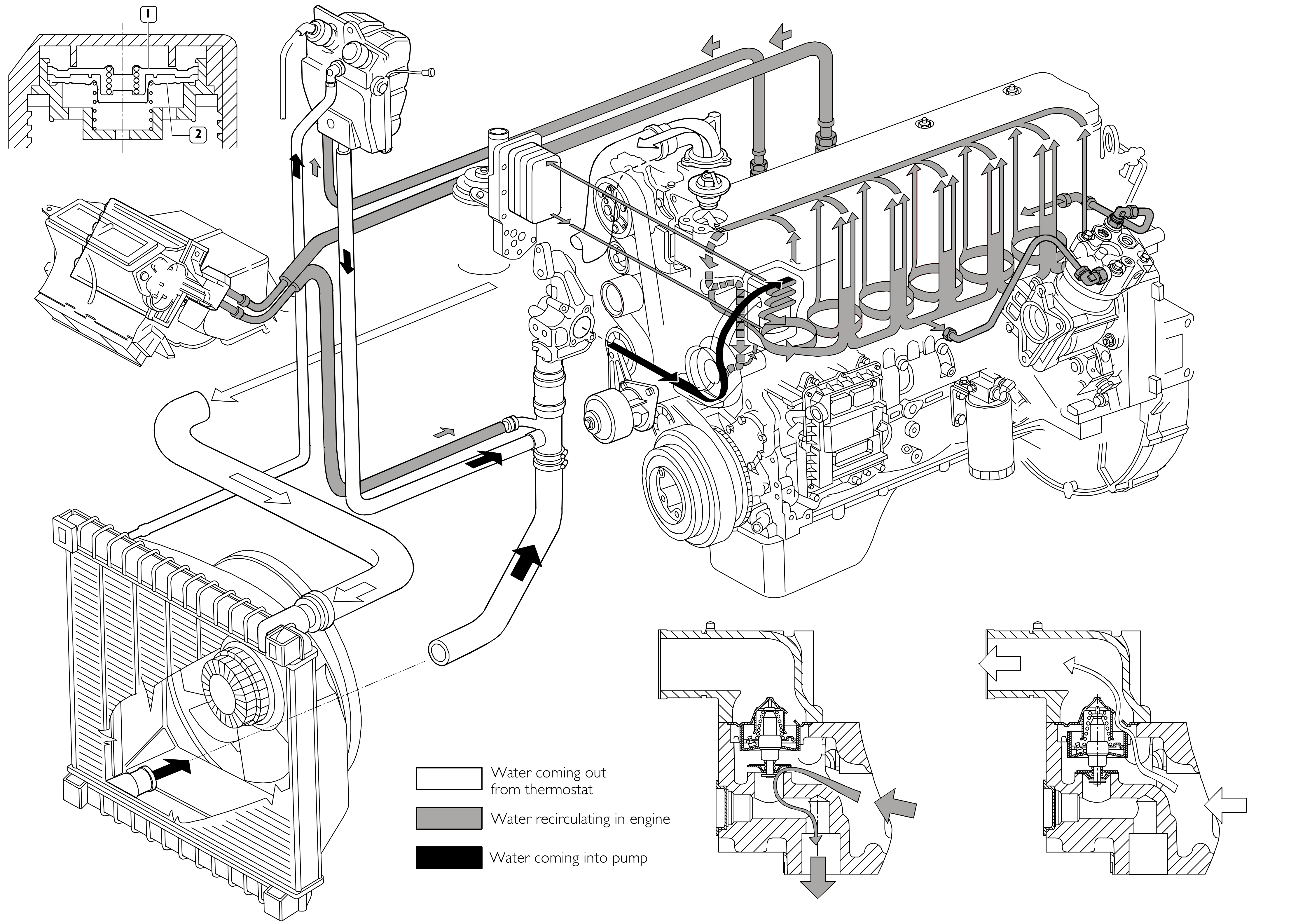
LUBRICATION SYSTEM LAYOUT

5432 COOLING SYSTEM

The engine cooling system, of the closed-loop forced-circulation type, is composed of the following components:

- expansion tank whose plug embeds two valves: an exhaust valve 2 and an intake valve 1, that adjust the system pressure;
- radiator, whose task is dissipating heat subtracted to engine by coolant;
- viscous fan;
- an heat exchanger to cool lubricating oil (see lubrication);
- a water pump of the centrifugal type housed in the front engine block part;
- a thermostat adjusting coolant circulation.

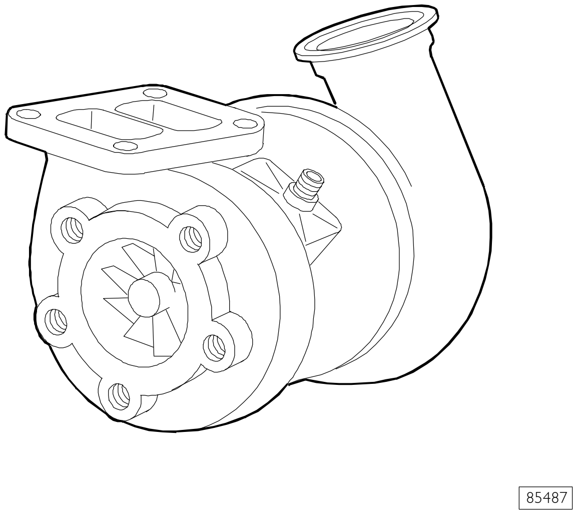
Figure 19



COOLING SYSTEM LAYOUT

BOOSTER
542410 Turbosupercharger

Figure 20

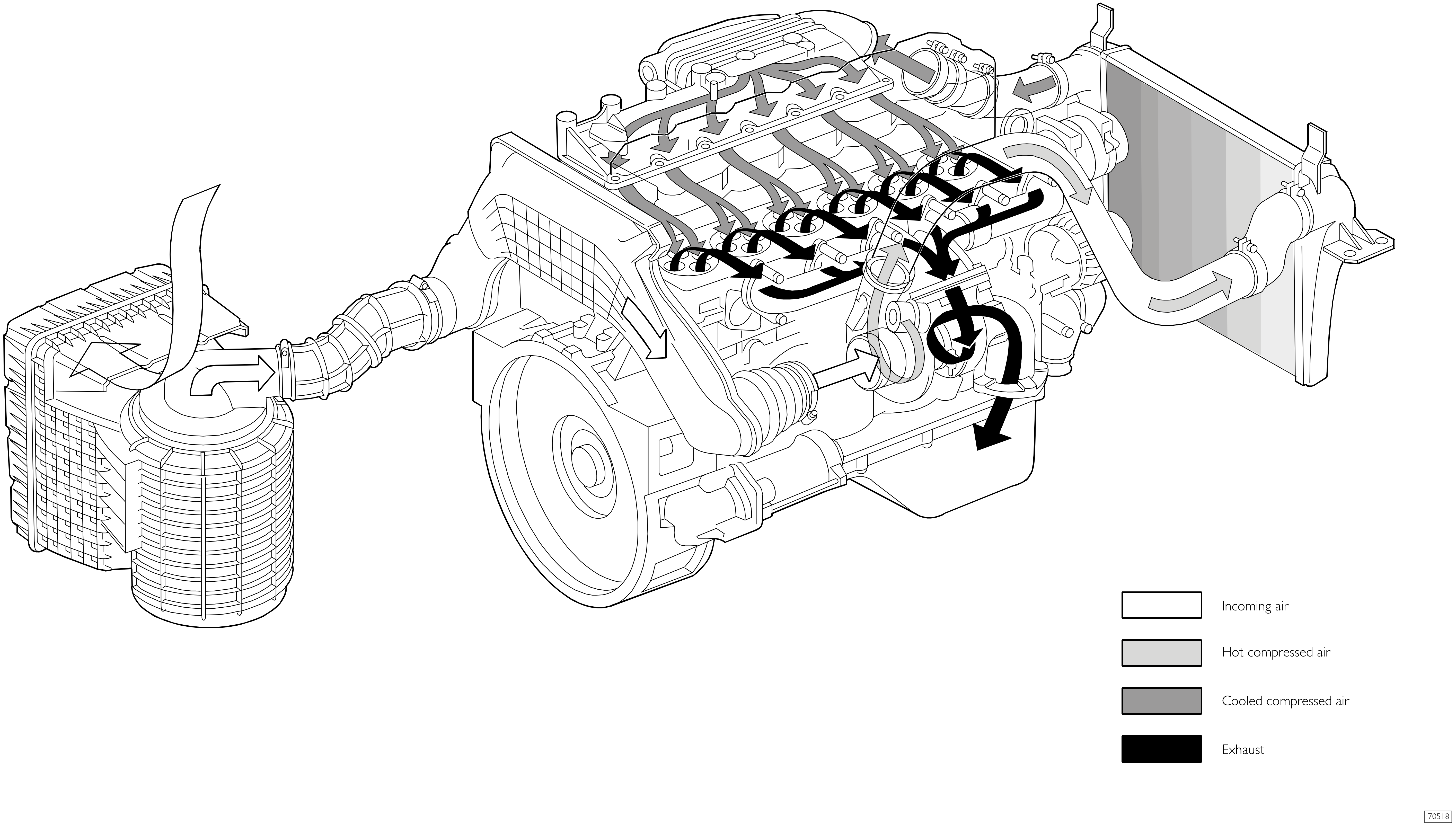


Borg Warner Turbo Systems K27.2
TURBOSUPERCHARGER

Supercharging pressure: 1.5 bars.

TURBOSUPERCHARGER LAYOUT

Figure 21



Troubleshooting guide

FOREWORD

A good diagnosis is carried out above all with electronic diagnostic instruments (Modus/IWT/IT200) developed by Iveco.

When a vehicle enters the workshop, information provided by vehicle driver are kept under right consideration, but the first thing to do is connecting Modus/IWT/IT2000 and carefully performing a complete diagnosis.

- failure memory reading
- parameters reading
- engine test
- etc.

It is useful to print the results, especially in case the Help Desk assistance has to be requested.

Diagnosis through instruments

MODUS

Computerised diagnostic station aimed to provide a diagnosis for braking systems, pneumatic suspensions, electronically-controlled engines and systems.

The station is equipped with auxiliary functions such as electronic control units programming, spare parts catalogue searching, time schedules, etc.

The vehicle is equipped with the “30-pole” diagnosis socket placed aside the U.C.I.

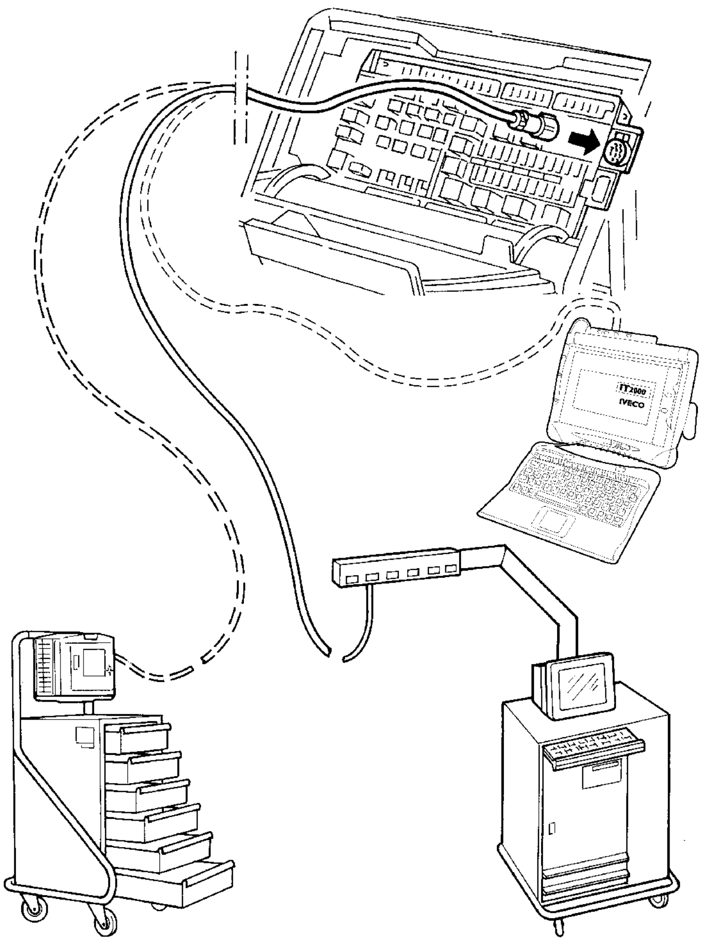
IWT

The IVECO WIRING TESTER expands and integrates MODUS.
This instrument has been implemented by IVECO to improve vehicle electric and electronic systems diagnosis.
The vehicle is equipped with the **“30-pole”** diagnosis socket placed aside the U.C.I., therefore it is necessary to use cable **“4”**.

IT2000

IT2000 is a diagnostic instrument of all Electronic Systems for IVECO vehicles.
It allows an immediate intervention on the vehicle recognising it from its chassis number.
It stores the results of performed diagnostic interventions.
It can be used also as portable Personal Computer and is preset for the remote diagnosis.
By using MODUS as mother station, it is possible to update and configure the IT2000.
IT2000 is interfaced with the vehicle through a 30-pole diagnosis socket placed aside the UCI.

Figure 1



70729

DIAGNOSTICS

Main engine operating anomalies:

1 - The engine does not start;
2 - The engine is excessively heated;
3 - The engine lacks efficiency;
4 - The engine has black or dark grey smokes;
5 - The engine has grey smokes (tending to white);
6 - The engine has cerulean smokes;
7 - The engine has anomalous rattles;
8 - The engine stops;
9 - Excessive or insufficient oil pressure;
10 - Excessive fuel consumption.

1	THE ENGINE DOES NOT START

Check		Action
Efficient connections to battery terminals	NO →	Clean, check, tighten terminal nuts, or replace them.
YES ↓		
Efficient batteries.	NO →	Carry out the checks described in "Electric system" Repair Manual.
YES ↓		
Efficient starter.	NO →	Carry out the checks described in "Electric system" Repair Manual.
YES ↓		
Absence of air seepages in the low-pressure supply circuit.	NO →	Remove seepage causes. Perform the drain.
YES ↓		
Absence of water traces in the supply circuit.	NO →	Remove seepage causes. Clean the supply circuit including the tank.
YES ↓		
Efficient fuel prefilter - filter.	NO →	Replace.

(continued)

Check		Action
Efficient pre-post heating system.	NO →	Diagnosis with Modus - IT2000 - IWT.
YES ↓		
Efficient high-pressure pump.	NO →	Engine Test with Modus - IT2000 - IWT.
YES ↓		
Efficient injector.	NO →	Engine Test with Modus - IT2000 - IWT. Check O-Ring seal.
YES ↓		
Correct compression ratio.	NO →	Revise the engine or limit intervention to affected parts (valves, elastic rings, etc.).

2 THE ENGINE IS EXCESSIVELY HEATED

Check		Action
Correct cooling liquid level.	NO →	Check possible losses and restore the level.
YES ↓		
Efficient water pump and fan control belts.	NO →	Check, adjust tension and possibly replace the parts.

(continued)

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Efficient water pump.	NO →	Revise or replace the assembly.
YES ↓		
Efficient thermostat.	NO →	Replace.
YES ↓		
Efficient radiator.	NO →	Carry out an accurate washing, check whether there are liquid leakages; possibly replace the part.
YES ↓		
Efficient air filter and circuit pipings.	NO →	Clean or replace faulty parts.
YES ↓		
The engine brake is disengaged.	NO →	Check and possibly replace.
YES ↓		
Efficient cylinder head.	NO →	Replace.
YES ↓		
Efficient fan.	NO →	Replace.

3	THE ENGINE LACKS POWER

Check		Action
Efficient fuel filters.	NO →	Replace, proceeding as described in "Use and Maintenance" booklet.
YES ↓		
Efficient low- and high-pressure supply circuit.	NO →	Check system fittings seal.
YES ↓		
Efficient thermostat.	NO →	Replace.
YES ↓		
Presence of fuel in the tank.	NO →	Check fuel level.
YES ↓		
Efficient fuel floating device in the tank.	NO →	Check small priming pump and clean the floating device from possible impurities.
YES ↓		
Efficient high-pressure pump.	NO →	Engine Test with Modus - IWT - IT2000, possibly replace.
YES ↓		
Efficient injectors and correctly-operating flow limiter.	NO →	Engine Test with Modus - IWT - IT2000, possibly replace. Check O-Ring seal.

(continued)

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Efficient rail overpressure valves. — NO → Disconnect fuel return piping from rail and check the presence of blow-by.

YES ↓

Correct compression ratio. — NO → Engine Test with Modus – IWT – IT2000.

YES ↓

Efficient turbosupercharger (blades, bearings, actuators integrity) — NO → Repair or replace the assembly.

YES ↓

Efficient valve clearance. — NO → Check – restore.

4 THE ENGINE HAS BLACK OR DARK GREY SMOKES

Efficient air filter. — NO → Replace.

YES ↓

Efficient injectors. — NO → Engine Test with Modus – IWT – IT2000. Check O-Ring seal.

YES ↓

Correct compression ratio. — NO → Engine Test with Modus – IWT – IT2000.

(continued)

5	THE ENGINE HAS GREY SMOKES (TENDING TO WHITE)

Efficient injectors. — NO → Engine Test with Modus – IWT – IT2000. Check O-Ring seal.

YES ↓

Correct cooling liquid level. — NO → Probable cooling liquid passage in bursting chambers. Replace cylinder head gasket or revise the engine.

6	THE ENGINE HAS CERULEAN SMOKES

Presence of oil in the cylinders. — YES → Excessive oil consumption. Turbine oil blow-by. Blow-by from valve guide.

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7	THE ENGINE HAS ANOMALOUS RATTLES		
	Rattle located in drive shaft.	YES →	Check clearances and main journals ovalities; screws securing for main caps and engine flywheel; oil pressure. Replace the parts or revise the engine.
	NO ↓		
	Rattle located in connecting rods.	YES →	Check clearances and connecting rod journals ovalities; screws securing for connecting rod caps; connecting rods quadrature. Replace the parts or revise the engine.
	NO ↓		
	Rattle located in plungers.	YES →	Check clearances between plungers and cylinder barrels; elastic rings integrity; plunger pins – hubs clearance. Replace the parts or revise the engine.
	NO ↓		
	Rattle located in cylinder head.	YES →	Check: operating clearance between rocker arms and distribution setting valves. Adjust.
	NO ↓		
	Rattle located in distribution.	YES →	Check and possibly replace the gears.
	YES ↓		
	Rattle located in air compressor.	YES →	Revise or replace the air compressor.
	NO ↓		
	Rattle located in injectors.	YES →	Check and calibrate them according to what is described in S.I. 1094 or replace them.

8 THE ENGINE STOPS

Check		Action
Presence of fuel in the tank.	NO →	Carry out the refueling and, if necessary, carry out the drain.
YES ↓		
Efficient fuel filters.	NO →	Replace.
YES ↓		
Efficient supply circuit.	NO →	Check the circuit and carry out the drain.

9 INSUFFICIENT OR EXCESSIVE OIL PRESSURE

Check		Action
The pressure regulating valve correctly intervenes.	NO →	Check and possibly replace.
YES ↓		
Efficient oil pump and delivery pipings.	NO →	Check and possibly replace.
YES ↓		
Efficient main and connecting rod bearings.	NO →	Replace the bearings and possibly adjust the drive shaft.
YES ↓		
Correct engine oil SAE viscosity.	NO →	Replace the engine oil with another one with a correct viscosity.

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10 EXCESSIVE FUEL CONSUMPTION

Efficient fuel tank and pipings. — NO → Remove possible leakages and replace the deteriorated parts.

YES

Efficient air filter. — NO → Replace.

SECTION 3

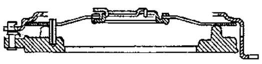
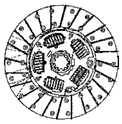
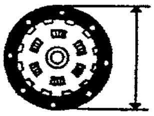
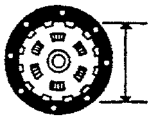
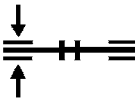
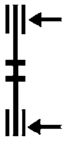
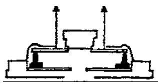
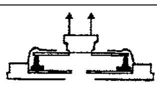
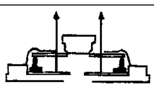
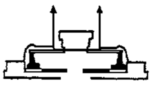
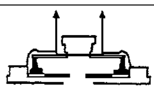
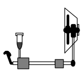
Clutch

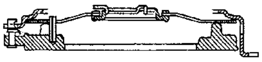
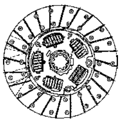
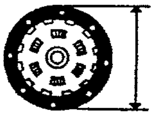
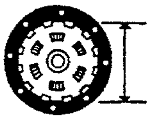
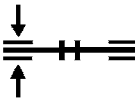
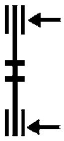
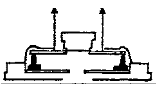
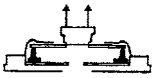
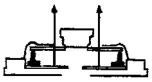
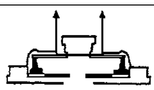
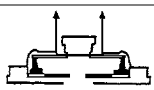
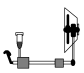
DESCRIPTION

Clutch

The clutch is of the single–plate, dry–operating type, with engagement mechanism of the pull type with baffle spring. The engagement control is hydraulic and comprises the master cylinder, with embedded oil tank, and the operating cylinder.

SPECIFICATIONS AND DATA

13" CLUTCH with gearboxes: 2855S.5 – 2855S.6 – 2870S.9 Engine: 4 cylinders			VALEO	A.P.
	Type		Dry single–plate	
	Engagement mechanism		Pull with baffle spring	
	Driven plate		With friction gaskets	
	Driven plate hub		With spring drives	
	Ø External gaskets	mm	330	
	Ø Internal gaskets	mm	194.5	200
	(New) plate thickness	mm	8.5 ± 0.3	
	Max. driven plate mismatching	mm	~ 0.2	
	Load on plate–pusher	N	10100	10500
	Disengagement load	N	2000	
	Minimum plate–pusher lift	mm	1.5	
	Detachment stroke	mm	10^{+2}_{0}	
	Max. consumption stroke	mm	14	13.6
	Hydraulic control		Servo–assisted main cylinder with integrated oil tank – operator cylinder	
	Oil type		**Tutela TRUCK DOT SPECIAL**	

13"/14" CLUTCH with gearboxes: 2855S.5 – 2855S.6 Engine: 6 cylinders			VALEO
	Type		Dry single–plate
	Engagement mechanism		Pull with baffle spring
	Driven plate		With friction gaskets
	Driven plate hub		With spring drives
	External gaskets ∅	mm	330
	Internal gaskets ∅	mm	194.5
	(New) plate thickness	mm	9.4 ± 0.3
	Max. driven plate mismatching	mm	~ 0.2
	Load on plate–pusher	N	12000
	Disengagement load	N	2900
	Minimum plate–pusher lift	mm	1.5
	Detachment stroke	mm	10^{+2}_{0}
	Max. consumption stroke	mm	12.2
	Hydraulic control		Servo–assisted main cylinder with integrated oil tank – operator cylinder
	Oil type		**Tutela TRUCK DOT SPECIAL**

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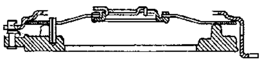
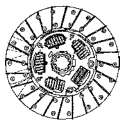
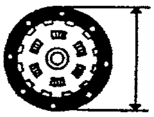
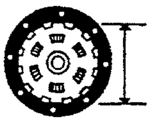
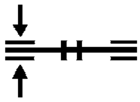
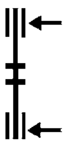
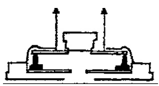
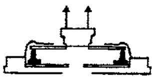
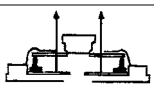
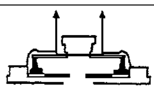
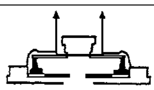
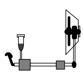
14" CLUTCH with gearboxes: 2865S.6 – 2870S.9 Engine: 6 cylinders			VALEO
	Type		Dry single–plate
	Engagement mechanism		Pull with baffle spring
	Driven plate		With friction gaskets
	Driven plate hub		With spring drives
	External gaskets ∅	mm	350
	Internal gaskets ∅	mm	195
	(New) plate thickness	mm	9.4 ± 0.3
	Max. driven plate mismatching	mm	~ 0.2
	Load on plate–pusher	N	12000
	Disengagement load	N	2900
	Minimum plate–pusher lift	mm	1.5
	Detachment stroke	mm	10^{+2}_{0}
	Max. consumption stroke	mm	12.2
	Hydraulic control		Servo–assisted main cylinder with integrated oil tank – operator cylinder
	Oil type		**Tutela TRUCK DOT SPECIAL**

DIAGNOSTICS

Main clutch operating anomalies:

1 – Noises when the pedal is lowered;
2 – Noises when the pedal is released;
3 – The clutch jerks;
4 – The clutch does not disengage itself;
5 – The clutch slips;
6 – Anomalous driven plate gasket wear.

1 NOISES WHEN THE PEDAL IS LOWERED

Excessively worn, damaged or scarcely lubricated thrust bearing.	YES →	Replace the thrust bearing.
NO ↓		
Excessive clearance between gearbox entry shaft grooves and related seat on driven plate hub.	YES →	Replace the shaft and, if necessary, the driven plate too.

2 NOISES WHEN THE PEDAL IS RELEASED

Broken or excessively deteriorated driven plate springs.	YES →	Replace the driven plate.
NO ↓		
Worn gearbox entry shaft.	YES →	Replace the shaft and, if necessary, the driven plate.
NO ↓		
Thrust bearing having clearance on engagement manifold.	YES →	Replace the thrust bearing.

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3 THE CLUTCH JERKS

Oil or grease on engine flywheel, or on driven plate gaskets.	YES	Remove the inconvenience generating the fouling; accurately clean the flywheel, then replace the driven plate.
NO ↓		
Buckled plate–pushing ring.	YES	Replace the clutch.
NO ↓		
Irregularly consumed friction gaskets due to driven plate mismatching.	YES	Replace the driven plate.
NO ↓		
Weak clutch baffle spring or baffle spring with broken blades.	YES	Replace the clutch.

4 THE CLUTCH DOES NOT DISENGAGE ITSELF

Oil or grease on driven plate gaskets.	YES	Remove the inconvenience generating the fouling; accurately clean the flywheel, then replace the driven plate.
NO ↓		
Worn gearbox entry shaft grooves so that the driven plate sliding is prevented.	YES	Replace the shaft and, if necessary, the driven plate too.

(continued)

5	THE CLUTCH SLIPS

Worn or burnt driven plate gaskets.	YES →	Replace the driven plate.
NO ↓		
Weak clutch baffle spring or baffle spring with broken blades.	YES →	Replace the clutch.
NO ↓		
Oil or grease on driven plate gaskets.	YES →	Remove the inconvenience generating the fouling and replace the driven plate.

6	ANOMALOUS DRIVEN PLATE GASKET WEAR

The driver keeps, during the drive, his foot rested on the clutch pedal.	YES →	The driver must avoid this wrong attitude and rest his foot on the clutch pedal only when it is necessary.
NO ↓		
Baffle spring with yielded or broken blades.	YES →	Replace the clutch.

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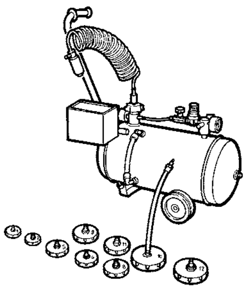
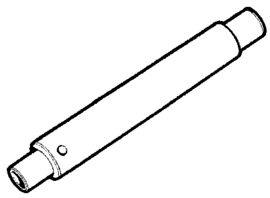
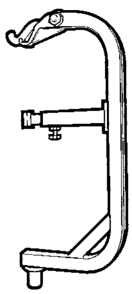
TIGHTENING TORQUES

PART	TORQUE	
	Nm	(kgm)
Hexagonal screw securing disk pusher to flywheel	23.5 ± 2.5	(2.4 ± 0.2)
Hexagonal nut for securing clutch timing case to engine	46 ± 5	(4.7 ± 0.5)
Screw stud securing clutch case with engine	19 ± 2	(1.9 ± 0.2)

TOOLS

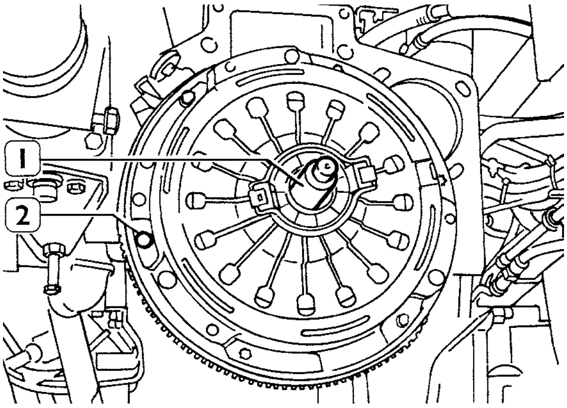
TOOL No.		DENOMINATION
99306010		Air drain apparatus for brakes and clutches system
99370306		Guide pin for clutch plate centring
99370547		Disengagement and re–engagement support for clutch assembly (to be applied to hydraulic jack)

505210 REMOVAL AND REFITTING

Removal

After removing the gearbox propeller shaft as described in the relevant sections, remove the clutch assembly as follows:

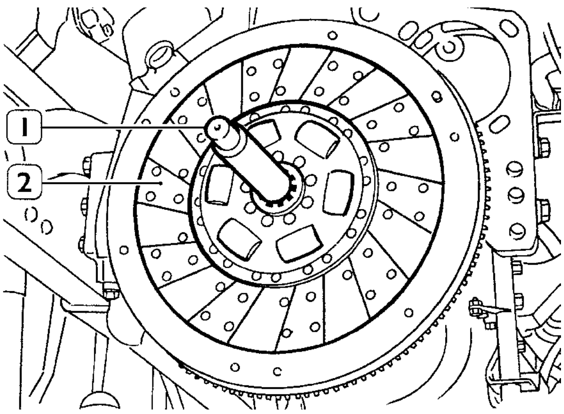
Figure 1



33696

Insert clutch–centering pin 99370306 or 99370280 (1), unscrew assembly–securing screws (2) and withdraw the assembly.

Figure 2



33697

Withdraw pin (1) and remove the driven plate (2).

Refitting

For refitting, reverse the removal operations.
Check conditions of fastening screws and replace the faulty ones.
Clean accurately threads and contact surfaces.

DRIVEN PLATE OVERHAUL

Upon overhauling the clutch plate, no repair is provided since components are only submitted to visual inspection to determine their wear conditions.
These checks and the overhauling procedures are specified in the following paragraphs.

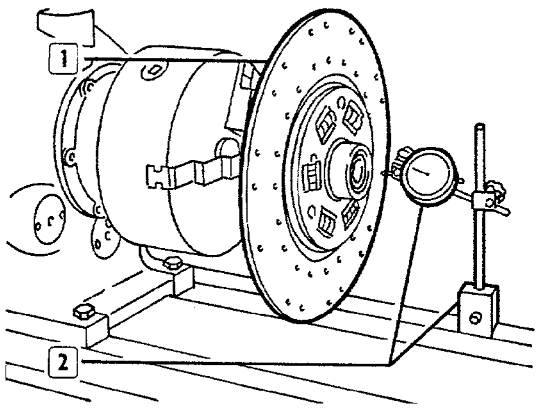
Damper hub check

Visually inspect the hub and check absence of breaks; spring drives shall not rotate into their seats and hub outline shall be within the tolerance values specified on drawing.
Replace the entire plate if the hub shows one of the above faults or hub grooved coupling sizes are out of tolerance values.

Friction gaskets

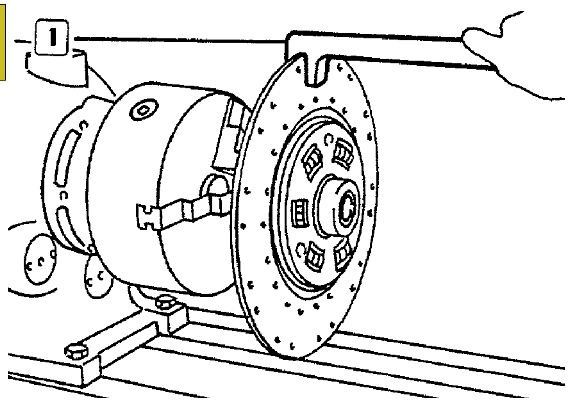
Replace the entire driven plate if gaskets are excessively worn or dirty with oil or grease, or burning traces or removal from the driving plate are visible.

Figure 3



Before fitting a new driven plate, check its centring as follows:
Place the driven plate (1) on a lathe, then using a magnetic–base gauge (2), check that the plate surface is not out of line at any point.
Max. tolerance for driven plate is 0.20 mm.

Figure 4



If plate is out–of–line, use a fork wrench (1) as shown in the figure.

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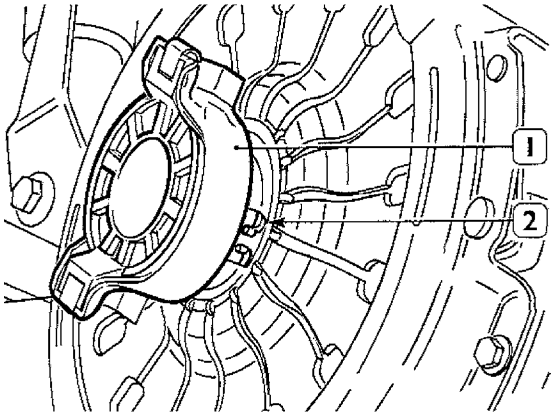
505254 THRUST BEARING REMOVAL – REFITTING

Figure 5

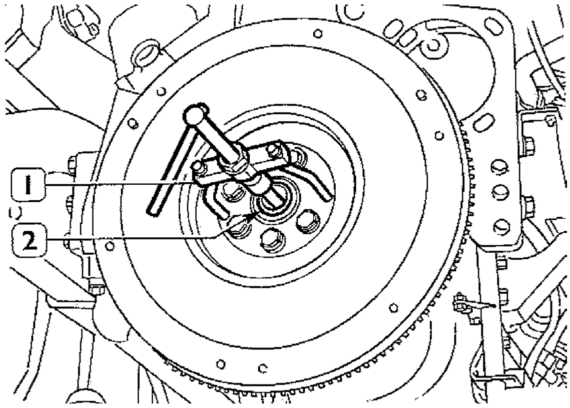


33698

Use the proper pliers to open the safety split ring (2) and withdraw the thrust bearing (1).
For refitting reverse removal operations.

540852 REPLACING CLUTCH SHAFT SUPPORT BEARING

Figure 6



33699

Use the universal extractor 99348004 (1) and remove bearing (2).
For refitting use the proper beater.

If any fluid leaks are detected in the main and operator cylinder, replace them.

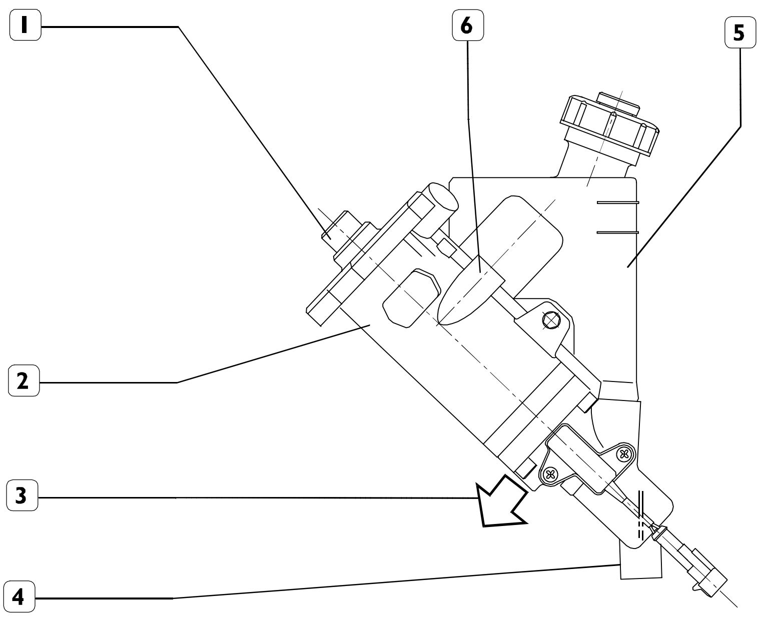
HYDRAULIC CONTROL

The hydraulic control to disengage clutch is made up of a mini servo–clutch with built–in oil tank and of a clutch disengaging cylinder.

Mini servo–clutch

This cylinder adopts an air–assisted system of operation, activation of which is regulated by a spring type load sensor characterised by a threshold value. The initial part of the stroke of the piston, below the activation threshold, is not power–assisted whereas, above this threshold, the air pressure, suitably regulated by a set of valves, is activated in order to activate the piston at constant.

Figure 7



1. Piston – 2. Master cylinder – 3. Air vent – 4. Oil outlet – 5. Oil reservoir – 6. Air supply fitting

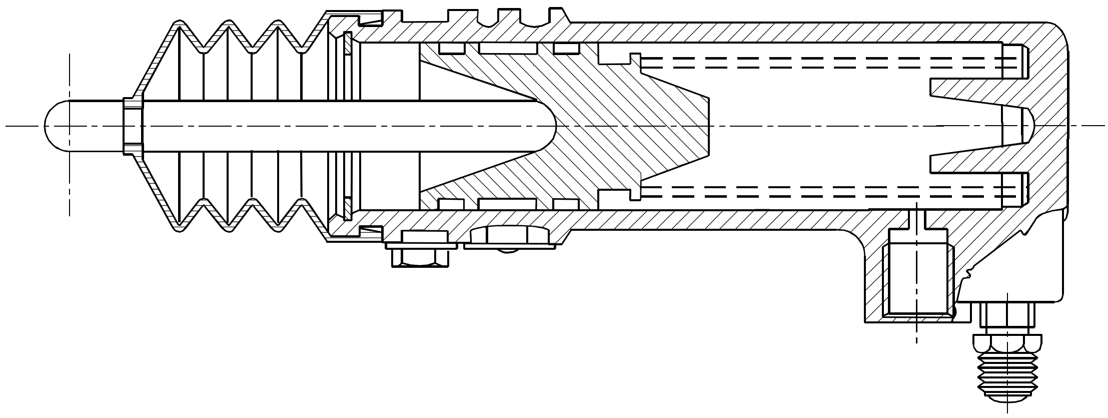
Travel 38 mm – Tank capacity min. 150 cm^3 / max. 200 cm^3

Connections

Air supply pressure (Fitting 6)	10 bar	Travel	38 mm
Hydraulic pressure (Fitting 4)	50 bar	Tank capacity	min. 150 cm^3 max. 200 cm^3

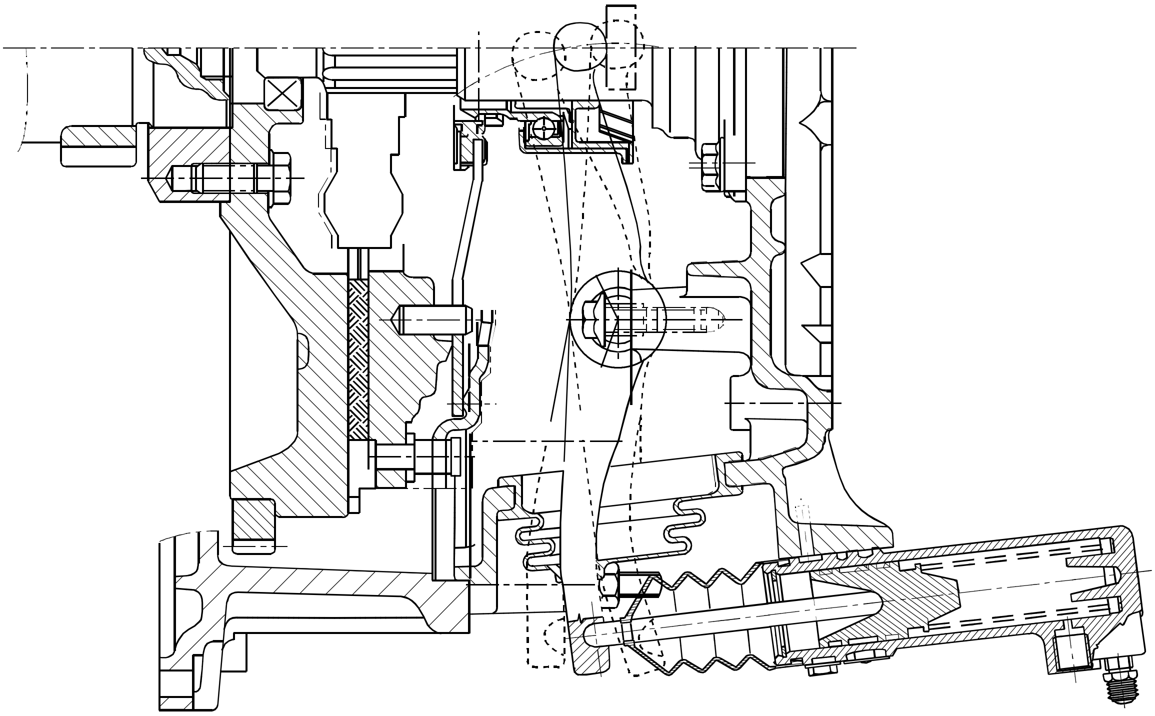
Clutch disengaging cylinder

Figure 8



Clutch mounting assembly

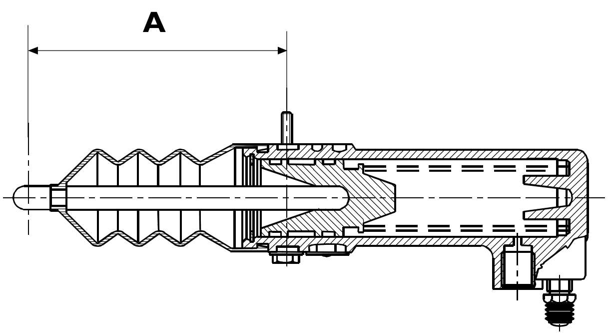
Figure 9



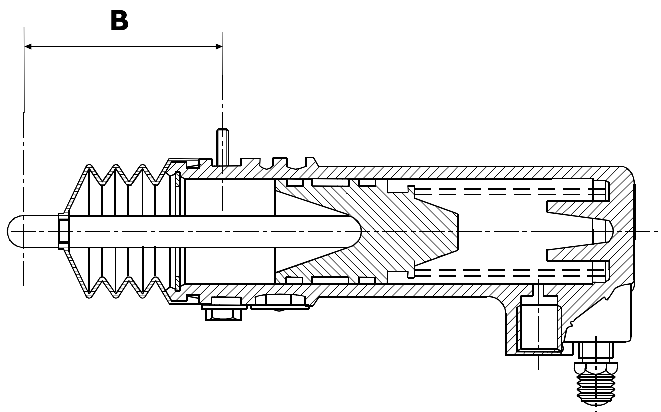
87560

Clutch wear control

Figure 10



87561



87562

A = mm 117 (cylinder travel with new clutch)

B = mm 50 (cylinder travel with worn out clutch)

ADJUSTING PEDAL AND STOP POSITION SCREWS

Clutch pedal clearance

Axial clearance between push rod (5) connected to clutch pedal (7) and piston (6) of mini servo–clutch must range between 0.5 and 1 mm. This value is checked by measuring clutch pedal idle travel, which must range between 2 and 4 mm. Clutch pedal idle travel must be read on part outer profile as indicated in figure. If prescribed value is not matched, below described adjusting procedure has to be performed:

- ❑ loosen lock nut (2) and screw up screw (1) until clearance is reset; then, unscrew the screw by 45° ÷ 90° and lock the screw by the lock nut;
- ❑ drive pedal up to stop; from stop position, let pedal freely return to rest position; pay attention to this movement, which must be fast. Repeat this operation three times.

Then, check that clearance is correct. If it is not, drive screw (1) by 45° at a time and go on driving until correct value is obtained.

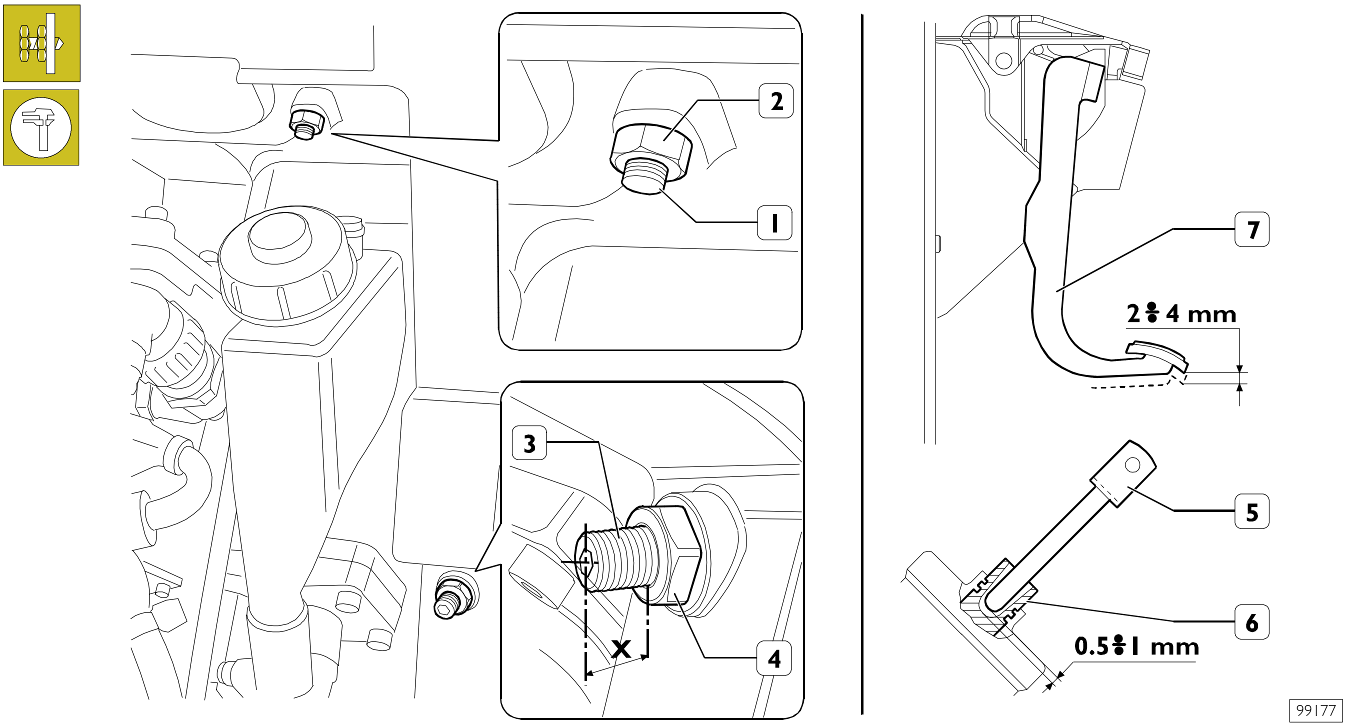
Clutch pedal travel

This operation must be only performed after adjusting the clearance, as described above.

- ❑ loosen lock nut (4) and drive screw (3) until a projection is obtained of X = 8 ± 0.5 mm of the screw from lock nut plane.

NOTE Dimension control must be performed with lock nut beating against pedals set support body. The lock nut must be from an original supply (4.8 mm height).

Figure 11



CLUTCH CONTROL DRAIN PROCEDURE

After connecting the mini servo–clutch to clutch disengaging cylinder in use position via the hose, open clutch disengaging cylinder drain screw and pour clutch liquid contained in mini servo–clutch tank. As liquid is starting to come out from the drain screw, close the screw.

Now, take clutch disengaging cylinder off its fastener and, keeping the cylinder upright with the push rod oriented upwards, press up the push rod (twice).

Thereafter, repeat movement operation (twice) up to push rod bottom with the cylinder oriented horizontally and hydraulic feed fitting oriented upwards.

Check clutch disengaging cylinder travel by fully driving the pedal and, if measured travel is not yet complying with values prescribed on the drawing, repeat once again above described operations.

SECTION 4

Gearboxes

DIAGNOSTICS

Main gearbox operating anomalies:

1 – Noises;
2 – Spontaneous gears disengagement and engagement irregularities;
3 – Gears engagement difficulty and hardness.

1 NOISES

Excessive clearance between gears.	YES →	Revise the gearbox and replace worn gears.
NO ↓		
Worn gears, bearings, synchronising rings and coupling bodies.	YES →	Overhaul transmission and worn parts.
NO ↓		
Insufficient lubricating oil level in box.	YES →	Add **TUTELA ZC 90** oil restoring the exact level.
NO ↓		
Insufficient oil pressure (only for gearboxes equipped with oil pump).	YES →	Replace the oil pump.

2 SPONTANEOUS GEARS DISENGAGEMENT AND ENGAGEMENT IRREGULARITIES

Exact engagement manoeuvre.	YES →	Completely engage the gears before releasing the clutch pedal.
NO ↓		
Forks breakage.	YES →	Disassemble the gearbox, revise the parts and carry out necessary replacements.

(continued)

Worn synchronising rings.	YES →	Check gears and sliding sleeves for gears engagement, replacing the deteriorated ones; replace synchronising rings.
NO ↓		
Faulty epicyclic reduction gear operation (gearbox 2870.9).	YES →	Check and replace the deteriorated parts.

3 GEARS ENGAGEMENT DIFFICULTY AND HARDNESS

Fork hardening on rod.	YES →	Disassemble gearbox case and search for the hardening reason; carry out the suitable repairs.
NO ↓		
Sliding sleeves obstructed when displacing.	YES →	Check and carry out suitable repairs.
NO ↓		
Unsuitable lubricating oil quality inserted into the case.	YES →	Discharge the oil and refill with **TUTELA ZC 90** oil.

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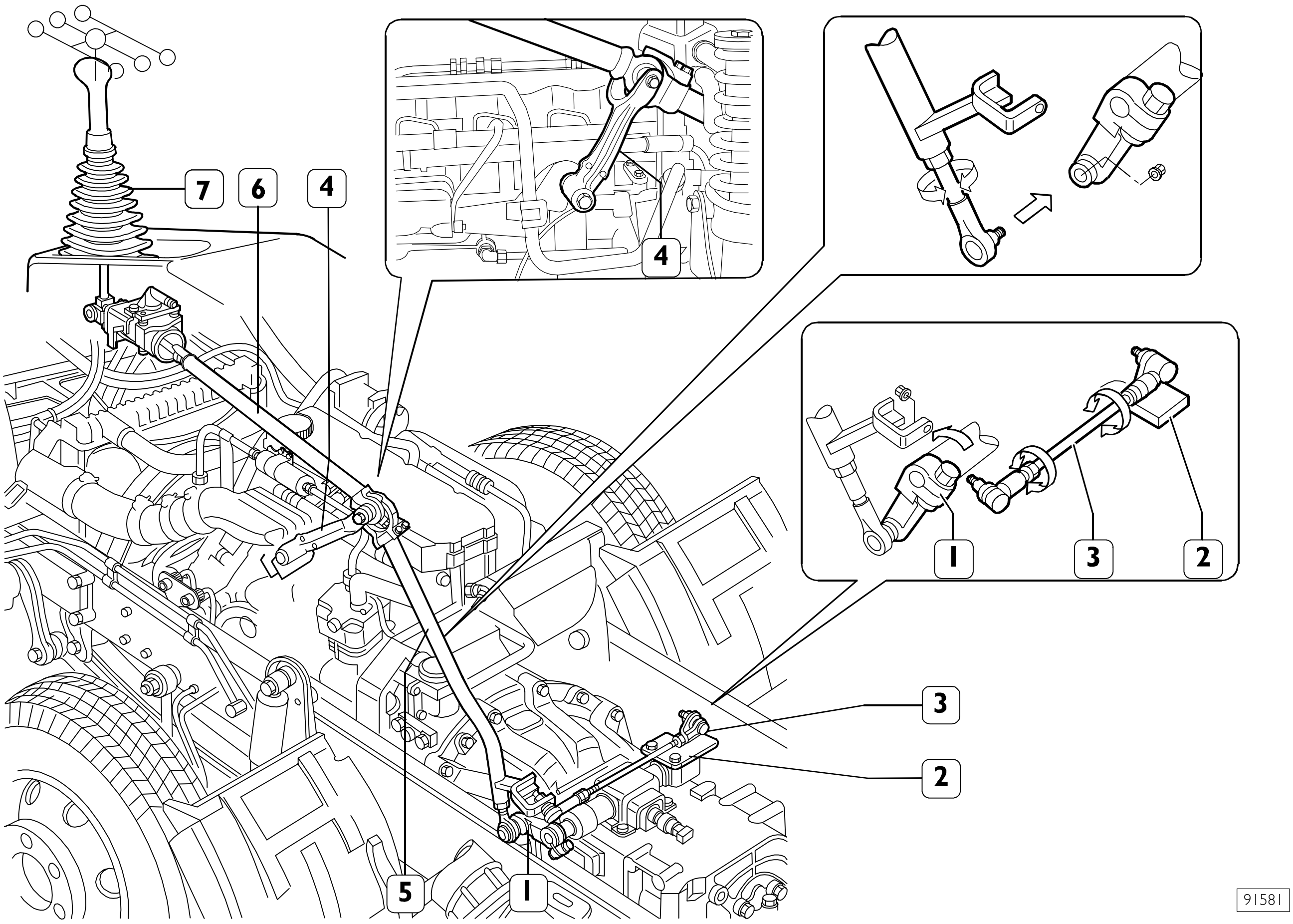
Gears control connection

The gears–controlling tie–rods bearing support is secured in the same chassis point on all models in the EuroCargo range, while the adjustment tie–rod reaction plate is secured to the gearbox gears control in different positions according to the gearbox itself.

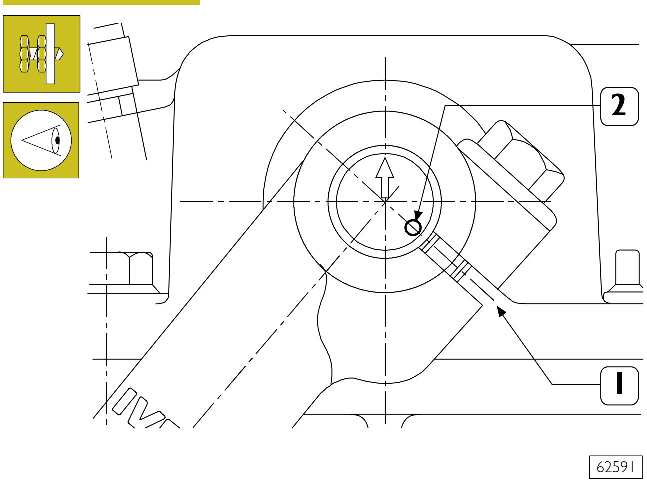
Figure 1



1. Gears control lever – 2. Reaction plate secured to gears control – 3. Adjustment tie–rod – 4. Bearing support – 5. Adjustable fixed tie–rod – 6. Telescopic tie–rod – 7. Gears lever

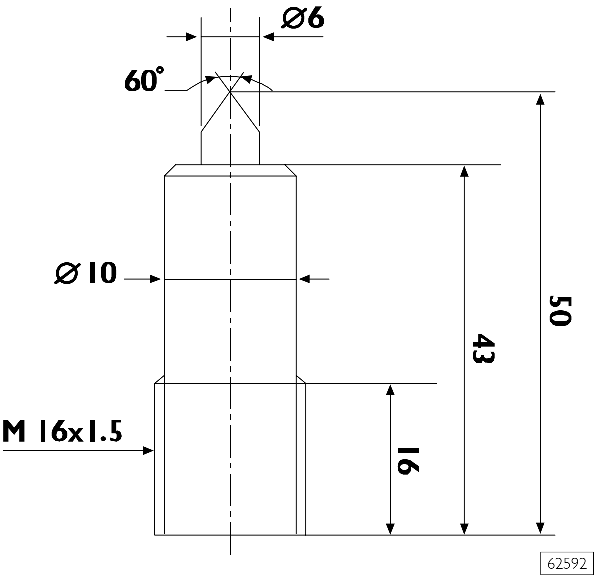
Gearbox control tie–rods adjustment

Figure 2



- ❑ Check or position, if disassembled, the gears control lever on the transverse control: upon assembling the lever, the milling (1) must correspond with the reference notch (2) punched on the transverse shaft;
- ❑ position the gearbox in idle;
- ❑ in order to be sure about such operation, it is enough to longitudinally push the transverse rod: if the rod performs the movement, it means that it is in idle.

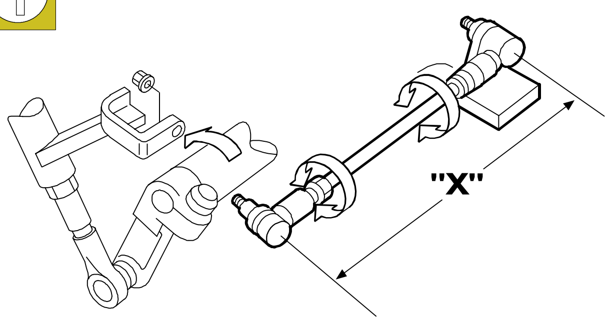
Figure 3



62592

❑ It is necessary that the gearbox remains in such a condition for the whole operation. In order to be sure of that, in place of the Idle–R.M. switch, a screw can be applied with equal sizes (M 16x1.5 mm) with its bit chamfered at 60° that, completely screwed, blocks any transverse rod movement for gearboxes 2855.5/.6 and 2865.6 and the internal control shaft for gearbox 2870.9; anyway, it is enough to check that the idle condition remains during the different steps (avoiding lever forcings);

Figure 4

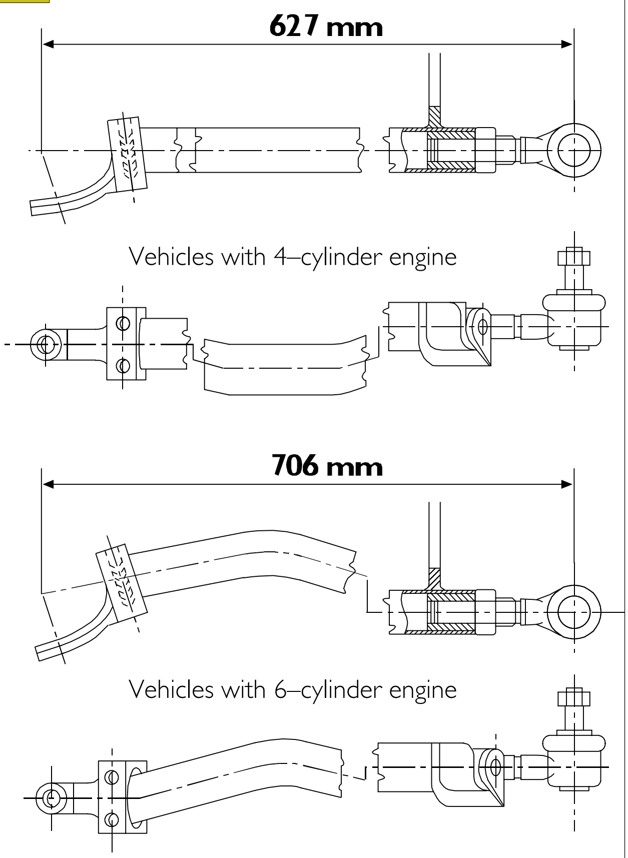


62593

❑ position the reaction plate on gears control and screw the securing screws without completely tightening them;

❑ check/adjust the length (X) of the gearbox control reaction tie–rod that must be 329 mm;

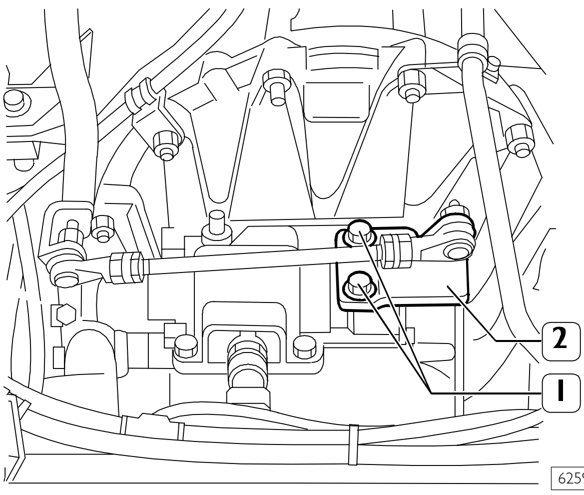
Figure 5



62594

❑ check/adjust the adjustable fixed tie–rod length that must be:
– 627 mm for models with 4–cylinder engine;
– 706 mm for models with 6–cylinder engine;

Figure 6



62595

❑ close securing screws (1) of the reaction plate (2) on gears control;

❑ unscrew the previously inserted screw to block the gearbox in Idle position and assemble again the Idle–R.M. switch tightening it at the described torque.

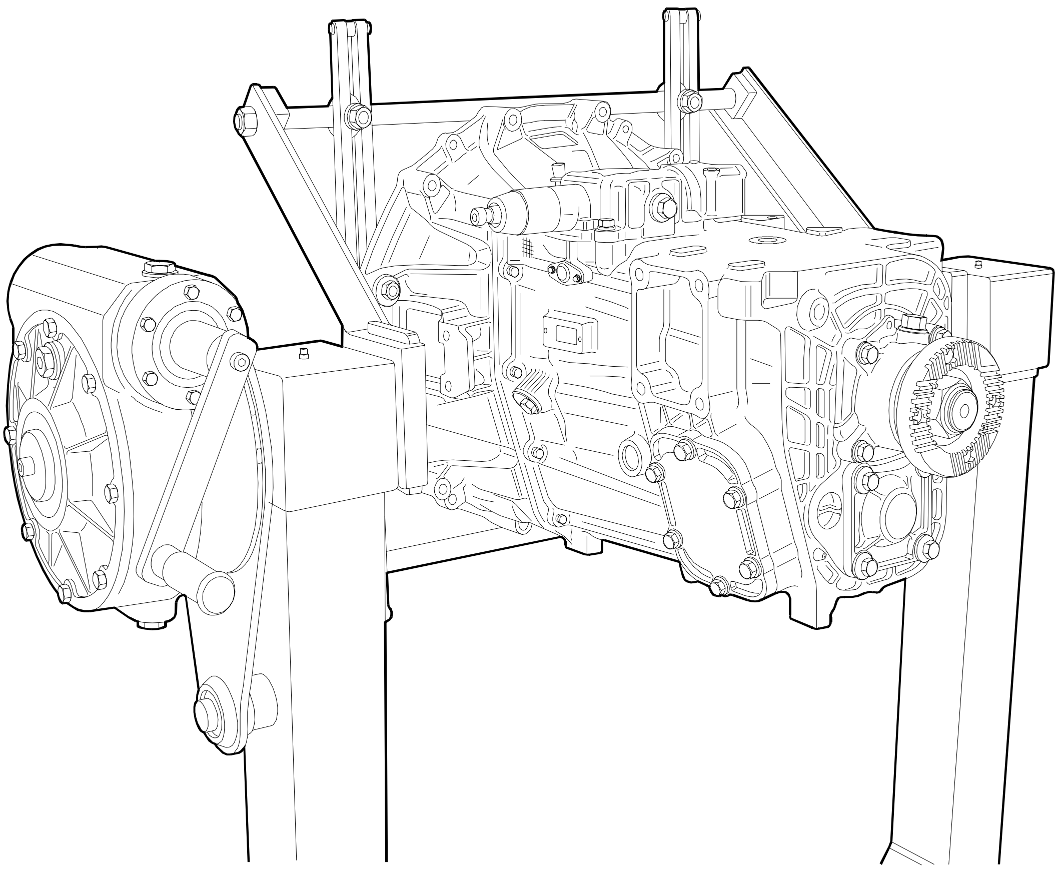
5302 Gearbox 2855S.5 – 2855S.6

DESCRIPTION

The IVECO 2855S.6 gearbox is of the mechanical type with 1st, 2nd gear engagement through a double–cone synchronising ring and 3rd, 4th, 5th and 6th gear engagement with free–ring synchronising rings. The reverse motion engagement is with a quick–connection sliding sleeve.
The gearbox case is made of light alloy and is composed of a front half–case and a rear half–case.
Three openings are obtained in the rear half–case for the possible application of a power takeoff.
Motion transmission is realised through a series of gears, always meshed and with helical teeth.

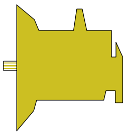
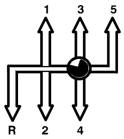
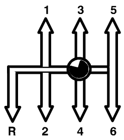
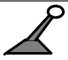
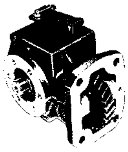
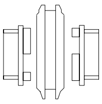
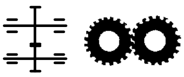
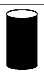
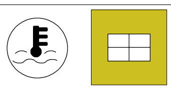
The gears are keyed or obtained on four shafts: motion entry, primary, secondary and reverse motion shafts.
The gear obtained on the motion entry shaft and those keyed on primary and reverse motion shafts idly rotate on cylindrical roller cages.
Motion entry shaft and primary shaft are supported by ball bearings in the gearbox case.
The secondary shaft is front and rear supported by tapered–roller bearings that are axially adjustable through an adjustment ring.
The gears engagement and selection control is mechanical.

Figure 1



IVECO 2855S.5 – 2855S.6 GEARBOX ASSEMBLY

SPECIFICATIONS AND DATA

	GEARBOX	2855S.5	2855S.6
	Type	Mechanical	
	Gears	5 forward gears and reverse gear	
	Gears		6 forward gears and reverse gear
	Gears engagement control	Mechanical	
	Power takeoff	Upon request	
	Gears engagement: 1st ⇒ 2nd 3rd ⇒ 5th 3rd ⇒ 6th Reverse gear Gears anti–disengagement	 Double–cone synchronizer Free–ring synchronizer Free–ring synchronizer Quick–connection type Sliding sleeve holding through rollers and springs.	
	Gears	With helical teeth	
	Gear ratio First Second Third Fourth Fifth Sixth Reverse gear	 1 : 6.339 1 : 3.643 1 : 2.308 1 : 1.484 1 : 1.000 – 1 : 5.455	 1 : 6.433 1 : 3.643 1 : 2.308 1 : 1.484 1 : 1.000 1 : 0.783 1 : 5.630
	Oil type Amount	**TUTELA ZC 90** 5 kg. (5.5 litres)	
	Fixed hubs assembly temperature	100 °C to 130 °C	

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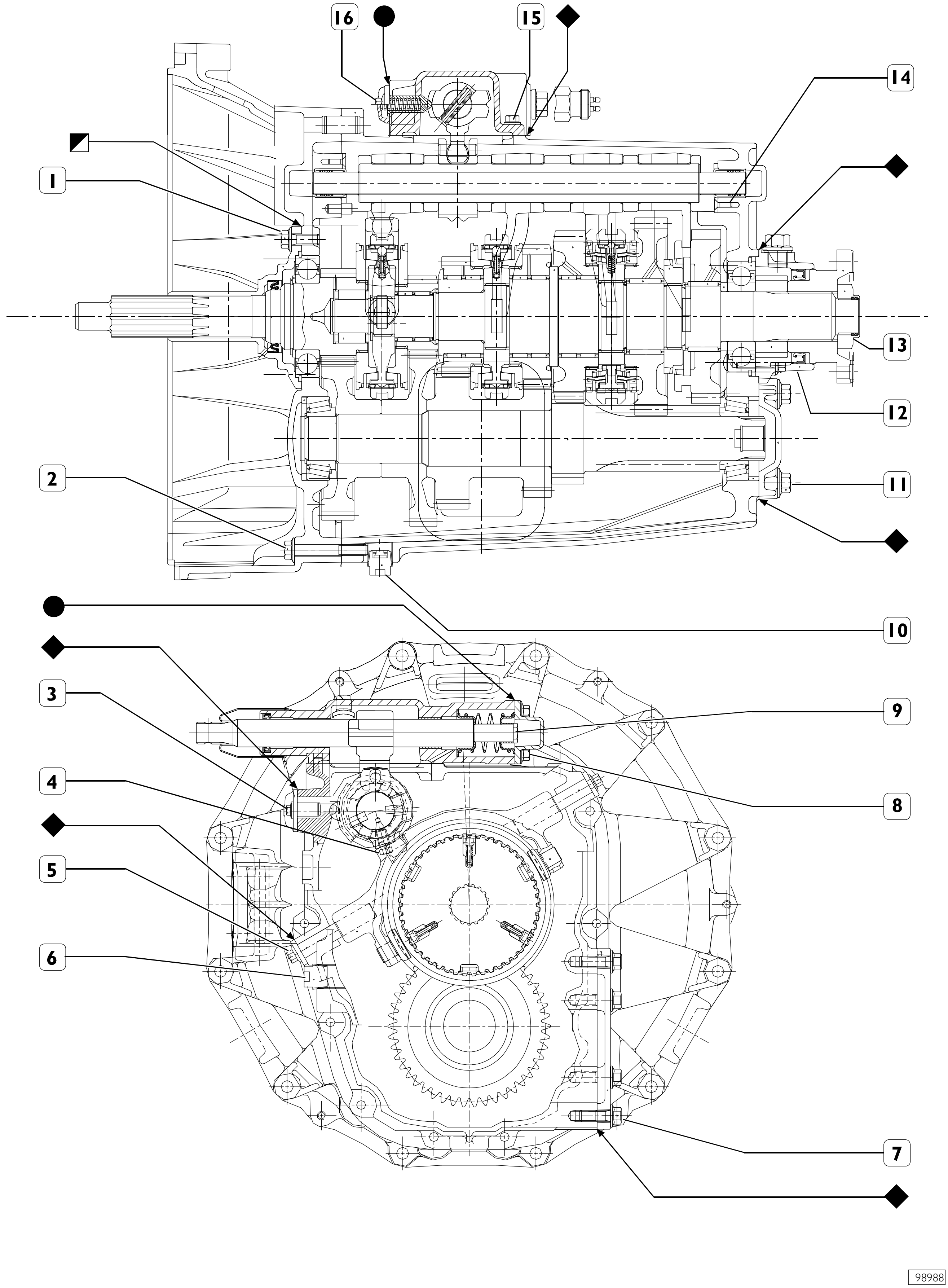
	Transmission shaft bearing end play	0 to 0.05
	Adjustment of transmission shaft bearing end play. using shims.	Through rings
	Thickness of transmission shaft bearing end play adjustment rings.	from 3.90 to 5.00 mm with step of 0.05 mm. (supplied in kit)
	Secondary shaft bearings assembly temperature	85 °C
	Secondary shaft bearings adjusting rings thicknesses	2.40 – 2.45 – 2.50 – 2.55 – 2.60 – 2.65 –2.70 – 2.75 – 2.80

Figure 2



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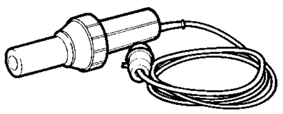
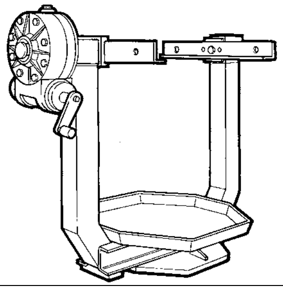
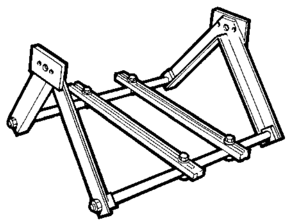
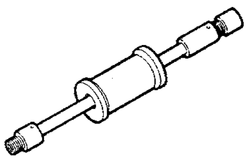
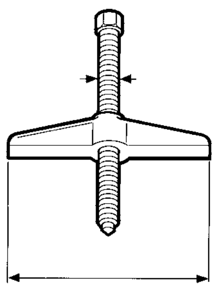
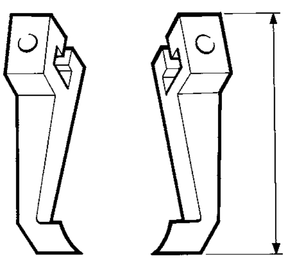
TIGHTENING TORQUES

PART			TORQUE	
			Nm	(kgm)
1	Flanged hexagonal head screw for securing front cover	1st step	20 ± 1	(2 ± 0.1)
		2nd step	25°	
2	Flanged hexagonal head screw for joining half–boxes		45.5 ± 4.5	(4.6 ± 0.5)
3	Release–proof push rod cover securing screw		22.5 ± 2.5	(2.3 ± 0.2)
4	Screw for securing hub to fork control rod		39 ± 2	(4.0 ± 0.2)
5	Flanged hexagonal head screw for pin on 5th – 6th fork		14.5 ± 1.5	(1.5 ± 0.1)
6	Threaded plug with external driving hexagon for oil level		27.5 ± 2.5	(2.8 ± 0.3)
7	Flanged hexagonal head screw for securing covers on side power takeoff connection windows		38 ± 4	(3.9 ± 0.4)
8	Flanged hexagonal head screw for securing transverse axle cover on control *		19 ± 2	(1.9 ± 2)
9	Transverse axle screw *		30 ± 3	(3.0 ± 0.3)
10	Threaded plug with external driving hexagon for oil discharge		27.5 ± 2.5	(2.8 ± 0.3)
11	Flanged hexagonal head screw for securing rear cover on secondary shaft		58 ± 6	(5.9 ± 0.6)
12	Flanged hexagonal head screw for securing rear cover on primary shaft		43 ± 4	(4.4 ± 0.4)
13	Output flange locking nut on primary shaft		467 ± 23	(47.6 ± 2.3)
14	Flat–head screw with TORX mark to secure rib washer *		9.5 ± 0.5	(0.96 ± 0.05)
15	Flanged hexagonal head screw for securing upper cover supporting external controls		33.5 ± 3.5	(3.4 ± 0.4)
16	Flanged hexagonal head screw for securing spring check flange on external control		19 ± 2	(1.9 ± 2)
–	Flanged hexagonal head screw for securing upper cover for internal controls (only for right–hand drive)		45.5 ± 4.5	(4.6 ± 0.5)
–	Flanged hexagonal head screw for securing clutch disengagement lever support		45.5 ± 4.5	(4.6 ± 0.5)

* Apply thread–braking LOCTITE 270 on the screw
♦ Apply liquid gasket LOCTITE 510 sealant
● Apply liquid gasket LOCTITE 518 sealant
◩ Apply sealant LOCTITE 5910 liquid seal.

TOOLS

TOOL No.		DENOMINATION
99305121		Hot–air apparatus
99322205		Rotating stand for assembly revision (capacity 1000 daN, couple 120 daN/m)
99222225		Assembly bearing support (to be applied on stand 99322205)
99340205		Percussion extractor
99341003		Simple–effect bridge
99341009		Pair of brackets

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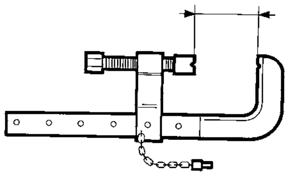
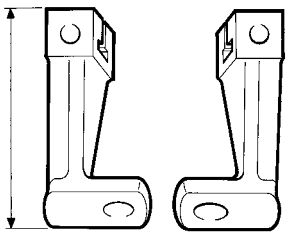
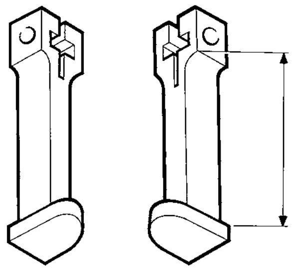
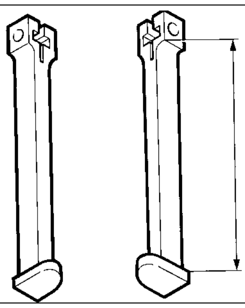
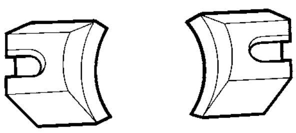
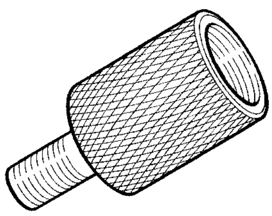
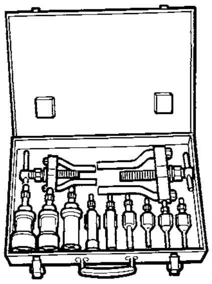
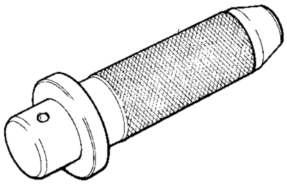
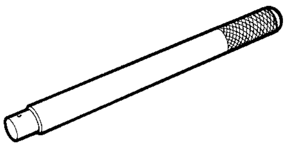
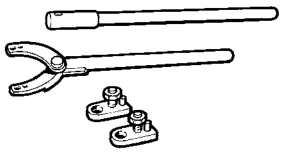
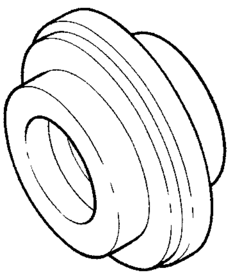
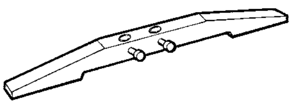
TOOLS

TOOL No.		DENOMINATION
99341015		Clamp
99341017		Pair of brackets with hole
99341019		Pair of tie–rods for holds
99341020		Pair of tie–rods for holds
99341025		Holds
99342143		Peg for removing reverse gear shaft (use with 99340205)

TOOLS

TOOL No.		DENOMINATION
99348004		Universal extractors for interiors 5 to 70
99370006		Handle for interchangeable beaters
99370007		Handle for interchangeable beaters
99370317		Reaction lever with flange check extension
99370349		Keyer for drive shaft front gasket assembling (use with 99370006)
99370466		Comparator–holder basis for secondary shaft bearings adjustment (use with 99395604)

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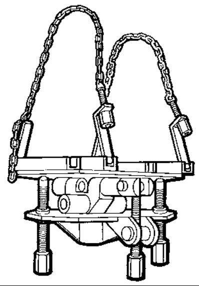
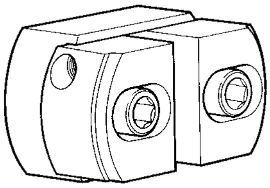
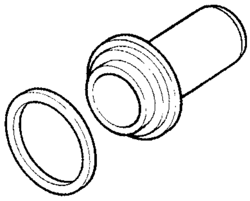
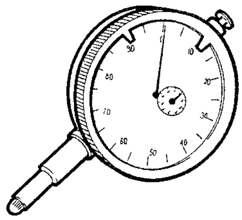
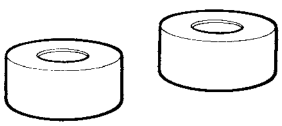
TOOLS

TOOL No.		DENOMINATION
99370629		Gearbox bearing support during vehicle disconnection and re–connection
99374092		Beater for external bearings race assembling (69–91) (use with 99370007)
99374201		Keyer for assembling gasket on rear gearbox cover
99395604		Comparator (0 – 10 mm)
99396031		Calibrated rings for secondary shaft bearings adjustment (use with 99370466).

GEARBOX 2855S.6 REMOVAL – REFITTING

Before carrying out disengagement/re–engagement operations, disconnect battery cables and place the vehicle under safety conditions.

Removal

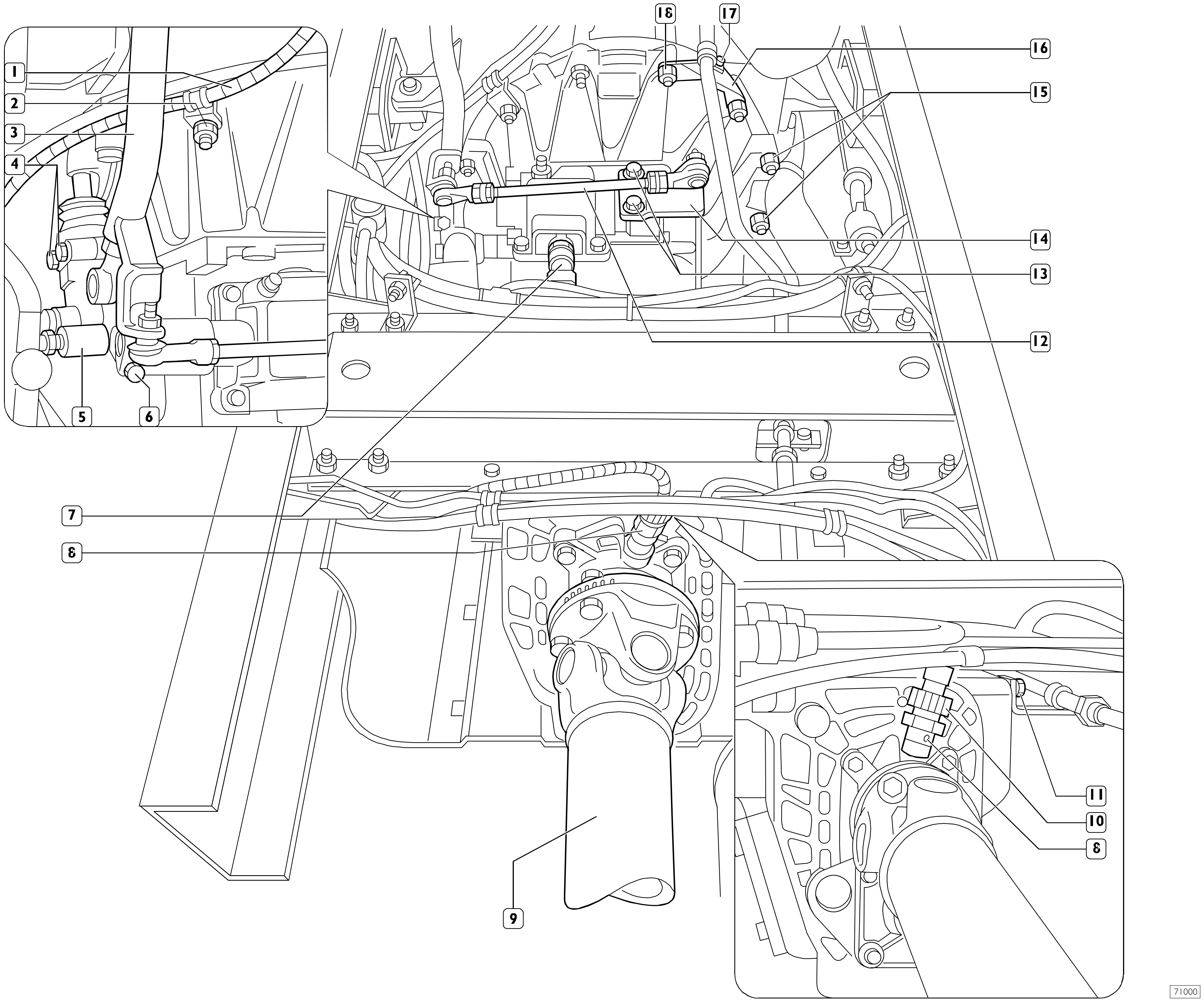
- loosen securing bolt (17), unscrew securing nuts (18) and detach air piping supporting bracket (16);
- unscrew securing nut (2) and detach air piping supporting bracket (1);
- unscrew securing nuts (13) and detach bracket (14) of reaction tie–rod (12);
- loosen securing screw (6) and detach from gearbox the gears control lever completed with tie–rod (3) and reaction tie–rod (12);
- disconnect reverse gear switch electric connection (7);
- unscrew securing nuts (15) of clutch bell to engine that will be able to be reached with difficulty from the lower vehicle part.
- rotate deadening guard locking rivets below the gearbox and remove the deadening guard;
- detach transmission shaft (9) as described in the related section;
- unscrew securing screws (4) and detach clutch control operating cylinder (5);
- disconnect electric connection (10) of odometer sensor (8);
- unscrew securing screw (11) and detach air piping support bracket;
- place an hydraulic jack equipped with support 99370629 under the gearbox;
- unscrew the remaining securing nuts of clutch bell to engine, move the gearbox backwards and lowering the jack remove it from below the vehicle.

Refitting

Suitably reverse the operations carried out for disengagement and tighten securing screws and nuts at the required torque.

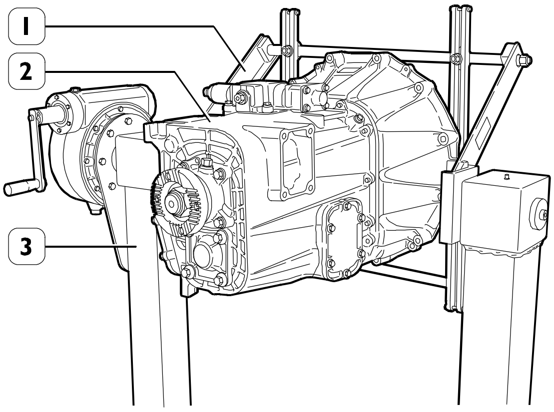
Upon re–engaging the gearbox, pay attention that the clutch control lever fork is correctly meshed to the thrust bearing.

Figure 3



GEARBOX DISASSEMBLY

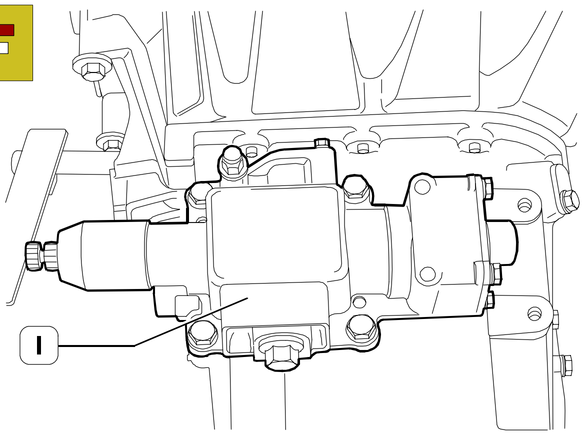
Figure 4



71666

Place gearbox (2) on rotating stand 99322205 (3) equipped with brackets 99322225 (1) and discharge lubrication oil.

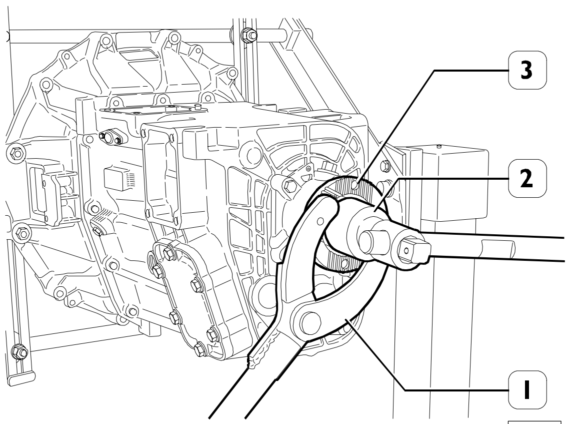
Figure 5



71667

Disassemble the external control box (1).

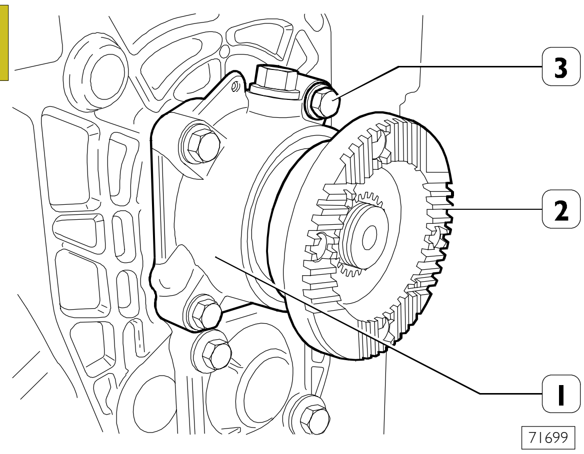
Figure 6



78685

Apply reaction lever 99370317 (1) on motion outlet flange (3) and unscrew nut on primary shaft with wrench 99355081 (2).

Figure 7

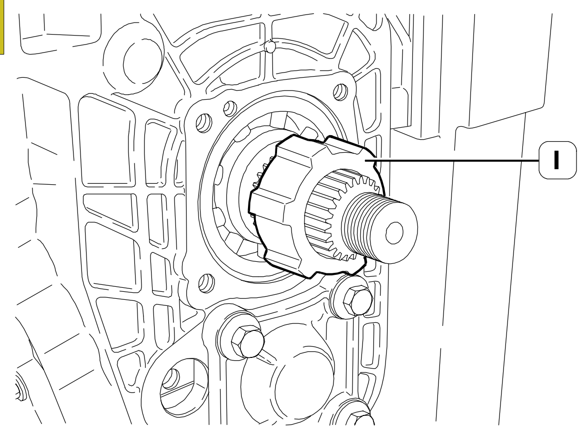


71699

Remove flange (2), unscrew securing screws (3) and remove cover (1).

NOTE Disassembling rear cover from gearbox to replace the sealing gasket can also be carried out with a gearbox assembled on the vehicle by disconnecting the transmission shaft and proceeding as shown for the gearbox assembled on a rotating stand.

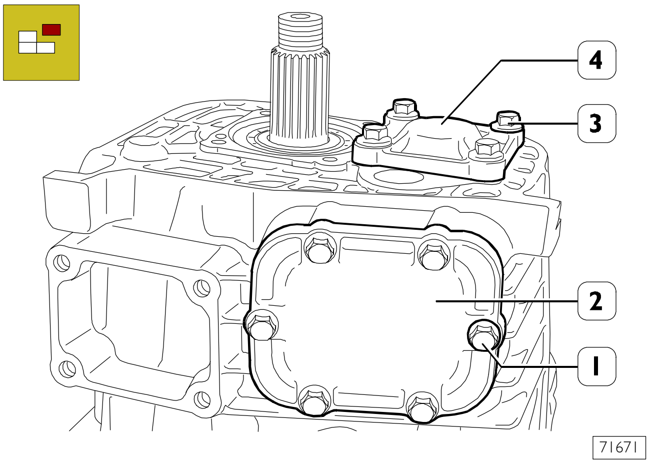
Figure 8



71670

Remove phonic wheel (1) for odometer control.

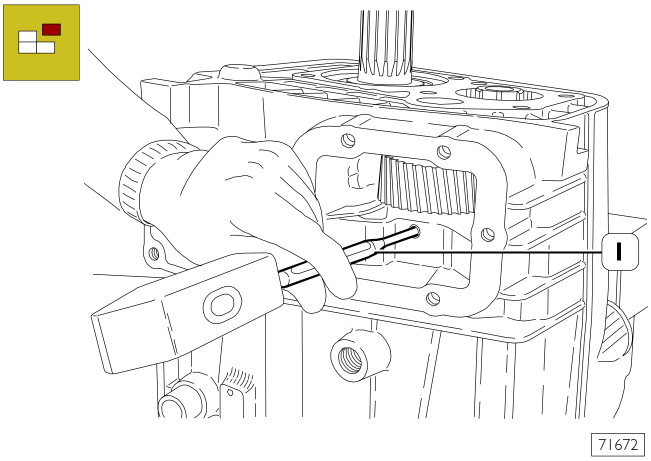
Figure 9



Unscrew screws (2) and dismount cover (1).

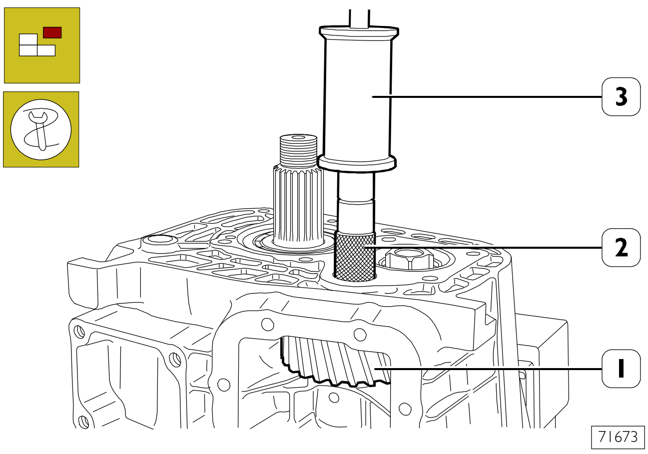
Take off spring (3) and take out push rod (4).

Figure 10



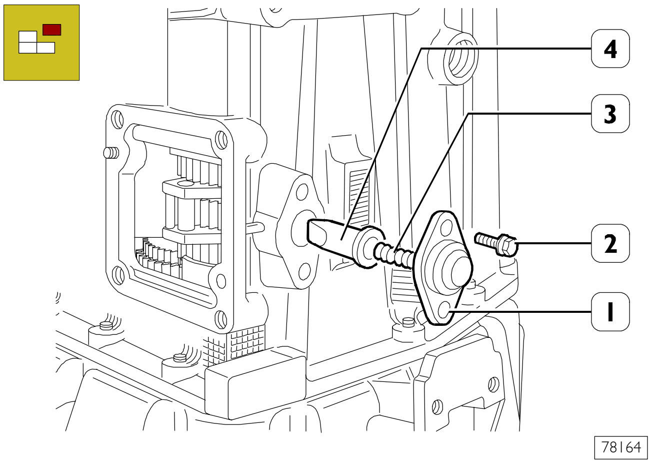
With a punch (1) with an adequate diameter, push inside the elastic peg till it abuts.

Figure 11



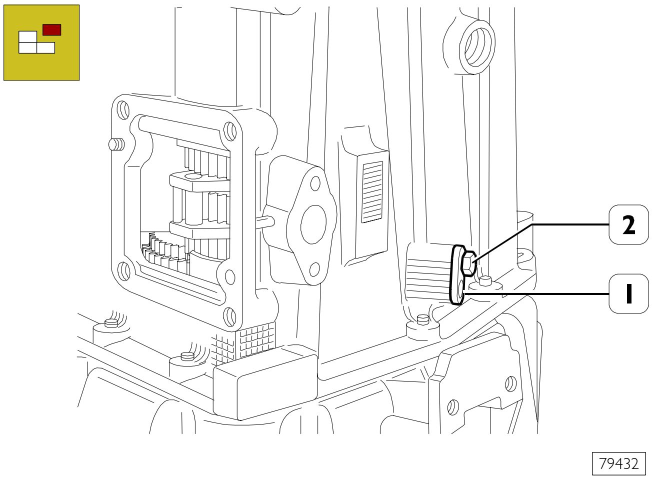
Place extraction peg 99342143 (2) and percussion extractor 99340205 (3). Extract the reverse gear supporting pin and remove the gear (1) with related shoulder washer and cylindric roller bearing.

Figure 12



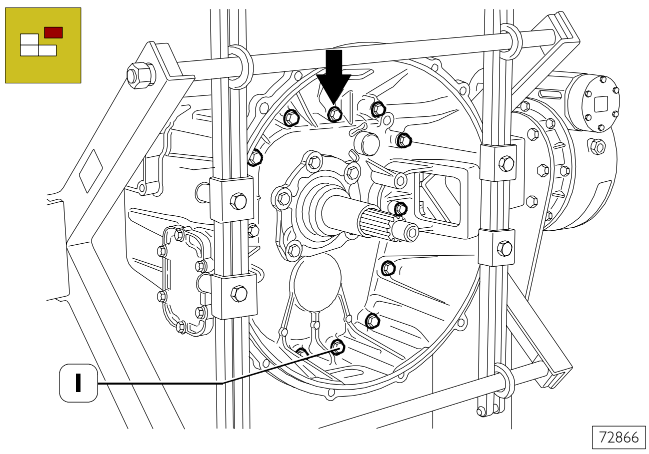
Release the screws (2) and remove the cover (1).
Remove the spring (3) and extract the push rod (4).

Figure 13



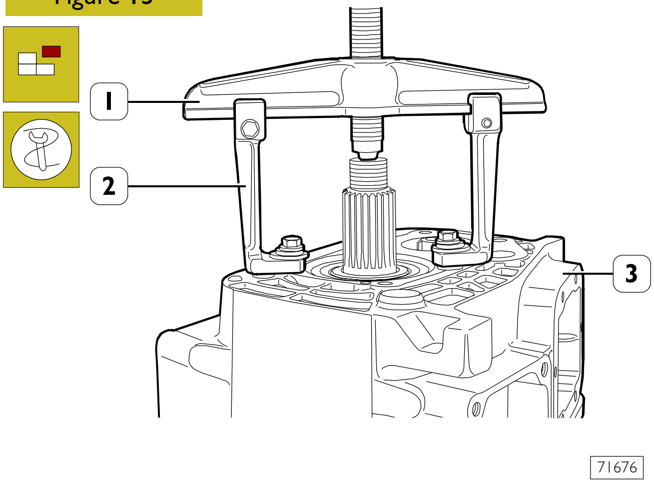
Unscrew screws (2) and take fork pin (1) off both gear–box sides.

Figure 14



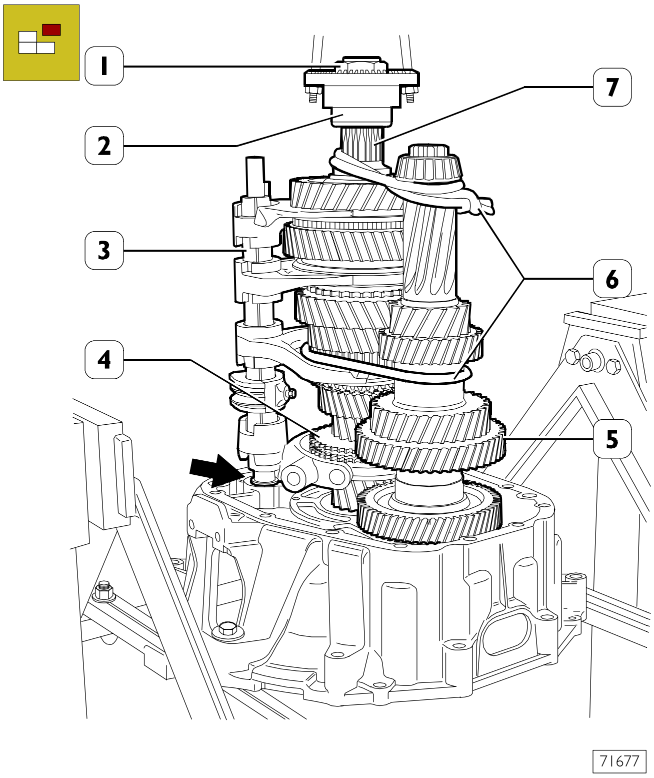
Unscrew the two securing screws for clutch disengagement lever support and remove it from the gearbox.
Unscrew screws (1), leaving a safety one (→) to be removed after having vertically placed the gearbox.

Figure 15



Extract rear half–case (3) with rear axle 99341003 (1) equipped with the pair of brackets 99341017 (2).

Figure 16

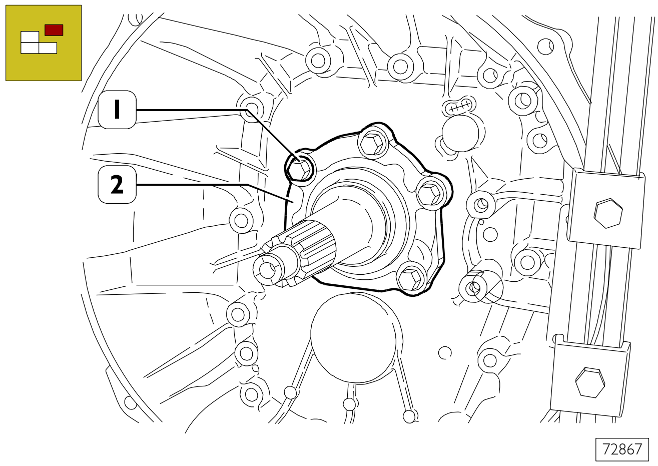


Assemble on primary shaft (7) motion outlet flange (2) and lock it with nut (1). Tie with a rope (6) secondary shaft (5) to primary shaft (7) and with the help of a lifting device extract shafts from front half–case together with internal drive shaft (3).

NOTE Assist the internal drive shaft when going out of its seat by operating in the point shown (→) with suitable tools.

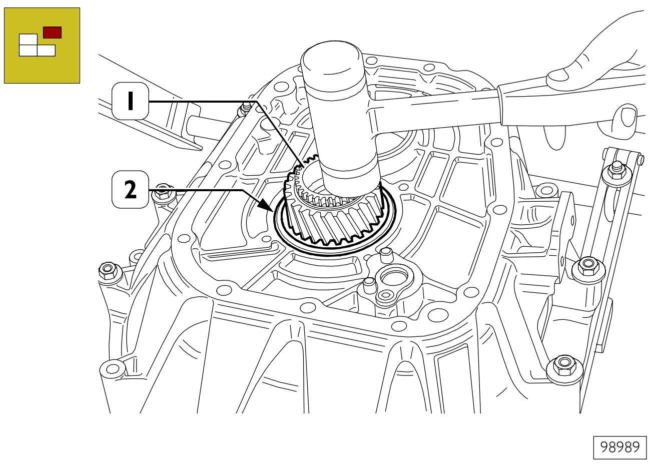
NOTE Keep the complete synchronizer (4) manually assembled in order to prevent check springs and rollers from falling.

Figure 17



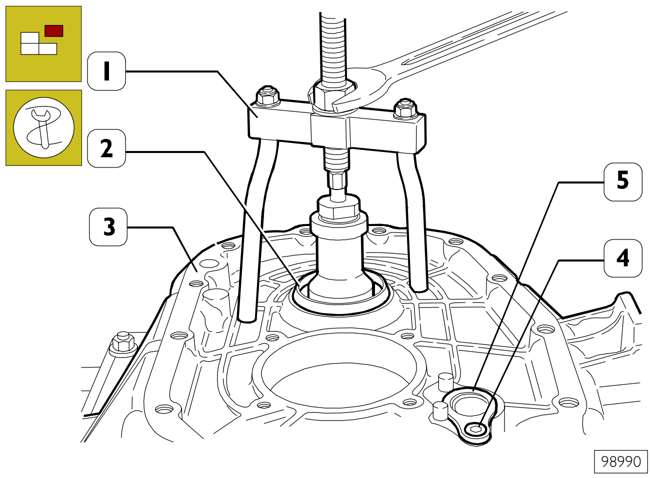
Unscrew screws (1) and remove cover (2) on motion inlet shaft.

Figure 18



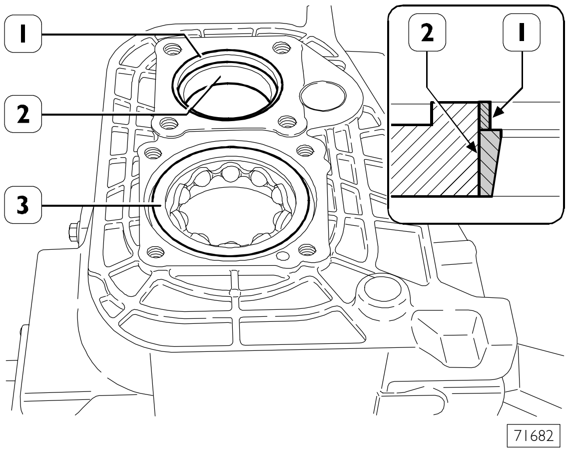
Remove cylindric roller bearing from motion inlet shaft (1) and heat contact surface (2) of front half–case. With a plastic hammer extract motion inlet shaft (1) completed with ball bearing.

Figure 19



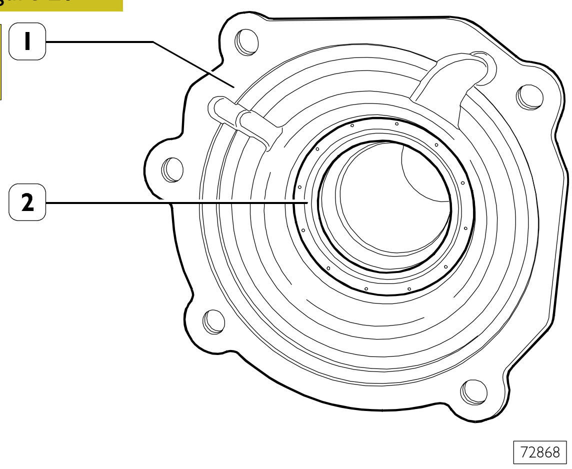
Extract rolling race (2) of tapered roller bearing of secondary shaft, from front half–case (3) with extractor 99348004 (1). Remove the adjustment ring.
Unscrew TORX mark screw (4), take off rib washer (5) and recover underlying bushing.

Figure 20



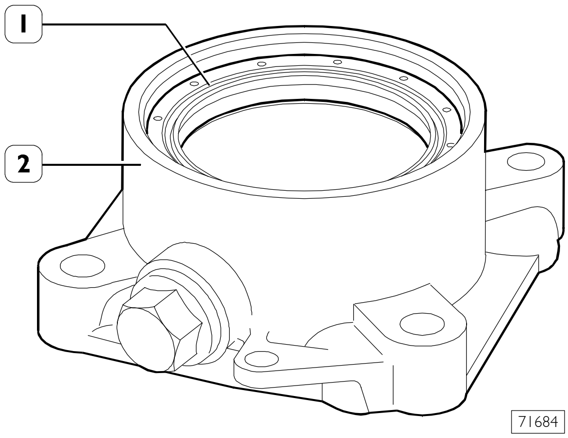
With a suitable beater, extract from rear half–case the external race (2) of roller bearing and spacer (1). From inside the half–case, towards the outside, extract ball bearing (3). Always from inside the half box, unscrew TORX mark screw, take off rib washer and recover underlying bushing.

Figure 21



Extract sealing gasket (2) from motion inlet shaft cover (1).

Figure 22



Extract sealing gasket (1) from primary shaft cover (2).

Checks

GEARBOX CASE

Gearbox case and related covers must not show cracks. Contact surfaces between covers and gearbox case must not be damaged or distorted.
Bearing seats must not be damaged or excessively worn.

SHAFTS – GEARS

Shaft seats for bearings and gear toothings must not be damaged or worn.

HUBS – SLIDING SLEEVES – FORKS

Grooves on hubs and related sliding sleeves must not be damaged. The sliding sleeve must freely slide on the hub. Sliding sleeve positioning rollers must not be damaged or worn. Engagement toothing of sliding sleeves must not be damaged.
Forks must be healthy and must not show any sign of wear.

BEARINGS

Roller bearings or roller cages must be in perfect conditions and not show traces of wear or overheatings.
By keeping bearings manually pressed and making them simultaneously rotate along two directions, no roughness or noise when sliding must be detected.

NOTE Upon assembling, the following must always be replaced: rings, sealing gasket and springs for sliding sleeves positioning rollers.

SYNCHRONIZERS – COUPLING BODIES

Check wear of synchronising rings and respective coupling bodies: they must not show any sign of wear.

NOTE Upon assembling, do not mutually exchange the checked parts.

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GEARBOX ASSEMBLY

Butter with hermetic type "B" the threaded part of all screws that must be screwed in the through–holes.

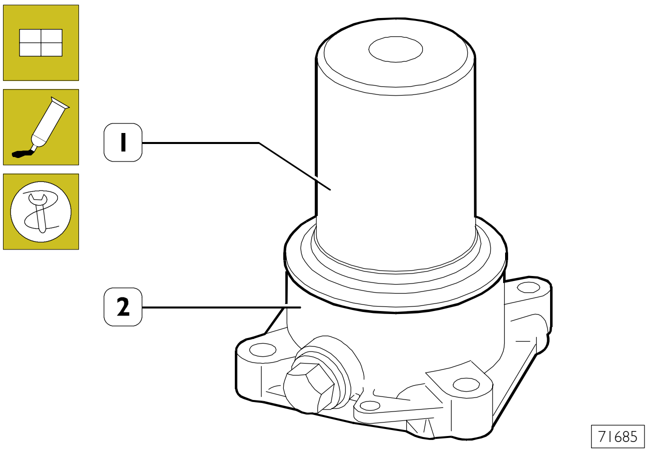
Clean the joining surfaces of case and covers and apply "LOCTITE 510" putty, before assembling, on one of the two components.

Upon assembling, make sure that the sealing gaskets are already lubrified, or butter with oil or grease the sealing lip of inlet and primary shafts gaskets.

Do not insert oil before 20 min and do not try the gearbox before 1h and 30 min.

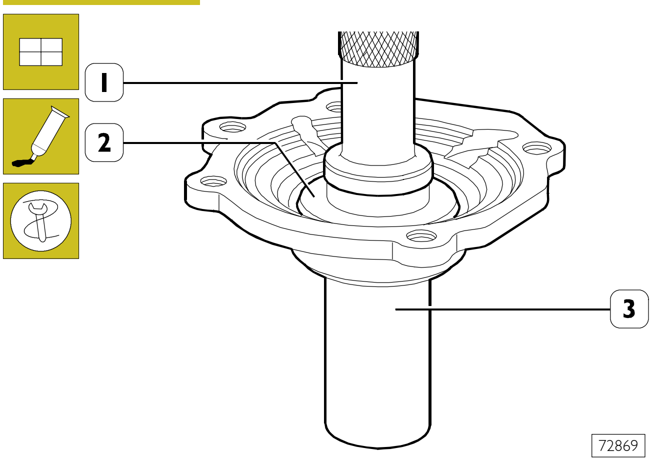
Assemble bearing cages into their respective seats and oil with TUTELA ZC 90.

Figure 23



Butter, with hermetic type "B", the coupling seat surface of cover (2) with sealing gasket and with keyer 99374201 (1) assemble the sealing gasket itself.

Figure 24

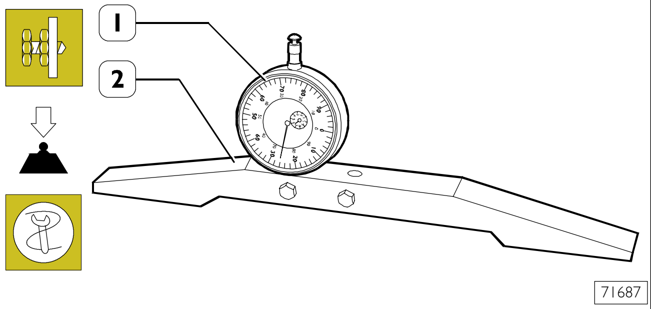


Butter, with hermetic type "B", the coupling seat surface of cover (3) with sealing gasket and with keyer 99370349 (2) and handle 9937006 (1) assemble the sealing gasket itself.

Bearings pre–load adjustment for secondary shaft

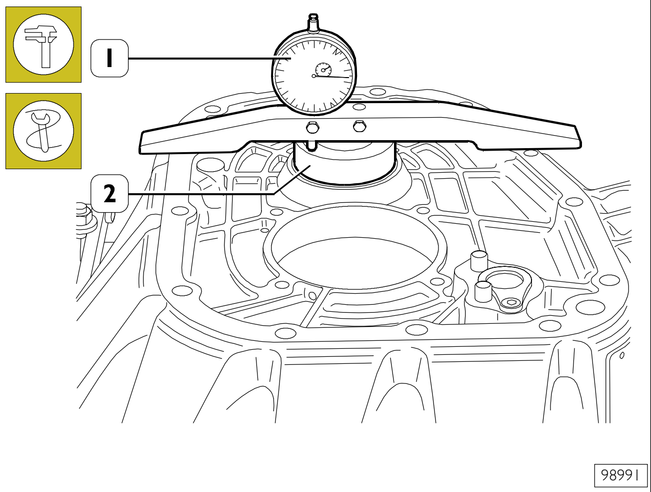
The bearings pre–load adjustment for the secondary shaft can be carried out with two procedures.

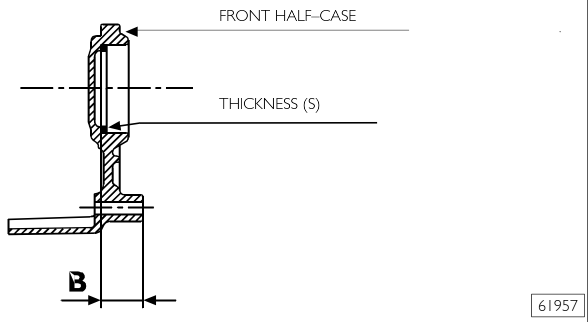
Figure 25



Assemble comparator 99395604 (1) on base 99370466 (2), pre–load it by 5 mm and zero it on an abutment plane.

Figure 26



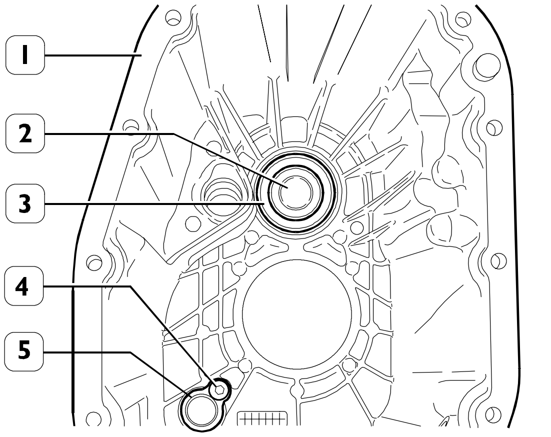


Place calibrated ring 99396031 (2) into its seat, without adjustment ring, of bevel roller bearing on front half–case; place base 99370466 completed with comparator (1), previously zeroed, as shown in Figure 24.

First method – Take note of the value read on the comparator (Example: 2.43 mm).

Second method – Take note of the value read on the comparator and add it to calibrated ring thickness.
[Example: 2.43 + 50.5 = 52.93 mm (Dimension **B**)].

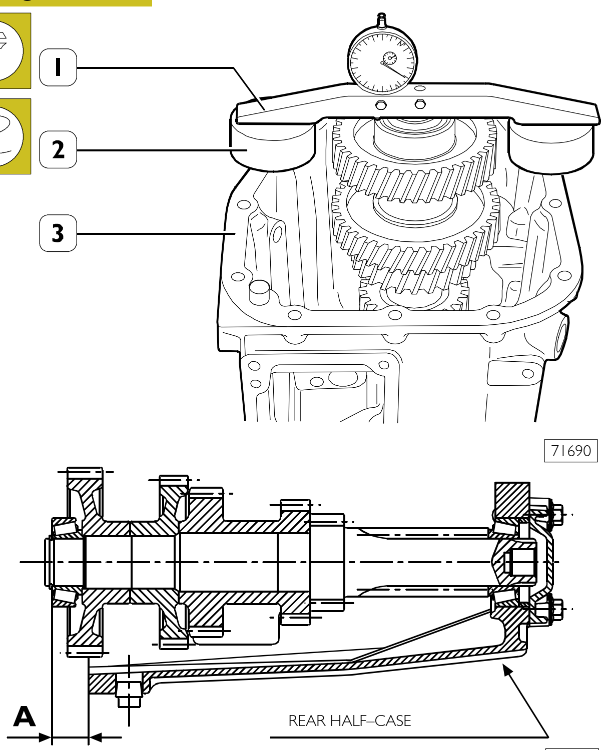
Figure 27



98992

Assemble on rear half–case (1) cover (2), spacer (1, Figure 19) and with beater 99374092 equipped with handle 99370007, assemble external race (3) of roller bearing, settling it till it abuts.
See Figure 30 for adjusting beater 99374092.
Fit inner control shaft bushing into its seat, put in rib washer (5) and screw TORX mark screw (4) with prescribed torque.

Figure 28



71690

61956

Assemble and simultaneously rotate, till it abuts, the secondary shaft completed with bearings in rear half–case (3). Place calibrated rings 99396032 (2) on half–case (3). Arrange, as shown in the figure, base 99370466 completed with previously–zeroed comparator (1); the comparator rod must abut on the external bearing ring. Carry out the measure on two diametrically–opposite points and perform the arithmetic mean.

First method – Take note of the value read on the comparator (Example 1.84 mm). The adjustment ring value is obtained by summing the two measured values (Example 2.43 + 1.84 = 4.27 mm)

Second method – Take note of the value read on the comparator and subtract it from the calibrated ring thickness [Example: 50.5 – 1.84 = 48.66 mm (Dimension **A**)].

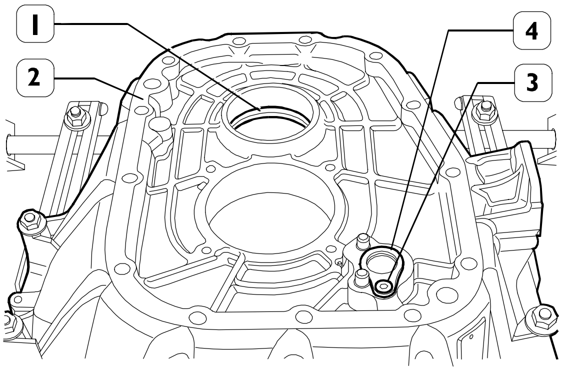
The adjustment ring value is obtained with formula
S = B – A Example: 52.93 – 48.66 = 4.27 mm.

Note: The difference between the two positions (A–B) establishes the value of the shim to be inserted in the front housing (taking into account that interference on the external track causes a reduction in the end play of the bearing of around 0.05 mm, this is also the preload in ambient temperature conditions).

NOTE The adjustment ring rounding is always carried out in excess. Example; thickness S = 4.27: thickness S = 4.3 is taken. Measuring of dimension "A", carried out with secondary shaft in vertical position, that, in addition to facilitating the measure itself, allows having an axial load on the rear bearing.

After having computed the thickness value of the adjustment ring, disassemble again secondary shaft and cover from rear half–case.

Figure 29



98993

Place adjustment ring (1), whose thickness is equal to the previously–obtained one, into the secondary shaft bearing seat on the front half–case (2).
Fit inner control shaft bushing into its seat, put in rib washer (4) and screw TORX mark screw (3) with prescribed torque.

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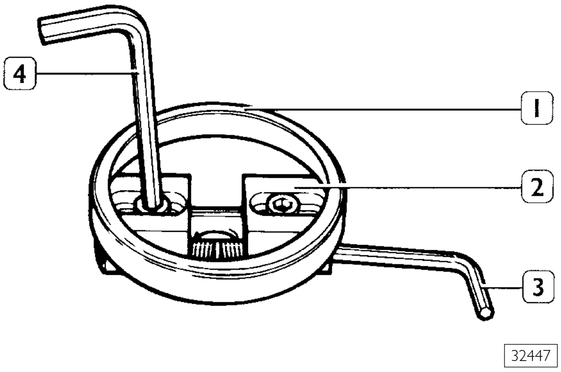
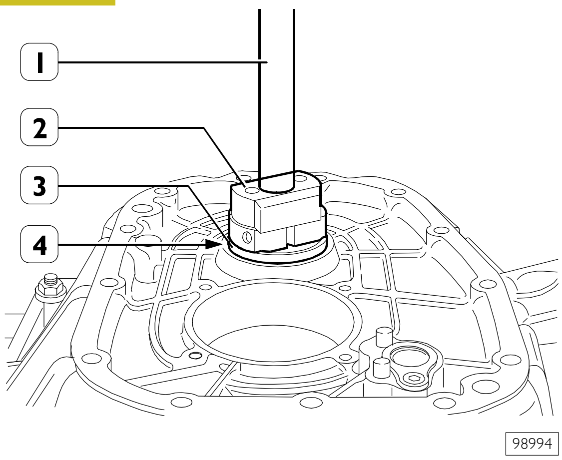
Figure 30



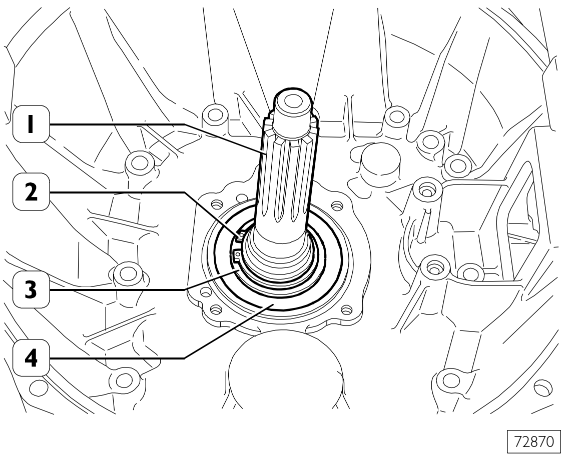
Centre external race (1) of bevel roller bearing of front cover secondary shaft on extensible beater 99374092 (2) adjusted with socket head screw (3). Lock beater with socket head screw (4).

Figure 31



Slightly heat seat (4) of secondary shaft bearing race on front half–case and assemble external race (3) by settling it till it abuts with beater 99374092 (2), equipped with handle 99370007 (1).

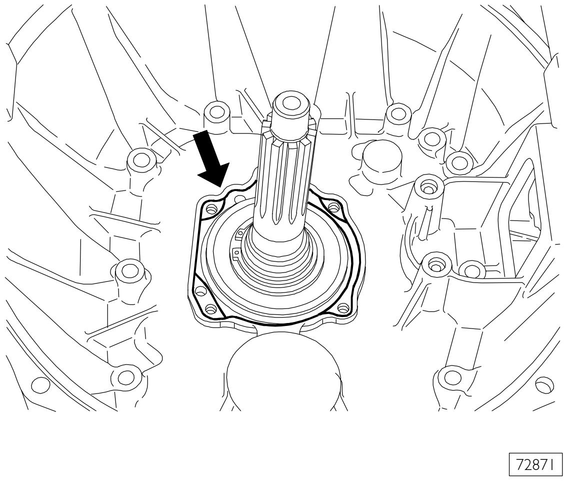
Figure 32



Slightly heat the ball bearing seat, assemble motion inlet shaft (1) completed with bearing (4), adjustment ring (3) and elastic ring (2). Settle the bearing till it abuts.

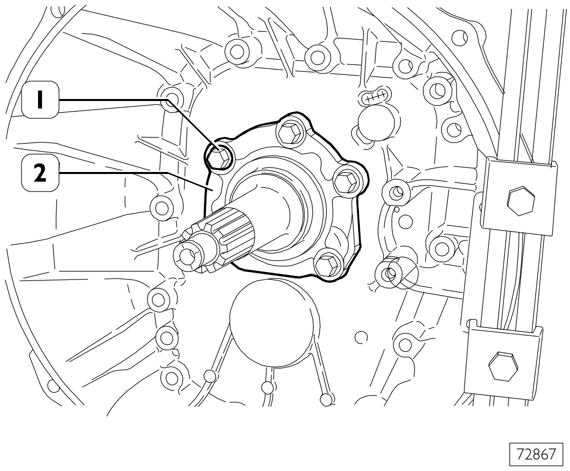
NOTE Before assembling on front half–case the motion inlet shaft, carry out bearing adjustment as described in the related procedure on page 36.

Figure 33



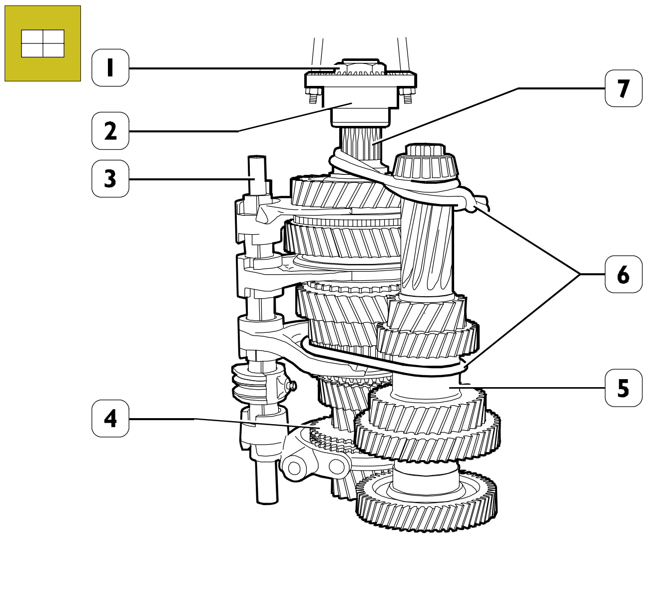
Apply LOCTITE 510 sealant on contact surfaces between front half–case and motion inlet shaft cover.

Figure 34



Assemble motion inlet shaft cover (2), screw screws (1) and tighten them at the required torque.

Figure 35



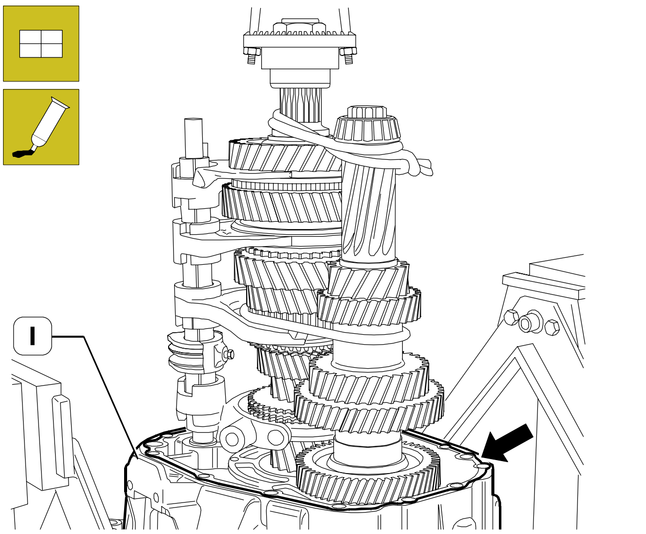
71859

Assemble on primary shaft (7) motion outlet flange (2) and lock it with nut (1). Put together on a bench and with the help of a lifting device, primary shaft (7), secondary shaft (5) and mutually tie them with a rope (6).

NOTE Keep complete synchronizer (4) manually assembled in order to prevent check springs and rollers from falling.

Place internal drive shaft (3) and manually keep it in position.

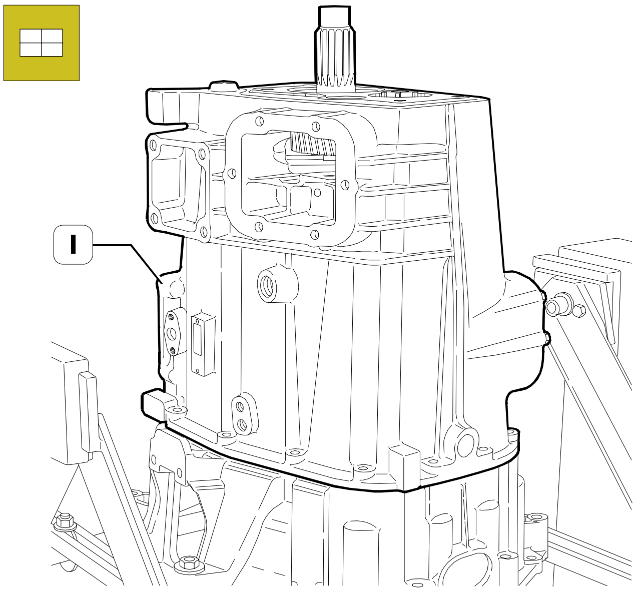
Figure 36



71860

Insert cylinder roller bearing into motion inlet shaft and assemble on front half–case (1) the three shafts together. Apply LOCTITE 510 sealant on contact surface (→) between the two half–cases.

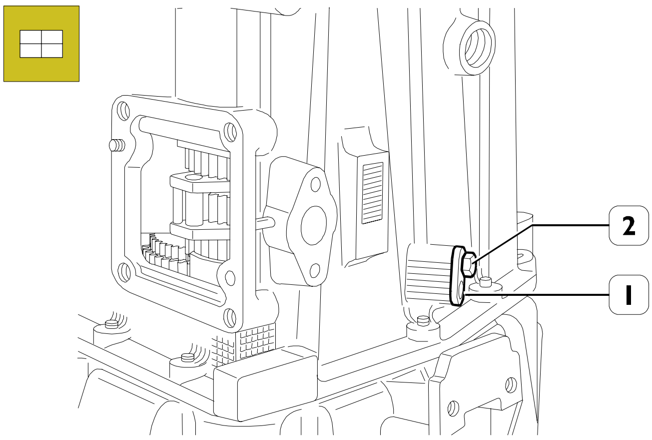
Figure 37



79433

Disassemble previously–assembled flange and nut and assemble rear half–case (1). Screw union screw between rear half–case and front half–case and tighten them at the required torque.

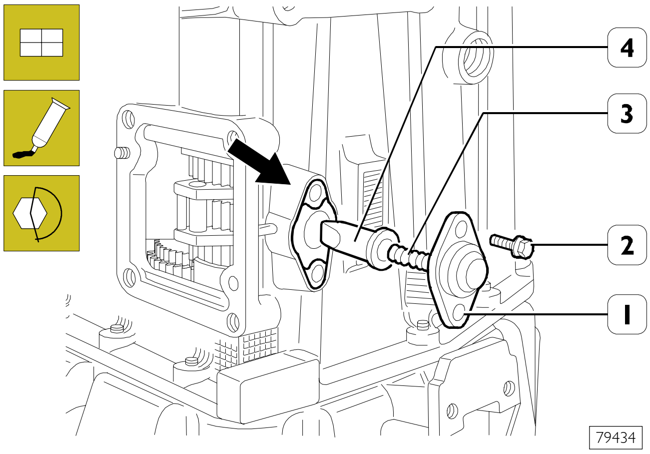
Figure 38



79432

Assemble fork pins (1) on both gearbox sides and screw screws (2) by tightening them at the required torque.

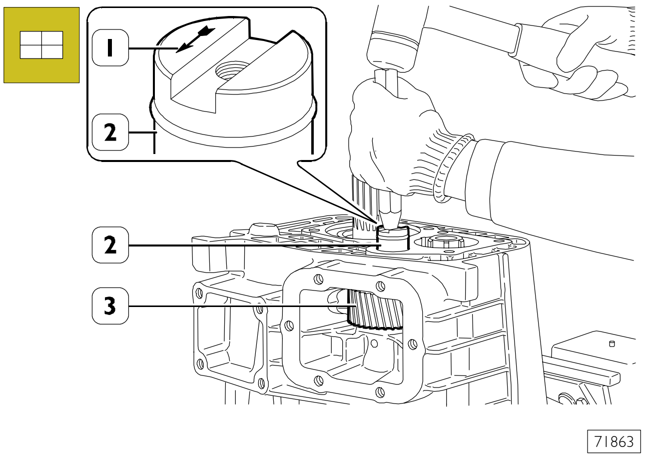
Figure 39



Apply sealer LOCTITE 510 on the surface (→) without staining the push rod supporting area (4).

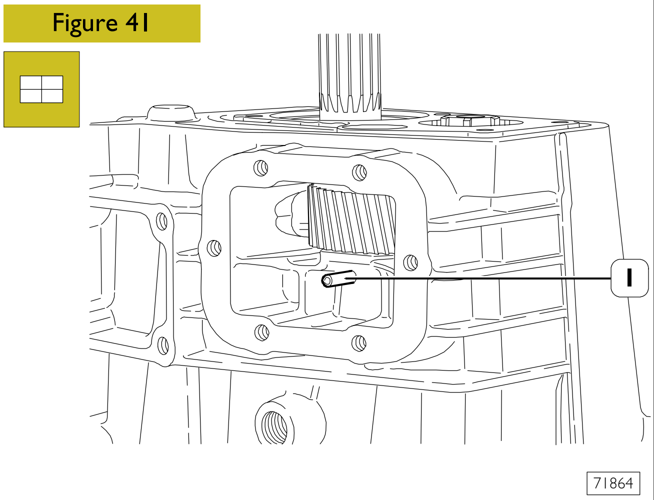
Put in push rod (4), spring (3), mount cover (1) and screw down screws (2) tightening them with rated torque.

Figure 40



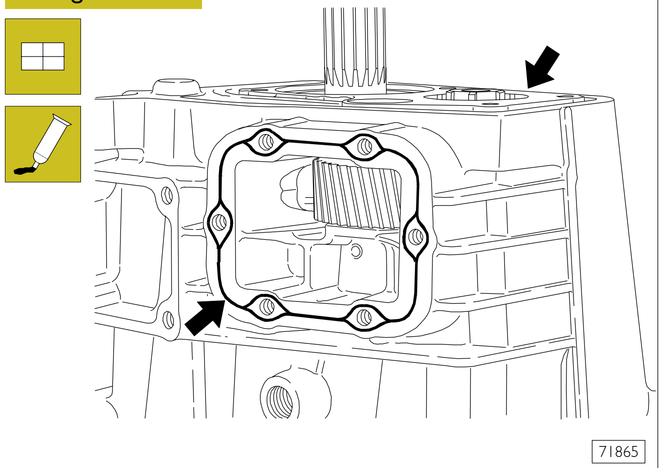
Assemble shoulder rings, placing them into their own seat and reverse gear (3) with cylindric roller bearing. Assemble reverse gear supporting shaft (2) with a suitable beater, paying attention that the arrow (1) punched on the shaft is facing the peg insertion hole.

Figure 41



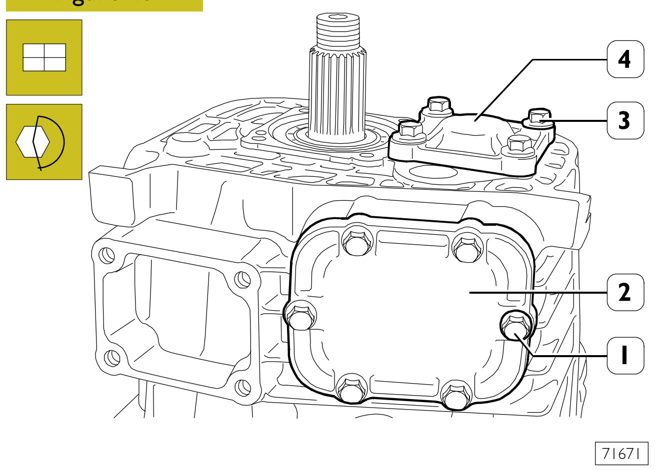
Assemble elastic peg (1).

Figure 42



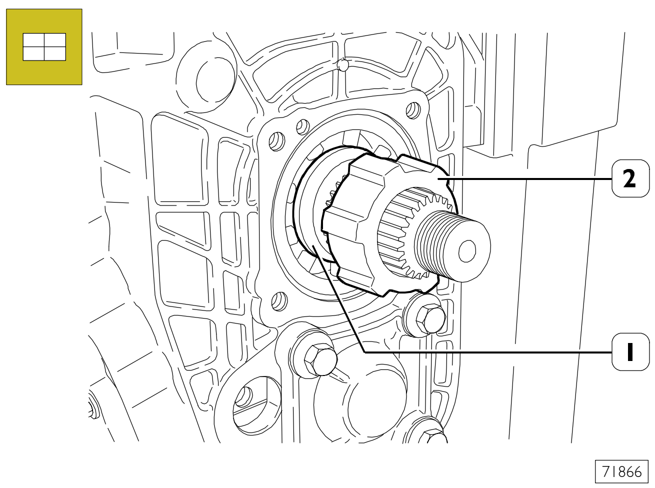
Apply LOCTITE 510 sealant on contact surface (→) between rear half–case and covers.

Figure 43



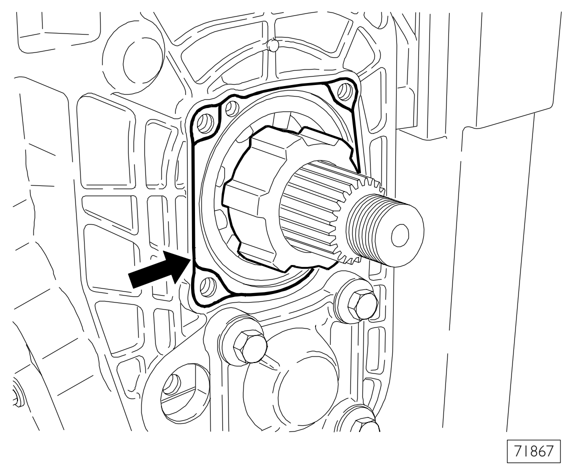
Assemble covers (2 and 4), screw screws (1 and 3) and tighten them at the required torque.

Figure 44



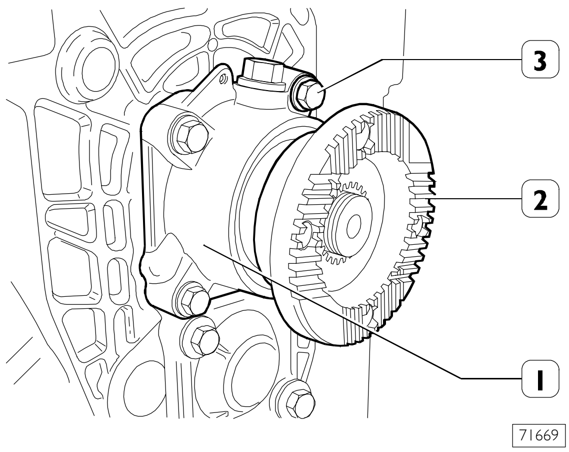
Slightly heat ball bearing (1) half–race and assemble it in its own seat on primary shaft. Assemble phonic wheel (2) for controlling the odometer.

Figure 45



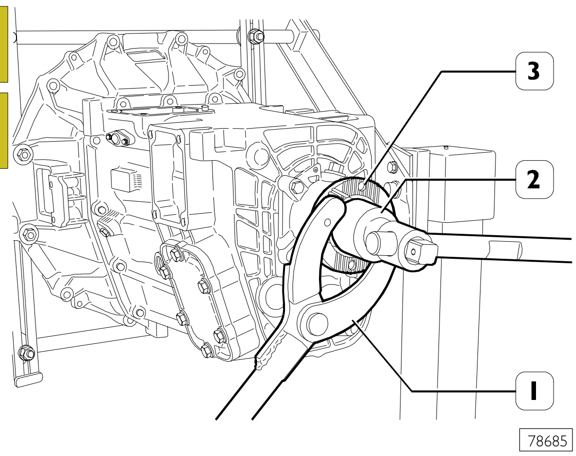
Apply LOCTITE 510 sealant on contact surface (→) between cover and rear half–case.

Figure 46



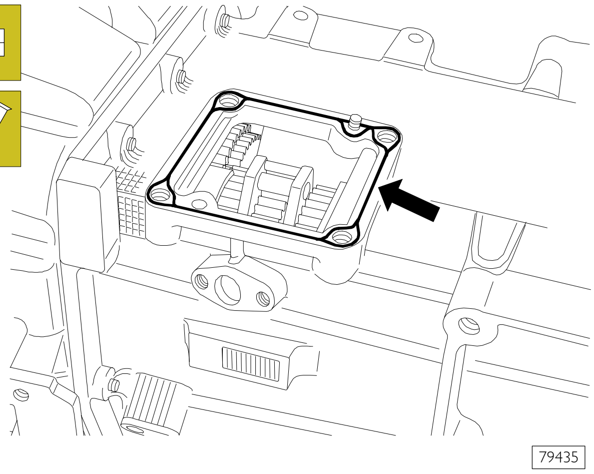
Assemble rear cover (1), screw screws (3) and tighten them at the required torque. Assemble motion outlet flange (2).

Figure 47



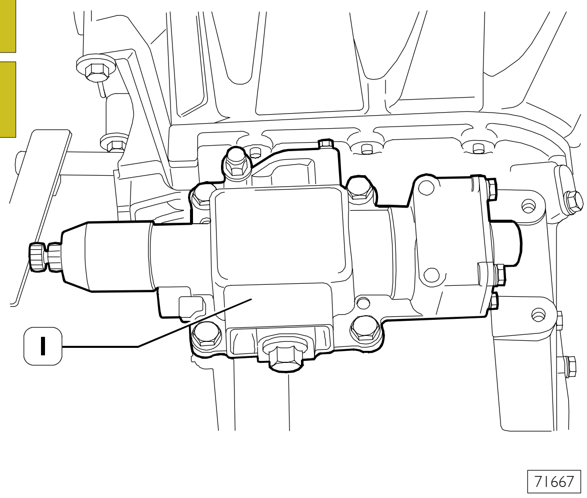
Assemble reaction bar 99370317 (1), motion outlet flange locking nut (3), key 99355081 (2) and tighten the locking nut at the required torque.

Figure 48



Apply LOCTITE 510 sealant on contact surface (→) between rear half–case and external control case.

Figure 49



Assemble complete external control box (1) and screw securing screws by tightening them at the required torque.

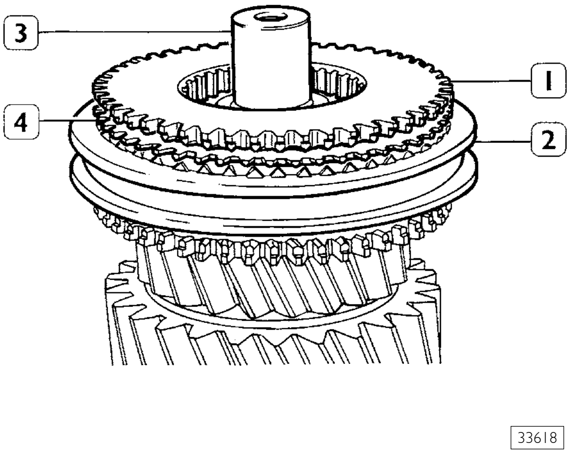
Assemble clutch disengagement lever and tighten the two securing screws at the required torque.

NOTE Insert lubrication oil in the prescribed amount after about 20 minutes from the last LOCTITE 510 sealant application.

Remove gearbox from rotating stand.

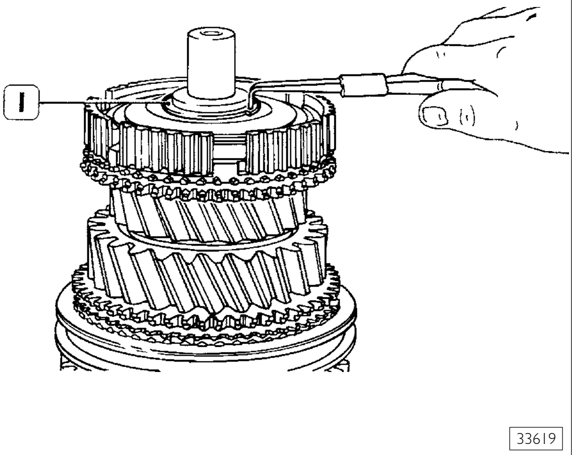
PRIMARY SHAFT DISASSEMBLY

Figure 50



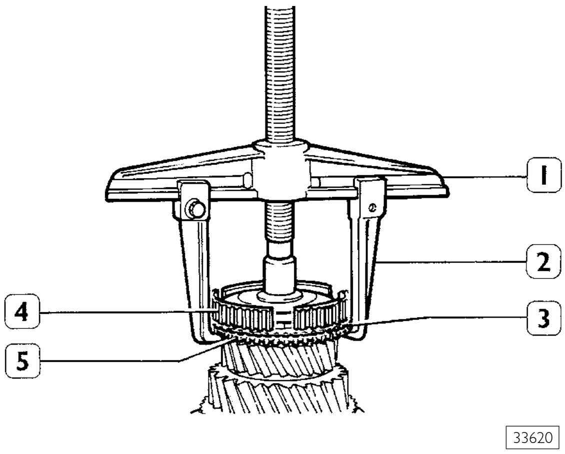
Tighten primary shaft (3) in a clamp. Remove coupling body (1), 6th speed synchronising ring (4) and sliding sleeve (2) for 5th and 6th speed gears, recovering check springs and rollers.

Figure 51



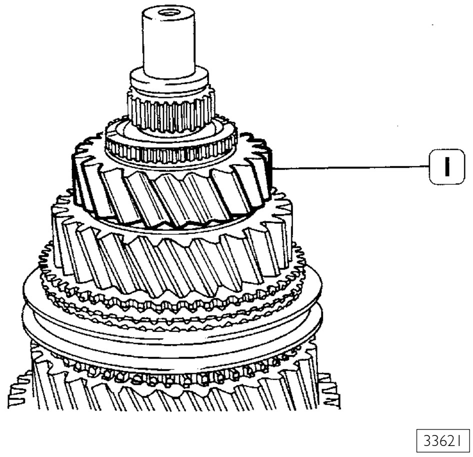
Remove elastic ring (1).

Figure 52



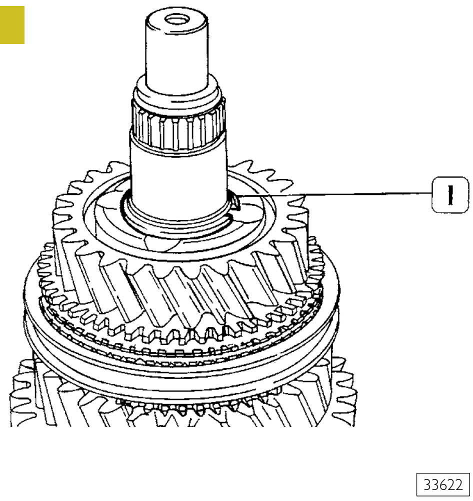
With extractor 99341003 (1) and brackets 99341009 (2), remove fixed 5th and 6th speed hub (4) together with synchronising ring (3) and 5th speed coupling body (5).

Figure 53



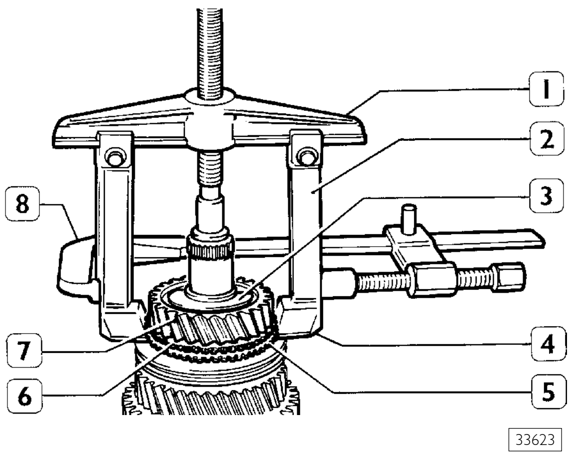
Remove 5th speed gear (1) and roller bearing below it.

Figure 54



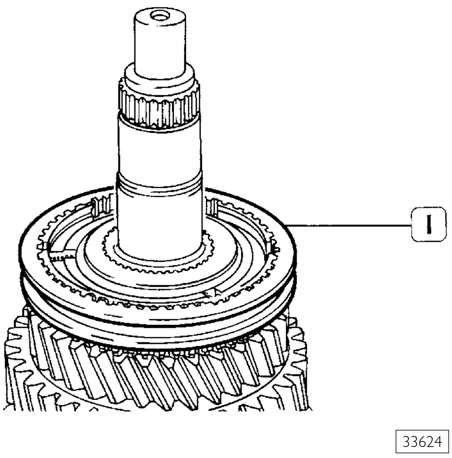
Remove elastic ring (1).

Figure 55



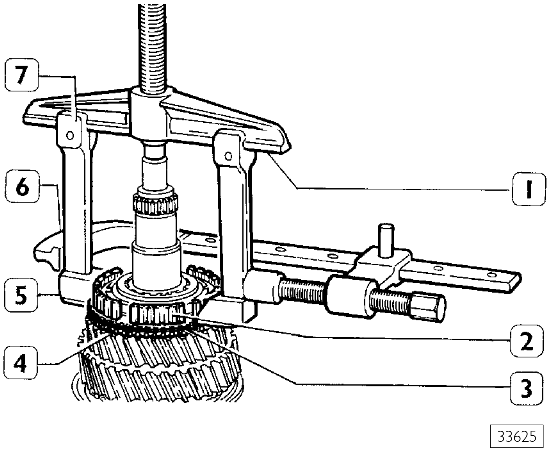
Remove 4th speed gear (7) together with roller bearing and bush (3) and coupling body (6) with holds 99341025 (4), tie–rods 99341019 (2), bridge 99341003 (1) and clamp 99341015 (8). Remove synchronising ring (5).

Figure 56



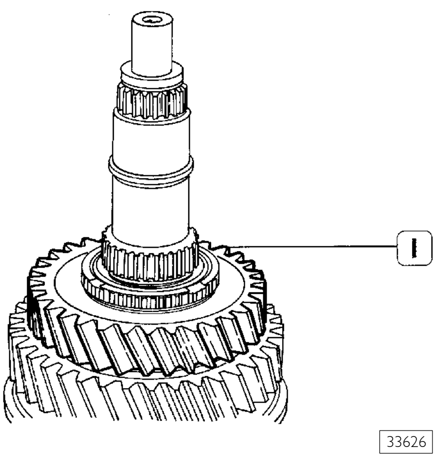
Remove 3rd and 4th gear sliding sleeve (1) recovering check springs and rollers.

Figure 57



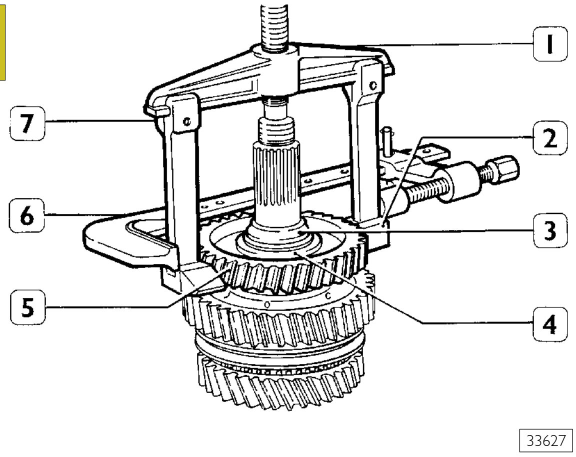
Extract 3rd and 4th speed fixed hub (2) and 3rd speed synchronising ring with holds 99341025 (5), tie–rods 99341019 (7), bridge 99341003 (1) and clamp 99341015 (6). Remove 3rd speed coupling body (4).

Figure 58



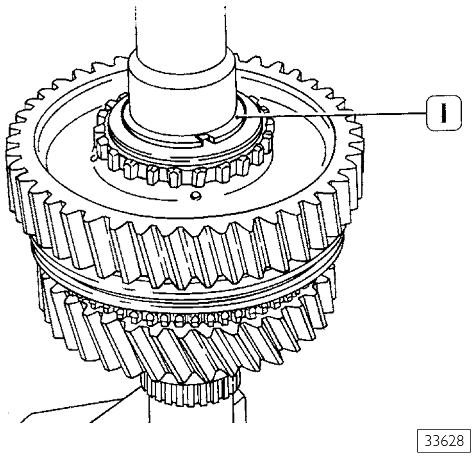
Remove 3rd speed gear (1) and roller bearing below it.

Figure 59



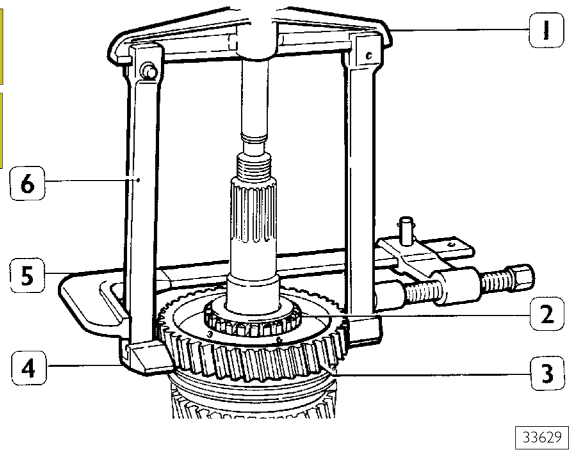
Turn the shaft over and extract reverse gear (5) with roller bearing below it, shoulder ring (4) and rolling half–race (3) with holds 99341025 (2), tie–rods 99341019 (7), bridge 99341003 (1) and clamp 99341015 (6).

Figure 60



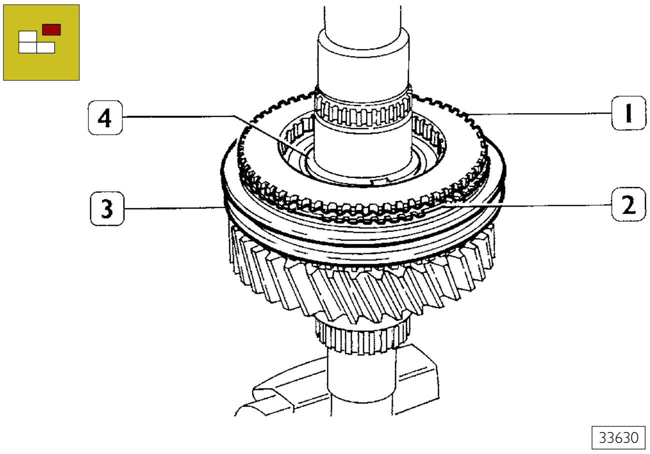
Remove elastic ring (1).

Figure 61



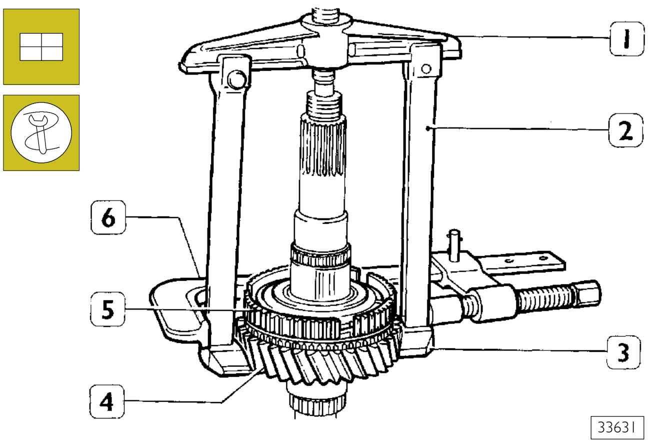
Extract 1st speed gear (3) together with roller bearing and fixed sleeve (2) for reverse gear with holds 99341023 (4), tie–rods 99341020 (6), bridge 99341003 (1) and clamp 99341015 (5).

Figure 62



Remove coupling body (1), synchronising ring (2), elastic ring (4) and sliding sleeve (3) for 1st and 2nd speed gears recovering rollers and springs.

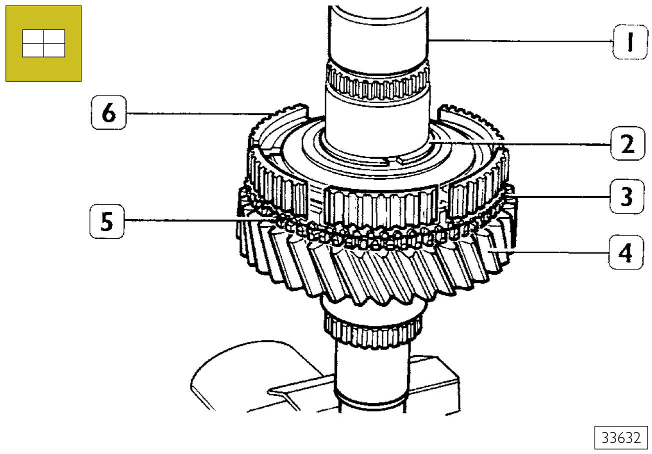
Figure 63



Extract 2nd speed (4) with roller bearing, coupling body, synchronising ring and 1st and 2nd speed fixed sleeve (5) with holds 99341023 (3), tie–rods 99341020 (2), bridge 99341003 (1) and clamp 99341015 (6).

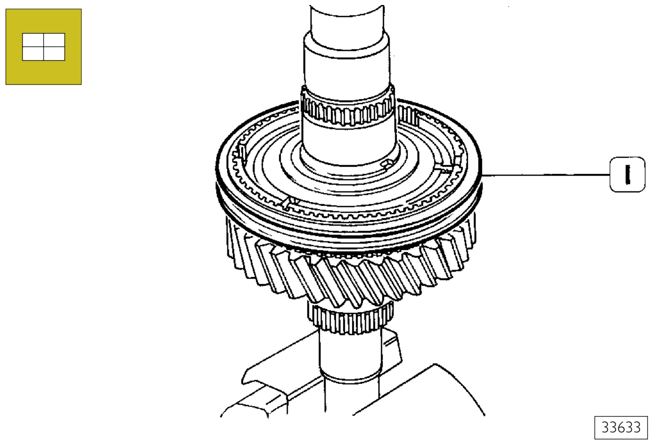
PRIMARY SHAFT ASSEMBLY

Figure 64



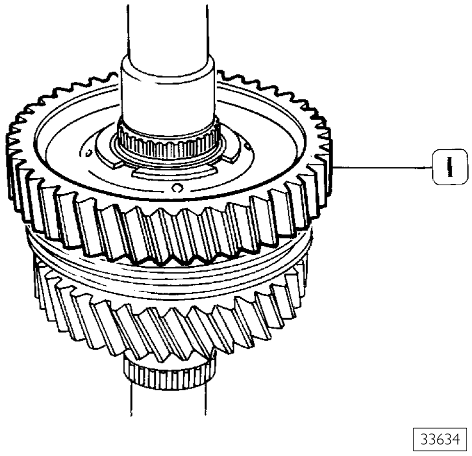
Assemble on primary shaft (1) 2nd speed gear (4), coupling body (5) and synchronising ring (3).
Heat fixed hub (6) for 1st and 2nd speed gears at a temperature of 100 °C to 130 °C and assemble it on primary shaft (1) with the internal diameter chamfering facing the opposite part of 2nd speed gear.
When keying the hub, pay attention that synchronising ring tangential stops are inserted into respective hub seats. Assemble elastic ring (2) with an apporpriate thickness so that the fixed hub has no axial clearance (max allowed 0.03 mm).

Figure 65



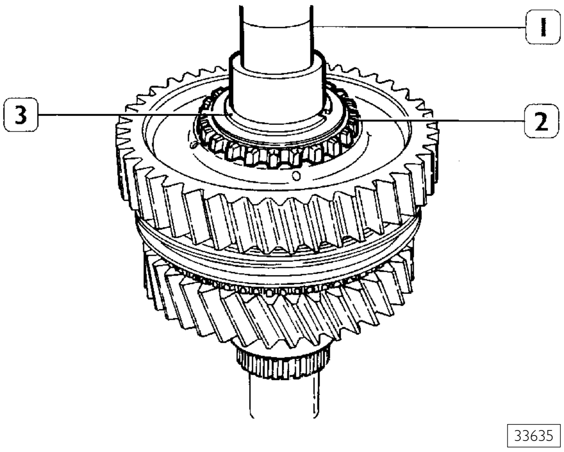
Assemble sliding sleeve (1) for 1st and 2nd speed gears, springs and rollers in fixed hub seats. Assemble synchronising ring and coupling body for 1st speed gear.

Figure 66



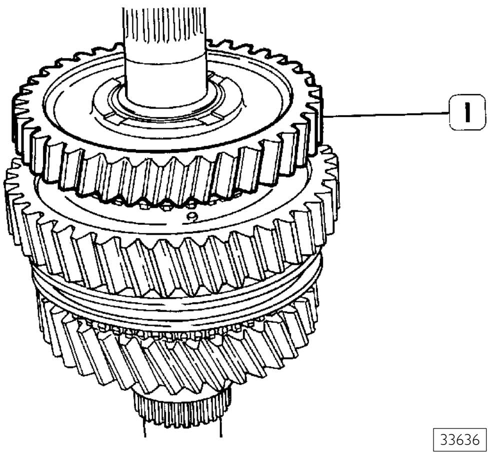
Assemble roller bearing and 1st speed gear (1).

Figure 67



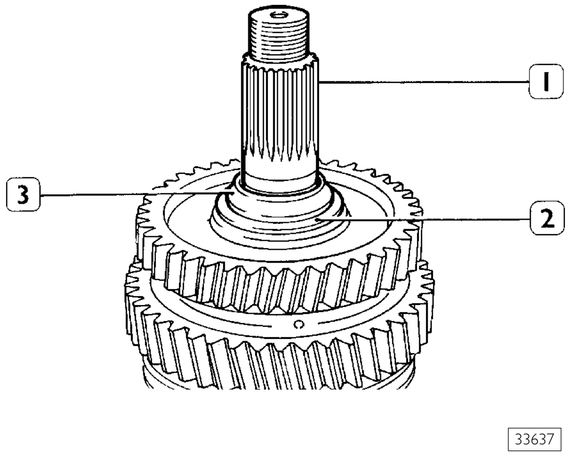
Heat at a temperature of 100 °C to 130 °C fixed hub (2) for reverse gear and assemble it on primary shaft (1); asemble elastic ring (3).

Figure 68



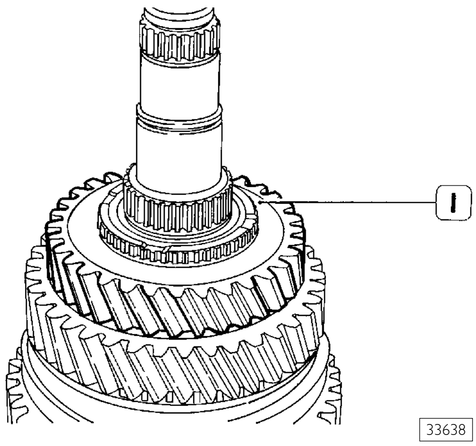
Assemble roller bearing and reverse gear (1).

Figure 69



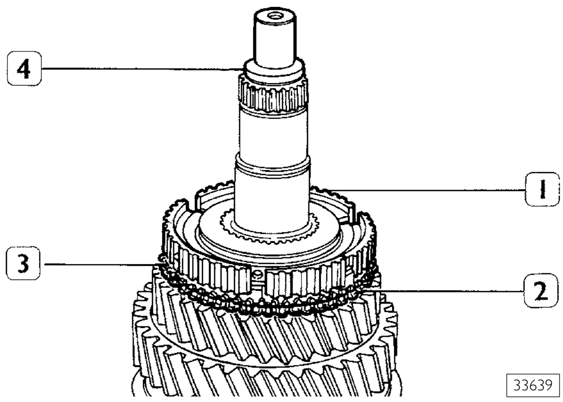
Assemble shoulder ring (2).
Slightly heat ball bearing rolling half–race (3) and assemble it on primary shaft (1).

Figure 70



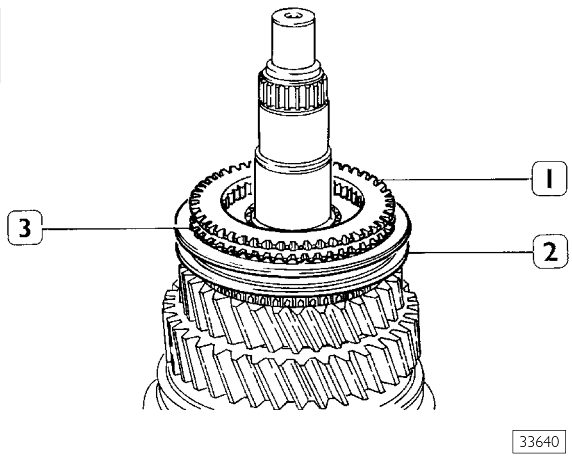
Turn the shaft over in a clamp, assemble roller bearing and 3rd speed gear (1).

Figure 71



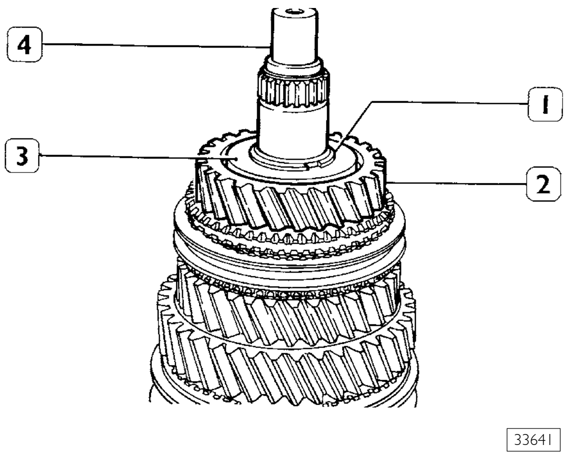
Assemble coupling body (2) and synchronising ring (3). Heat fixed hub (1) at a temperature of 100 °C to 130 °C and assemble it on shaft (4) paying attention that synchronising ring tangential stops are inserted into respective hub seats.

Figure 72



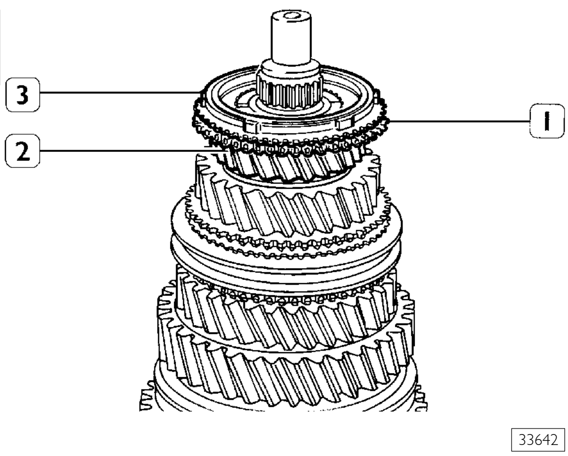
Assemble sliding sleeve (2) for 3rd and 4th speed gears, springs and rollers into fixed hub seats. Assemble synchronising ring (3) and coupling body (1) for 4th speed gear.

Figure 73



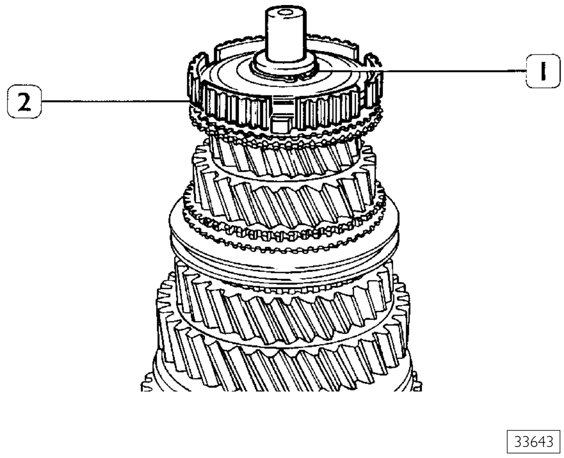
Assemble roller bearing and 4th speed gear (2). Heat bush (3) at a temperature of 100 °C to 130 °C, and assemble it on primary shaft (4). Assemble elastic ring (1).

Figure 74



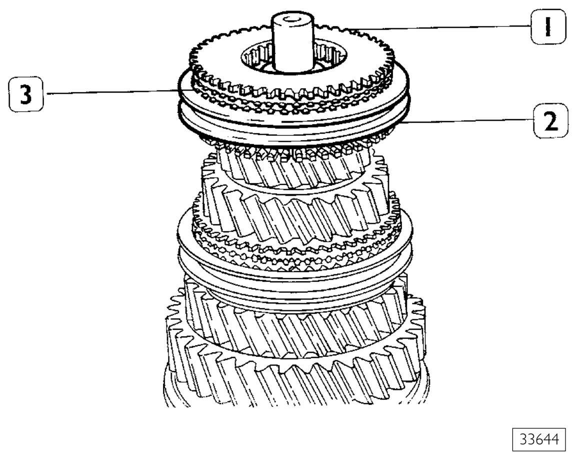
Assemble roller bearing, 5th speed gear (2), coupling body (1) and synchronising ring (3) for 5th speed gear.

Figure 75



Heat the fixed hub (2) for 5th and 6th speed gears at a temperature of 100 °C to 130 °C and install it on the primary shaft with the chamfer heading towards the 5th speed gear. When keying the hub pay attention that synchronising ring tangential stops are inserted into respective hub seats. Assemble elastic ring (1) with a suitable thickness so that the fixed hub has no axial clearance (max allowed 0.03 mm).

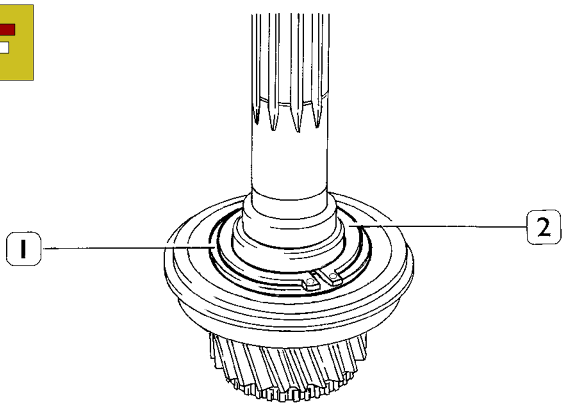
Figure 76



Assemble sliding sleeve (2) for 5th and 6th speed gears, springs and rollers. Assemble synchronising ring (3) and coupling body (1) for 6th speed gear.

MOTION INLET SHAFT DISASSEMBLY

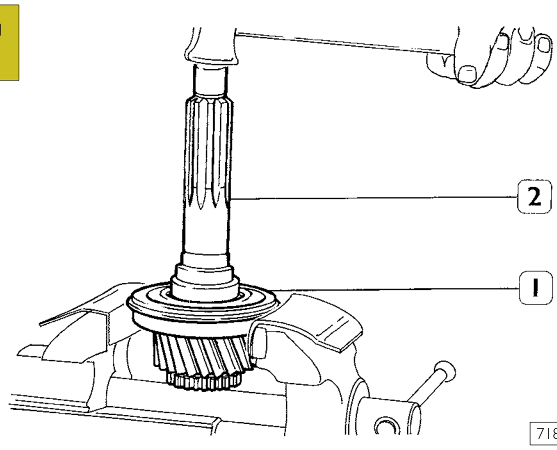
Figure 77



71869

Remove elastic ring (2) and adjustment ring (1).

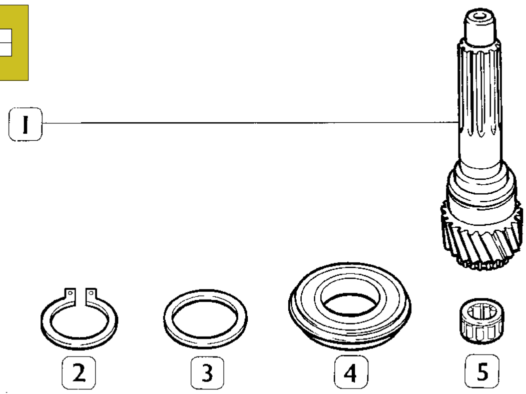
Figure 78



71870

Abut bearing (1) on a vice, as shown in the figure, and by beating on shaft (2), extract it from the bearing itself.

Figure 79

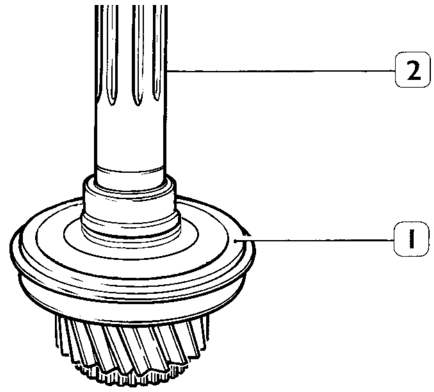


71871

PARTS COMPOSING THE MOTION INLET SHAFT
1. Motion inlet shaft – 2. Elastic ring – 3. Adjustment ring – 4. Ball bearing – 5. Cylindric roller bearing.

MOTION INLET SHAFT ASSEMBLY

Figure 80

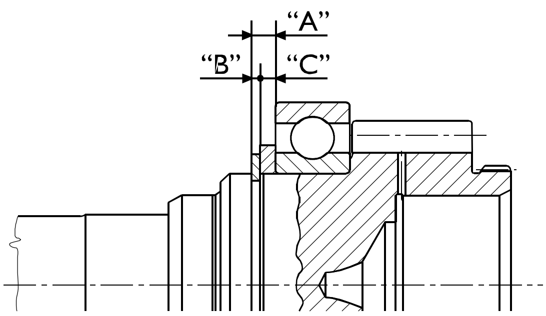


71872

Assemble ball bearing (1) on motion inlet shaft (2) and carry out its adjustment.

Motion inlet shaft bearing adjustment

Figure 81



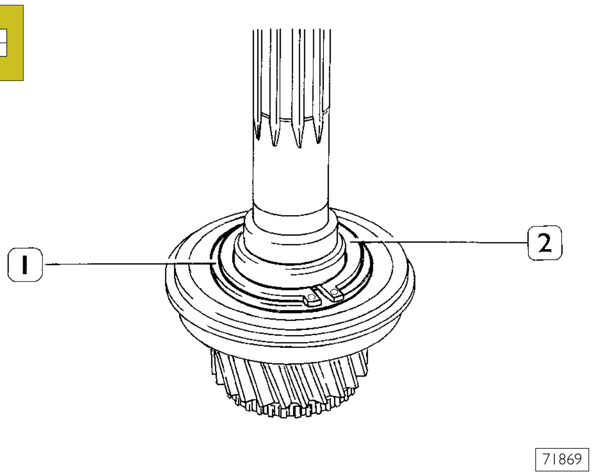
62455

- ❑ Assemble bearing on motion inlet shaft.
- ❑ Measure dimension "**A**".
- ❑ Measure seeger "**B**" thickness.
- ❑ Define spacer ring thickness to be inserted, by defect: **C = A– B.**

IVECO PARTS Motion inlet shaft bearing adjustment spacer ring thicknesses: mm 2.40 – 2.45 – 2.50 – 2.55 – 2.60 – 2.65 – 2.70 – 2.75 – 2.80.

Print 603.93.381

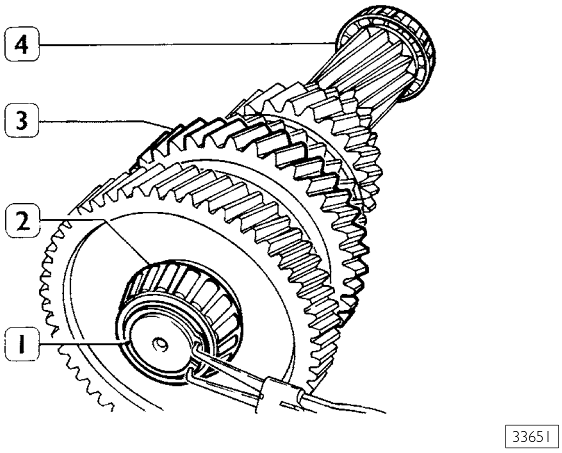
Figure 82



Assemble adjustment ring (1) whose thickness is equal to the previously–obtained one and assemble elastic ring (2).

SECONDARY SHAFT DISASSEMBLY

Figure 83



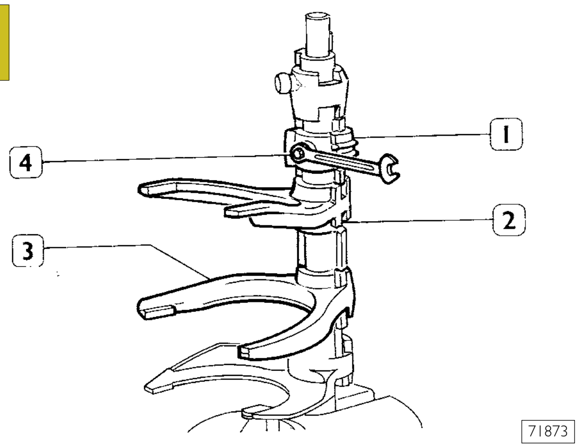
Remove elastic ring (1) from secondary shaft (3), extract bevel roller bearings (2 and 4) with a suitable punch (destructive operation).

SECONDARY SHAFT ASSEMBLY

Slightly heat bevel roller bearings (2 and 4, Figure 83) and assemble them on secondary shaft (3, Figure 83). Assemble elastic ring (1, Figure 83).

INTERNAL DRIVE SHAFT DISASSEMBLY

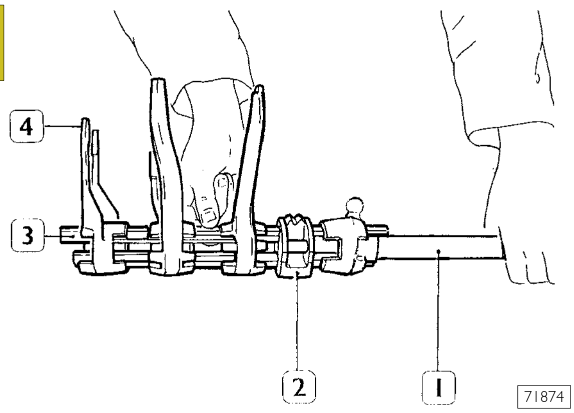
Figure 84



Mark fork (3) assembling position. Unscrew screw (4) and withdraw all forks (3) together with fork positioning rods (2) and hub (1).

INTERNAL DRIVE SHAFY ASSEMBLY

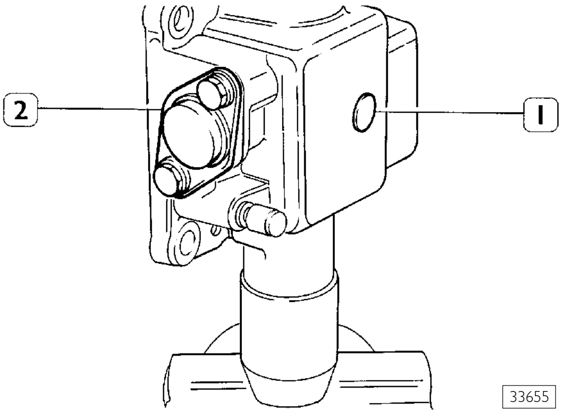
Figure 85



Place on a bench forks (4) and hub (2) according to the position marked upon disassembling. Place the two rods (3) inside fork holes and insert drive shaft (1). Tighten hub screw (2) at the required torque.

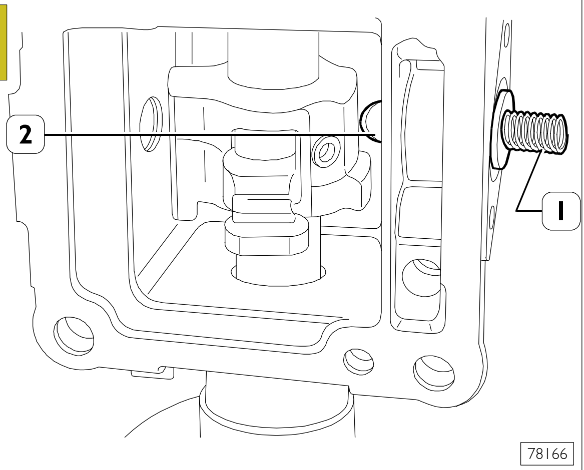
EXTERNAL CONTROL SHAFT DISASSEMBLY

Figure 86



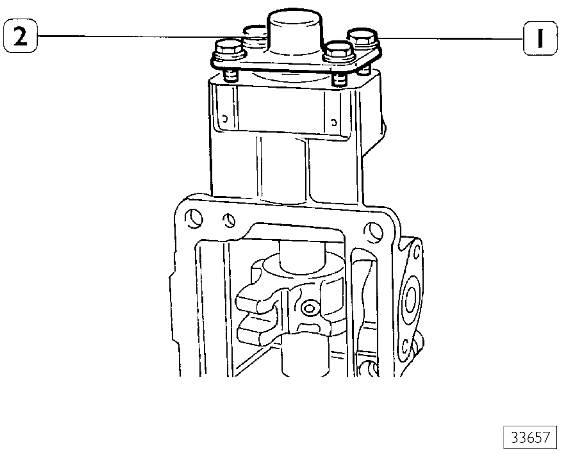
Tighten the shaft going out of the box in a clamp, remove plug (1) and disassemble cover (2).

Figure 87



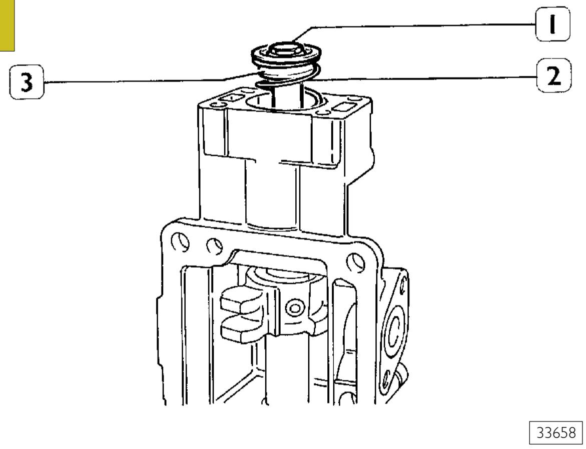
Remove control box pin (2) and spring (1).
Do not mix removed elements with those of the anti–release push rod.

Figure 88



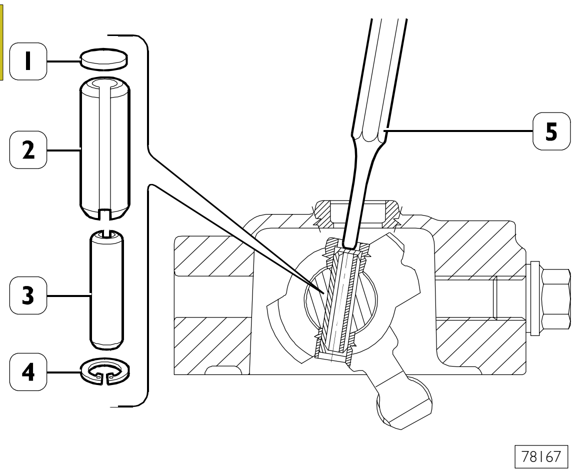
Unscrew screws (1) and disassemble cover (2).

Figure 89



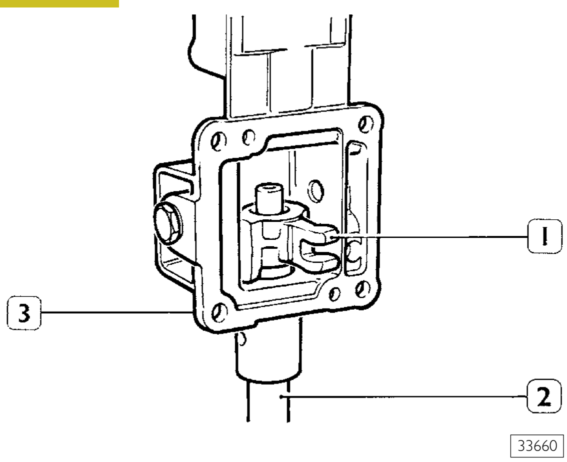
Unscrew screw (1) and remove spacer, upper cup (3) and spring (2). Remove lower cup.

Figure 90



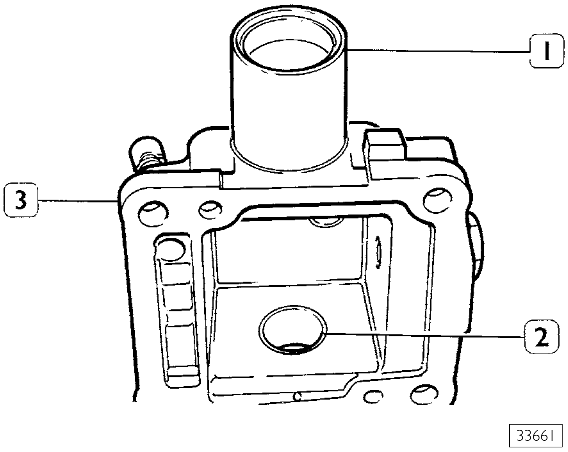
Remove the snap ring (4) and use a punch tool (5) having the right diameter to push the extraction washer (1) and remove flexible plugs (2) and (3).

Figure 91



Extract, from the control shaft (2), control selector (1) and box (3).

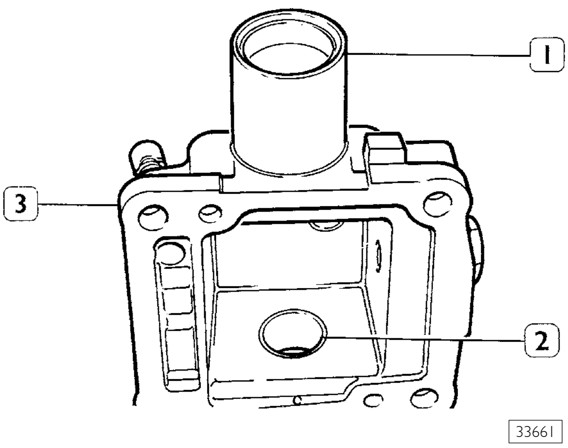
Figure 92



Extract, from the control box (3), sealing gasket (1) and bushes (2) with a suitable beater.

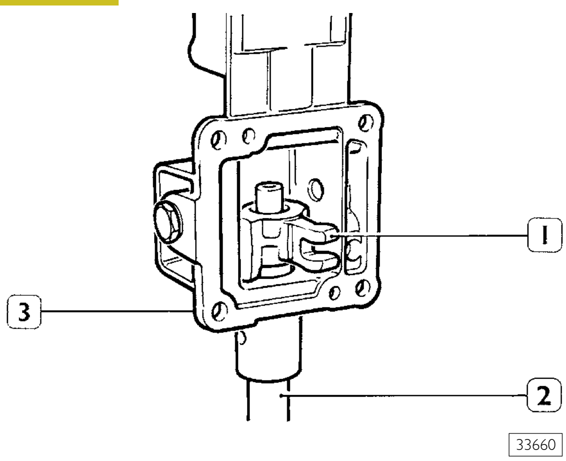
EXTERNAL CONTROL BOX ASSEMBLY

Figure 93



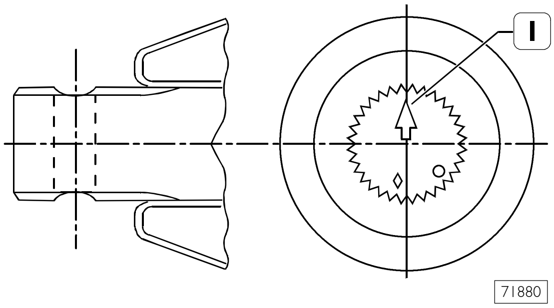
Assemble, in control box (3), sealing gasket (1) and bushes (2) with a suitable beater.

Figure 94



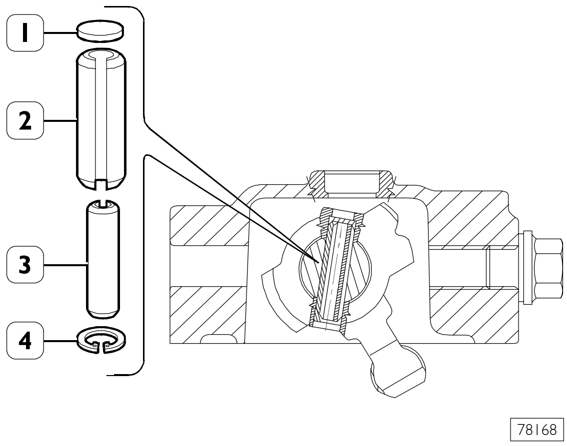
Tighten control shaft (2) in a clamp and assemble thereon box (3) and control selector (1).

Figure 95



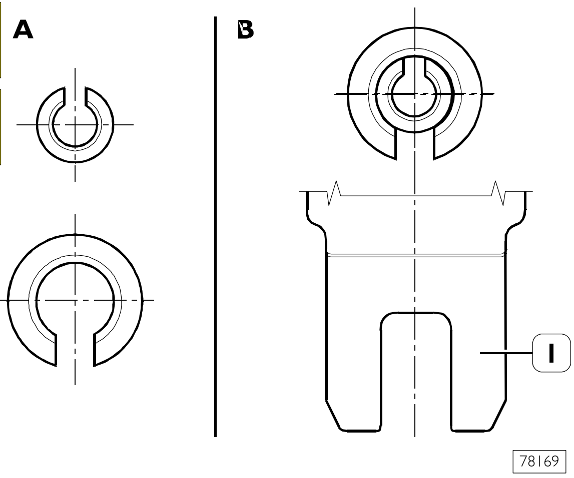
NOTE Upon assembling, the drive shaft must be assembled with the reference arrow (1) facing upwards.

Figure 96



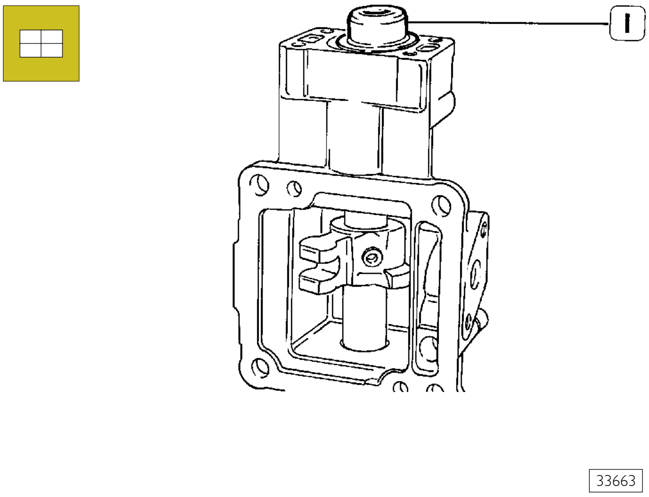
Insert the extraction washer (1) and use a punch tool having the right diameter to install the first plug (2). Install the second plug (3) and the snap ring (4).

Figure 97



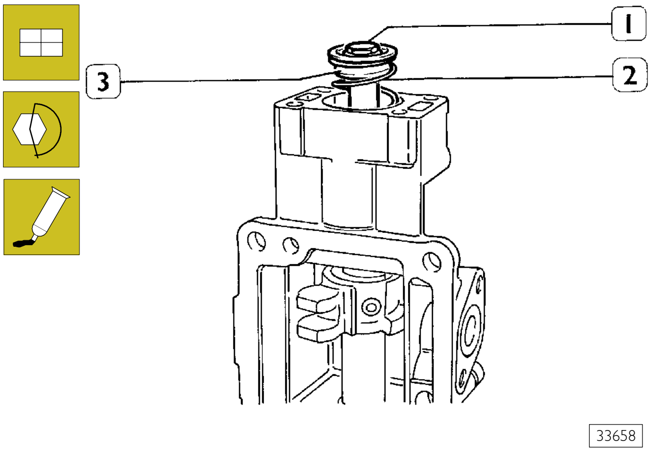
NOTE During installation, plug cuts shall be opposed by 180° (see detail A).
The bigger plug cut shall face the control selector (1) milled area (see detail B).

Figure 98



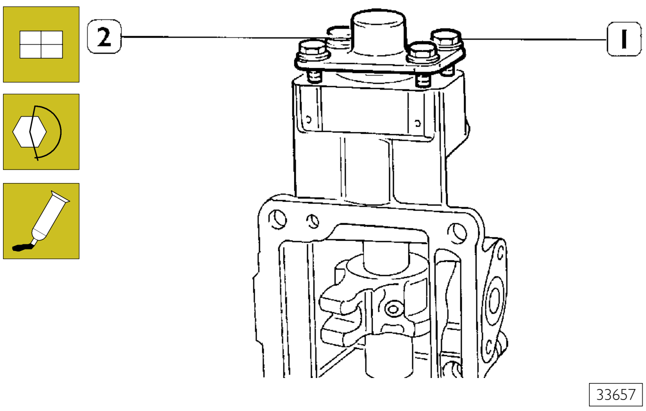
Assemble lower cup (1).

Figure 99



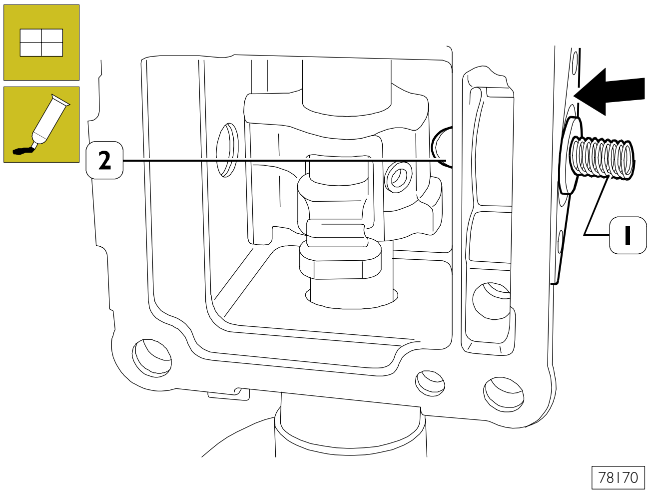
Install the spring (2), the upper cap (3), the spacer and the screw (1) and apply threading sealer LOCTITE 270 on the screw itself.
Tighten the screw (1) to 30 Nm (3.1 kgm).

Figure 100



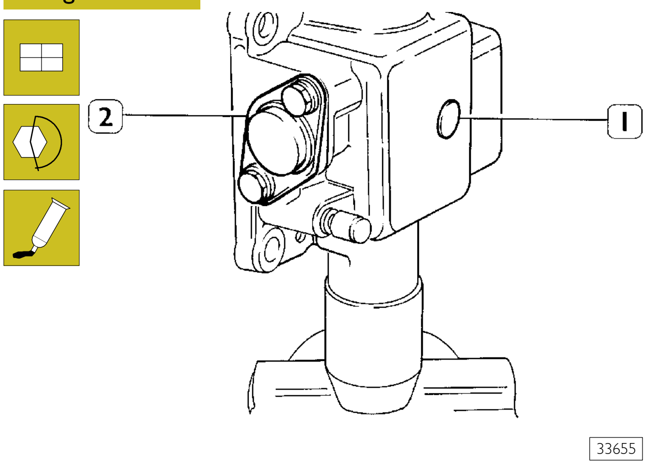
Clean joining surfaces of control box and cover (2) and apply "LOCTITE 510" adhesive on one of the two components. Assemble cover (2) and tighten screws (1) at a torque of 36.5 Nm (3.7 kgm).
Apply threading sealer LOCTITE 270 on the screws (1).

Figure 101



Install the pin (2), the spring (1) and apply sealer "LOCTITE 518" (→).

Figure 102

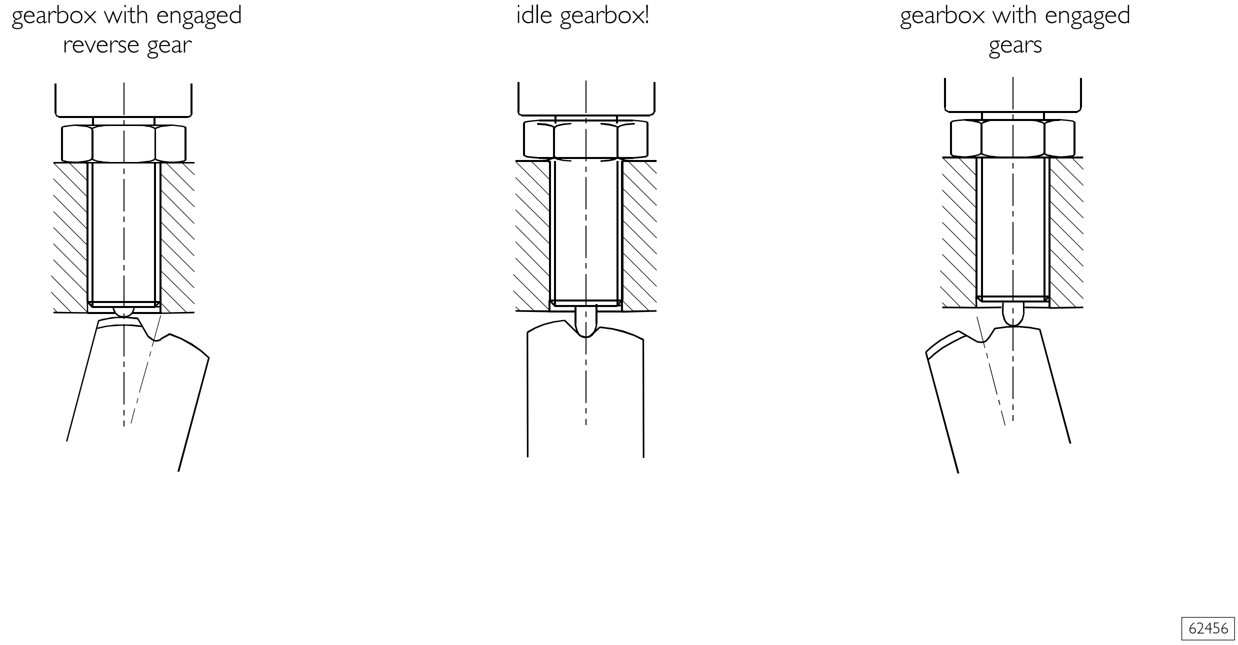


Install the cover (2) and tighten the screws to 19 Nm (1.9 kgm).
Apply sealer "LOCTITE 675" and refit the plug (1).

Idle–R.M. switch adjustment

NOTE The below–described sequence must be compulsorily complied with.

Figure 103



SWITCH ENGAGEMENT POSITIONS

For switch adjustment, it is necessary to carry out the following operations:

- ❑ apply silicone sealant on the threading;
- ❑ set gearbox in engaged reverse gear position;
- ❑ screw the switch till the reverse motion lamp turns on;
- ❑ screw again the switch by 45–60° corresponding to a stroke of 0.19–0.25 mm;
- ❑ tighten securing lock nut with a 24 wrench at a torque of 35 Nm.

5302 Gearbox 2865S.6

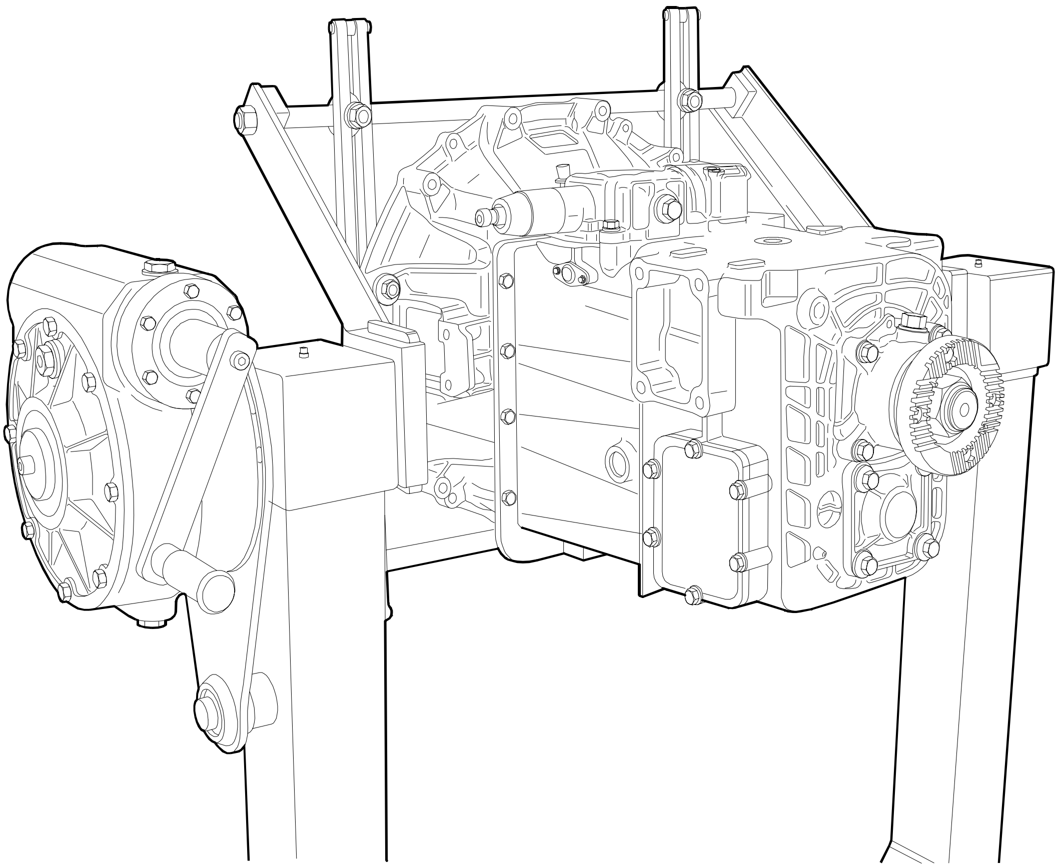
Page

DESCRIPTION

The IVECO 2865S.6 gearbox is of the mechanical type with 1st, 2nd gear engagement through a double–cone synchronising ring and 3rd, 4th, 5th and 6th gear engagement with free–ring synchronising rings. The reverse motion engagement is with a quick–connection sliding sleeve.
The gearbox case is made of light alloy and is composed of a front half–case and a rear half–case.
Three openings are obtained in the rear half–case for the possible application of a power takeoff.
Motion transmission is realised through a series of gears, always meshed and with helical teeth.

The gears are keyed or obtained on four shafts: motion entry, primary, secondary and reverse motion shafts.
The gear obtained on the motion entry shaft and those keyed on primary and reverse motion shafts idly rotate on cylindrical roller cages.
Motion entry shaft and primary shaft are supported by ball bearings in the gearbox case.
The secondary shaft is front and rear supported by tapered–roller bearings that are axially adjustable through an adjustment ring.
The gears engagement and selection control is mechanical.

Figure 1



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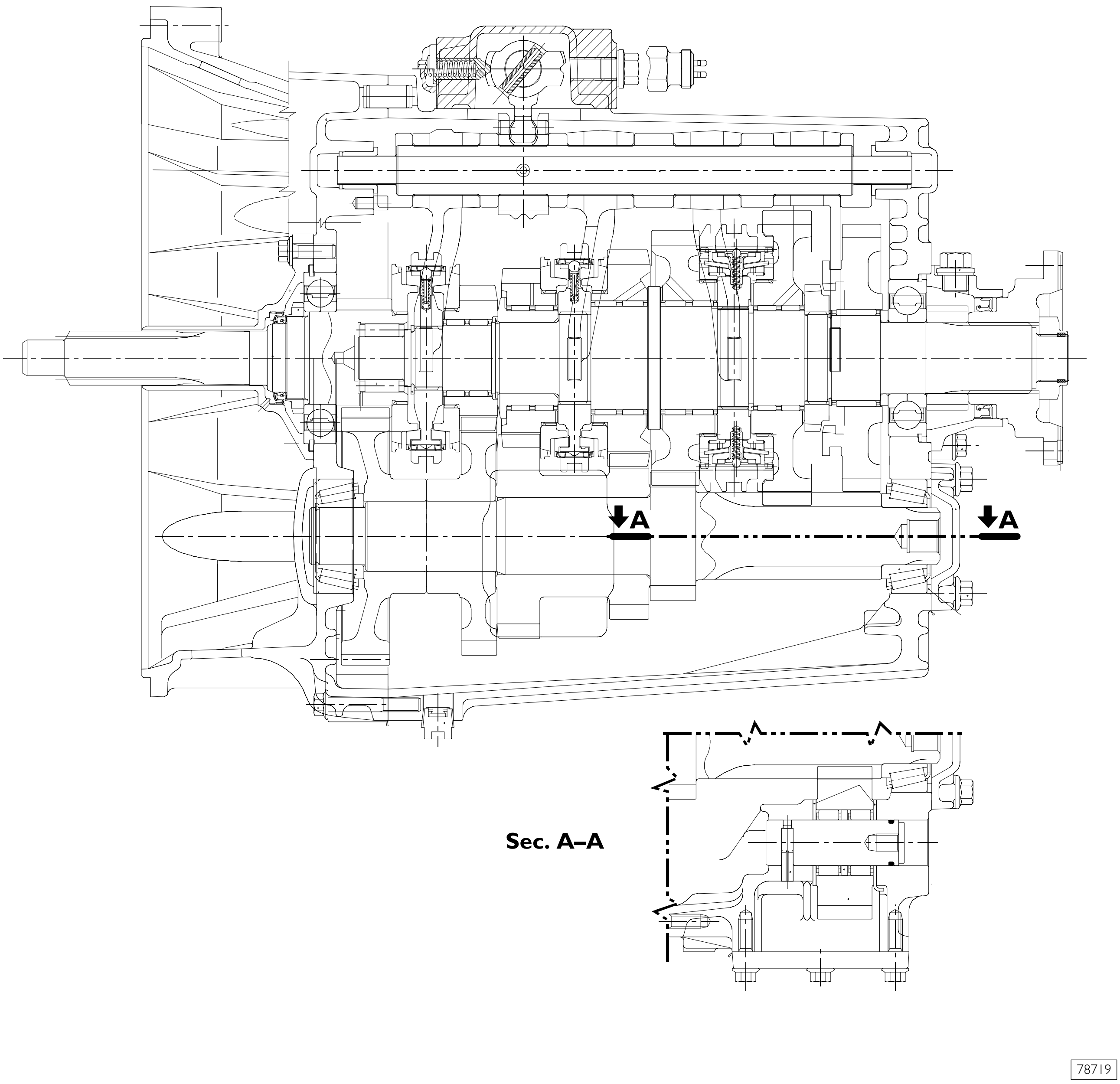
IVECO 2865S.6 GEARBOX ASSEMBLY

Figure 2



GEAR–BOX LONGITUDINAL SECTION 2865S.6 AND REVERSE GEAR SHAFT SECTION

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SPECIFICATIONS AND DATA

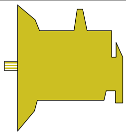
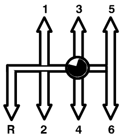
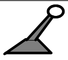
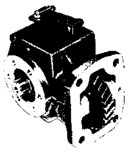
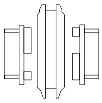
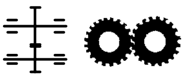
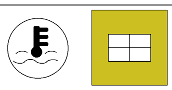
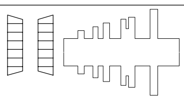
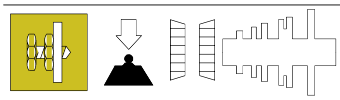
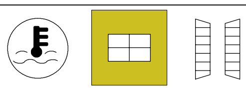
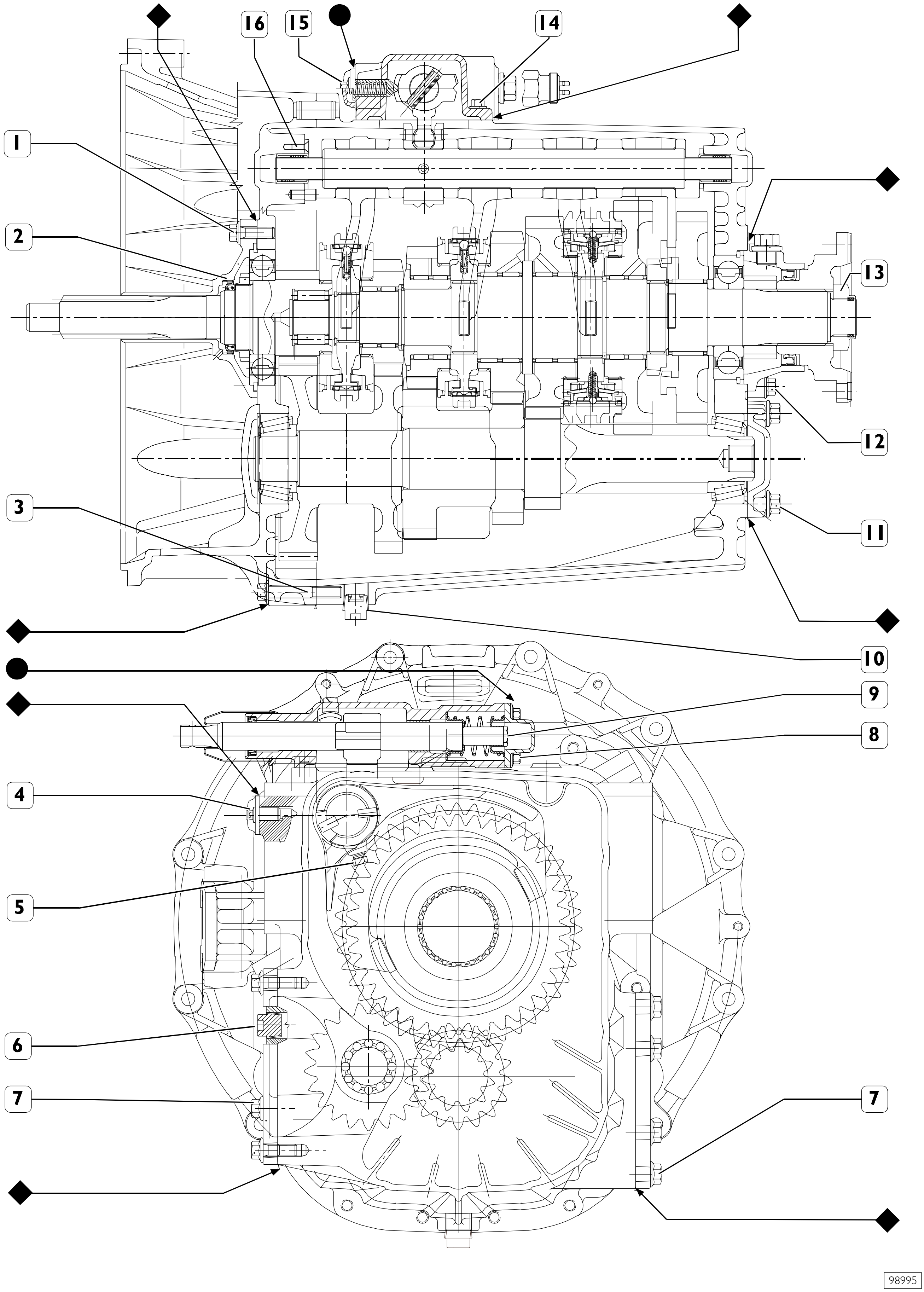
	GEARBOX	2865S.6
	Type	Mechanical
	Gears	6 forward gears and reverse gear
	Gears engagement control	Mechanical
	Power takeoff	Upon request
	Gears engagement: 1 st – 2nd 3rd – 4th – 5th – 6th Reverse gear Gears anti–disengagement	 Double–cone synchronizer Free–ring synchronizer Quick–connection type Sliding sleeve holding through rollers and springs.
	Gears	With helical teeth
	Gear ratio First Second Third Fourth Fifth Sixth Reverse gear	 1 : 9.007 1 : 5.015 1 : 3.206 1 : 2.066 1 : 1.370 1 : 1.000 1 : 8.170
	Oil type Amount	**TUTELA ZC 90** 8.1 Kg. (9 lt)
	Fixed hubs assembly temperature	100 °C to 130 °C
	Secondary shaft bearings	With tapered rollers
	Secondary shaft bearings pre–loading adjustment	By means of rings
IVECO PARTS	Secondary shaft pre–loading adjustment rings thickness mm	4.0–4.1–4.2–4.3–4.4–4.5–4.6 4.7–4.8–4.9–5.0–5.1–5.2–5.3 Supplied in a kit
	Secondary shaft bearingsassembly temperature	85 °C

Figure 3



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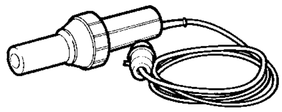
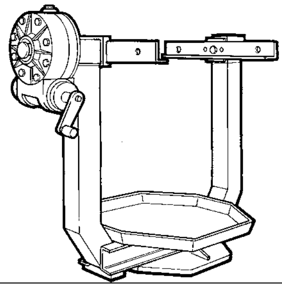
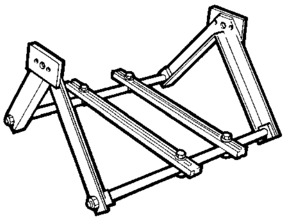
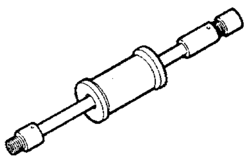
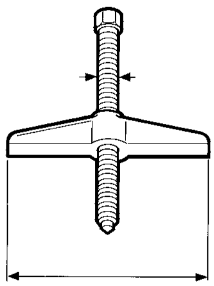
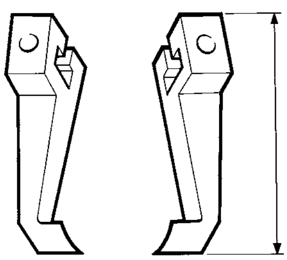
TIGHTENING TORQUES

PART		TORQUE	
		Nm	(kgm)
1	Flanged hexagonal head screw for securing front cover	32 ± 3	(3.3 ± 0.3)
2	Ring nut for securing entry shaft bearing	545 ± 55	(55.5 ± 5.6)
3	Flanged hexagonal head screw for joining clutch and case	45.5 ± 4.5	(4.6 ± 0.5)
4	Release–proof push rod cover securing screw	22.5 ± 2.5	(2.3 ± 0.2)
5	Screw for securing fork control rod hub	39 ± 2	(4.0 ± 0.2)
6	Threaded plug with external operating hexagon for oil level	27.5 ± 2.5	(2.8 ± 0.3)
7	Flanged hexagonal head screw for securing covers on side power takeoffs connection windows	38 ± 4	(3.9 ± 0.4)
8	Screw with plane washer for securing transverse axle cover on external control *	19 ± 2	(1.9 ± 0.2)
9	Transverse axle screw *	30 ± 3	(3.0 ± 0.3)
10	Threaded plug with external operating hexagon for oil discharge	27.5 ± 2.5	(2.8 ± 0.3)
11	Flanged hexagonal head screw for securing rear cover on secondary shaft	58 ± 6	(5.9 ± 0.6)
12	Flanged hexagonal head screw for securing rear cover on primary shaft	43 ± 4	(4.4 ± 0.4)
13	Locking nut for outlet primary shaft flange	467 ± 23	(47.6 ± 2.3)
14	Flanged hexagonal head screw for securing upper external controls support cover	33.5 ± 3.5	(3.4 ± 0.4)
15	Flanged hexagonal head screw for securing spring check flange on external control	19 ± 2	(1.9 ± 0.2)
16	Flat–head screw with TORX mark to secure rib washer *	9.5 ± 0.5	(0.96 ± 0.05)
–	Flanged hexagonal head screw for securing clutch disengagement lever support	46.5 ± 4.5	(4.6 ± 0.4)

* Apply thread–braking LOCTITE 270 on the screw
♦ Apply liquid gasket LOCTITE 510 sealant
• Apply liquid gasket LOCTITE 518 sealant.

TOOLS		
TOOL No.		DENOMINATION
99305121		Hot–air apparatus
99322205		Rotating stand for assembly revision (capacity 1000 daN, couple 120 daN/m)
99322225		Assembly bearing support (to be applied on stand 99322205)
99340205		Percussion extractor
99341003		Simple–effect bridge
99341009		Pair of brackets

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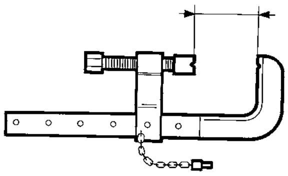
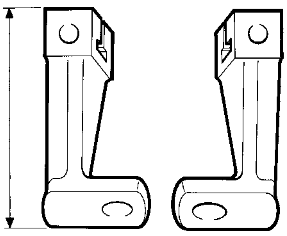
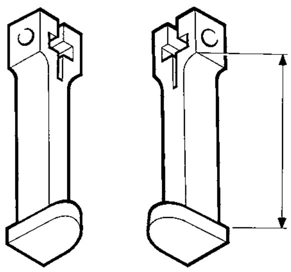
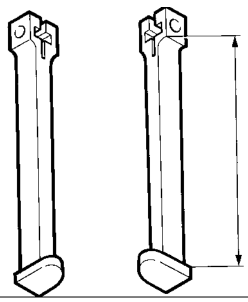
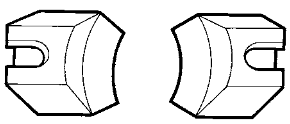
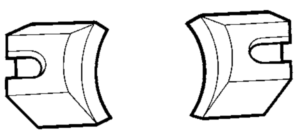
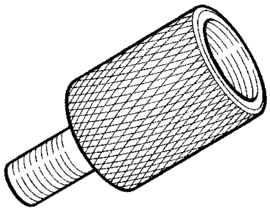
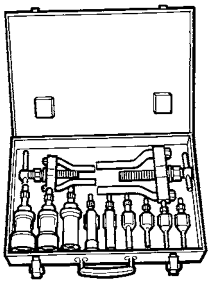
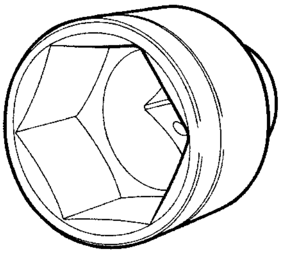
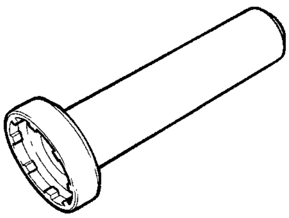
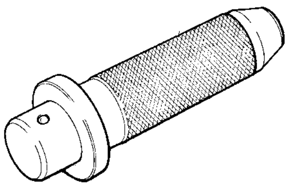
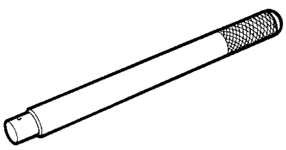
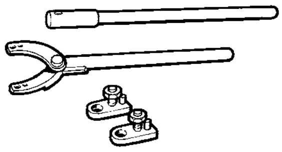
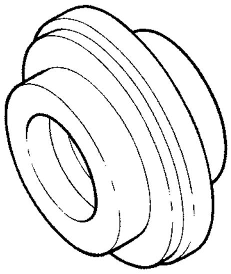
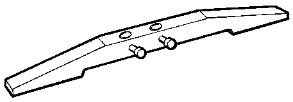
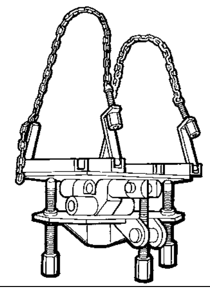
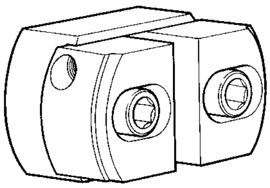
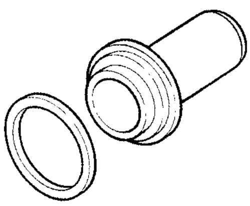
TOOLS

TOOL No.		DENOMINATION
99341015		Clamp
99341017		Pair of brackets with hole
99341019		Pair of tie–rods for holds
99341020		Pair of tie–rods for holds
99341023		Holds
99341025		Holds

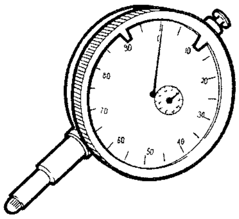
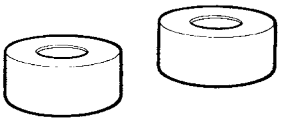
TOOLS

TOOL No.		DENOMINATION
99342143		Peg for removing reverse gear shaft (use with 99340205)
99348004		Universal extractors for interiors 5 to 70
99355081		Bush for disassembling and re–assembling motion outlet flange nut (use with 99370317)
99355174		Wrench for disassembling and re–assembling ring nut, gearbox top gear shaft
99370006		Handle for interchangeable beaters
99370007		Handle for interchangeable beaters

TOOLS

TOOL No.		DENOMINATION
99370317		Reaction lever with flange check extension
99370349		Keyer for drive shaft front gasket assembling (use with 99370006)
99370466		Comparator basis
99370629		Gearbox bearing support during vehicle disconnection and re–connection
99374092		Beater for external bearings race assembling (69–91) (use with 99370007)
99374201		Keyer for assembling gasket on rear gearbox cover

TOOLS

TOOL No.		DENOMINATION
99395604		Comparator (0 – 10 mm)
99396032		Calibrated rings for secondary shaft bearings adjustment (use with 99370466)

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GEARBOX 2865S.5 DISENGAGEMENT/ RE–ENGAGEMENT

Before carrying out disengagement/re–engagement operations, disconnect battery cables and place the vehicle under safety conditions.

Disengagement

Lift the calender and turn the cabin over.

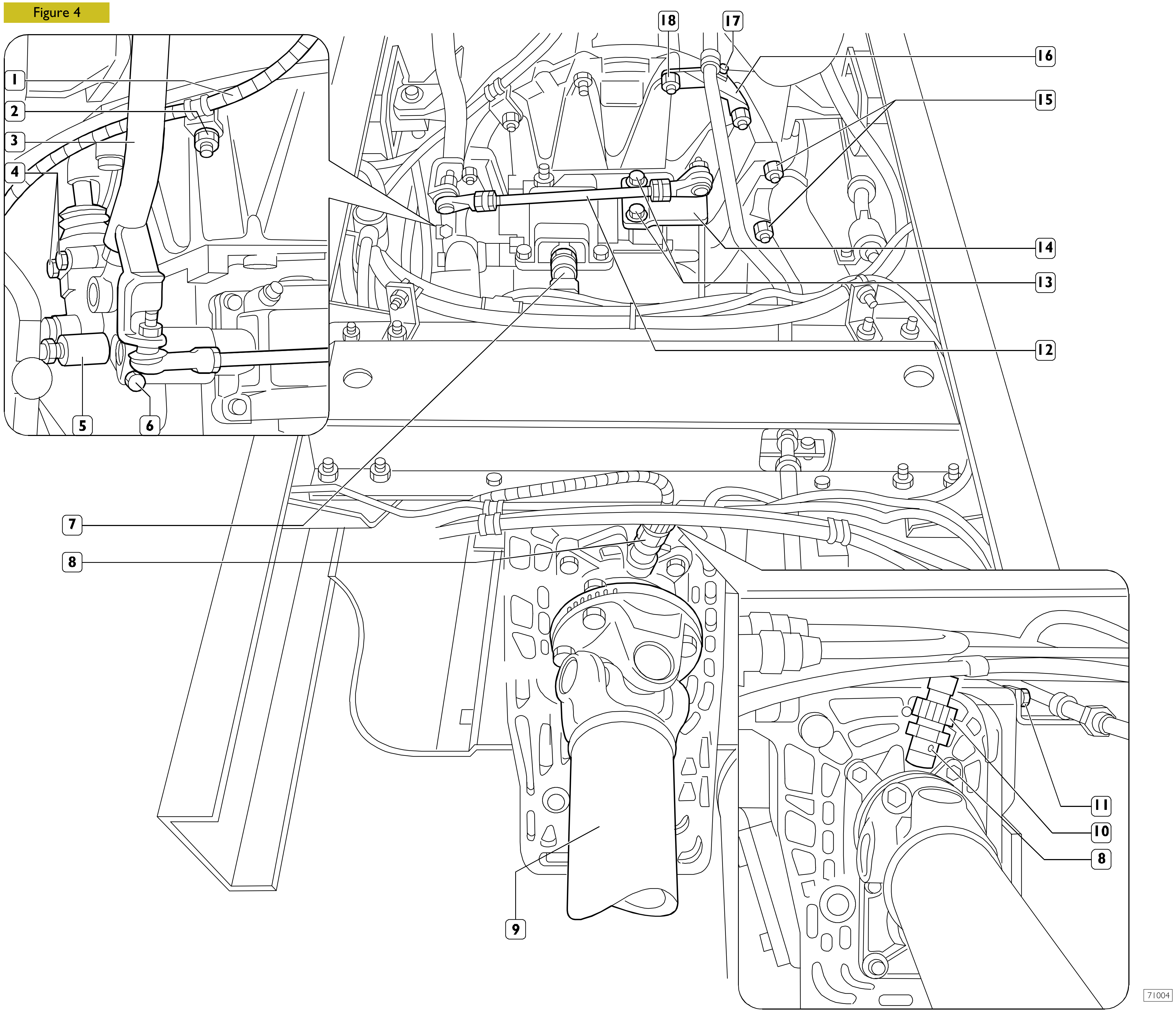
- loosen securing bolt (17), unscrew securing nuts (18) and detach air piping supporting bracket (16);
- unscrew securing nut (2) and detach air piping supporting bracket (1);
- unscrew securing nuts (13) and detach bracket (14) of reaction tie–rod (12); loosen securing screw (6) and detach from gearbox the gears control lever completed with tie–rod (3) and reaction tie–rod (12);
- disconnect reverse gear switch electric connection (7);
- unscrew securing nuts (15) of clutch bell to engine that will be able to be reached with difficulty from the lower vehicle part.
- rotate deadening guard locking rivets below the gearbox and remove the deadening guard;
- detach transmission shaft (9) as described in the related section;
- unscrew securing screws (4) and detach clutch control operating cylinder (5);
- disconnect electric connection (10) of odometer sensor (8);
- unscrew securing screw (11) and detach air piping support bracket;
- place an hydraulic jack equipped with support 99370629 under the gearbox;
- unscrew the remaining securing nuts of clutch bell to engine, move the gearbox backwards and lowering the jack remove it from below the vehicle.

Re–engagement

Suitably reverse the operations carried out for disengagement and tighten securing screws and nuts at the required torque.

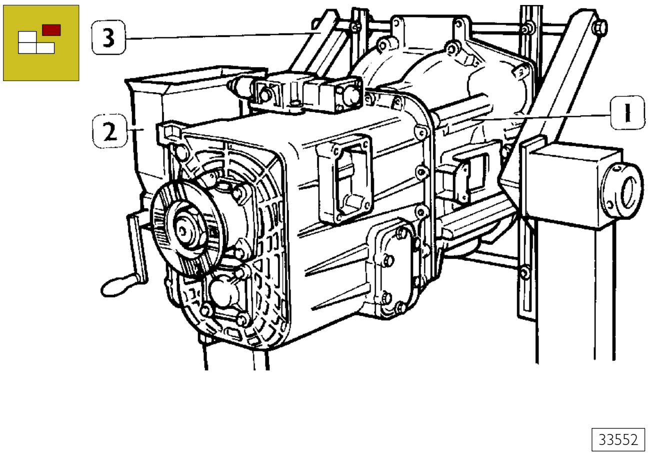
Upon re–engaging the gearbox, pay attention that the clutch control lever fork is correctly meshed to the thrust bearing.

Figure 4



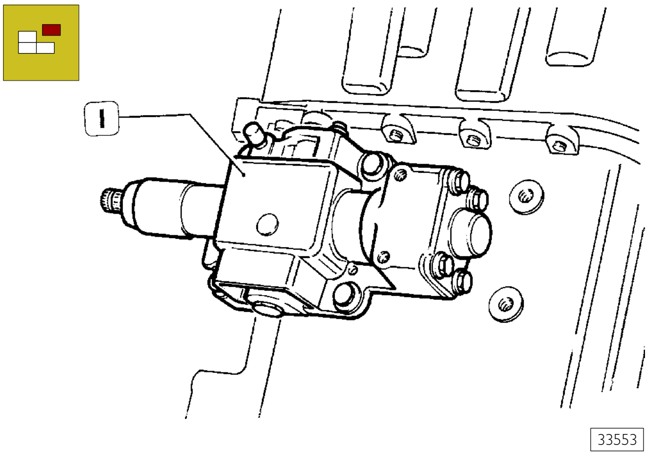
GEARBOX DISASSEMBLY

Figure 5



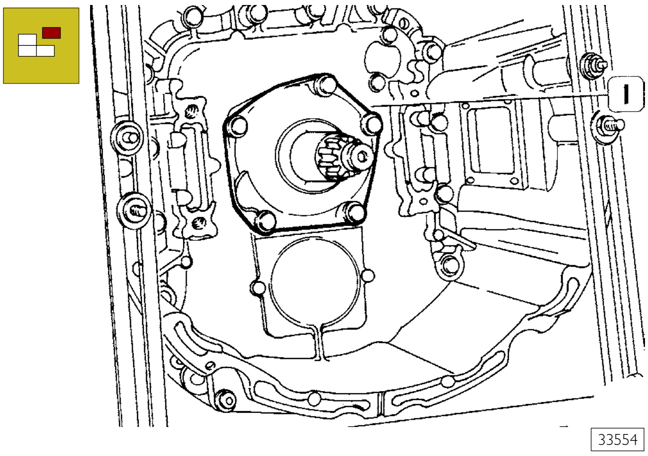
Place gearbox (1) on rotating stand 99322205 (2) equipped with brackets 99322225 (3) and discharge the lubricating oil.

Figure 6



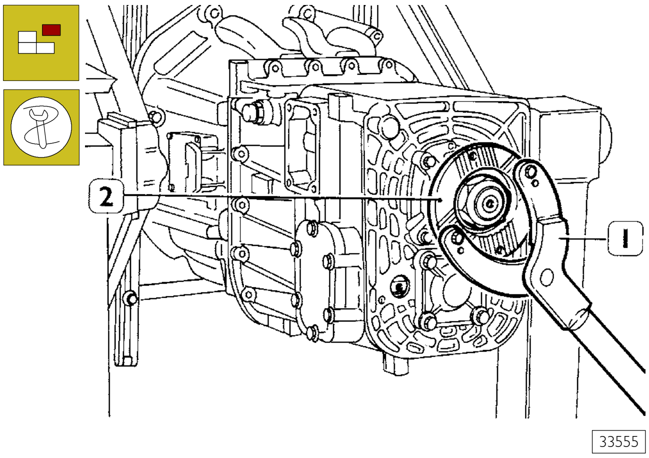
Disassemble external control box (1).

Figure 7



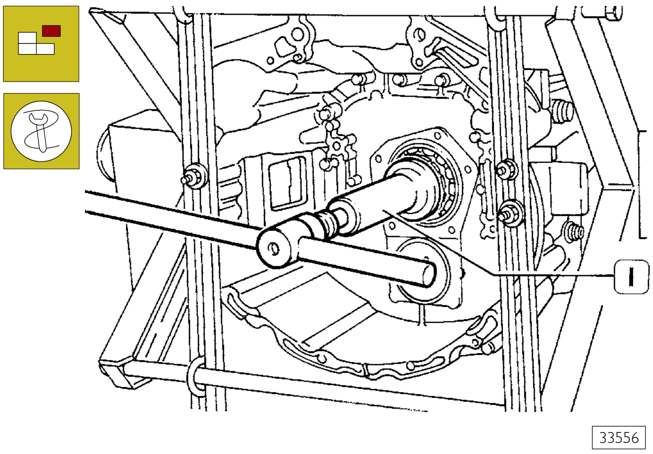
Unscrew the two securing screws for clutch disengagement lever support and remove lever from gearbox.
Disassemble cover (1) on motion entry shaft.

Figure 8



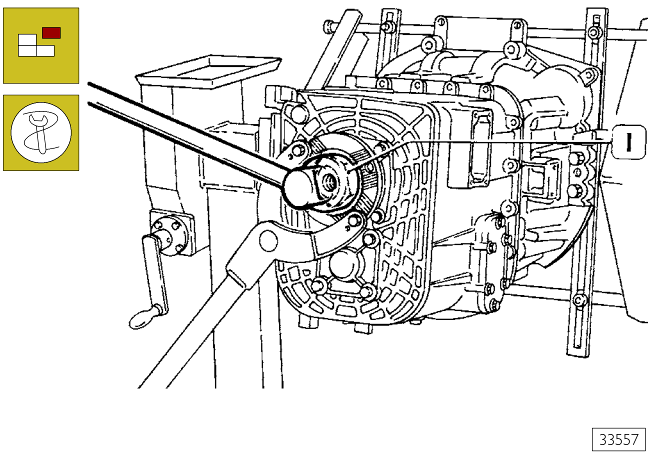
Apply reaction lever 99370317 (1) on motion outlet flange (2) and engage a gear.

Figure 9



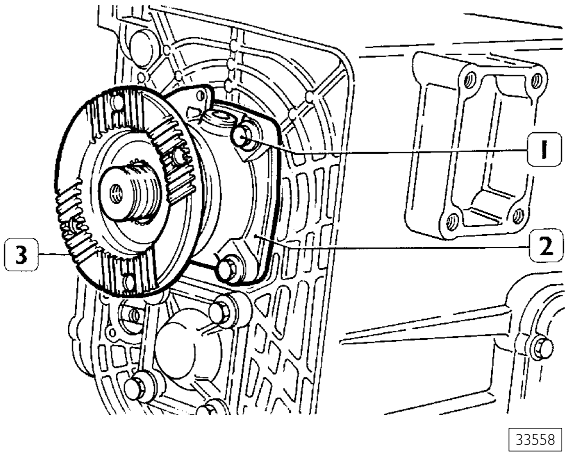
Loosen ring nut on motion entry shaft with wrench 99355174 (1).

Figure 10



Unscrew the primary shaft screw with wrench 99355081 (1).

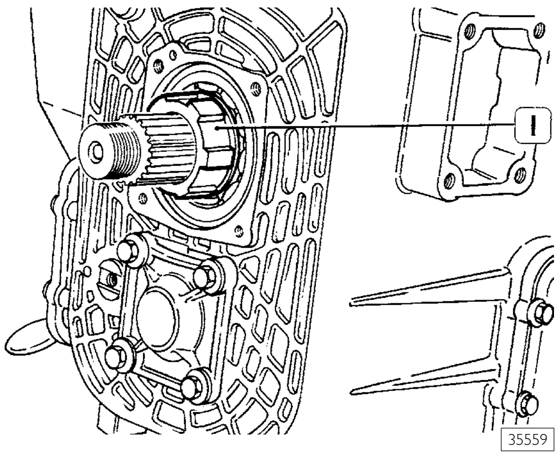
Figure 11



Disengage engaged gear, remove flange (3), uscrew screws (1) and remove cover (2).

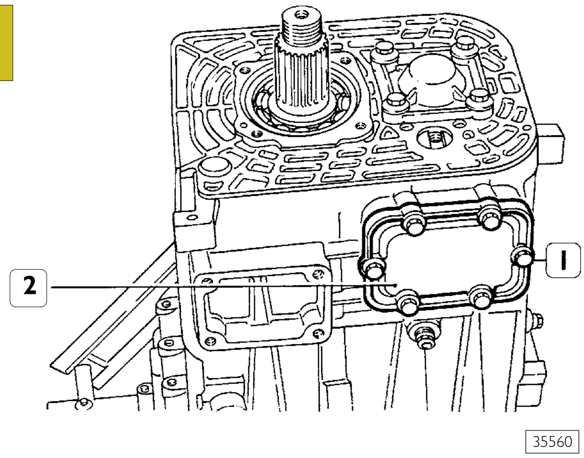
NOTE The disassembly of rear gearbox cover for replacing the sealing gasket can be carried out also with gearbox assembled on the vehicle, by detaching the transmission shaft and proceeding as shown for the gearbox assembled on rotating stand.

Figure 12



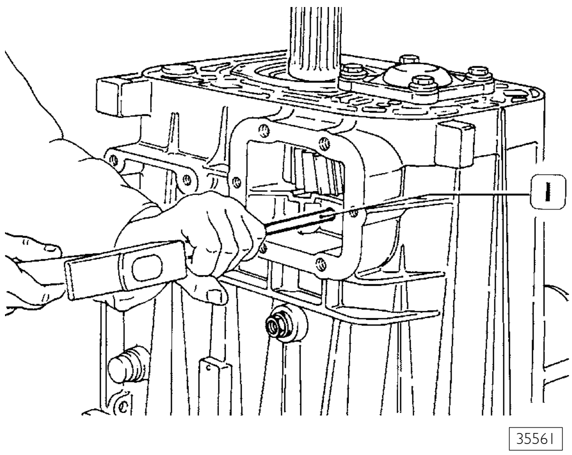
Remove phonic wheel (1) for odometer control.

Figure 13



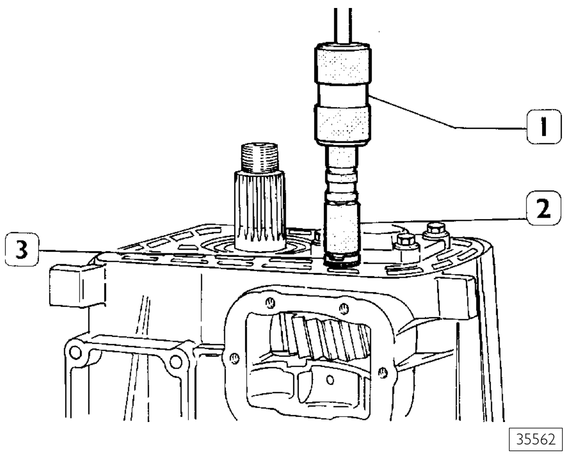
Unscrew screws (1) and remove cover (2).

Figure 14



Beat with a punch (1) and push the elastic peg till it abuts.

Figure 15



Place extraction peg 99342143 (2) and percussion extractor 99340205 (1). Withdraw the reverse gear supporting pin and remove the same gear with related shoulder washers and cylindrical roller bearing.

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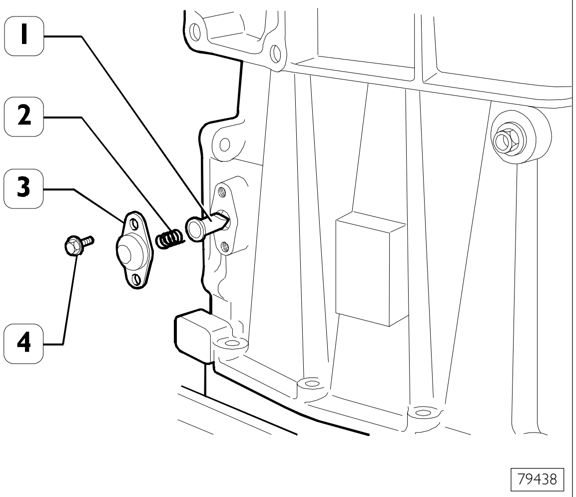
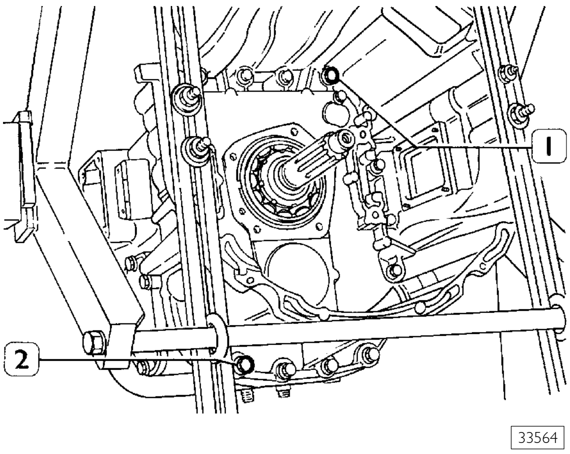
Figure 16



Unscrew screws (4) and take off cover (3).

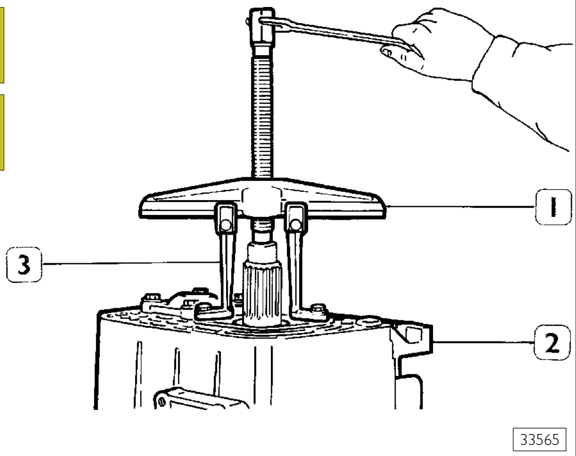
Take off spring (3) and take out push rod (1).

Figure 17



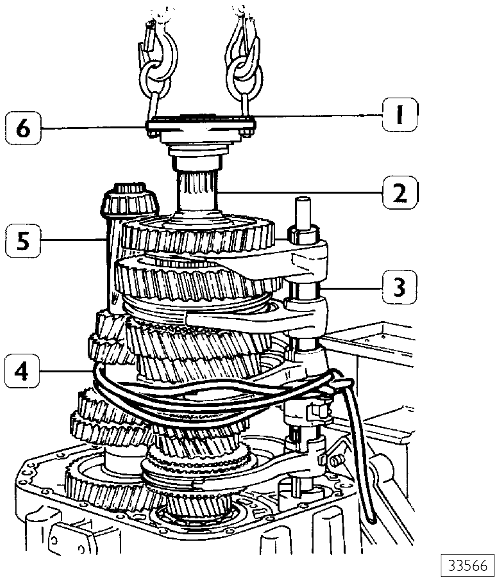
Unscrew screws (1 and 2).

Figure 18



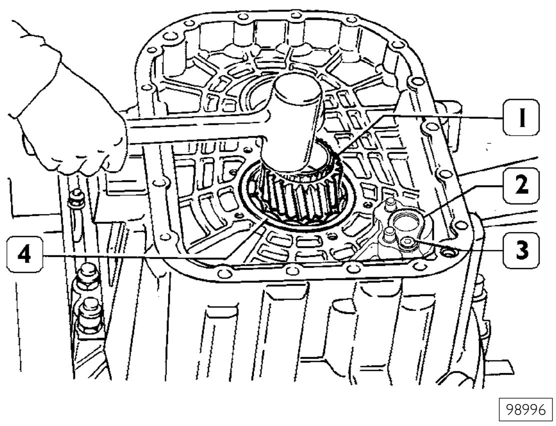
Extract box (2) with bridge 99341003 (1) equipped with the pair of brackets 99341017 (3).

Figure 19



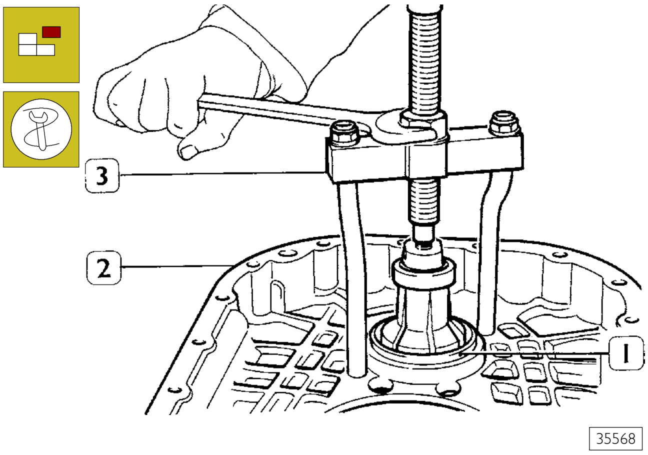
Assemble motion outlet flange (6) on primary shaft (2) and lock it with nut (1). Tie secondary shaft (5) and internal control shaft (3) with a rope (4) to primary shaft (2) and with the help of a lifting device remove the shafts from the rear cover.

Figure 20



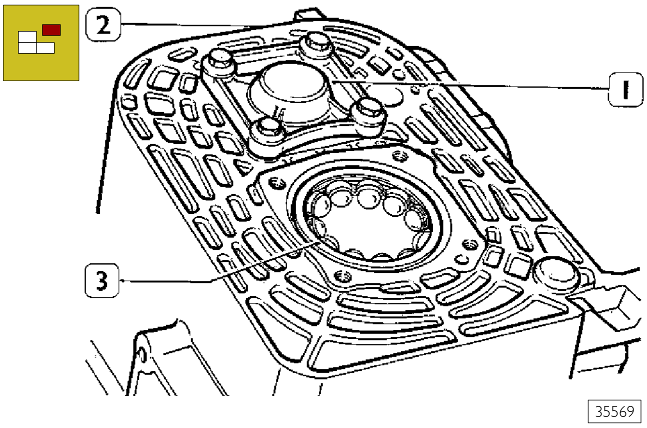
Remove from motion entry shaft (1) the cylindrical roller bearing and heat the cover contact surface (2). With a plastic hammer, extract motion entry shaft (1) completed with ball bearing, elastic ring and ring nut.
Unscrew TORX mark screw (3), take off rib washer (2) and recover underlying bushing.

Figure 21



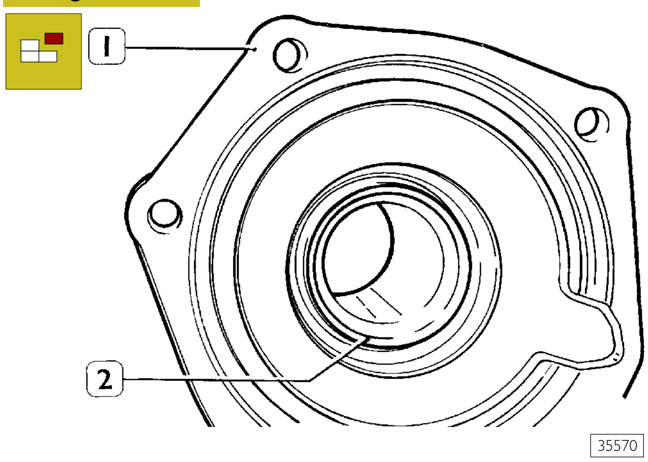
Extract rolling race (1) of the secondary shaft tapered roller bearing, from front cover (2) with extractor 99348004 (3). Remove the adjustment ring.

Figure 22



Remove cover (1) and underlying spacer.
Extract, from case (3), the external race of secondary shaft tapered roller bearing, and the ball bearing (2) with a suitable beater.
From inside the half box, unscrew TORX mark screw, take off rib washer and recover underlying bushing.

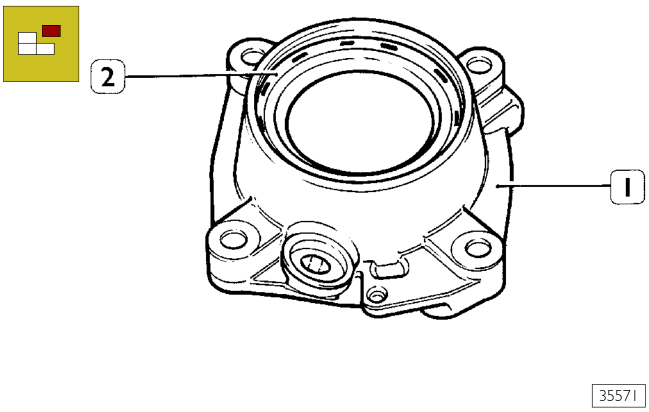
Figure 23



Extract from motion entry shaft cover (2) the sealing gasket (1) with a suitable beater.

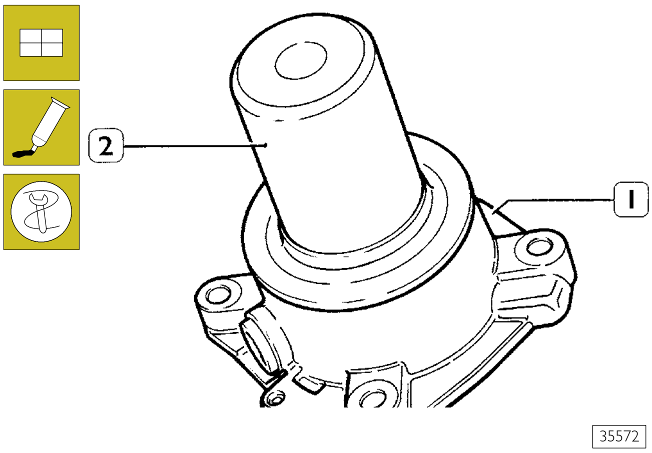
530514 Rear cover sealing gasket replacement

Figure 24



Extract from primary shaft cover (1) the sealing gasket (2) with a suitable beater.

Figure 25



Butter with sealing compound type “B”, the coupling seat surface of cover (1), and with keyer 99374201 (2) assemble the sealing gasket.

Checks

GEARBOX CASE

Gearbox case and related covers must not show cracks.
Contact surfaces between covers and gearbox case must not be damaged or distorted.
Bearing seats must not be damaged or excessively worn.

SHAFTS – GEARS

Shaft seats for bearings and gear toothings must not be damaged or worn.

HUBS – SLIDING SLEEVES – FORKS

Grooves on hubs and related sliding sleeves must not be damaged. The sliding sleeve must freely slide on the hub. Sliding sleeve positioning rollers must not be damaged or worn. Sliding sleeves engagement toothings must not be damaged.
Forks must be intact and not show any sign of wear.

BEARINGS

Roller bearings or roller cages must be in perfect conditions and not show traces of wear or overheating.
Keeping the bearings pressed with a hand and making them simultaneously rotate along the two directions, no roughnesses or noises when sliding must be detected.

NOTE Upon assembling, the following must always be replaced: rings, sealing gaskets and springs for sliding sleeves positioning rollers.

SYNCHRONIZERS – COUPLING BODIES

Check wear of synchronizing rings and respective coupling bodies: they must not have any sign of wear.

NOTE Upon assembling, do not mutually exchange the controlled parts.

GEARBOX ASSEMBLY

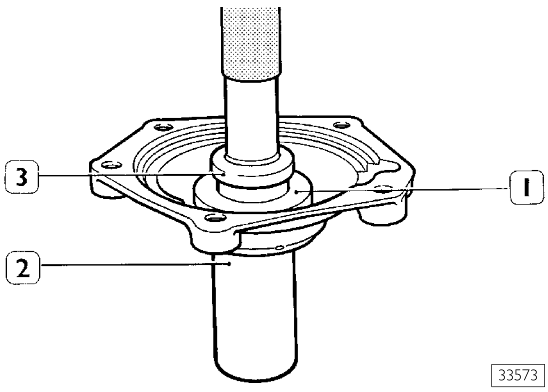
Butter with sealing compound type “B” the threaded part of all screws that have to be screwed into the through–holes.

Clean joining surface of case and covers and apply “LOCTITE 510” adhesive, before assembling, on one of the two components.

Do not insert oil before 20 min. and do not try the gearbox before 1h and 30 min.
Assemble bearing cages into their respective seats and oil with TUTELA ZC 90.

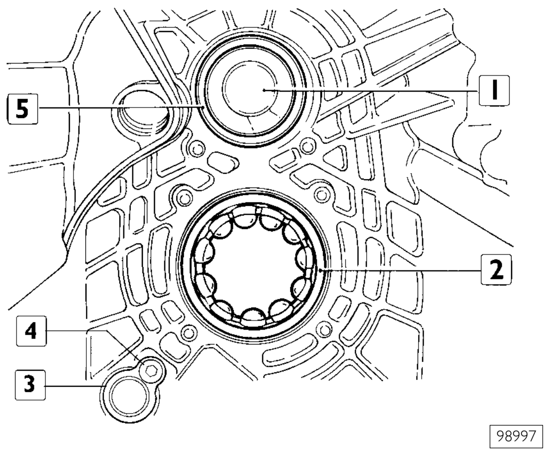
In order to guarantee oil seal upon assembly, make sure that sealing gaskets are already lubricated, or: butter with oil or grease the gasket sealing lip for entry and primary shafts.

Figure 26



Butter, with sealing compound type “B”, the coupling seat surface of cover (2) and with keyer 99370349 (1) and handle 99370006 (3) assemble the sealing gasket.

Figure 27

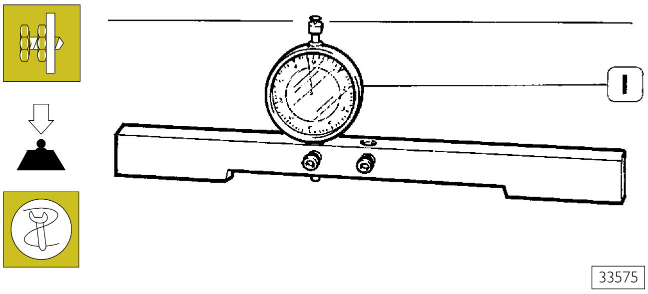


Assemble cover (1), spacer and with a suitable beater, the external race (5) of tapered roller bearing. Slightly heat the case contact surface with ball bearing and assemble the bearing itself.
Fit inner control shaft bushing into its seat, put in rib washer (3) and screw TORX mark screw (4) with prescribed torque.

Bearings pre–loading adjustment for secondary shaft

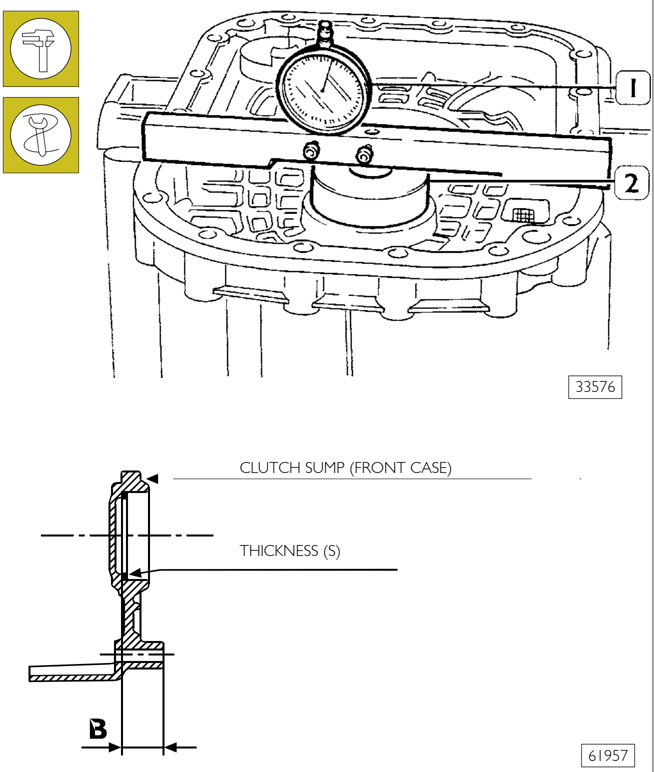
The pre–loading adjustment for secondary shaft bearings can be carried out with two procedures.

Figure 28



Assemble comparator (1) on base 99370466 (2).
Pre–load it with 5 mm and zero it on a striker plane.

Figure 29

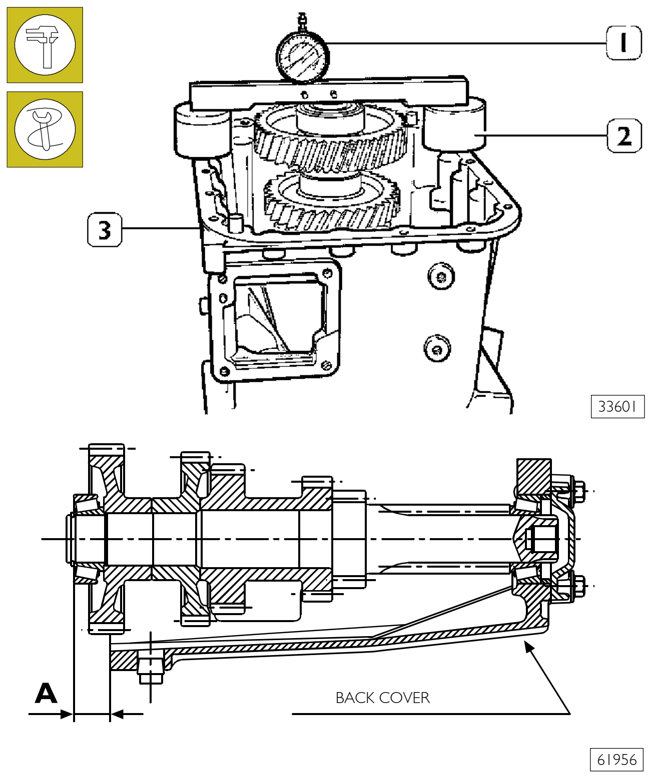


Place calibrated ring 99396032 (2) in the tapered roller bearing seat, without adjustment ring, on front cover; place base 99370466 completed with previously zeroed comparator (1), as shown in Figure 28.

First method – Take note of the value read on comparator (Example: 2.43 mm).

Second method – Take note of the value read on comparator and add it to calibrated ring thickness [Example: 2.43 + 50.5 = 52.93 mm (dimension **B**)].

Figure 30



Assemble and simultaneously rotate secondary shaft completed with bearings into rear case (3), so that it settles. Place calibrated rings 99396032 (2) on case (3). Arrange, as shown in Figure 30, base 99370466 completed with previosuly zeroed comparator (1): the comparator rod must abut on external bearing ring. Carry out the measure on two diametrally–opposed points and carry out the arithmetic mean.

First method – Take note of the value read on comparator (Example: 1.84 mm). The adjustment ring value is obtained by adding the two measured values (Example: 2.43 + 1.84 = 4.27 mm)

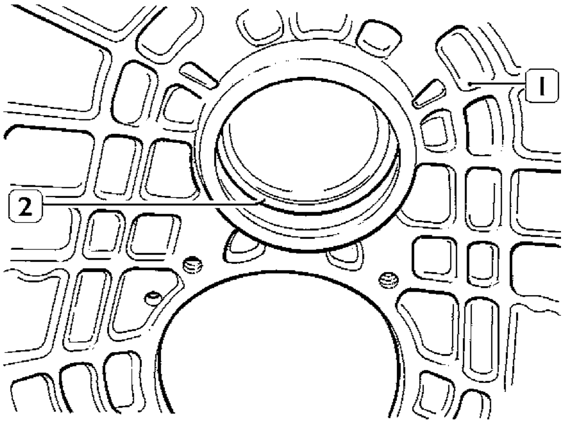
Second method – Take note of the value read on comparator and subtract it from calibrated ring thickness [Example: 50.5 – 1.84 = 48.66 mm (dimension **A**)].

The adjustment ring value is obtained through formula
S = B – A Example: 52.93 – 48.66 = 4.27 mm.

NOTE The adjustment ring rounding is carried out always in excess. Example: thickness S = 4.27: thickness S = 4.3 is taken.
The measure for dimension "A" is carried out with secondary shaft in vertical position that, in addition to making the measure itself easier, allows having an axial load on rear bearing.

After having computed the adjustment ring thickness value, disassemble again secondary shaft from rear case.

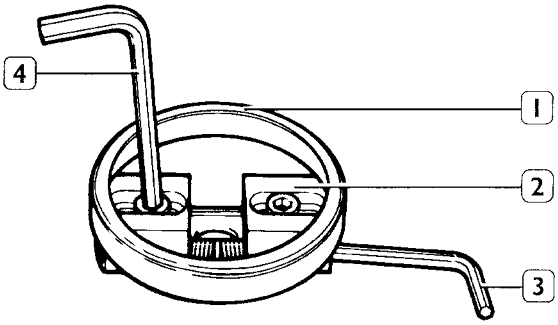
Figure 31



33604

Place, into the secondary shaft bearing seat on front cover (1), the adjustment ring (2) whose thickness is equal to the previously–obtained one.

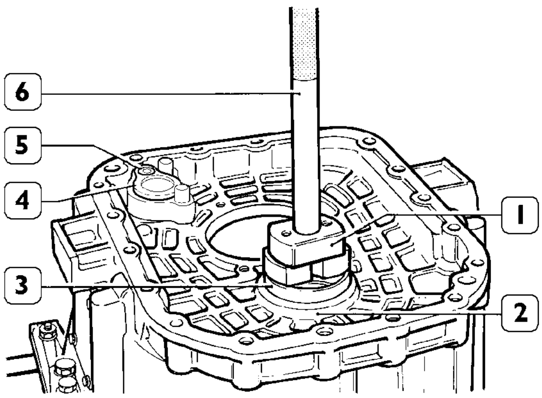
Figure 32



32447

Center the external race (1) of secondary shaft tapered roller bearing of front cover on extendable beater 99374092 (2) adjusted with the setscrew wrench (3). Lock the beater with the setscrew wrench (4).

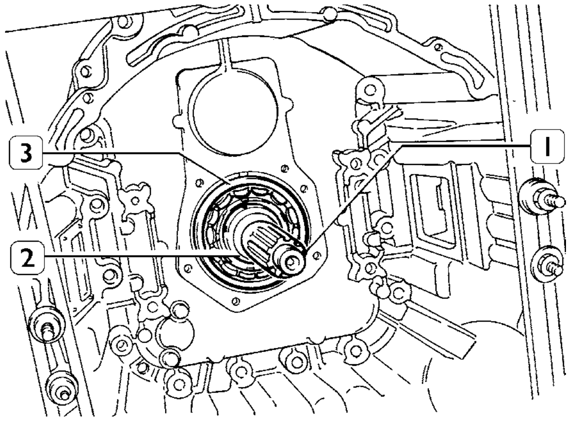
Figure 33



98998

Slightly heat seat (2) of secondary shaft bearing race and assemble external race (3) settling it till it abuts with beater 99374092 (1), equipped with handle 99370007 (6).
Fit inner control shaft bushing into its seat, put in rib washer (4) and screw TORX mark screw (5) with prescribed torque.

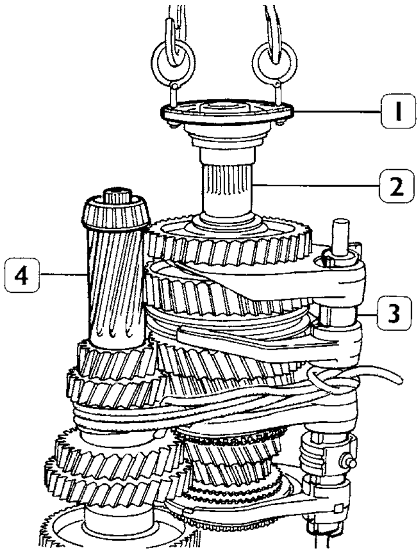
Figure 34



33606

Slightly heat the ball bearing seat, assemble motion entry shaft (1) completed with ball bearing, rolling half–races and ring nut (2). Settle bearing (3) till it abuts.

Figure 35



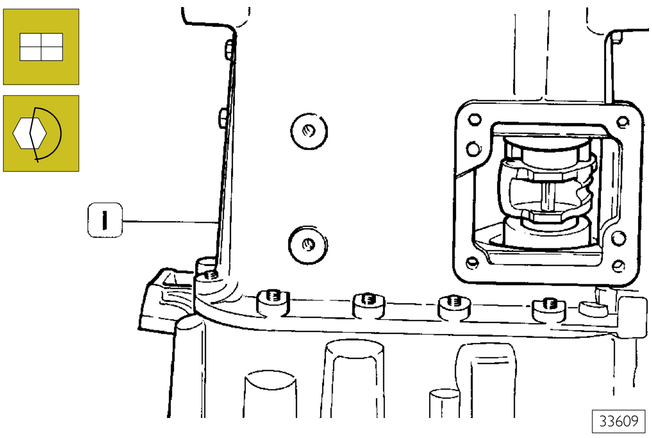
33607

Temporarily assemble on primary shaft the motion outlet flange and secure it with a check nut. Assemble together, on a bench and with the help of a lifter, primary shaft (2), secondary shaft (4) and engagement fork control shaft (3); keep them mutually joined by means of a rope.

Figure 36

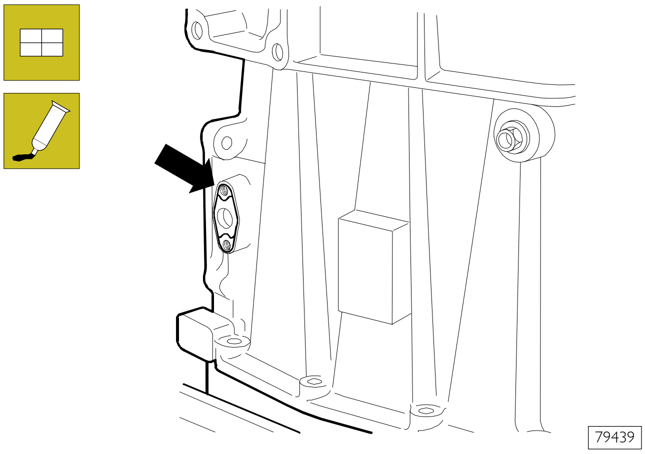
Insert cylindric roller bearing into motion entry shaft and assemble the three shafts together on front cover (1).

Figure 37



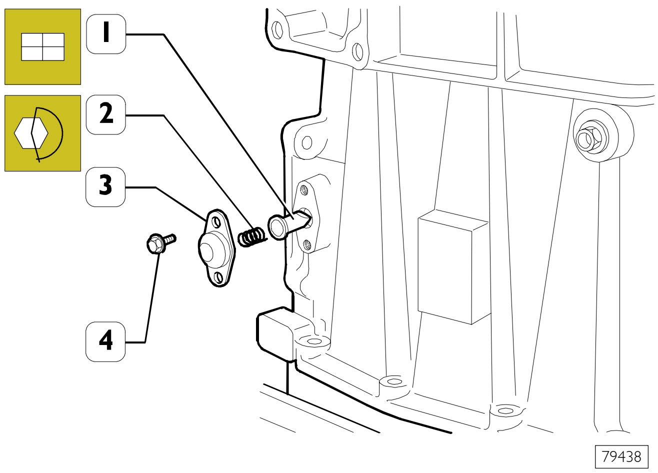
Remove temporarily previously–assembled ring nut and nut and assemble gearbox case (1). Tighten screws joining front cover and case at the required torque.

Figure 38



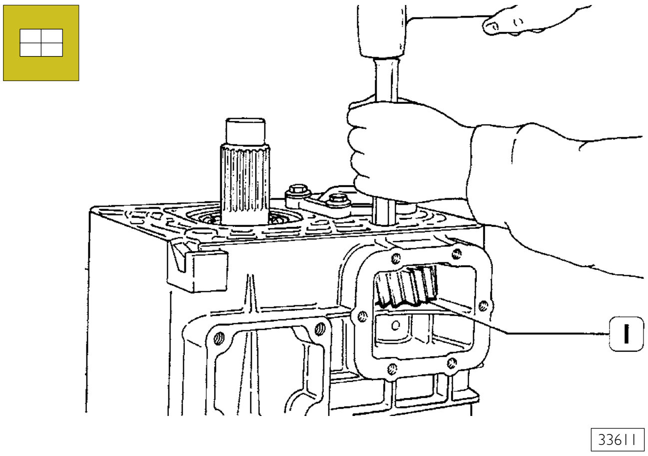
Apply sealer LOCTITE 510 on the surface (→) without staining the push rod supporting area (1, Figure 39).

Figure 39



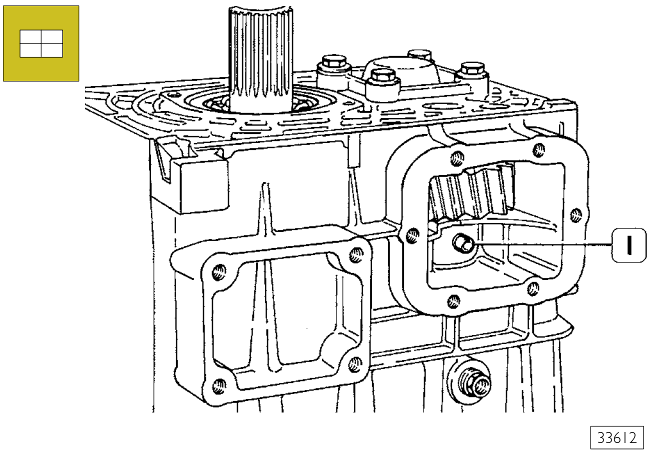
Put in push rod (1), spring (2), mount cover (3) and screw down screws (4) tightening them with rated torque.

Figure 40



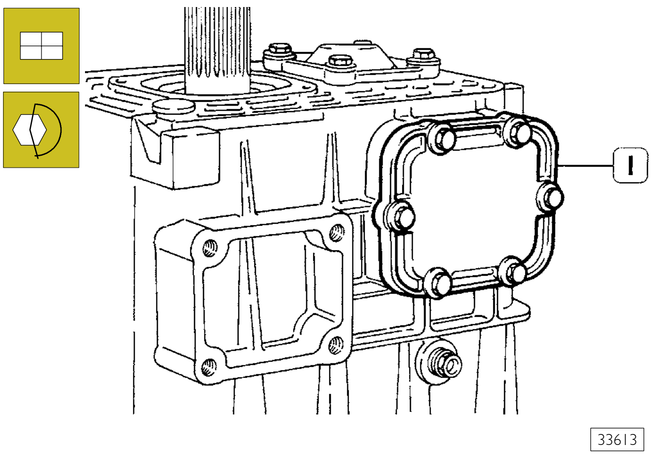
Assemble shoulder rings, placing them into their own seat and reverse gear (1) with the cylindrical roller bearing. Assemble reverse gear supporting shaft with a suitable beater.

Figure 41



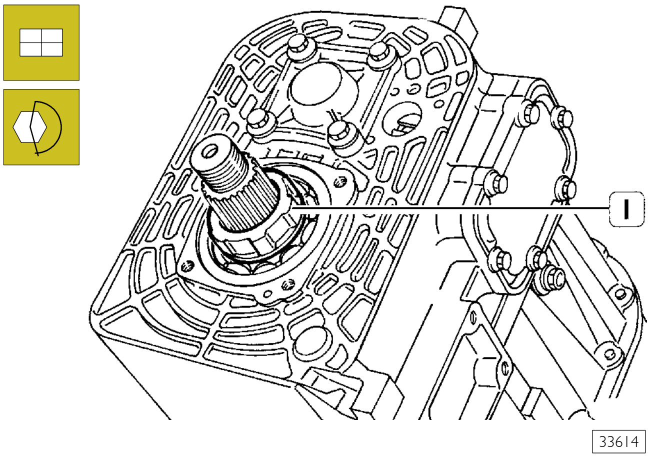
Assemble elastic peg (1).

Figure 42



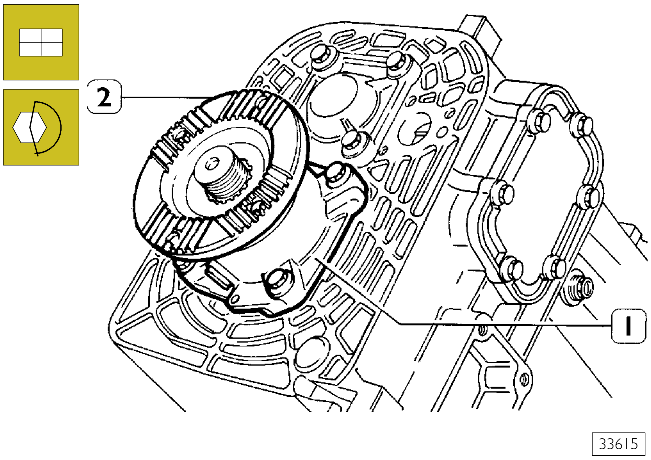
Assemble cover (1) by tightening the screws at the required torque.

Figure 43



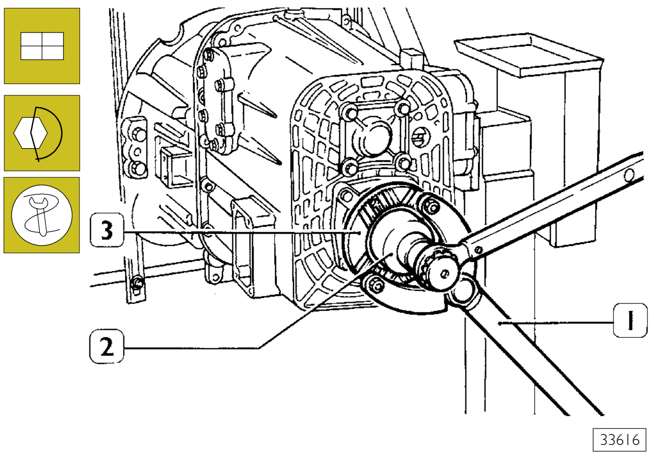
Slightly heat ball bearing half–race and assemble it into its own seat on primary shaft. Assemble the odometer controlling phonic wheel (1).

Figure 44



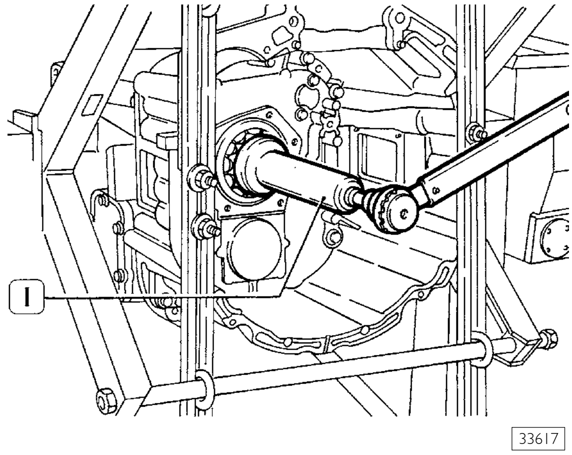
Assemble rear cover (1), completed with sealing gasket, by tightening the securing screws at the required torque. Assemble motion outlet flange (2).

Figure 45



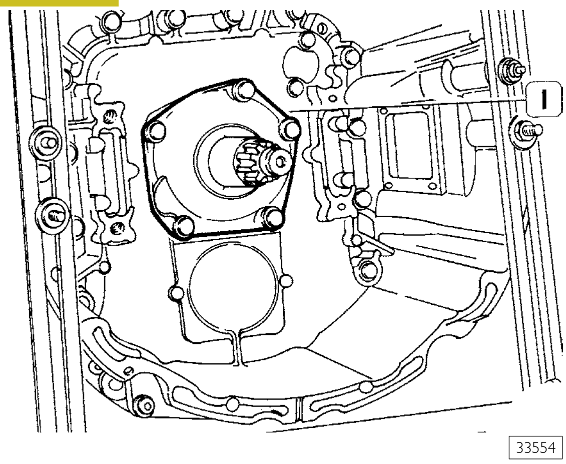
Assemble reaction bar 99370317 (1), motion outlet flange locking nut (3), wrench 99355081 (2) and tighten the locking nut at the required torque.

Figure 46



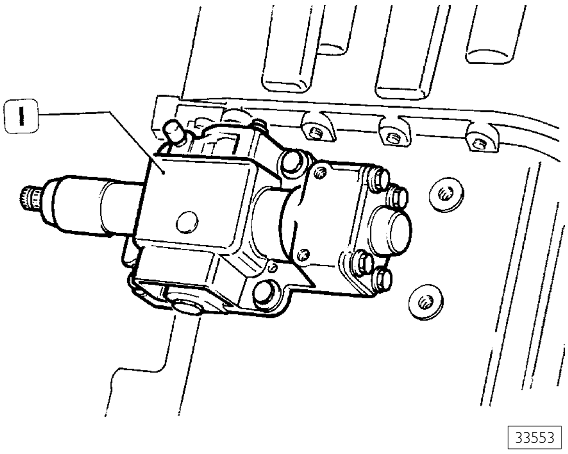
Lock motion outlet flange rotation with bar 99370317, engage a gear and with wrench 99355174 (1) tighten the ring nut on motion inlet shaft at the required torque.

Figure 47



Assemble cover (1), completed with sealing gasket, on motion inlet shaft and tighten securing screws at the required torque. Assemble clutch disengagement lever and tighten securing screws at the required torque.

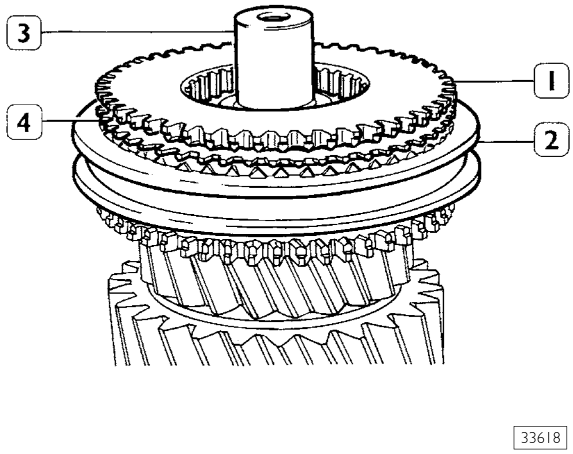
Figure 48



Assemble the complete external control box (1).
Insert lubrication oil in the required amount, after about 20 min from application of LOCTITE 510 sealant.
Remove gearbox from rotating stand.

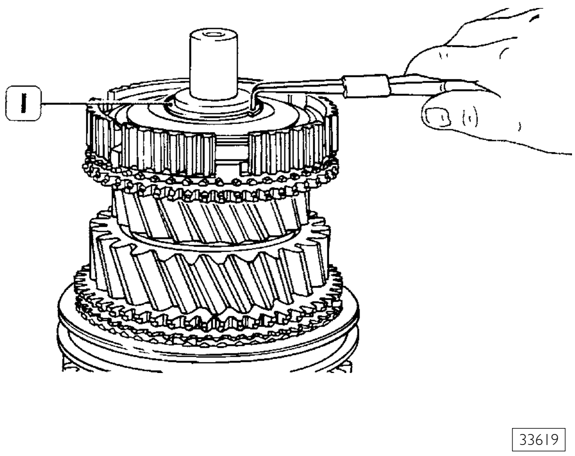
PRIMARY SHAFT DISASSEMBLY

Figure 49



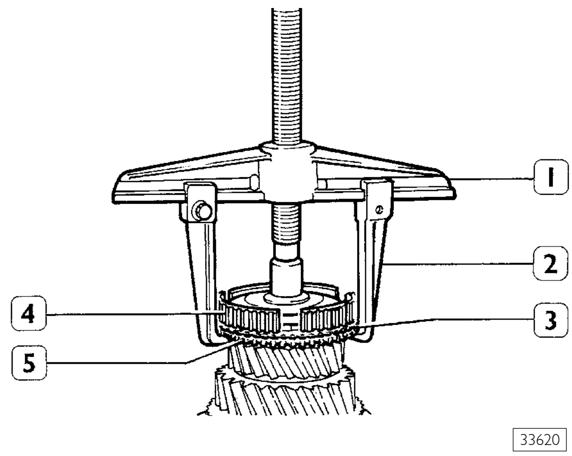
Tighten primary shaft (3) in a clamp. Remove coupling body (1), 6th speed synchronising ring (4) and sliding sleeve (2) for 5th and 6th speed gears, recovering check springs and rollers.

Figure 50



Remove elastic ring (1).

Figure 51



With extractor 99341003 (1) and brackets 99341009 (2), remove fixed 5th and 6th speed hub (4) together with synchronising ring (3) and 5th speed coupling body (5).

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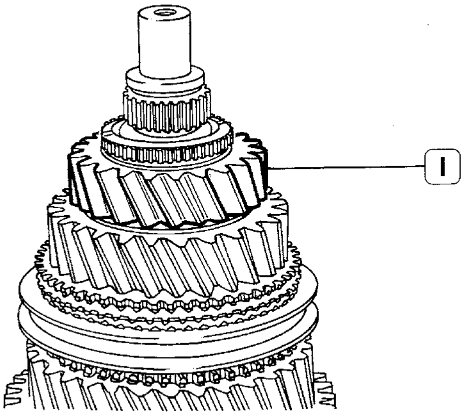
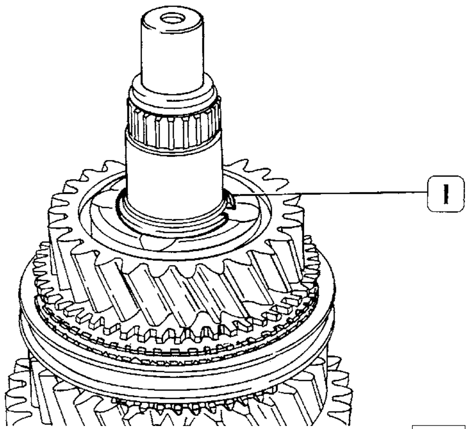
Figure 52



33621

Remove 5th speed gear (1) and roller bearing below it.

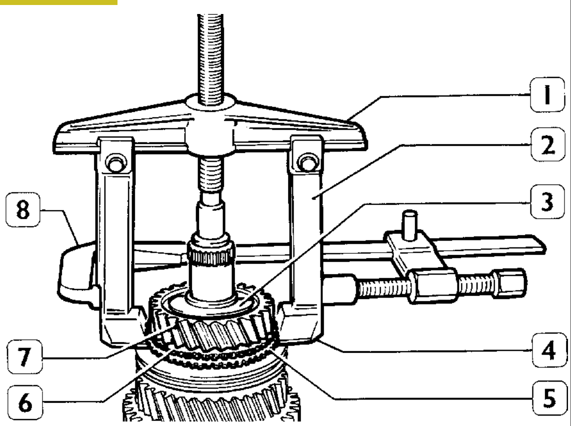
Figure 53



33622

Remove elastic ring (1).

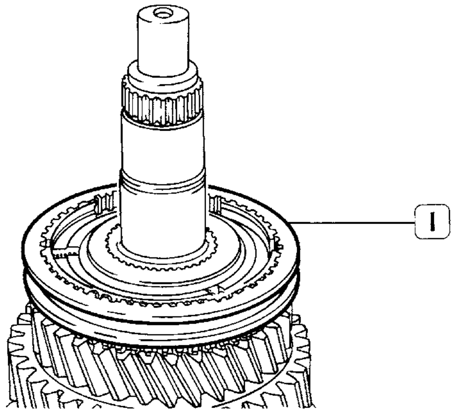
Figure 54



33623

Remove 4th speed gear (7) together with roller bearing and bush (3) and coupling body (6) with holds 99341025 (4), tie–rods 99341019 (2), bridge 99341003 (1) and clamp 99341015 (8). Remove synchronising ring (5).

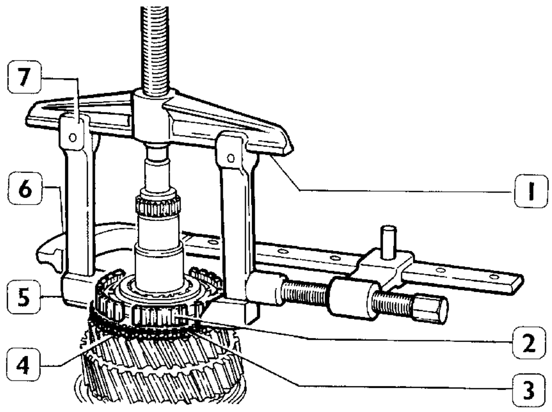
Figure 55



33624

Remove 3rd and 4th gear sliding sleeve (1) recovering check springs and rollers.

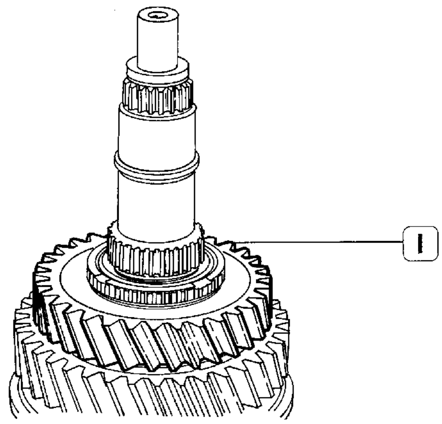
Figure 56



33625

Extract 3rd and 4th speed fixed hub (2) and 3rd speed synchronising ring with holds 99341025 (5), tie–rods 99341019 (7), bridge 99341003 (1) and clamp 99341015 (6). Remove 3rd speed coupling body (4).

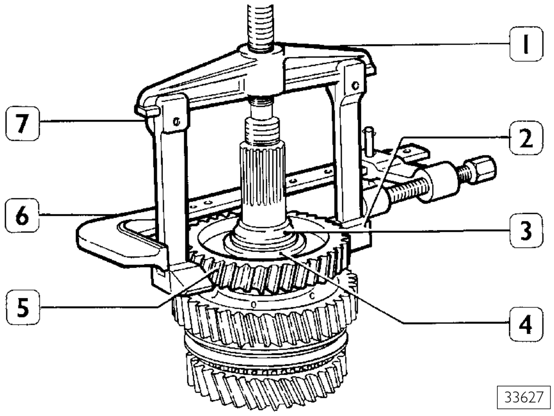
Figure 57



33626

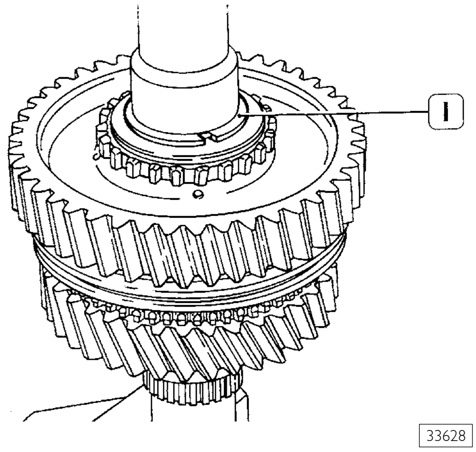
Remove 3rd speed gear (1) and roller bearing below it.

Figure 58



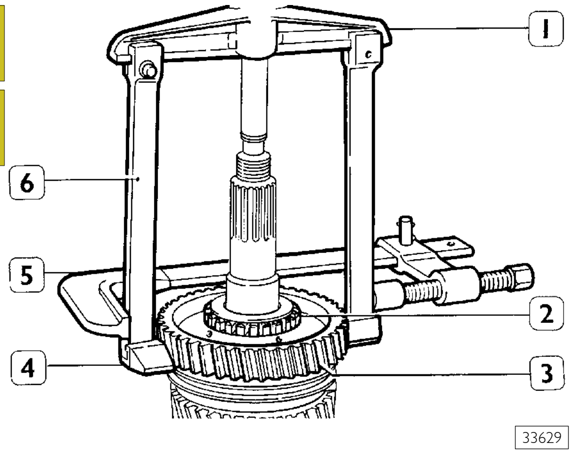
Turn the shaft over and extract reverse gear (5) with roller bearing below it, shoulder ring (4) and rolling half–race (3) with holds 99341025 (2), tie–rods 99341019 (7), bridge 99341003 (1) and clamp 99341015 (6).

Figure 59



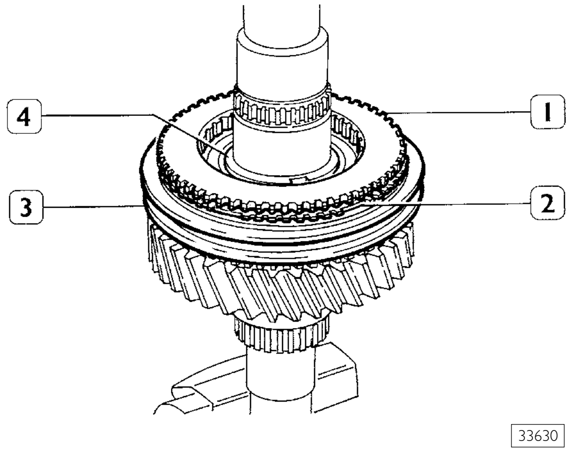
Remove elastic ring (1).

Figure 60



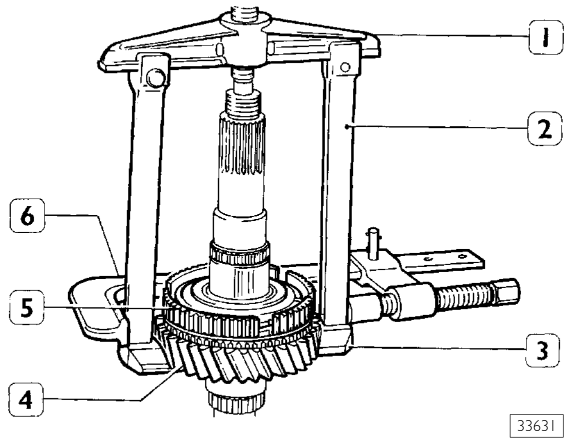
Extract 1st speed gear (3) together with roller bearing and fixed sleeve (2) for reverse gear with holds 99341023 (4), tie–rods 99341020 (6), bridge 99341003 (1) and clamp 99341015 (5).

Figure 61



Remove coupling body (1), synchronising ring (2), elastic ring (4) and sliding sleeve (3) for 1st and 2nd speed gears recovering rollers and springs.

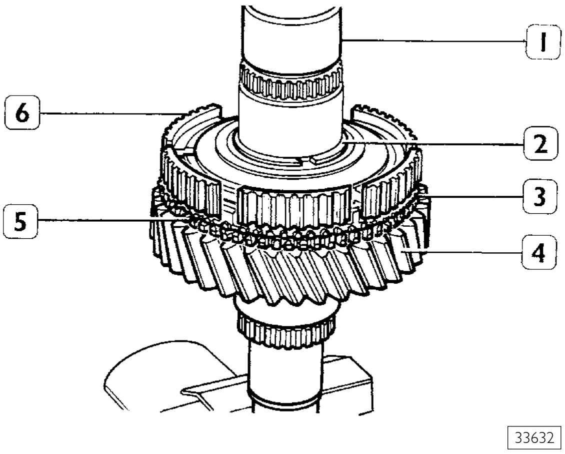
Figure 62



Extract 2nd speed (4) with roller bearing, coupling body, synchronising ring and 1st and 2nd speed fixed sleeve (5) with holds 99341023 (3), tie–rods 99341020 (2), bridge 99341003 (1) and clamp 99341015 (6).

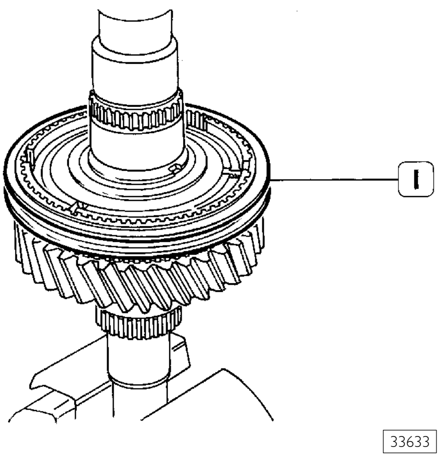
PRIMARY SHAFT ASSEMBLY

Figure 63



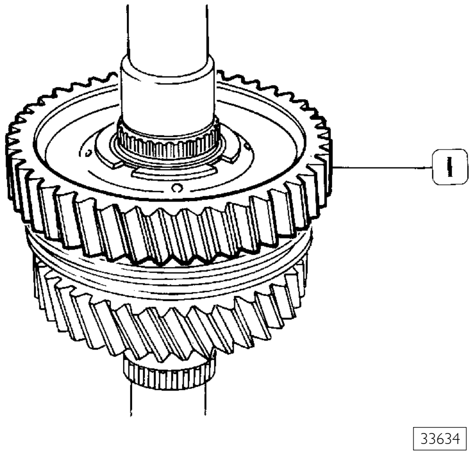
Assemble on primary shaft (1) 2nd speed gear (4), coupling body (5) and synchronising ring (3).
Heat fixed hub (6) for 1st and 2nd speed gears at a temperature of 100 °C to 130 °C and assemble it on primary shaft (1) with the internal diameter chamfering facing the opposite part of 2nd speed gear.
When keying the hub, pay attention that synchronising ring tangential stops are inserted into respective hub seats. Assemble elastic ring (2) with an apporpriate thickness so that the fixed hub has no axial clearance (max allowed 0.03 mm).

Figure 64



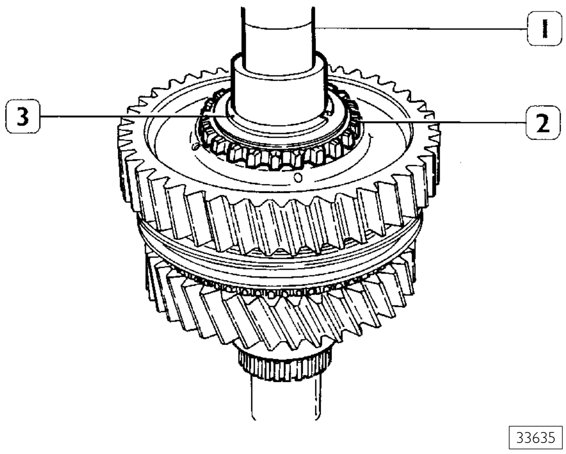
Assemble sliding sleeve (1) for 1st and 2nd speed gears, springs and rollers in fixed hub seats. Assemble synchronising ring and coupling body for 1st speed gear.

Figure 65



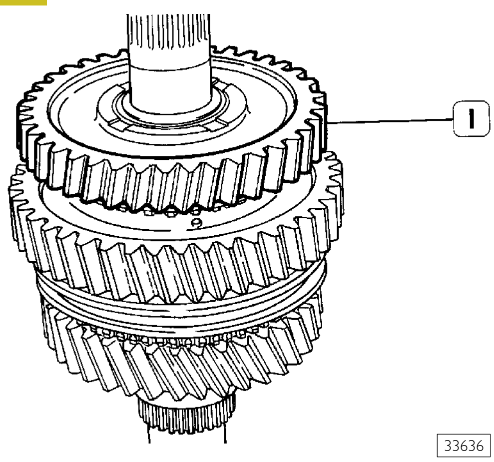
Assemble roller bearing and 1st speed gear (1).

Figure 66



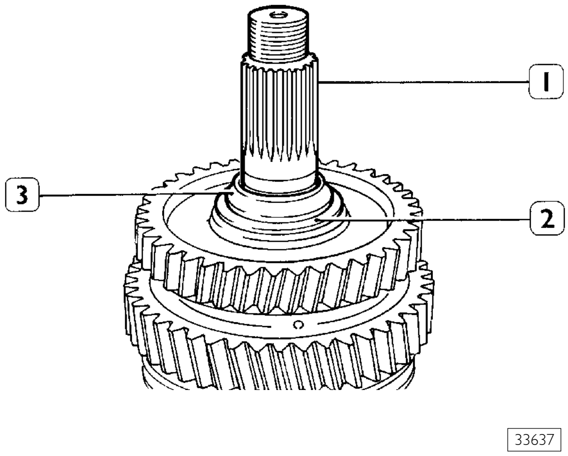
Heat at a temperature of 100 °C to 130 °C fixed hub (2) for reverse gear and assemble it on primary shaft (1); asemble elastic ring (3).

Figure 67



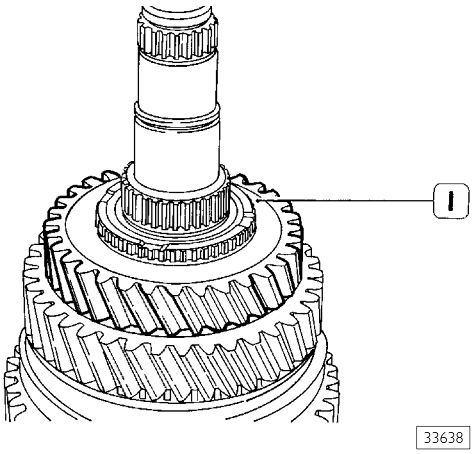
Assemble roller bearing and reverse gear (1).

Figure 68



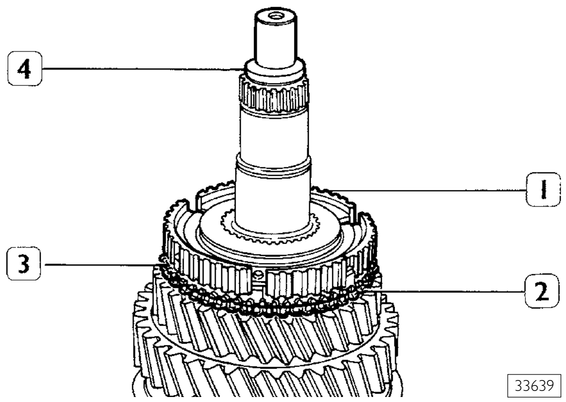
Assemble shoulder ring (2).
Slightly heat ball bearing rolling half–race (3) and assemble it on primary shaft (1).

Figure 69



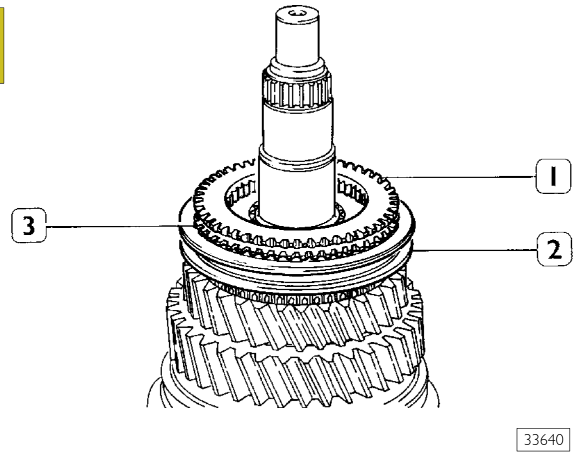
Turn the shaft over in a clamp, assemble roller bearing and 3rd speed gear (1).

Figure 70



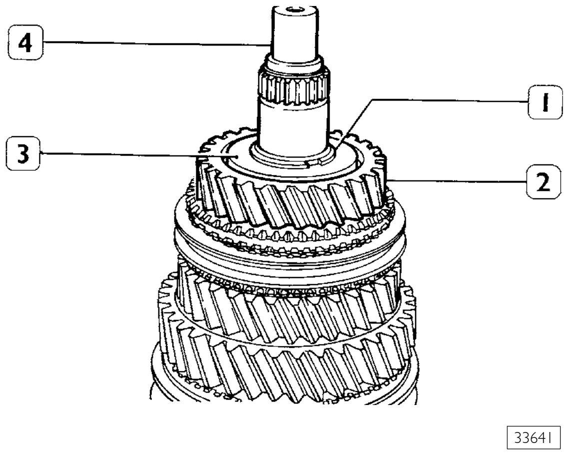
Assemble coupling body (2) and synchronising ring (3). Heat fixed hub (1) at a temperature of 100 °C to 130 °C and assemble it on shaft (4) paying attention that synchronising ring tangential stops are inserted into respective hub seats.

Figure 71



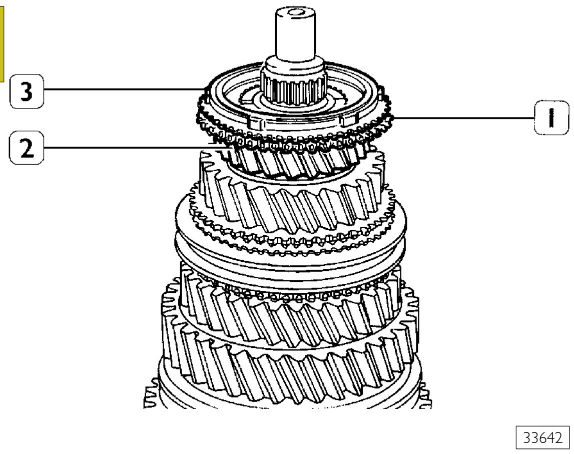
Assemble sliding sleeve (2) for 3rd and 4th speed gears, springs and rollers into fixed hub seats. Assemble synchronising ring (3) and coupling body (1) for 4th speed gear.

Figure 72



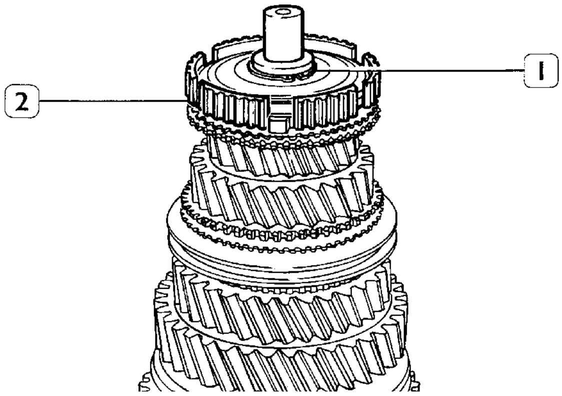
Assemble roller bearing and 4th speed gear (2). Heat bush (3) at a temperature of 100 °C to 130 °C, and assemble it on primary shaft (4). Assemble elastic ring (1).

Figure 73



Assemble roller bearing, 5th speed gear (2), coupling body (1) and synchronising ring (3) for 5th speed gear.

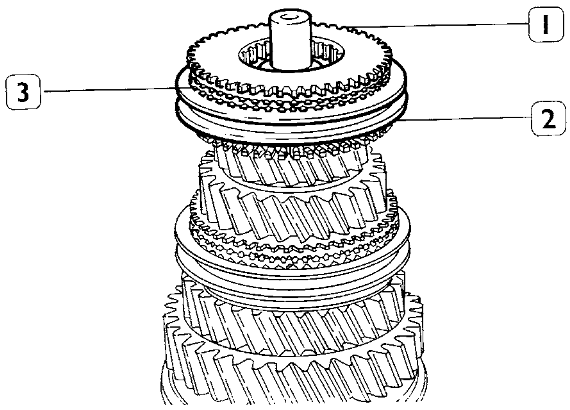
Figure 74



33643

Heat fixed hub (2) for 5th and 6th speed gears, at a temperature of 100 °C to 130 °C, and assemble it on secondary shaft (3) with its chamfering facing 5th speed gear. When keying the hub pay attention that synchronising ring tangential stops are inserted into respective hub seats.
Assemble elastic ring (1) with a suitable thickness so that the fixed hub has no axial clearance (max allowed 0.03 mm).

Figure 75

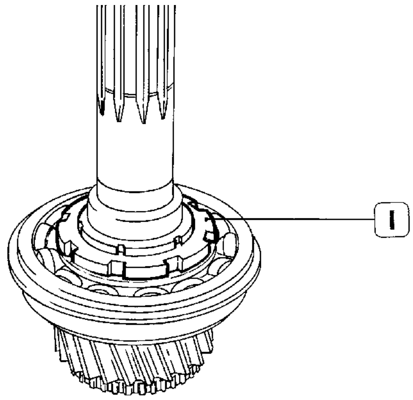


33644

Assemble sliding sleeve (2) for 5th and 6th speed gears, springs and rollers. Assemble synchronising ring (3) and coupling body (1) for 6th speed gear.

MOTION ENTRY SHAFT DISASSEMBLY

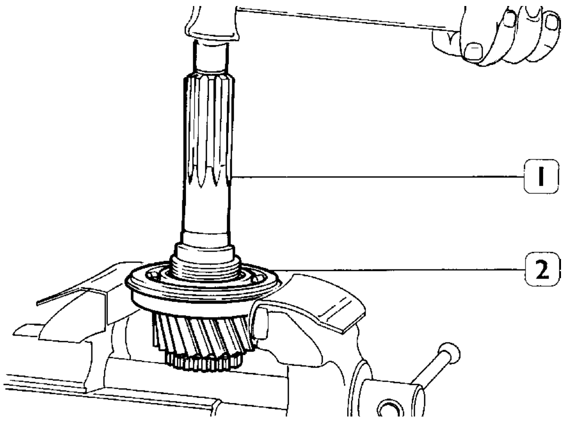
Figure 76



33645

Unscrew ring nut (1).

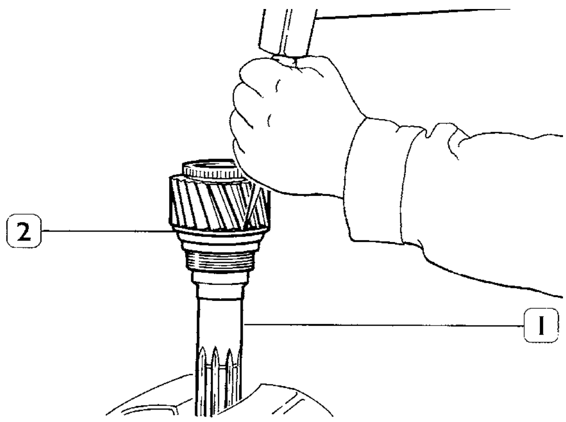
Figure 77



33646

Abut bearing (2), motion entry shaft (1) on a clamp and by beating the shaft extract ball roller bearing (2) and a rolling half–race of motion entry shaft (1).

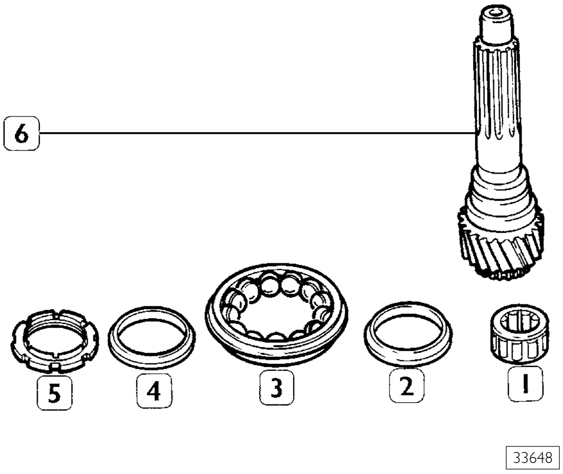
Figure 78



33647

Extract the other rolling half–race (2) from motion entry shaft (1) with a suitable punch.

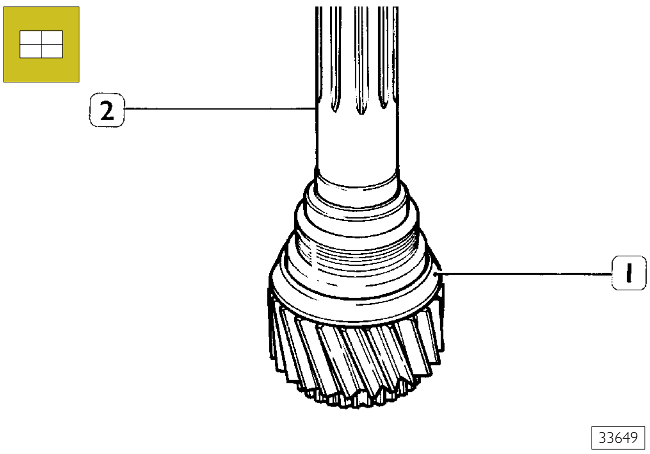
Figure 79



PARTS COMPOSING THE MOTION ENTRY SHAFT
1. Cylindrical roller bearing – 2. Rolling hald–race – 3. Ball bearing – 4. Rolling half–race – 5. Ring nut – 6. Motion entry shaft

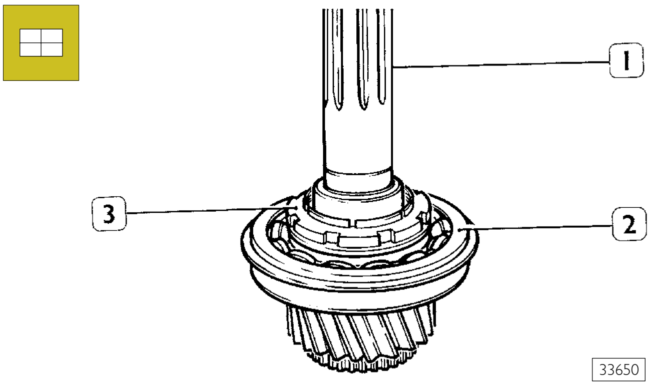
MOTION ENTRY SHAFT ASSEMBLY

Figure 80



Slightly heat rolling half–race (1) and assemble it on motion entry shaft (2).

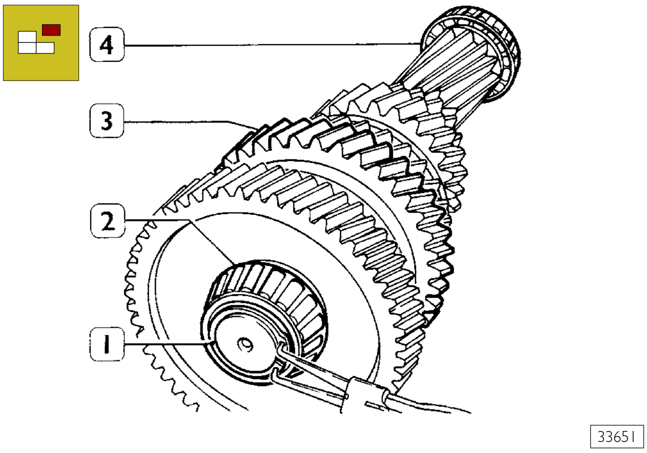
Figure 81



Assemble ball roller bearing (2); heat the other rolling half–bearing and assemble it on motion entry shaft (1). Temporarily screw ring nut (3).

SECONDARY SHAFT DISASSEMBLY

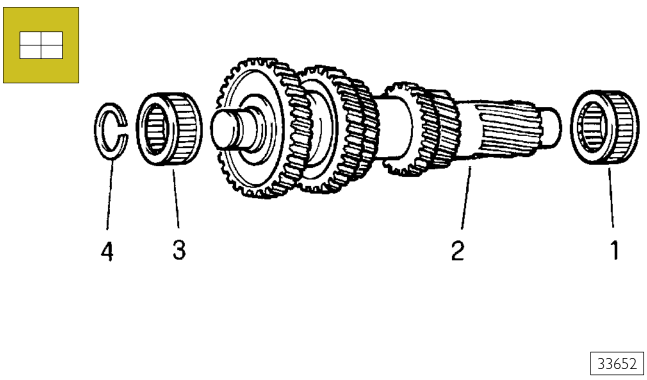
Figure 82



Remove elastic ring (1) from secondary shaft (3), and extract tapered roller bearings (2 and 4) with a suitable punch (destructive operation).

SECONDARY SHAFT ASSEMBLY

Figure 83



Slightly heat tapered roller bearings (1 and 3) and assemble them on secondary shaft (2). Assemble elastic ring (4).

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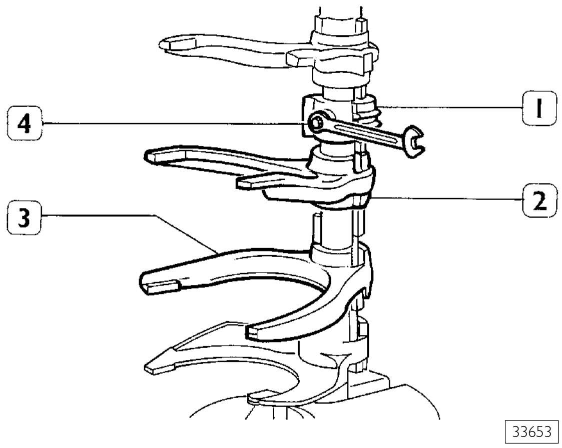
INTERNAL CONTROL SHAFT DISASSEMBLY

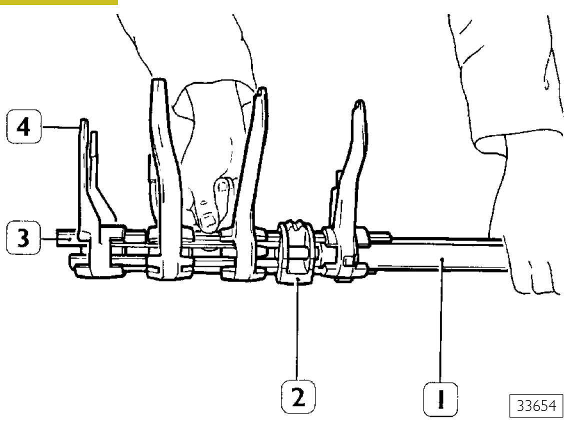
Figure 84



Mark fork (3) assembly position. Unscrew screw (4) and withdraw all forks (3) together with fork positioning rods (2) and hub (1).

INTERNAL CONTROL SHAFT ASSEMBLY

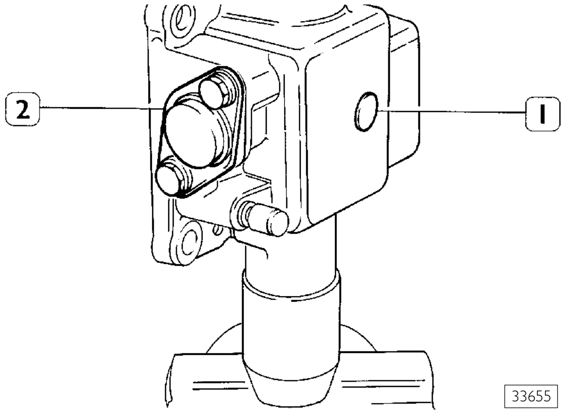
Figure 85



Place on a bench forks (4) and hub (2) according to the position marked upon disassembling. Place the two rods (3) inside fork holes and insert drive shaft (1). Tighten hub screw (2) at the required torque.

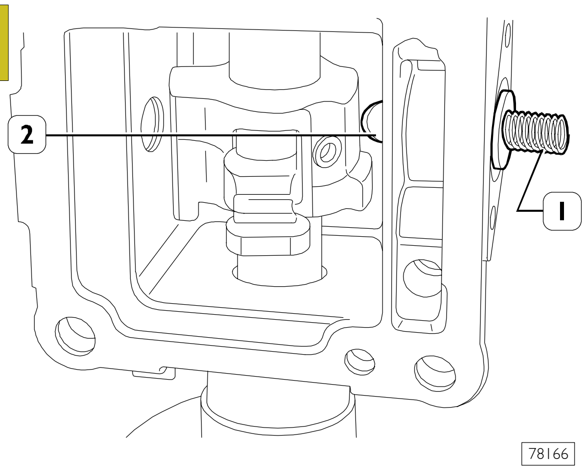
EXTERNAL CONTROL SHAFT DISASSEMBLY

Figure 86



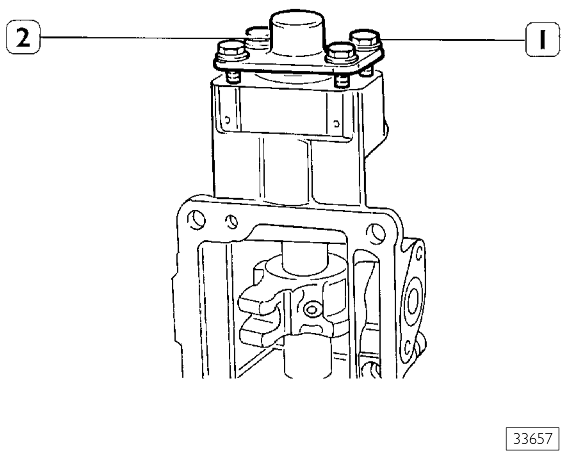
Tighten the shaft going out of the box in a clamp, remove plug (1) and disassemble cover (2).

Figure 87



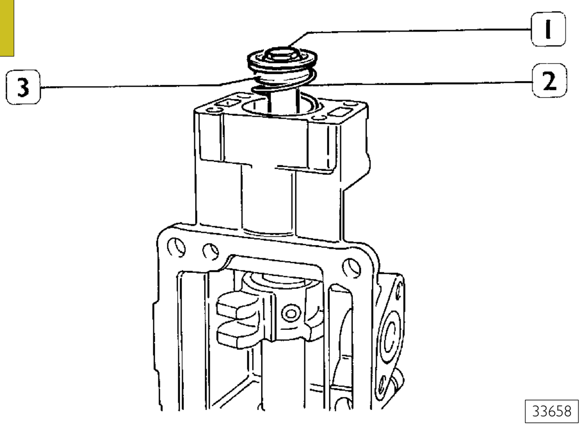
Remove control box pin (2) and spring (1).
Do not mix removed elements with those of the anti–release push rod.

Figure 88



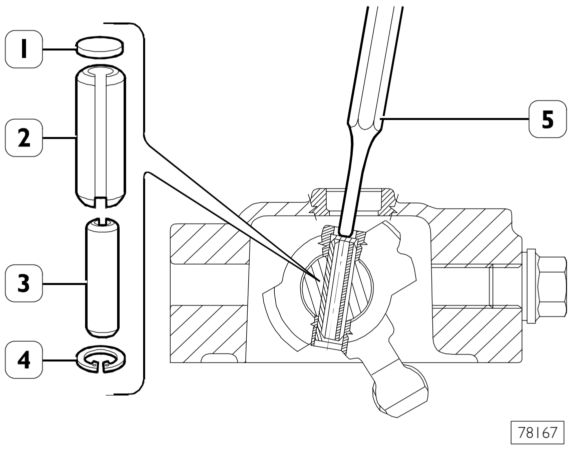
Unscrew screws (1) and disassemble cover (2).

Figure 89



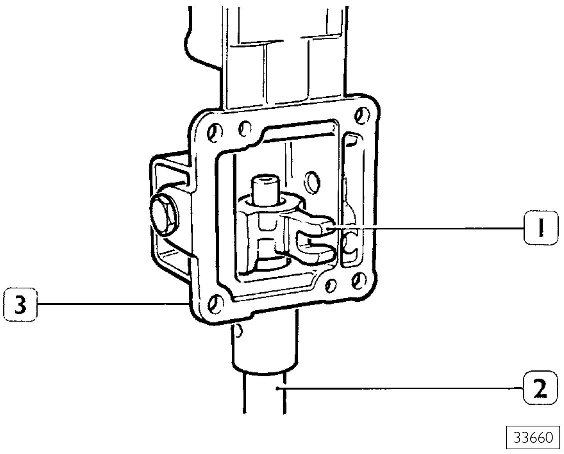
Unscrew screw (1) and remove spacer, upper cup (3) and spring (2). Remove lower cup.

Figure 90



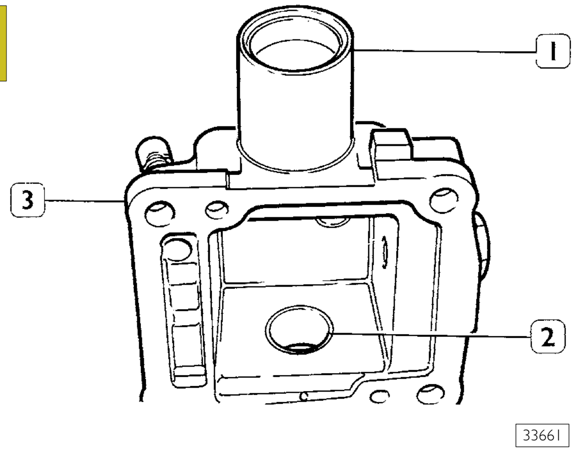
Remove the snap ring (4) and use a punch tool (5) having the right diameter to push the extraction washer (1) and remove flexible plugs (2) and (3).

Figure 91



Extract, from the control shaft (2), control selector (1) and box (3).

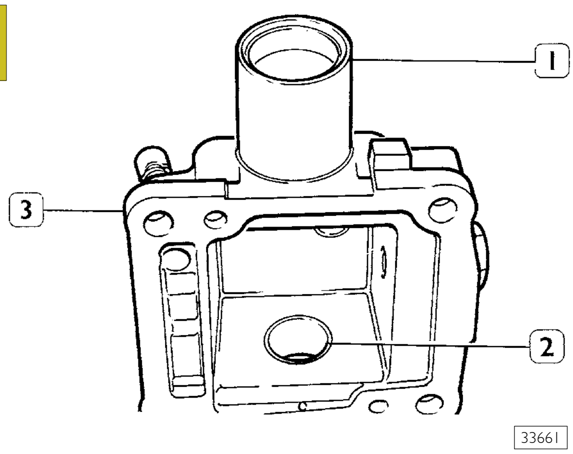
Figure 92



Extract, from the control box (3), sealing gasket (1) and bushes (2) with a suitable beater.

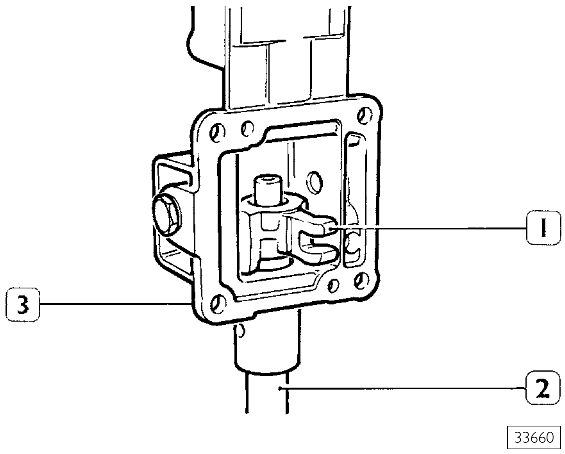
EXTERNAL CONTROL BOX ASSEMBLY

Figure 93



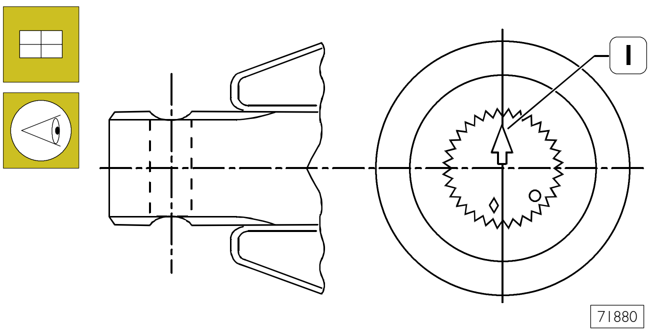
Assemble, in control box (3), sealing gasket (1) and bushes (2) with a suitable beater.

Figure 94



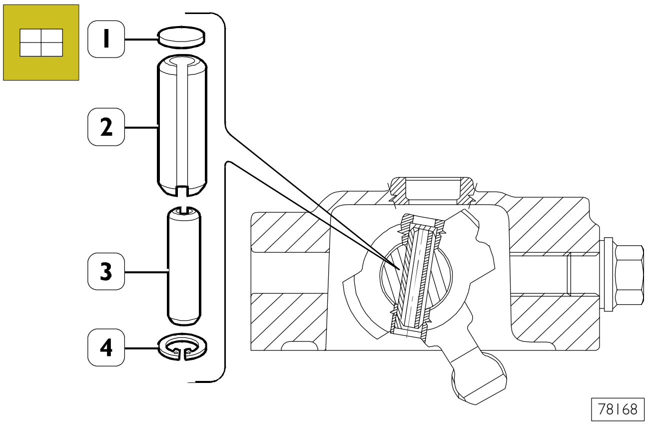
Tighten control shaft (2) in a clamp and assemble thereon box (3) and control selector (1).

Figure 95



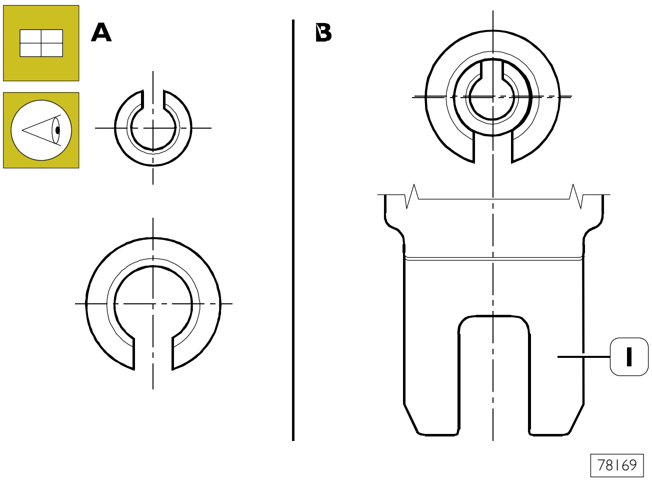
NOTE Upon assembling, the drive shaft must be assembled with the reference arrow (1) facing upwards.

Figure 96



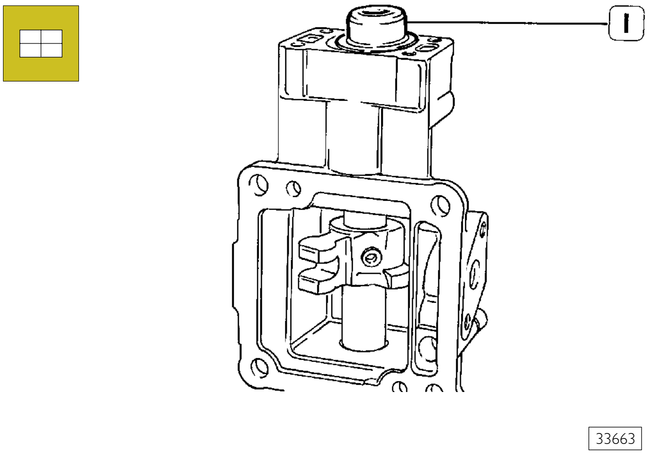
Insert the extraction washer (1) and use a punch tool having the right diameter to install the first plug (2). Install the second plug (3) and the snap ring (4).

Figure 97



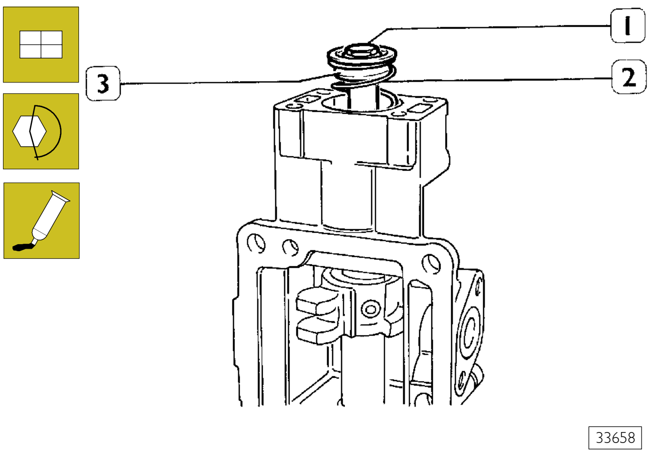
NOTE During installation, plug cuts shall be opposed by 180° (see detail A).
The bigger plug cut shall face the control selector (1) milled area (see detail B).

Figure 98



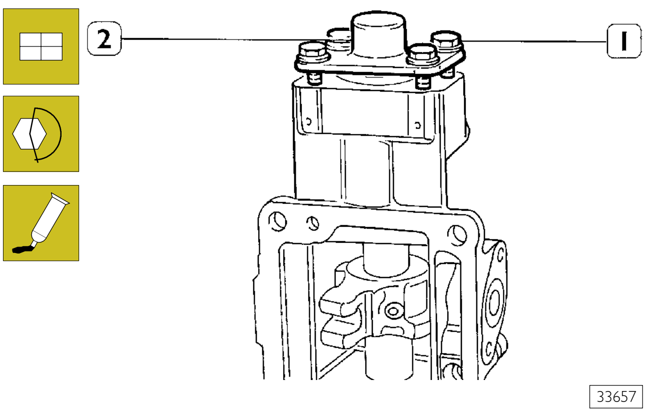
Assemble lower cup (1).

Figure 99



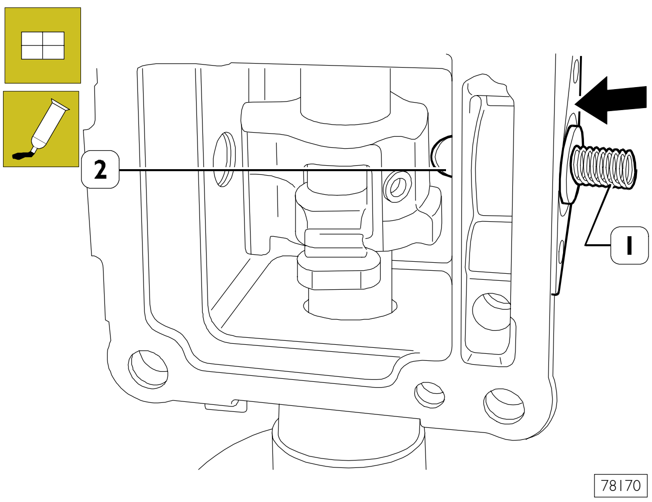
Install the spring (2), the upper cap (3), the spacer and the screw (1) and apply threading sealer LOCTITE 270 on the screw itself.
Tighten the screw (1) to 30 Nm (3.1 kgm).

Figure 100



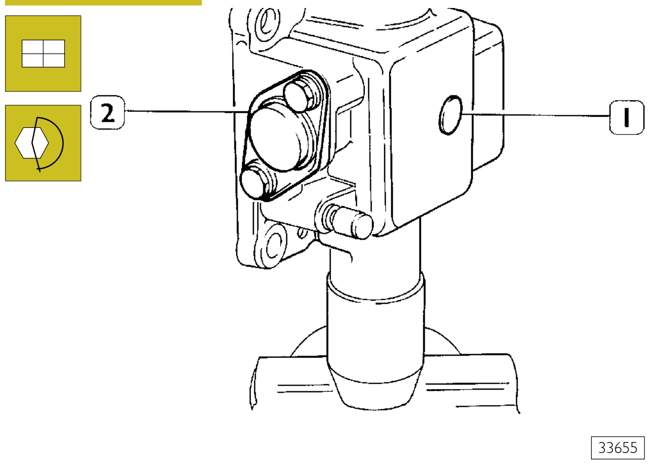
Clean joining surfaces of control box and cover (2) and apply "LOCTITE 510" adhesive on one of the two components. Assemble cover (2) and tighten screws (1) at a torque of 36.5 Nm (3.7 kgm).
Apply threading sealer LOCTITE 270 on the screws (1).

Figure 101



Install the pin (2), the spring (1) and apply sealer "LOCTITE 518" (→).

Figure 102

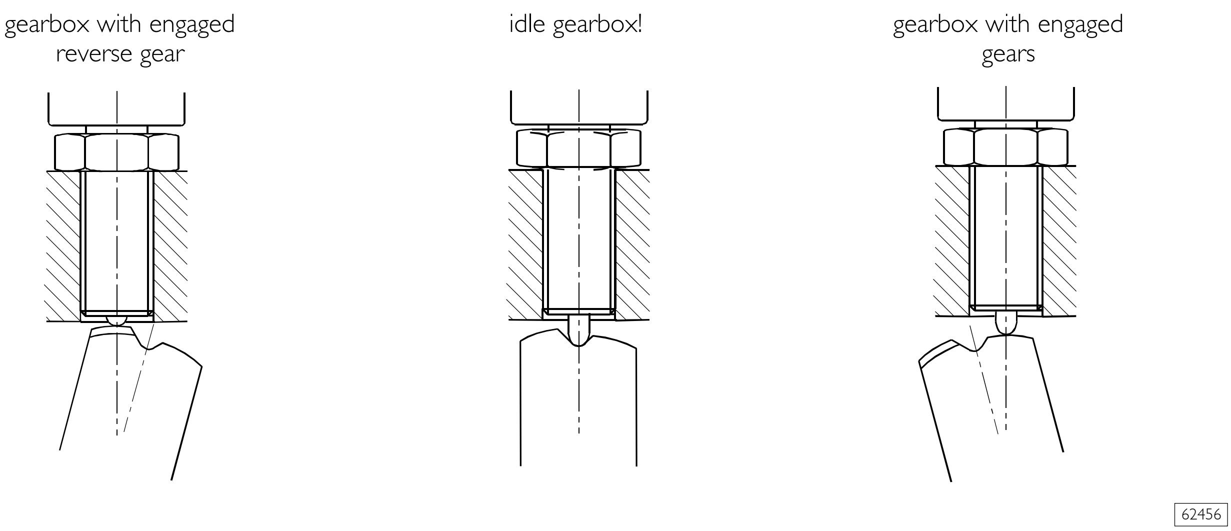


Install the cover (2) and tighten the screws to 19 Nm (1.9 kgm). Apply sealer "LOCTITE 675" and refit the plug (1).

Idle–R.M. switch adjustment

NOTE The below–described sequence must be compulsorily complied with.

Figure 103



SWITCH ENGAGEMENT POSITIONS

For switch adjustment, it is necessary to carry out the following operations:

- apply silicone sealant on the threading;
- set gearbox in engaged reverse gear position;
- screw the switch till the reverse motion lamp turns on;
- screw again the switch by 45–60° corresponding to a stroke of 0.19–0.25 mm;
- tighten securing lock nut with a 24 wrench at a torque of 35 Nm.

5302 Gearbox 2870S.9

DESCRIPTION

Gear–box 2870S.9 is a nine–gear mechanic type gear–box with 1st, 4th, 5th, 8th and 9th gears engaged by free ring synchronising rings, 2nd, 3rd, 6th and 7th gears by double cone synchronising ring.

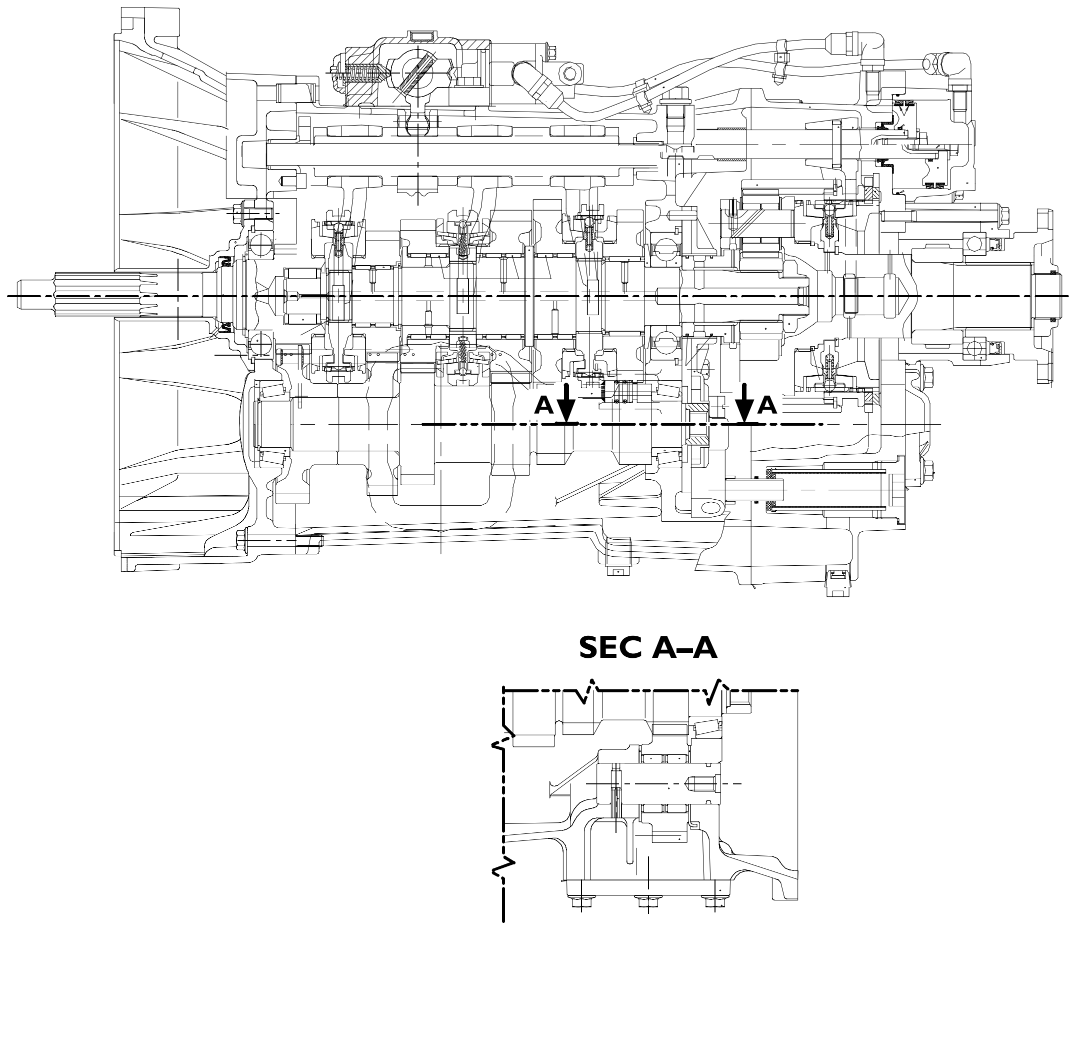
The reverse gear engagement is with quick–engagement sliding sleeve.

It is composed of a front section, comprising five ratios and reverse gear, and of a rear section comprising two ratios obtained through epicyclic reduction gear.

The gear switch is carried out mechanically through double–"H" control; the epicyclic reduction gear engagement is carried out mechanically with pneumatic switching.

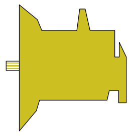
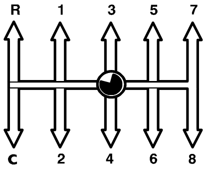
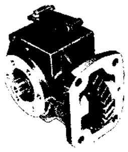
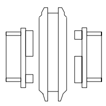
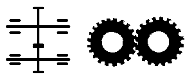
The gearbox is equipped with an oil pump for its lubrication.

Figure 1



2870S.9 GEARBOX LONGITUDINAL SECTION AND REVERSE GEAR SHAFT SECTION

SPECIFICATIONS AND DATA

	GEARBOX	2870S.9
	Type	Mechanical
	Gears	9 forward gears and reverse gear
	Gears engagement control	Mechanical
	Power takeoff	Upon request
	Gears engagement: 1st 2nd – 3rd 4th – 5th 6th – 7th 8th – 9th Reverse gear Gears anti–disen-gagement	 Free ring synchronising gear Double cone synchronising gear Free ring synchronising gear Double cone synchronising gear Free ring synchronising gear Quick–connection type Sliding sleeve holding through rollers and springs.
	Gears	With helical teeth
	Gear ratio First Second Third Fourth Fifth Sixth Seventh Eighth Ninth Reverse gear	 1 : 13.200 1 : 9.036 1 : 6.473 1 : 4.691 1 : 3.548 1 : 2.547 1 : 1.824 1 : 1.322 1 : 1.000 1 : 11.650

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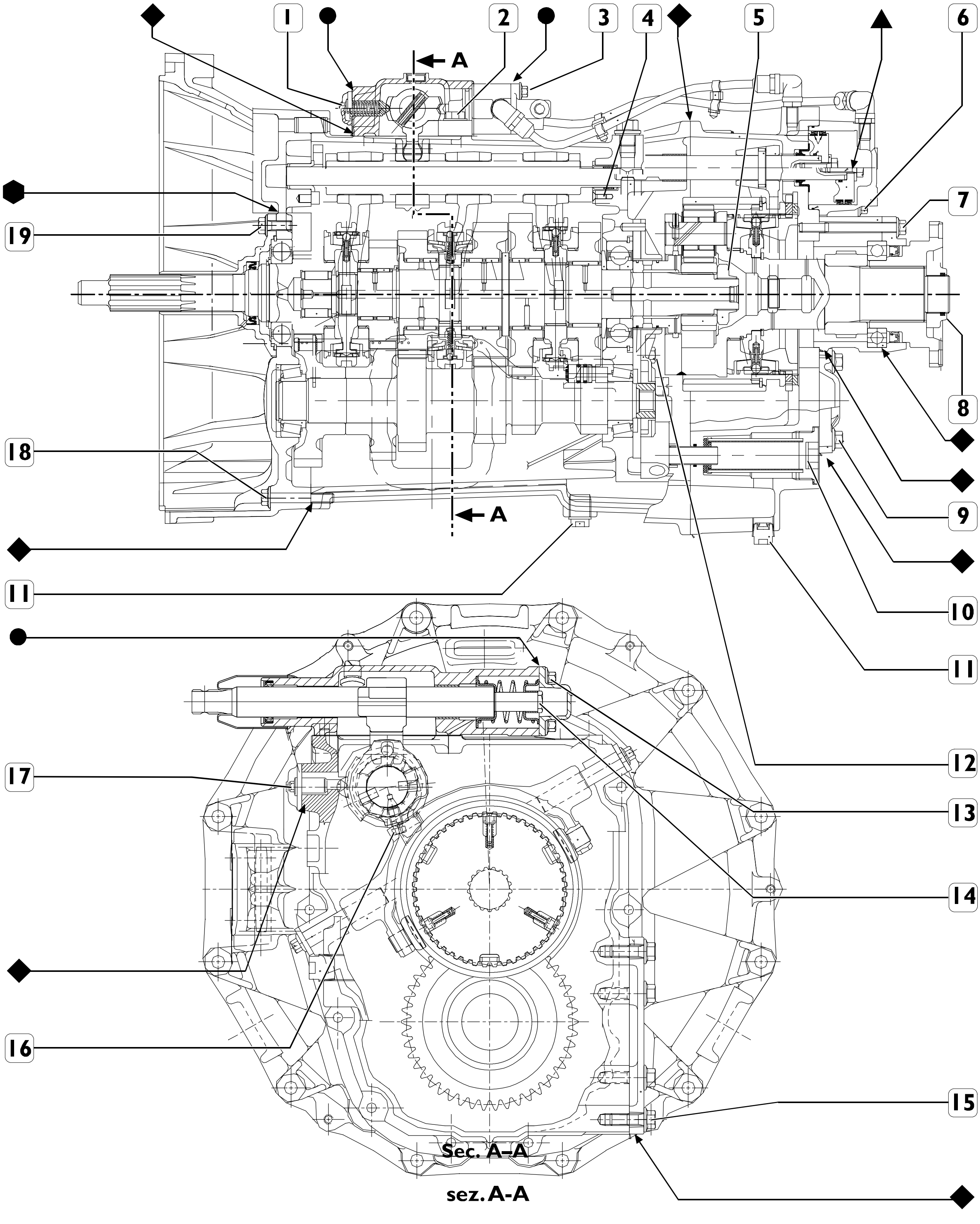
SPECIFICATIONS AND DATA

	Oil type Amount	**TUTELA ZC 90** 4.5 Kg. (5lt)
	Fixed hubs assem-bly temperature	100 °C to 130 °C
	Secondary shaft bearings	With tapered rollers
	Secondary shaft bearings pre–loading adjustment	Through rings
	Secondary shaft pre–loading adjustment rings thickness	2.5 – 2.7 – 2.8 – 2.9 – 3.1 – 3.2 3.3 – 3.4 – 3.5 – 3.6 – 3.7 – 3.8 Supplied in a kit
	Secondary shaft bearings assembly temperature	85 °C
	Motion entry shaft bearings adjusting rings thicknesses	2.40 – 2.45 – 2.50 – 2.55 – 2.60 – 2.65 – 2.70 – 2.75 – 2.80

Figure 2

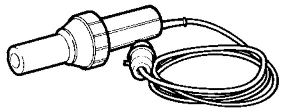
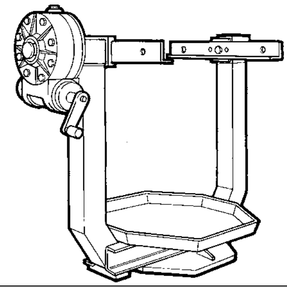
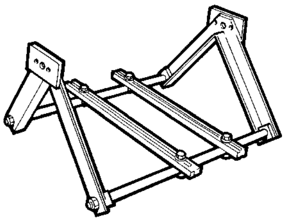
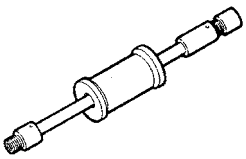
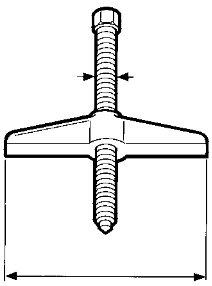
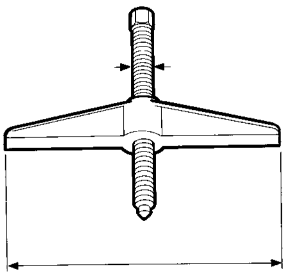


TIGHTENING TORQUES

PART		TORQUE	
		Nm	(kgm)
1	Flanged hexagonal head screw for securing spring check flange on external control	19 ± 2	(1.9 ± 0.2)
2	Flanged hexagonal head screw for securing upper external control support cover	33.5 ± 3.5	(3.4 ± 0.4)
3	Screw for securing reduction gear control valve	23.5 ± 2.5	(2.5 ± 0.3)
4	Ring nut for securing sun gear on primary shaft	372.5 ± 19.5	(38 ± 2)
5	Flat–head screw with TORX mark to secure rib washer *	9.5 ± 0.5	(0.96 ± 0.05)
6	Flanged hexagonal head screw for securing pneumatic reduction gear control cylinder to rear half–case	35.5 ± 3.5	(3.6 ± 0.4)
7	Flanged hexagonal head screw for securing rear cover on primary shaft	44.5 ± 4.5	(4.4 ± 0.5)
8	Output flange locking ring nut on planetary gear–holder shaft	559.5 ± 29.5	(57 ± 3)
9	Flanged hexagonal head screw for securing read cover on secondary shaft	58 ± 6	(5.9 ± 0.6)
10	Oil filter on half–case	320 ± 30	(32.6 ± 3.1)
11	Threaded plug with external manoeuvre hexagon for oil discharge	27.5 ± 2.5	(2.8 ± 0.3)
12	Hexagonal head screw for securing oil pump body to case	33.5 ± 3.5	(3.4 ± 0.4)
13	Flanged hexagonal head screw for securing transverse axle cover on drive *	19 ± 2	(1.9 ± 0.2)
14	Transverse axle screw *	30 ± 3	(3.1 ± 0.3)
15	Flanged hexagonal head screw for securing covers on side power takeoff connection windows	38 ± 4	(3.9 ± 0.4)
16	Screw for securing fork control rod hub	39 ± 2	(4.0 ± 0.2)
17	Idle positioner	78 ± 8	(8.0 ± 0.8)
18	Flanged hexagonal head screw for joining clutch cup and case	45.5 ± 4.5	(4.6 ± 0.6)
19	Flanged hexagonal head screw for securing front cover 1st step	20 ± 1	(2 ± 0.1)
	2nd step	25°	
–	Flanged hexagonal head screw for securing clutch disengagement lever support	46.5 ± 4.5	(4.6 ± 0.4)
–	Oval–headed screw for securing reduction gear reaction plate	21 ± 2	(2.1 ± 0.2)
–	Threaded plug with external manoeuvre hexagon for oil level	27.5 ± 2.5	(2.8 ± 0.3)
–	Flanged hexagonal head screw for securing upper internal controls cover (only for right–hand drive)	45.5 ± 4.5	(4.6 ± 0.5)

* Apply thread–braking LOCTITE 270 on the screw
◆ Apply liquid gasket LOCTITE 510 sealant
▲ Apply thread–braking LOCTITE 242 sealant
● Apply liquid gasket LOCTITE 518 sealant.
⬢ Apply LOCTITE 5910 sealant ‘liquid seal’ (Elipress).

TOOLS

TOOL No.		DESCRIPTION
99305121		Hot–air equipment
99322205		Revolving stand for overhauling units (capacity 1000 daN, couple 120 daN/m)
99322225		Unit bearing support (to be applied to stand 99322205)
99340205		Percussion puller
99341003		Single acting puller
99341004		Single acting puller

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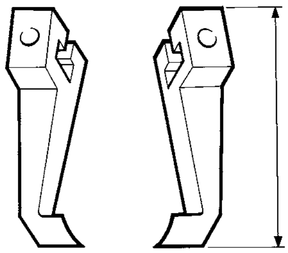
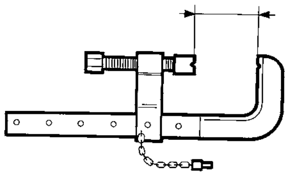
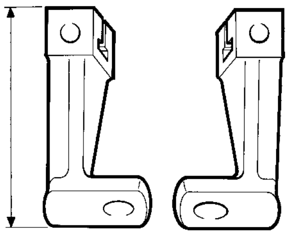
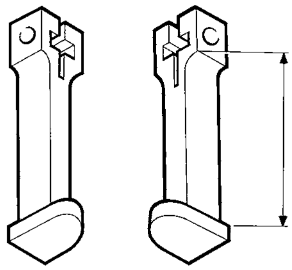
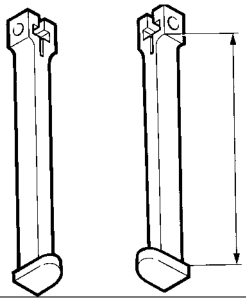
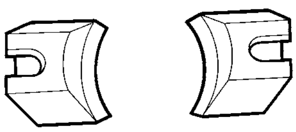
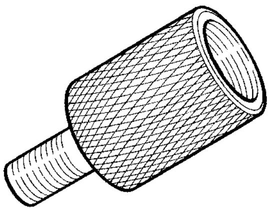
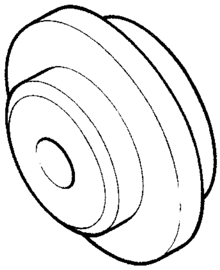
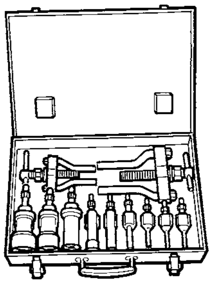
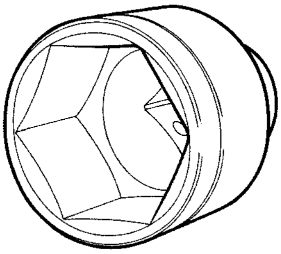
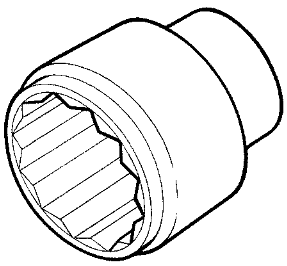
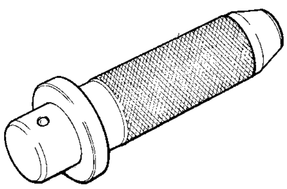
TOOLS

TOOL No.		DESCRIPTION
99341009		Pair of brackets
99341015		Clamp
99341017		Pair of brackets with hole
99341019		Pair of tie rods for grips
99341020		Pair of tie rods for grips
99341025		Grips

TOOLS

TOOL No.		DESCRIPTION
99342143		Peg for removing reverse gear shaft (to use with 99340205)
99345058		Thrust block for pullers
99348004		Universal extractor for interiors 5 to 70 mm
99355081		Bush for disassembling and assembling motion outlet flange nut (use with 99370317)
99355131		Wrench (55 mm) for gearbox sun gear retaining nut
99370006		Handle for interchangeable beaters

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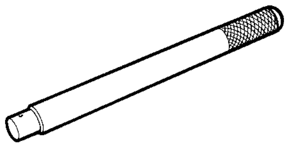
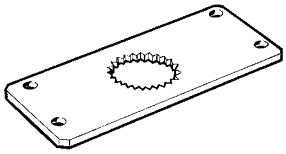
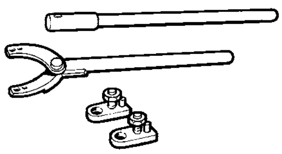
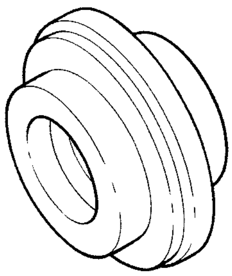
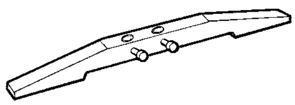
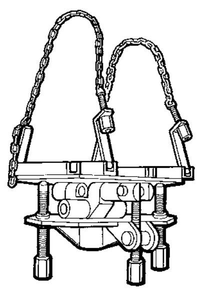
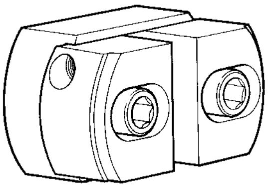
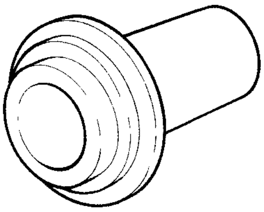
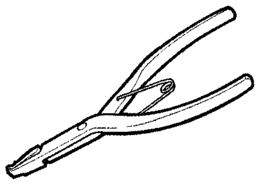
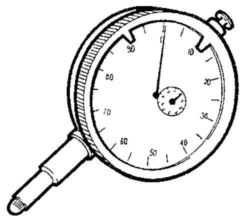
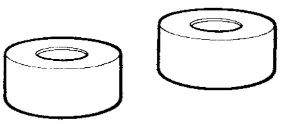
TOOLS

TOOL No.		DESCRIPTION
99370007		Handle for interchangeable beaters
99370130		Tool for holding the sun gear during nut removal and refitting
99370317		Reaction lever with extension for retaining flanges
99370349		Tool for fitting gasket on gearbox front cover (to use with 99370006)
99370466		Gauge base for transmission shaft bearing adjustment (to use with 99395604)
99370629		Support for holding gearbox during removal and refitting from/on vehicle

TOOLS

TOOL No.		DESCRIPTION
99374092		Beater for outer bearing race assembling (69–91) (use with 99370007)
99374229		Tool for refitting gasket on gearbox rear cover
99381125		Pliers for removing gearbox split rings
99395604		Comparator (0 : 10 mm)
99396031		Gauged rings for adjusting transmission shaft bearings (to use with 99370466)

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GEARBOX 2870S.9 DISENGAGEMENT/RE–ENGAGEMENT

Before carrying out disengagement/re–engagement operations, disconnect battery cables and place the vehicle under safety conditions.

Disengagement

Lift the calender and turn the cabin over.

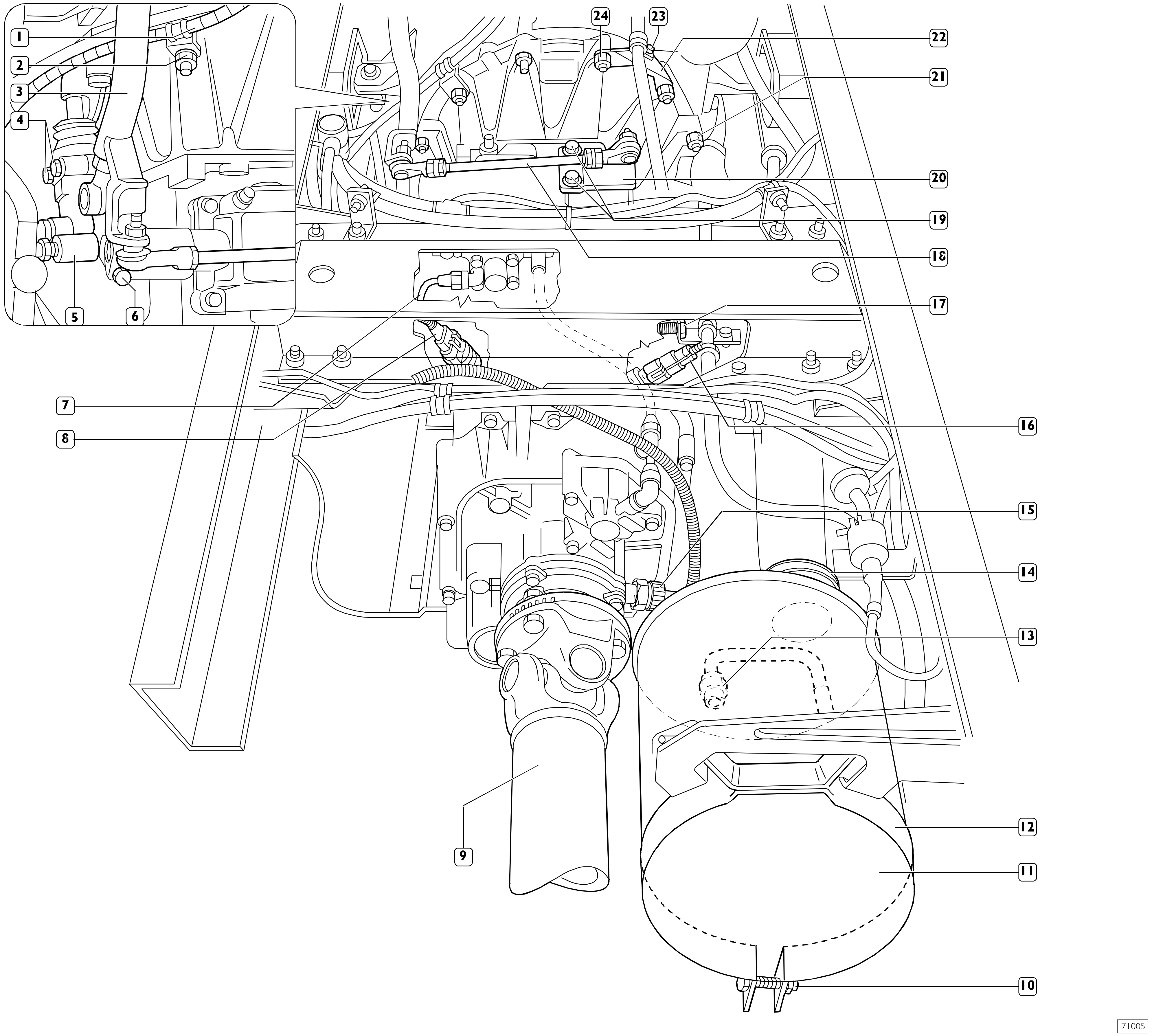
- loosen securing bolt (23), unscrew securing nuts (24) and detach air piping supporting bracket (22);
- unscrew securing nut (2) and detach air piping supporting bracket (1);
- unscrew securing nuts (19) and detach bracket (20) of reaction tie–rod (18);
- loosen securing screw (6) and detach from gearbox the gears control lever completed with tie–rod (3) and reaction tie–rod (18);
- disconnect reverse gear switch electric connection (16) and range–change switch electric connection (8);
- unscrew securing nuts (21) of clutch bell to engine that will be able to be reached with difficulty from the lower vehicle part.
- rotate deadening guard locking rivets below the gearbox and remove the deadening guard;
- detach transmission shaft (9) as described in the related section;
- disconnect air piping (13) from exhaust piping (11);
- detach terminal exhaust piping, operating on securing clip (14) bolt and on support band (12) bolt (10);
- unscrew securing screws (4) and detach clutch control operating cylinder (5);
- disconnect electric connection (15) of odometer sensor;
- unscrew securing screw (17) and detach air piping support bracket;
- place an hydraulic jack equipped with support 99370629 under the gearbox;
- unscrew the remaining securing nuts of clutch bell to engine, move the gearbox backwards and lowering the jack remove it from below the vehicle.

Re–engagement

Suitably reverse the operations carried out for disengagement and tighten securing screws and nuts at the required torque.

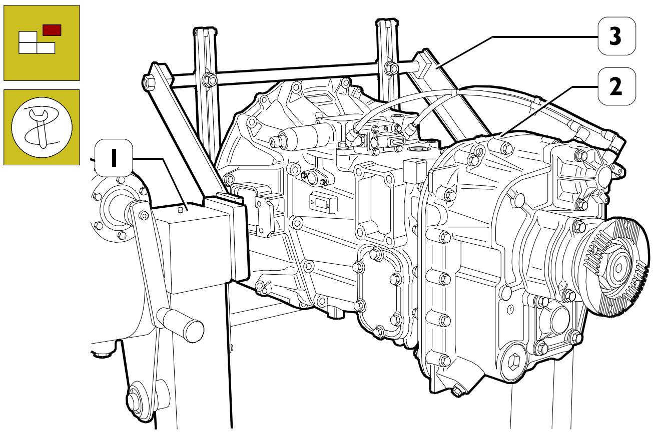
Upon re–engaging the gearbox, pay attention that the clutch control lever fork is correctly meshed to the thrust bearing.

Figure 3



GEARBOX DISASSEMBLY

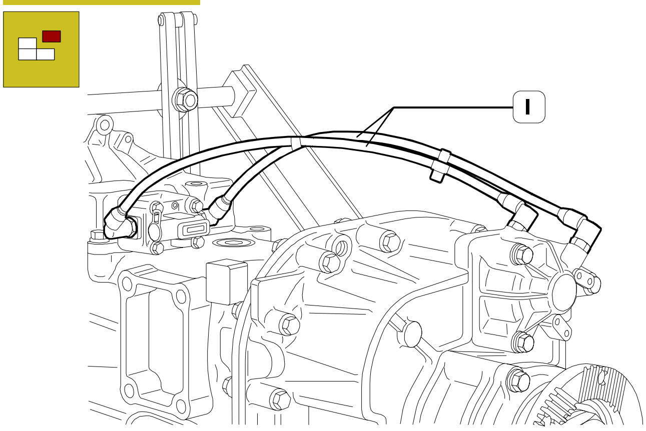
Figure 4



79429

Place gearbox (2) on rotating stand 99322205 (1) equipped with brackets 99322225 (3) and discharge lubricating oil.

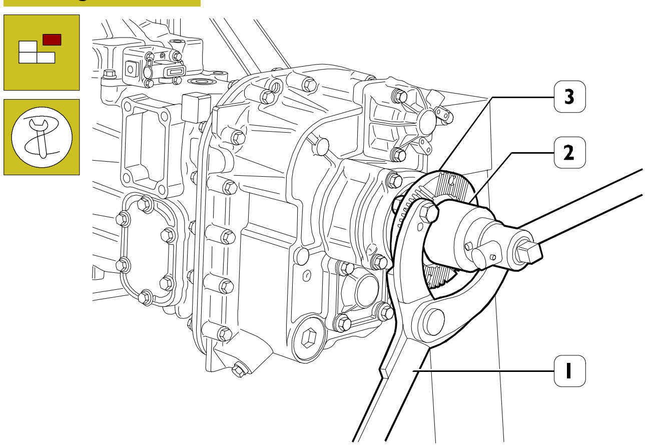
Figure 5



79440

Disconnect pneumatic pipings (1) of epicyclic reduction gear. Unscrew the two screws securing clutch disengagement lever support and remove lever from gearbox.

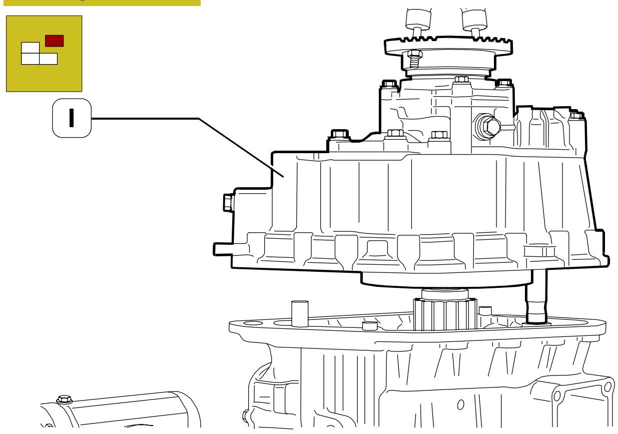
Figure 6



79441

Apply reaction lever 99370317 (1) and with key 99355081 (2) loosen nut securing motion outlet flange (3).

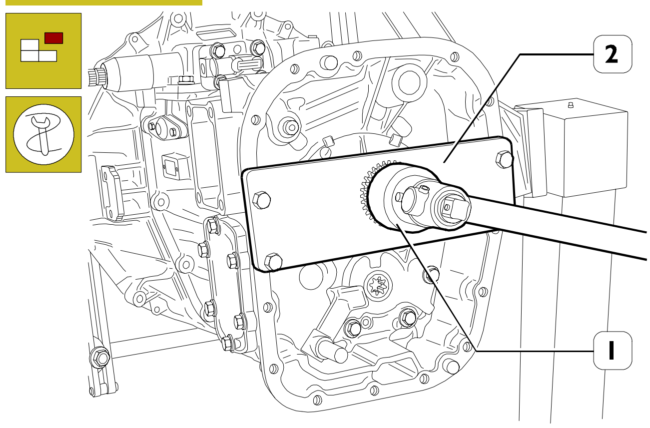
Figure 7



71886

Unscrew securing screws and with the help of a lifting device, remove epicyclic reduction gear assembly (1).

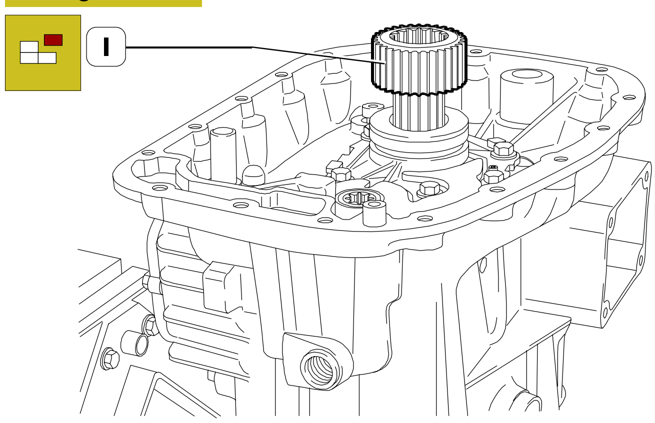
Figure 8



79442

Apply tool 99370130 (2) and, through wrench 99355131 (1), unscrew sun gear check nut.

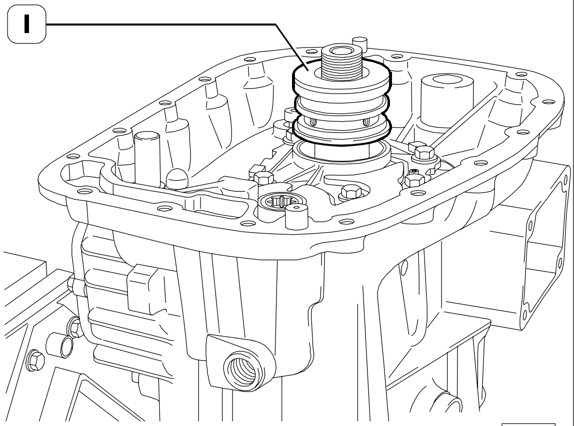
Figure 9



71888

Remove the sun gear (1).

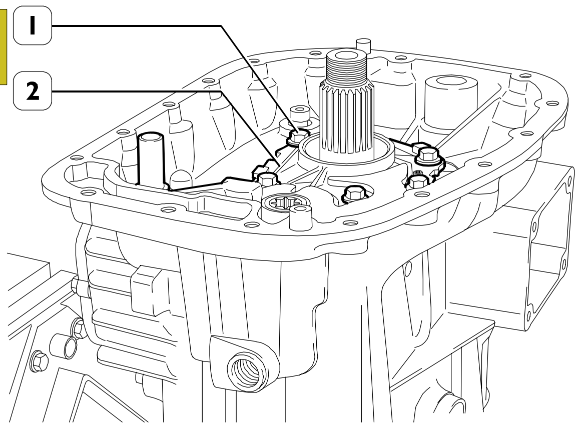
Figure 10



71889

Remove oil distributor (1) completed with sealing rings.

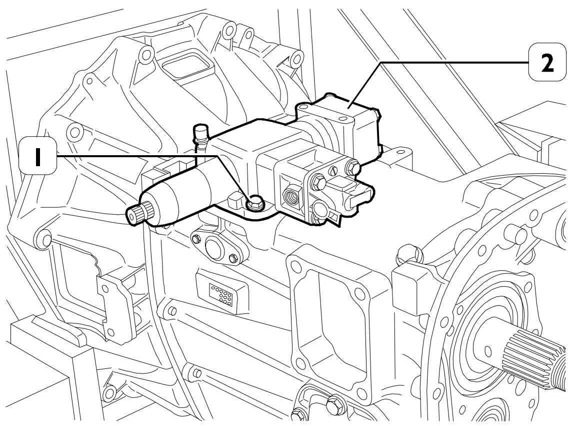
Figure 11



71890

Unscrew screws (1) and remove oil pump (2).

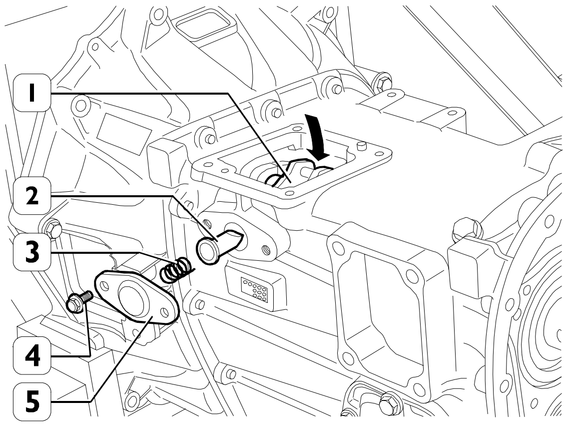
Figure 12



79443

Unscrew screws (1) and remove complete case (2) of external gear drive.

Figure 13

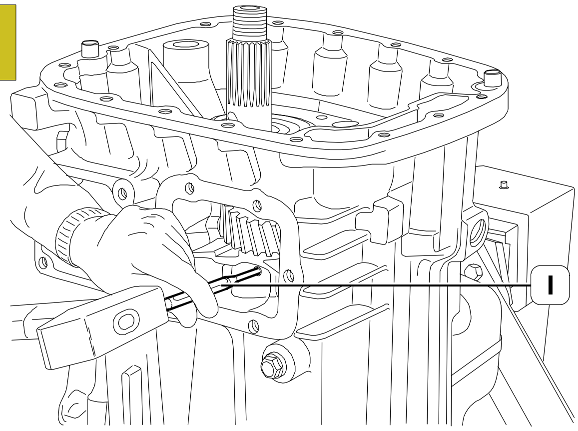


79444

Unscrew screws (4), dismount cover (5), take off spring (3) and take out push rod (2).

Move gear selector hub (1) inwards.

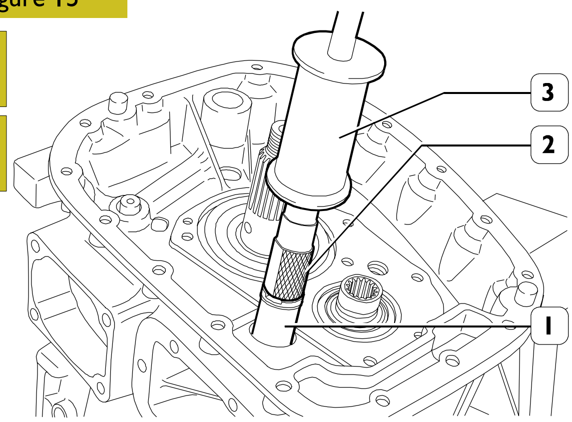
Figure 14



71893

Remove reverse gear cover; with a punch (1) of an adequate diameter, push the elastic peg inside till it abuts.

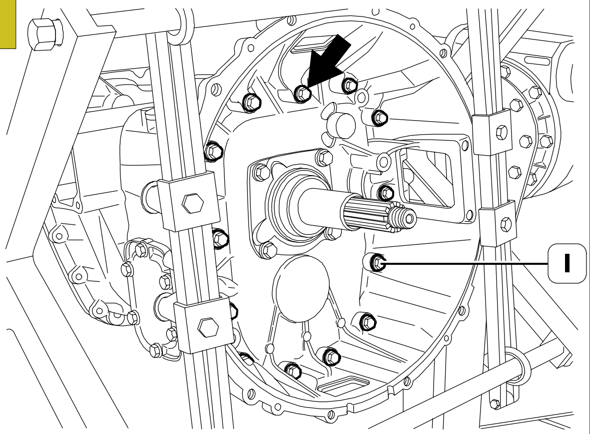
Figure 15



71894

Place extraction peg 99342143 (2) and percussion extractor 99340205 (3). Extract reverse gear support pin (1) and remove gear with related shoulder washers and cylindric roller bearing.

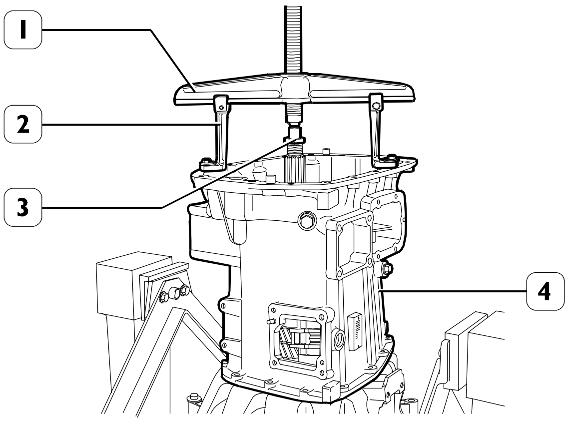
Figure 16



71895

Unscrew screws (1), leaving a safety one (→) to be removed after having placed the gearbox vertically.

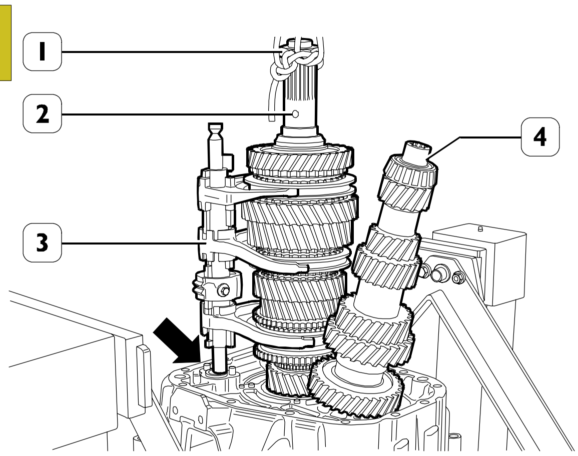
Figure 17



71896

Through extractor 99341004 (1), brackets 99341017 (2) and reaction block 99345058 (3), extract intermediate gearbox case (4).

Figure 18

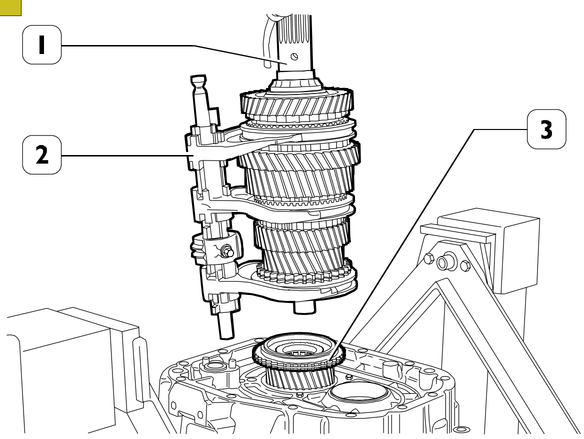


71897

Screw nut (1) on primary shaft (2), lift by about 10 to 20 mm primary shaft (2) together with internal drive shaft (3) and withdraw secondary shaft (4) by laterally displacing it.

NOTE Assist internal drive shaft extraction from its seat, by operating in the shown point (→) with suitable tools.

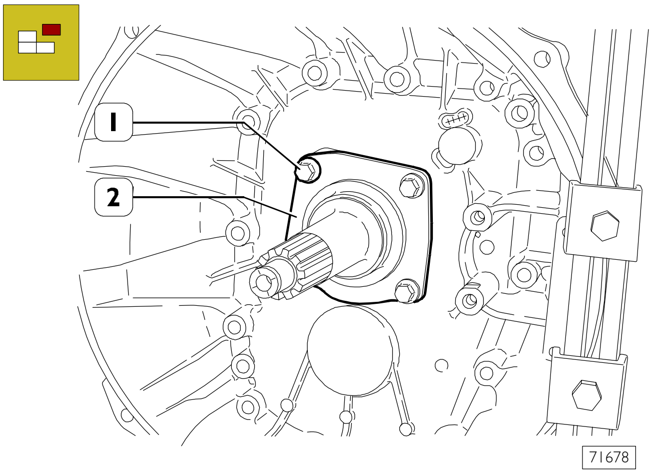
Figure 19



71898

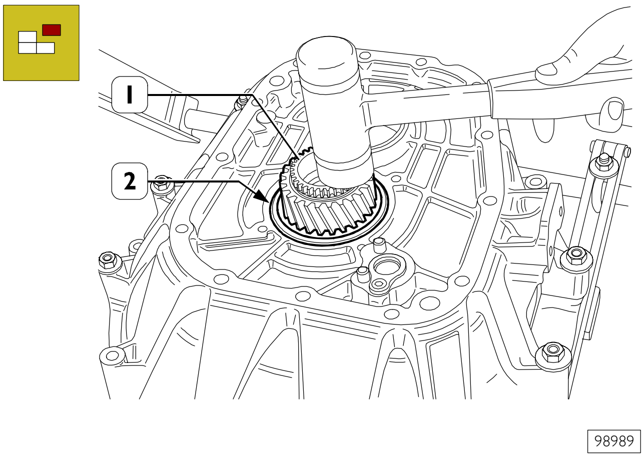
Lift and remove primary shaft (1) together with internal drive shaft (2).
Remove synchronizing rings (3).

Figure 20



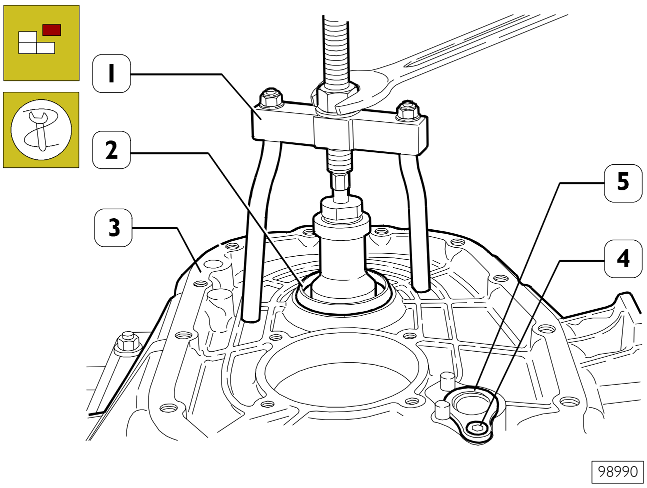
Unscrew screws (1) and remove cover (2) on motion inlet shaft.

Figure 21



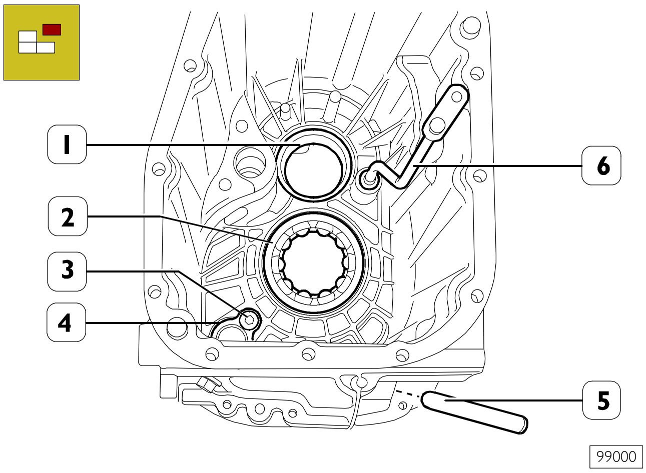
Remove cylindric roller bearing from motion inlet shaft (1) and heat front half–case contact surface (2). With a plastic hammer, extract motion inlet shaft (1) completed with ball bearing.

Figure 22



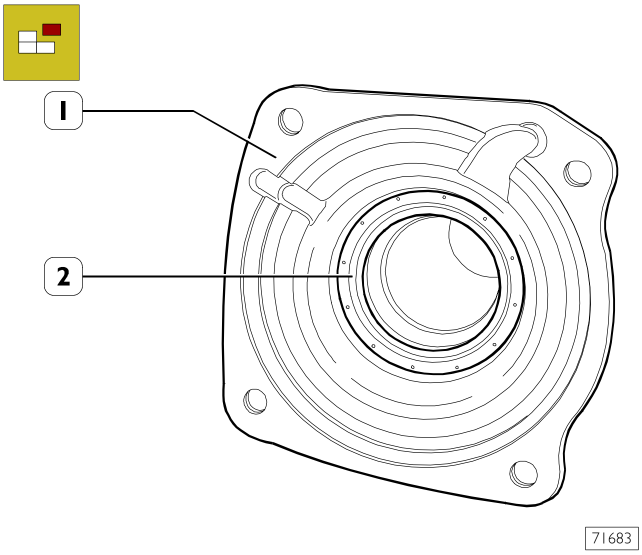
Extract rolling race (2) of secondary shaft bevel roller bearing from front half–case (3) with extractor 99348004 (1). Remove adjustment ring.
Unscrew TORX mark screw (4), take off rib washer (5) and recover underlying bushing.

Figure 23



From intermediate case, extract roller bearing rolling race (1), ball bearing (2), reduction gear engagement safety pin (5) and oil piping (6).
Unscrew TORX mark screw (3), take off rib washer (4) and recover underlying bushing.

Figure 24



Extract sealing gasket (2) from motion inlet shaft cover (1).

Checks

GEARBOX CASE

Gearbox case and related covers must not show cracks.
Contact surfaces between covers and gearbox case must not be damaged or distorted.
Bearing seats must not be damaged or excessively worn.

SHAFTS – GEARS

Shaft seats for bearings and gear toothings must not be damaged or worn.

HUBS – SLIDING SLEEVES – FORKS

Grooves on hubs and related sliding sleeves must not be damaged. The sliding sleeve must freely slide on its hub. Sliding sleeve positioning rollers must not be damaged or worn. Sliding sleeve engagement toothings must not be damaged.

Forks must be healthy and not show any sign of wear.

BEARINGS

Roller bearings or roller cages must be in perfect conditions and not show traces of wear or overheatings.
By keeping bearings manually pressed and making them simultaneously rotate along two directions, no roughness or noise when sliding must be detected.

NOTE Upon assembling, the following must always be replaced: rings, sealing gasket and springs for sliding sleeves positioning rollers.

SYNCHRONIZERS – COUPLING BODIES

Check wear of synchronising rings and respective coupling bodies: they must not show any sign of wear.

NOTE Upon assembling, do not mutually exchange the checked parts.

GEARBOX ASSEMBLY

Butter with hermetic type ”B” the threaded part of all screws that must be screwed in the through–holes.

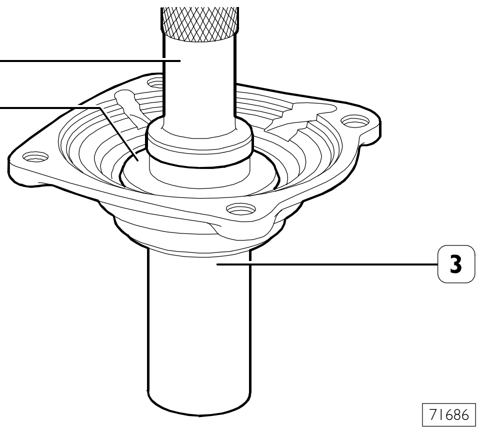
Clean the joining surfaces of case and covers and apply ”LOCTITE 510” putty, before assembling, on one of the two components.

Do not insert oil before 20 min and do not try the gearbox before 1h and 30 min.

Assemble bearing cages into their respective seats and oil with TUTELA ZC 90.

To guarantee assembly oil seal, make sure that sealing gaskets are already lubricated, or butter with oil or grease the sealing lip of inlet and primary shafts gaskets.

Figure 25

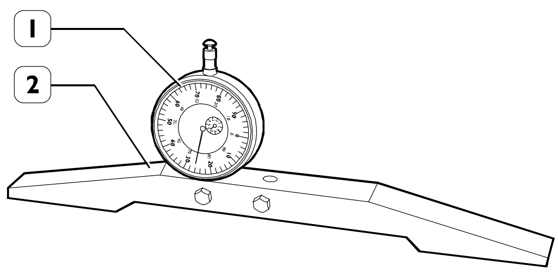


Butter, with hermetic type ”B”, the coupling seat surface of cover (3) with sealing gasket and with keyer 99370349 (2) and handle 99370006 (1) assemble the sealing gasket itself.

Bearings pre–load adjustment for secondary shaft

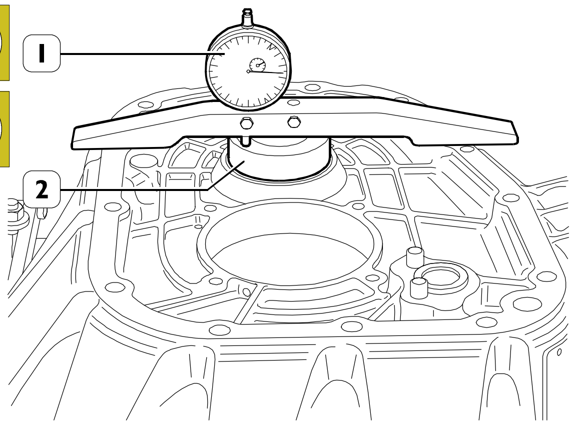
The bearings pre–load adjustment for the secondary shaft can be carried out with two procedures.

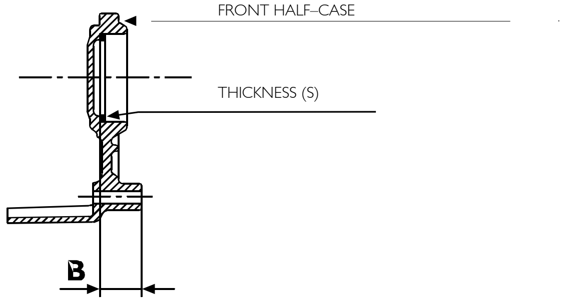
Figure 26



Assemble comparator 99395604 (1) on base 99370466 (2), pre–load it by 5 mm and zero it on an abutment plane.

Figure 27





Place calibrated ring 99396031 (2) into its seat, without adjustment ring, of bevel roller bearing on front half–case; place base 99370466 completed with comparator (1), previously zeroed, as shown in the figure.

First method – Take note of the value read on the comparator (Example: 2.43 mm).

Second method – Take note of the value read on the comparator and add it to calibrated ring thickness [Example: 2.43 + 50.5 = 52.93 mm (Dimension **B**)].

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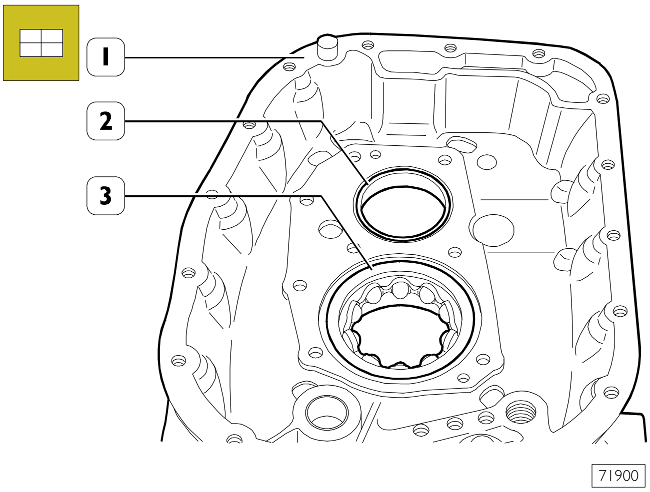
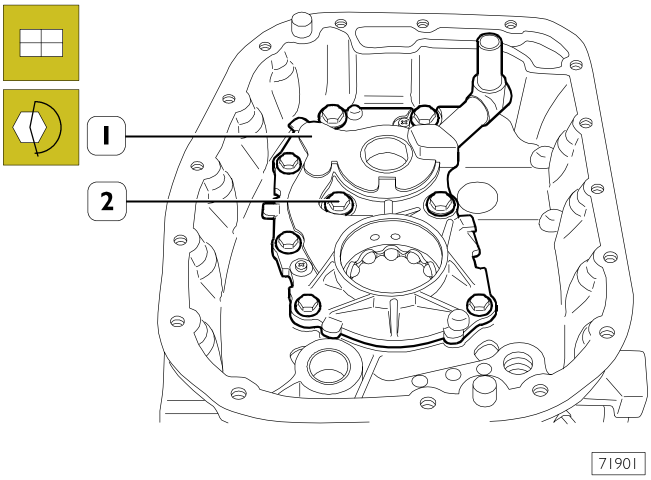
Figure 28



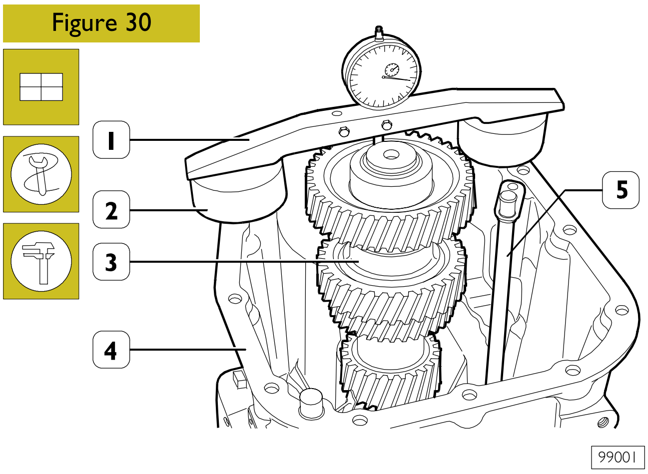
On intermediate case (1) assemble external race (2) for secondary shaft bearing and ball bearing (3) for primary shaft.

Figure 29



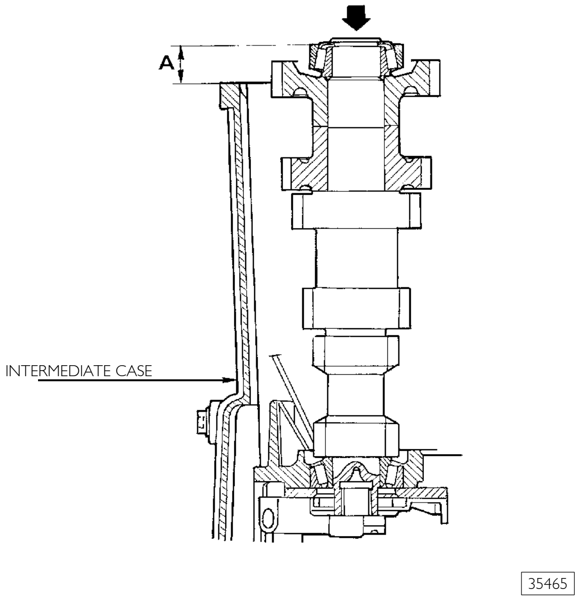
Assemble oil pump (1) by screwing screws (2) at the required torque; rotate the intermediate case.

Figure 30



Mount oil piping (5), fit inner control shaft bushing into its seat, put in rib washer (5) and screw TORX mark screw with prescribed torque.

Figure 31



Assemble and simultaneously rotate, till it abuts, the secondary shaft (3, Figure 30) completed with bearings in rear case. Place calibrated rings 99396031 (2, Figure 30) on the case (4, Figure 30). Arrange, as shown in the figure, base 99370466 completed with previously–zeroed comparator (1, Figure 30); the comparator rod must abut on the external bearing ring. Carry out the measure on two diametrically–opposite points and perform the arithmetic mean.

First method – Take note of the value read on the comparator (Example 1.84 mm). The adjustment ring value is obtained by summing the two measured values (Example 2.43 + 1.84 = 4.27 mm)

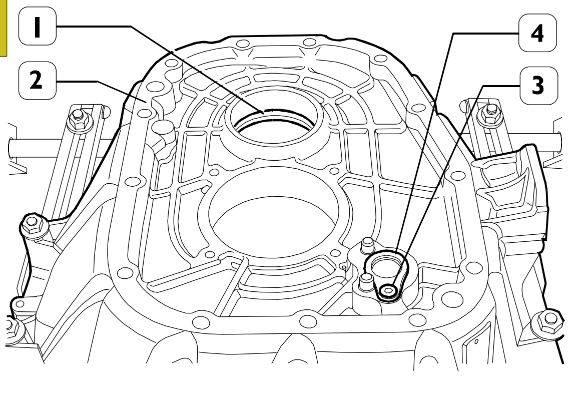
Second method – Take note of the value read on the comparator and subtract it from the calibrated ring thickness [Example: 50.5 – 1.84 = 48.66 mm (Dimension **A,** Figure 31)].

The adjustment ring value is obtained with formula
S = B – A Example: 52.93 – 48.66 = 4.27 mm.

NOTE The adjustment ring thickness choice is always carried out in excess. Example; thickness S = 4.27: thickness S = 4.3 is taken. Measuring of dimension "A", carried out with secondary shaft in vertical position, that, in addition to facilitating the measure itself, allows having an axial load on the rear bearing.

After having computed the thickness value of the adjustment ring, disassemble again secondary shaft (3, Figure 30) and oil pump (1, Figure 29).

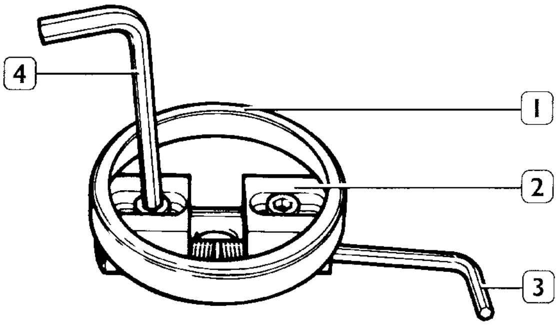
Figure 32



98993

Place adjustment ring (1), whose thickness is equal to the previously–obtained one, into the secondary shaft bearing seat on the front half–case (2).
Fit inner control shaft bushing into its seat, put in rib washer (4) and screw TORX mark screw (3) with prescribed torque.

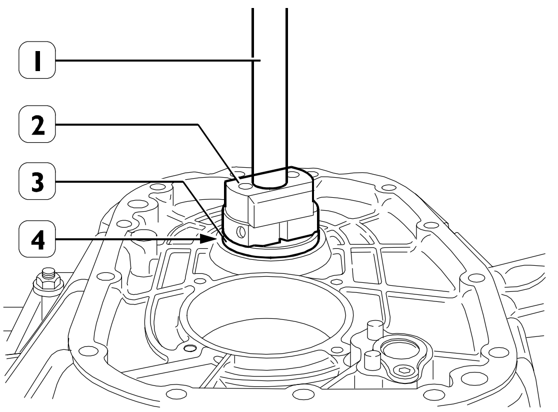
Figure 33



32447

Centre external race (1) of bevel roller bearing of front cover secondary shaft on extensible beater 99374092 (2) adjusted with socket head screw (3). Lock beater with socket head screw (4).

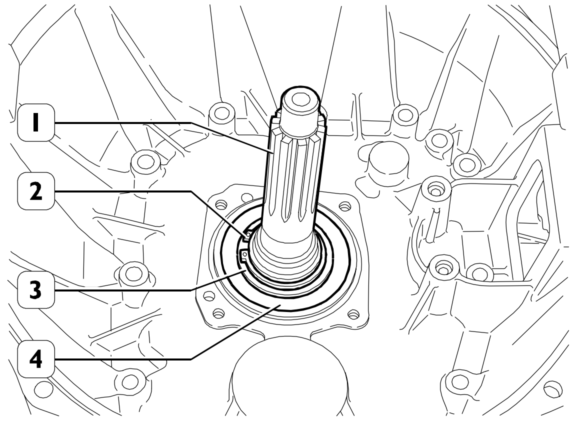
Figure 34



98994

Slightly heat seat (4) of secondary shaft bearing race on front half–case and assemble external race (3) by settling it till it abuts with beater 99374092 (2), equipped with handle 99370007 (1).

Figure 35

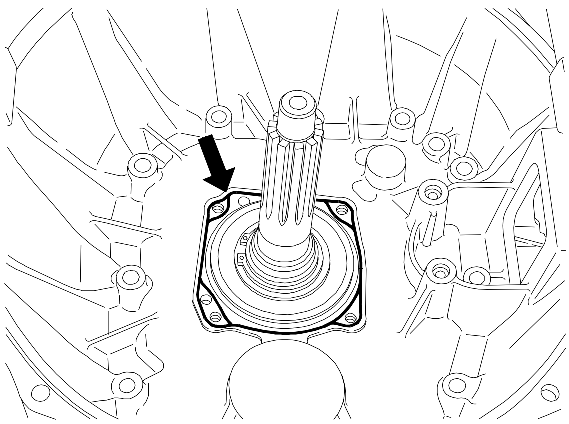


71693

Slightly heat the ball bearing seat, assemble motion inlet shaft (1) completed with bearing (4), adjustment ring (3) and elastic ring (2). Settle the bearing till it abuts.

NOTE Before assembling on front half–case the motion inlet shaft, carry out bearing adjustment as described in the related procedure on page 106.

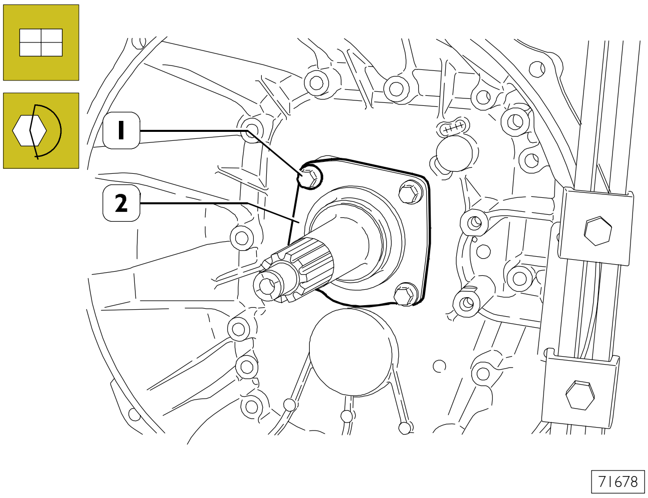
Figure 36



71679

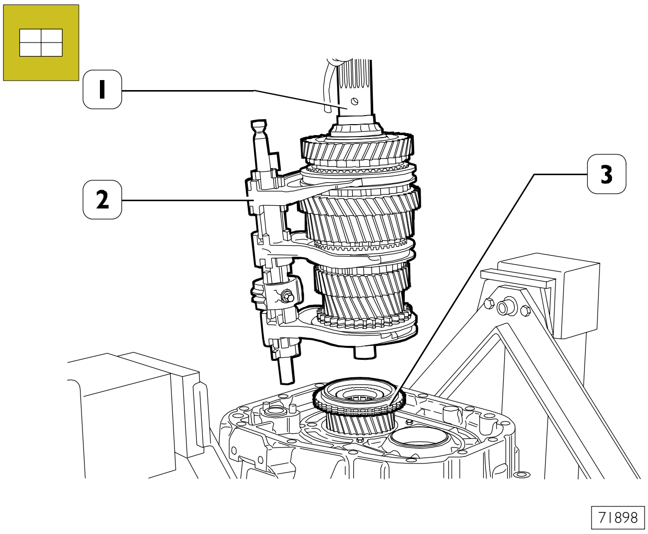
Apply LOCTITE 510 sealant on contact surfaces (→) between front half–case and motion inlet shaft cover.

Figure 37



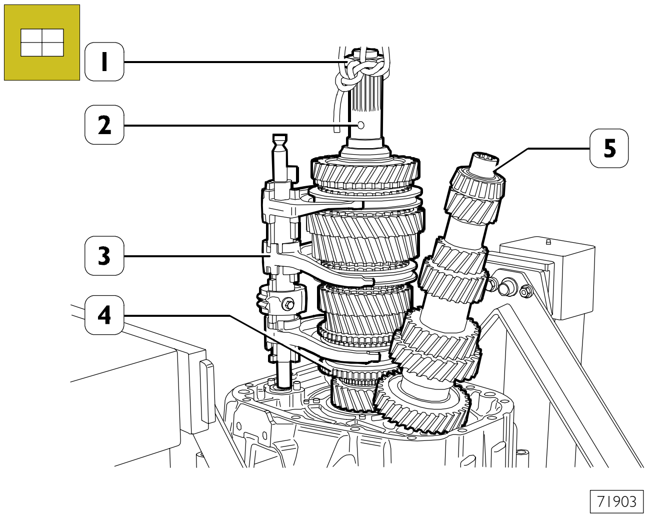
Assemble motion inlet shaft cover (2), screw screws (1) and tighten them at the required torque.

Figure 38



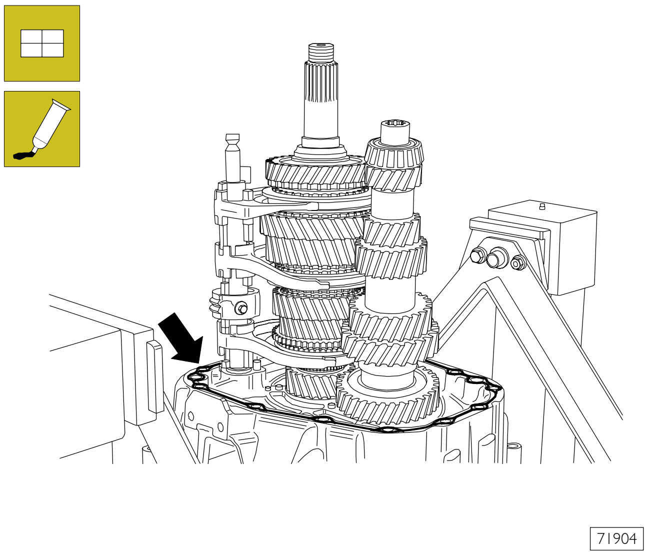
Insert roller bearing into motion inlet shaft, then assemble synchronising rings (3).
Assemble primary shaft (1) completed with internal drive shaft (2) without completely inserting it into motion inlet shaft.

Figure 39



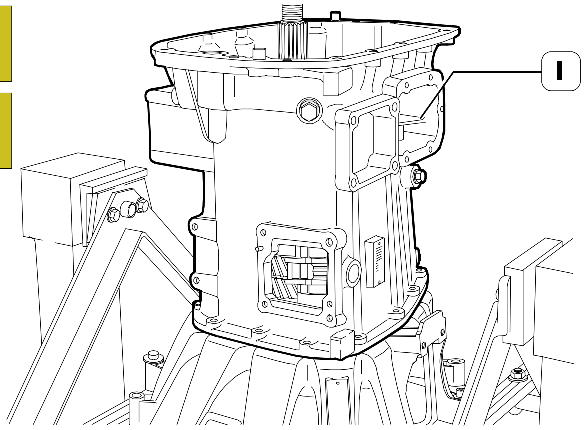
Assemble secondary shaft (5) and simultaneously lower primary shaft (2) and internal drive shaft (3). Pay attention to the exact insertion of synchronising rings (4).
Remove nut (1).

Figure 40



Apply LOCTITE 510 sealant on contact surface (→) between the front half–case and intermediate case.

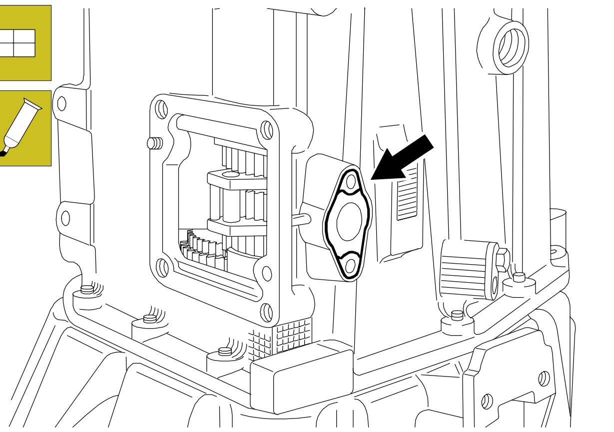
Figure 41



71905

Assemble reducing gear engagement safety pin (3, Figure 23). Assemble intermediate case (1) and screw the screws at the required torque.

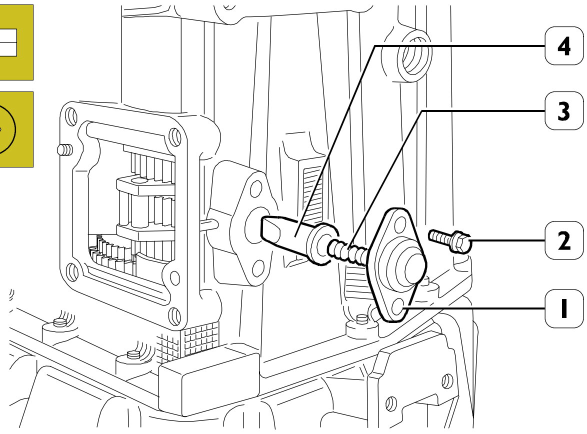
Figure 42



78165

Apply sealer LOCTITE 510 on the surface (→) without staining the push rod supporting area (4, Figure 43).

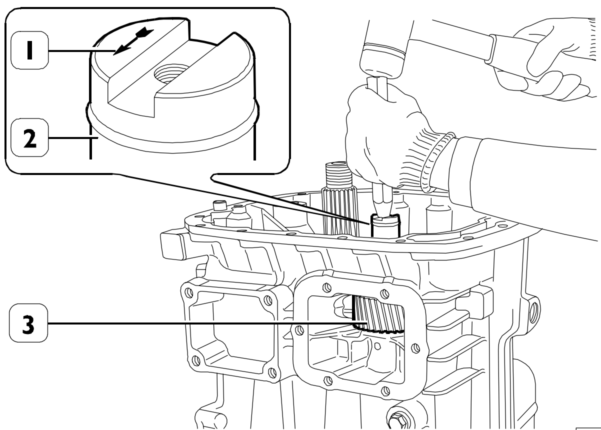
Figure 43



78164

Put in push rod (4), spring (3), mount cover (1) and screw down screws (2) tightening them with rated torque.

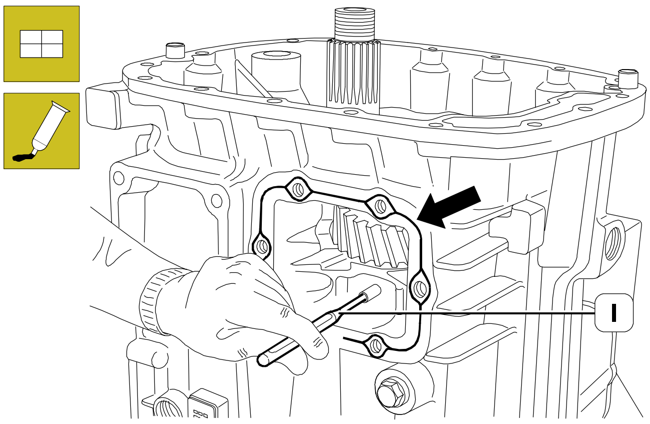
Figure 44



71907

Assemble shoulder rings, placing them into their own seat and reverse gear (3) with cylindric roller bearing. Assemble reverse gear supporting shaft (2) with a suitable beater, paying attention that the arrow (1) punched on the shaft is facing the peg insertion hole.

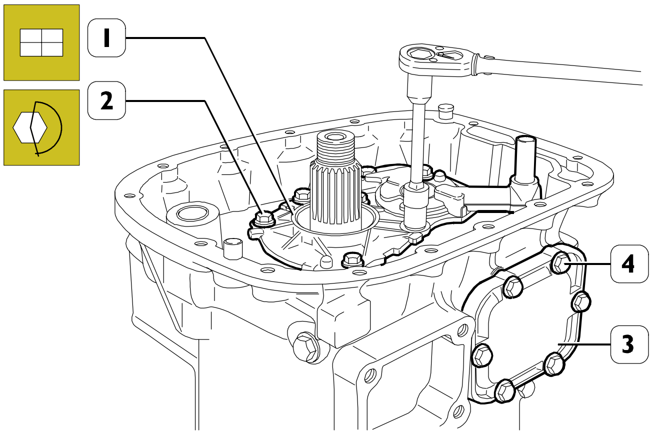
Figure 45



71908

Assemble elastic peg (1).
Apply LOCTITE 510 sealant on contact surface (→) between intermediate case and cover.

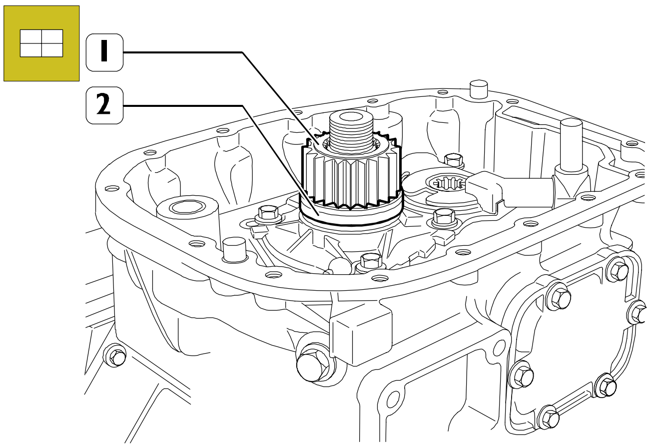
Figure 46



71909

Assemble oil pump (1) and tighten screws (2) at the required torque, assemble cover (3) and tighten screws (4) at the required torque.

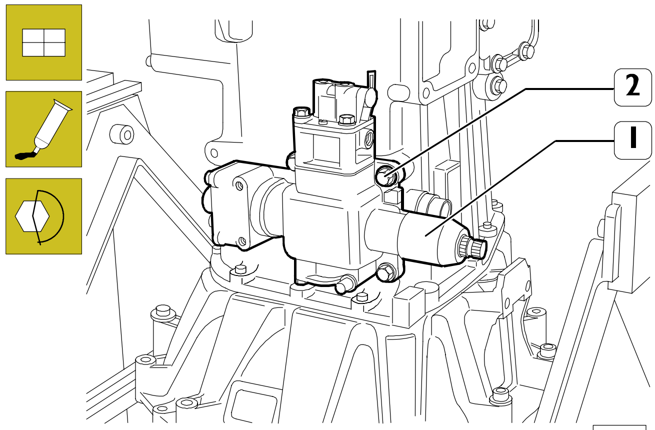
Figure 47



71910

Key–in oil distributor (2) and sun gear (1).

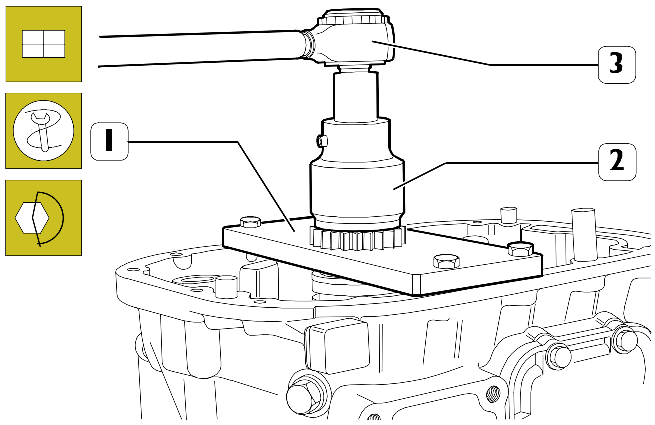
Figure 48



71911

Apply LOCTITE 510 sealant and assemble external gear drive (1) tightening screws (2) at the required torque.

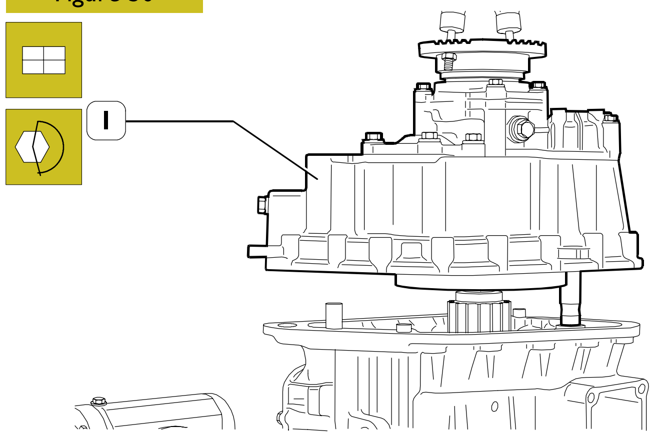
Figure 49



71912

Apply tool 99370130 (1) and, through wrench 99355131 (2) and dynamometric wrench (3), screw sun gear check nut, tightening it at the required torque.

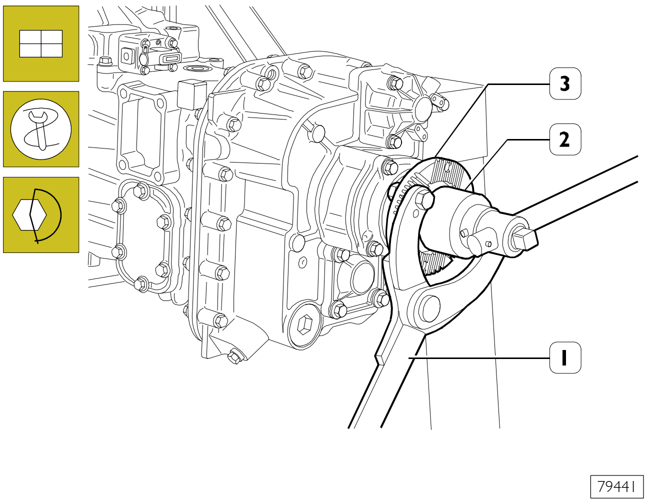
Figure 50



71886

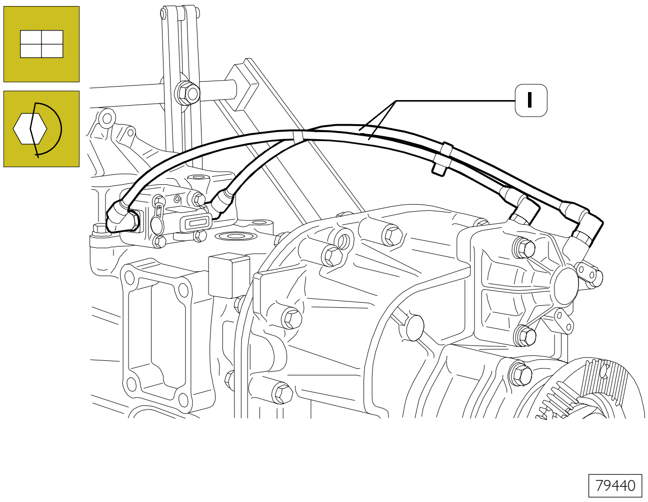
Assemble epicyclic reduction gear assemble (1) after having applied LOCTITE 510 sealant and tighten securing screws at the required torque.

Figure 51



Apply reaction lever 99370317 (1) and with wrench 99355081 (2) screw motion outlet flange securing nut (3) tightening it at the required torque.

Figure 52



Connect pneumatic pipings (1) of epicyclic reduction gear drive.
Assemble clutch disengagement lever and tighten the two securing screws at the required torque.

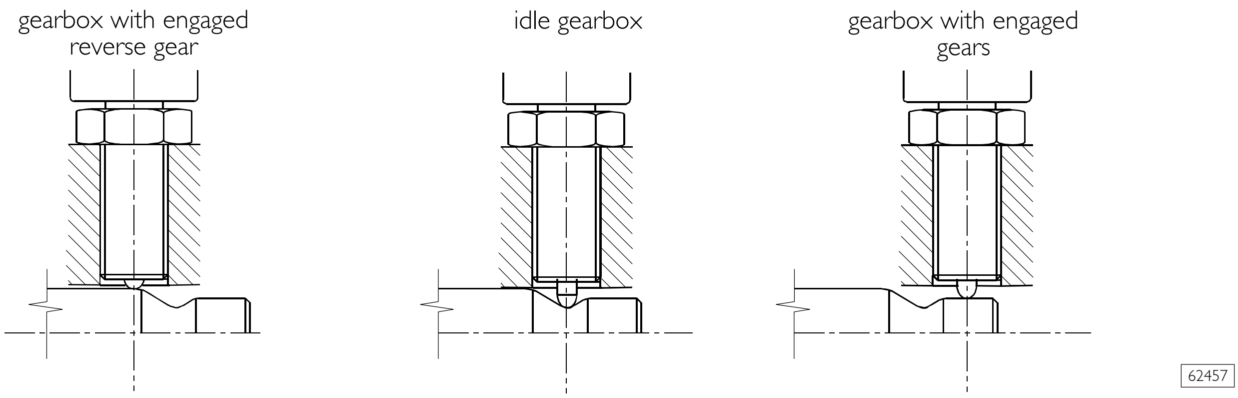
NOTE Insert lubrication oil in the prescribed amount after about 20 minutes from the last LOCTITE 510 sealant application.

Remove gearbox from rotating stand.

Idle–Reverse Gear switch adjustment

NOTE The below–described sequence must be compulsorily followed.

Figure 53



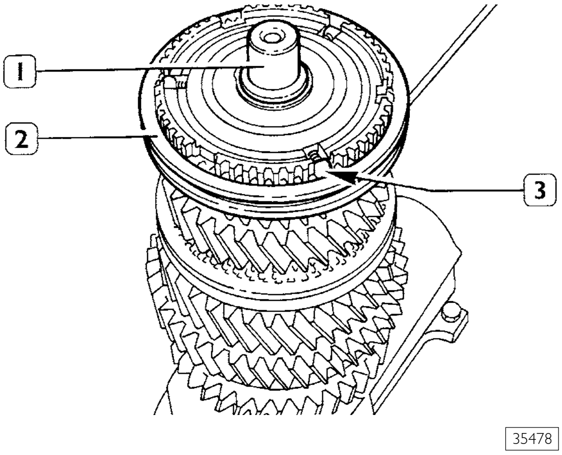
SWITCH INSERTION POSITIONS ON 2870.9 GEARBOX

For switch adjustment, it is necessary to carry out the following operations:

- ❑ Apply silicon sealant on threadings;
- ❑ Put gearbox in engaged reverse gear positions;
- ❑ Screw the switch till the reverse gear lamp turns on;
- ❑ Further screw the switch by 45–60° corresponding to a 0.19–0.25 mm stroke;
- ❑ Tighten securing lock nut with a 24–type wrench at a 35 Nm torque.

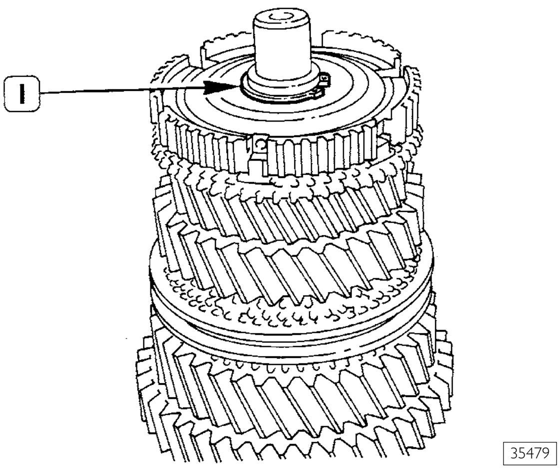
PRIMARY SHAFT DISASSEMBLY

Figure 54



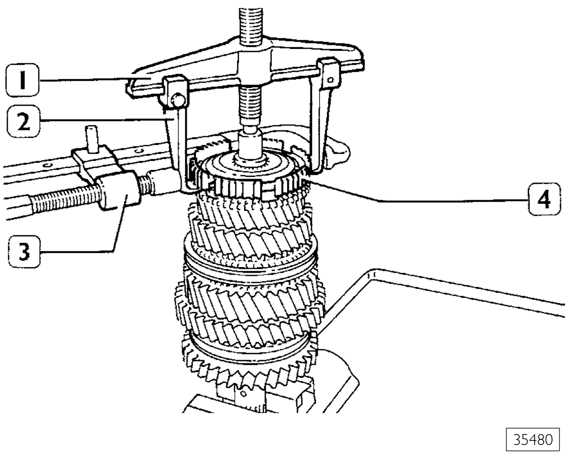
Tighten primary shaft (1) in a vice.
Withdraw sliding sleeve (2) for 4^{th}–5^{th} gear recovering springs, pins and rollers (3).

Figure 55



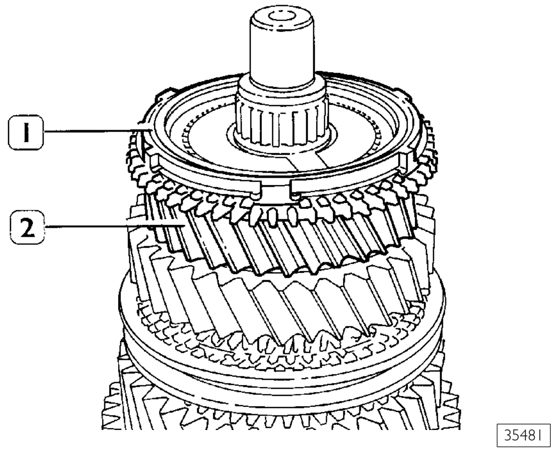
Through rounded–tip pliers, remove elastic ring (1).

Figure 56



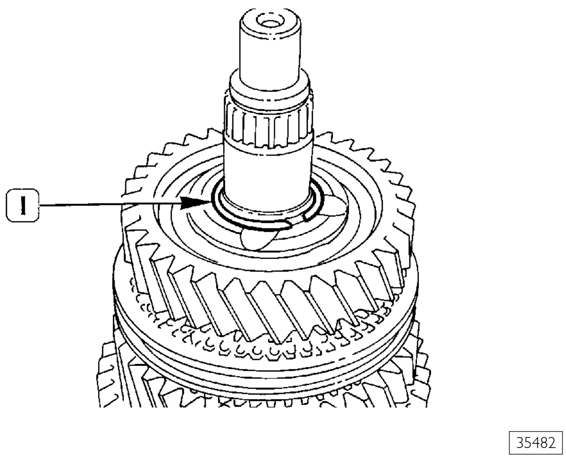
Through extractor 99341003 (1) completed with brackets (2) and clamp 99341015 (3), withdraw fixed 4^{th}–5^{th} gear hub (4).

Figure 57



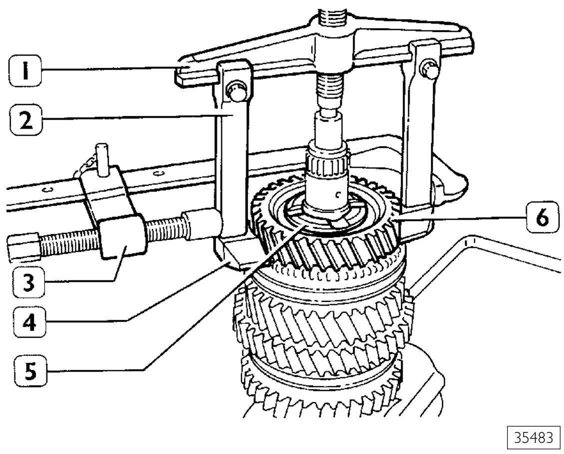
Remove synchronising ring and coupling body (1).
Withdraw 4^{th} speed gear (2) together with roller bearing.

Figure 58



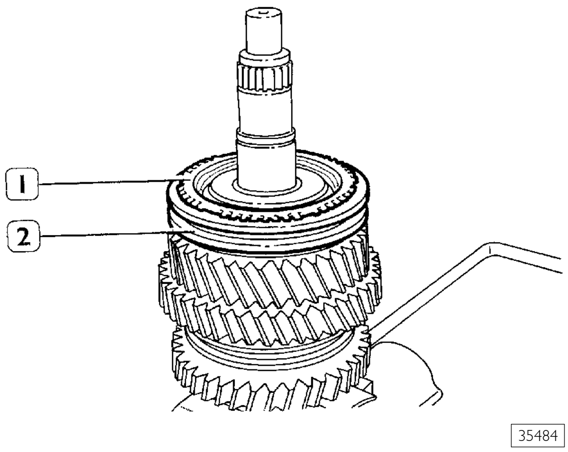
Remove elastic ring (1).

Figure 59



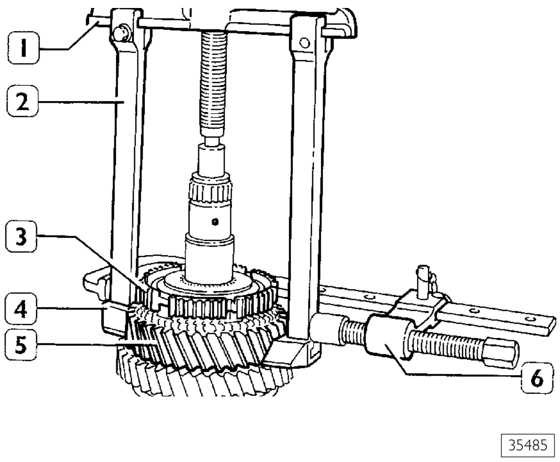
Through extractor 99341003 (1) completed with tie–rods (2), grips (4) and clamp 99341015 (3) extract 3^{rd} speed gear (5) together with bush (6) and roller bearing.

Figure 60



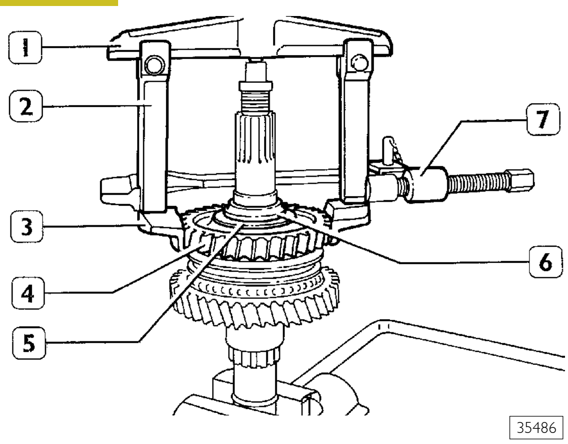
Remove synchronising ring and coupling body (1), withdraw sliding sleeve (2) recovering springs, pins and rollers.

Figure 61



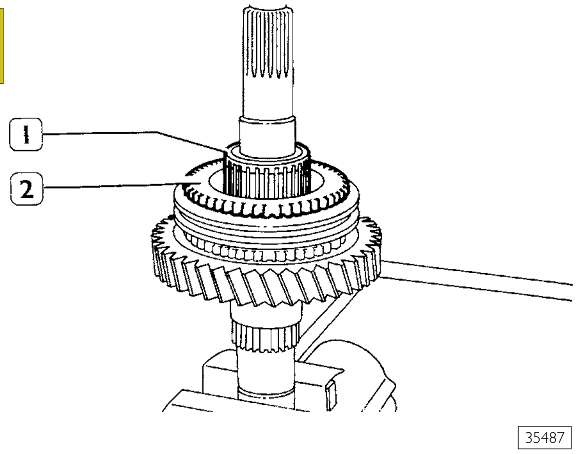
Through extractor 99341003 (1) completed with tie–rods (2), grips (4) and clamp (6), extract 2nd–3rd gear fixed hub (3) together with synchronising ring, coupling body and 2nd speed gear (5); recover the roller bearing.

Figure 62



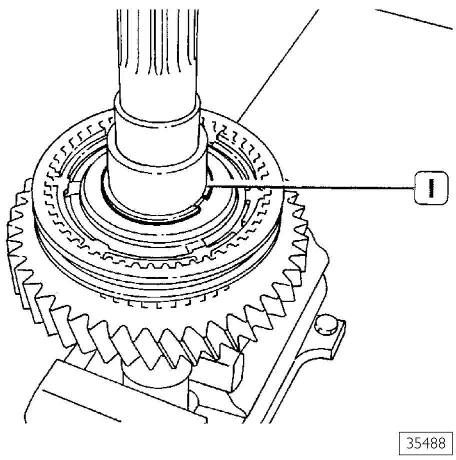
Turn primary shaft over, then through extractor 99341003 (1) completed with tie–rods (2), grips (3) and clamp (7), withdraw reverse gear (4) together with internal bearing (6) ring and shoulder ring (5).

Figure 63



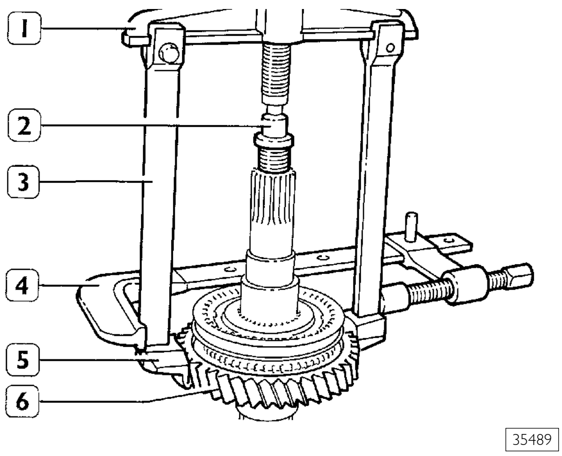
Withdraw roller bearing (1), synchronising ring and coupling body (2).

Figure 64



Through suitable pliers, remove elastic ring (1).

Figure 65



Through extractor 99341003 (1), reaction block (2), tie–rods (3), clamp (4), grips (5), withdraw 1st speed gear (6) completed with sliding sleeve, synchronising ring and roller bearing.

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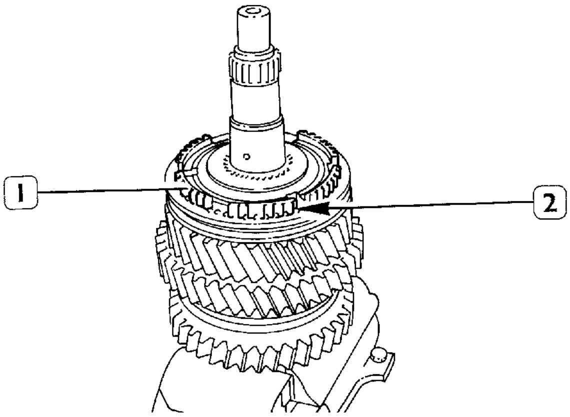
PRIMARY SHAFT ASSEMBLY

After having checked and possibly replaced all worn or broken components, in order to assemble the primary shaft, suitably reverse the previously–performed operations paying attention that:

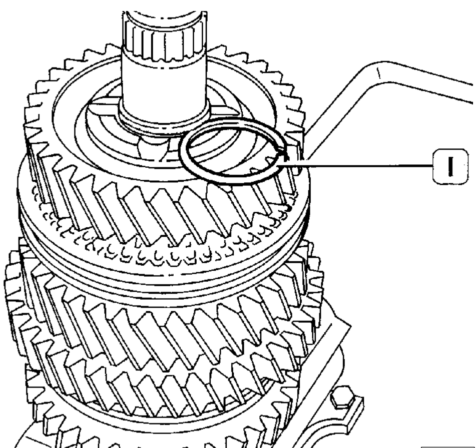
Figure 66



35490

- Fixed hubs (1) for 1st and reverse, 2nd – 3rd – 4th – 5th speed gears must be heated at a temperature of 100 to 130 °C and driven into the primary shaft, paying attention that synchronising ring stops (2) are inserted into the respective fixed hub seats.

Figure 67

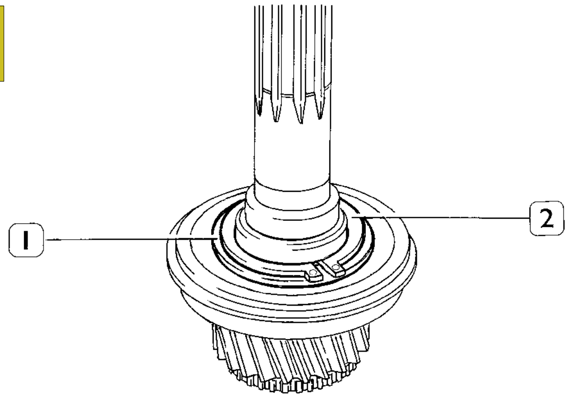


35491

- Elastic shoulder rings (1) are of an adequate thickness so that they do not show an axial clearance with fixed hubs (max. allowed 0.03 mm).

MOTION INLET SHAFT DISASSEMBLY

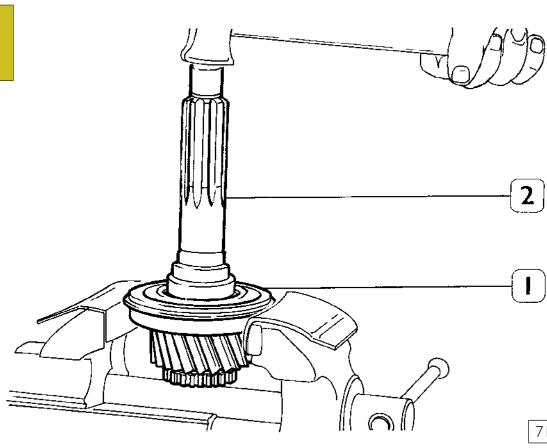
Figure 68



71869

Remove elastic ring (2) and adjustment ring (1).

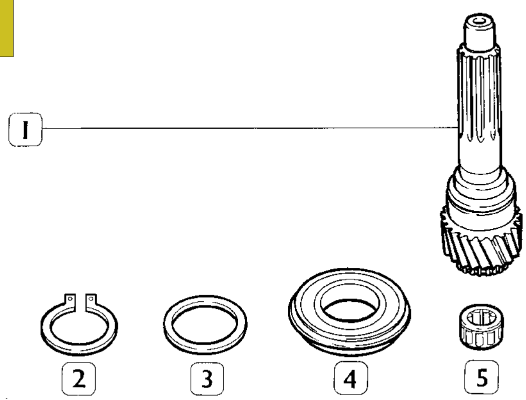
Figure 69



71870

Abut bearing (1) on a vice, as shown in the figure, and by beating onto shaft (2), extract it from the bearing itself.

Figure 70

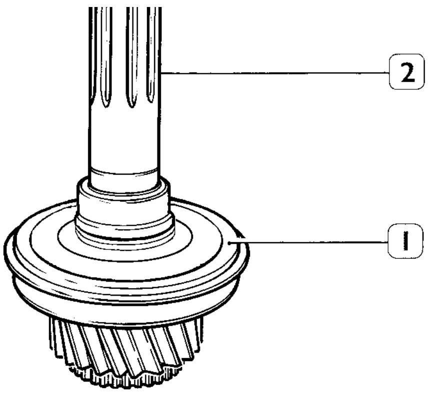


71871

PARTS COMPOSING THE MOTION INLET SHAFT
1. Motion inlet shaft – 2. Elastic ring – 3. Adjustment ring – 4. Ball bearing – 5. Cylindric roller bearing

MOTION INLET SHAFT ASSEMBLY

Figure 71

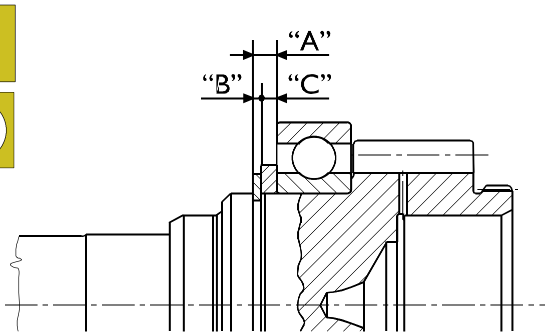


71872

Assemble ball bearing (1) on motion inlet shaft (2) and carry out its adjustment.

Motion inlet shaft bearing adjustment

Figure 72



62455

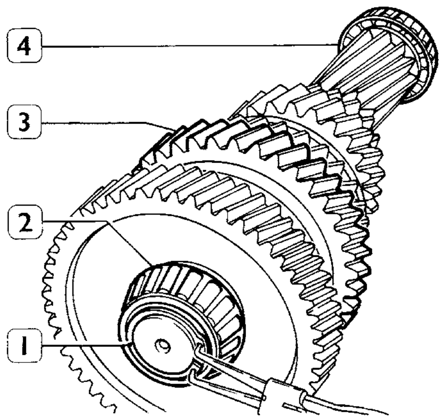
- Assemble bearing on motion inlet shaft.
- Measure dimension “**A**”.
- Measure seeger “**B**” thickness.
- Define thickness of spacer ring to be inserted, by defect: **C = A – B.**

Motion inlet shaft bearing adjustment spacer ring thicknesses: mm 2.40 – 2.45 – 2.50 – 2.55 – 2.60 – 2.65 – 2.70 – 2.75 – 2.80.

Assemble adjustment ring (1, Figure 68) whose thickness is equal to the previously–obtained one and assemble elastic ring (2, Figure 68).

SECONDARY SHAFT DISASSEMBLY

Figure 73



33651

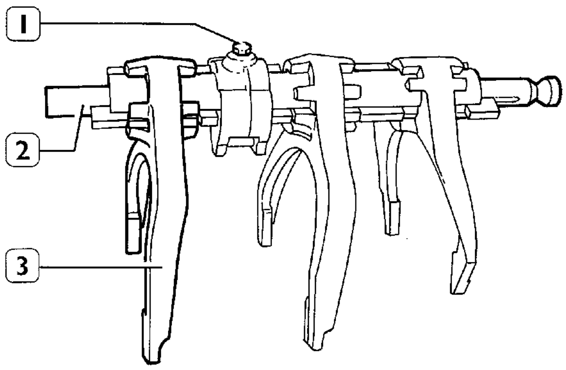
Remove elastic ring (1) from secondary shaft (3) and extract bevel roller bearings (2 and 4) with a suitable punch (destructive operation).

SECONDARY SHAFT ASSEMBLY

Slightly heat bevel roller bearings (2 and 4, Figure 73) and assemble them on secondary shaft (3, Figure 73). Assemble elastic ring (1, Figure 73).

INTERNAL DRIVE SHAFT DISASSEMBLY

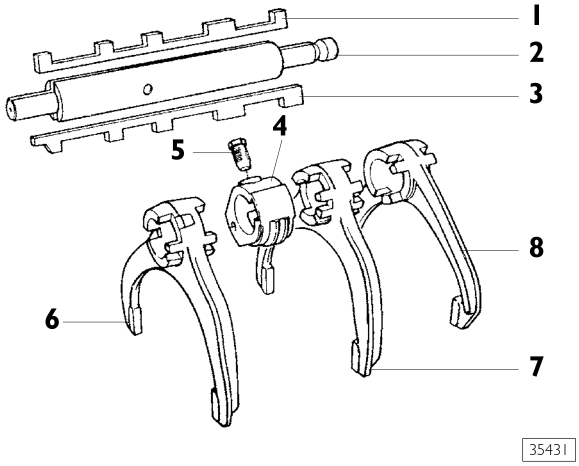
Figure 74



35497

Mark fork (3) assembling position. Unscrew screw (1), withdraw shaft (2) and decompose the assembly.

Figure 75



PARTS COMPOSING GEARS DRIVE

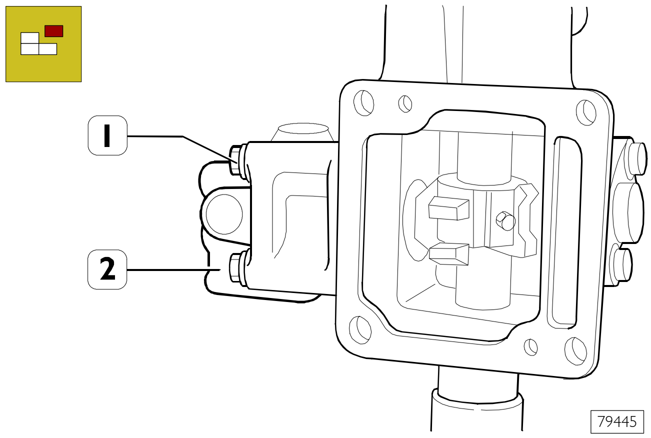
1. Selection rod – 2. Shaft – 3. Synchronising rod – 4. Hub – 5. Screw – 6. 4th–5th fork – 7. 2nd–3rd fork – 8. 1st and reverse gear fork

INTERNAL DRIVE SHAFT ASSEMBLY

Arrange on a bench forks (6–7–8) and hub (4) according to the position marked upon disassembling.
Place selection rod (1) so that the grooves are inserted into forks and hub; repeat the operation with synchronisation rod (3) and keeping them in position, insert shaft (2).
Screw the hub (4) screw (5) at the required torque.

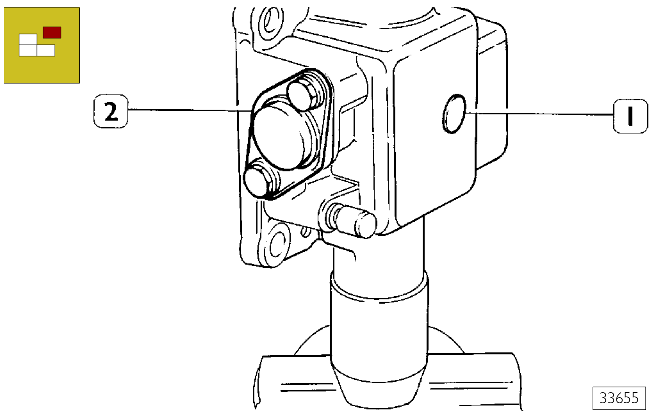
EXTERNAL DRIVE CASE DISASSEMBLY

Figure 76



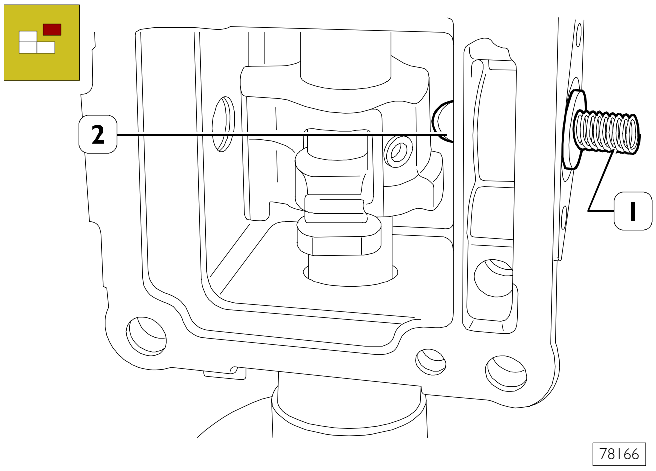
Secure the assembly in a vice, unscrew the four screws (1) and disassemble valve (2) of epicyclic reduction gear drive.

Figure 77



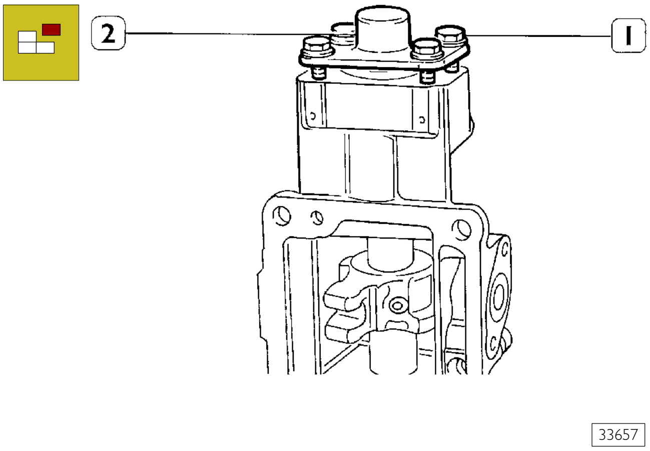
Tighten the shaft going out of the box in a clamp, remove plug (1) and disassemble cover (2).

Figure 78



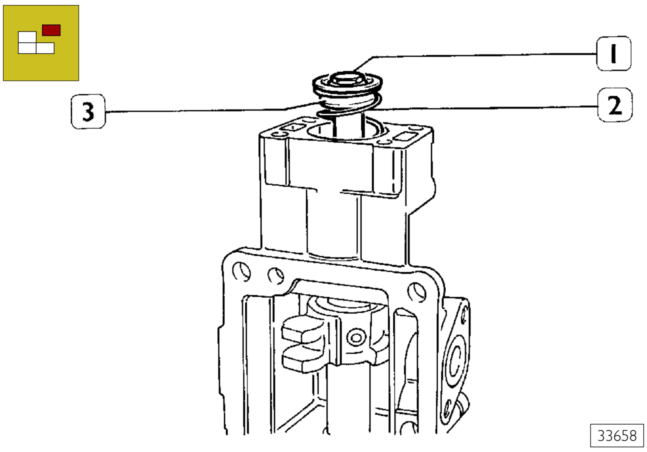
Remove control box pin (2) and spring (1).
Do not mix removed elements with those of the anti–release push rod.

Figure 79



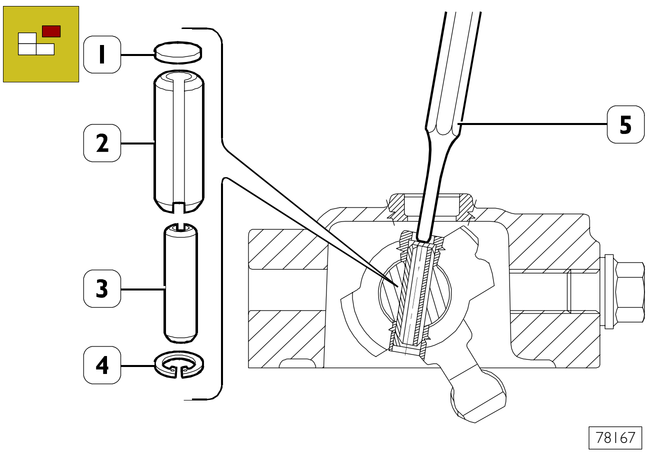
Unscrew screws (1) and disassemble cover (2).

Figure 80



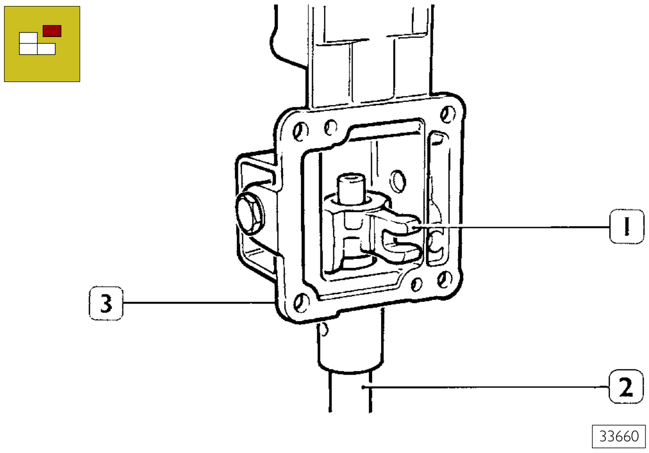
Unscrew screw (1) and remove spacer, upper cup (3) and spring (2). Remove lower cup.

Figure 81



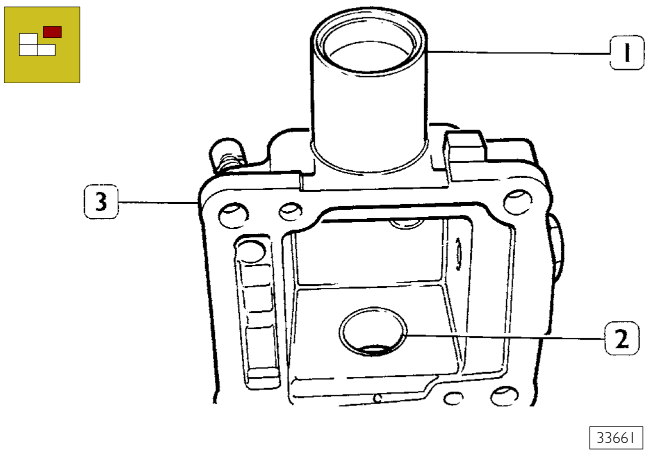
Remove the snap ring (4) and use a punch tool (5) having the right diameter to push the extraction washer (1) and remove flexible plugs (2) and (3).

Figure 82



Extract, from the control shaft (2), control selector (1) and box (3).

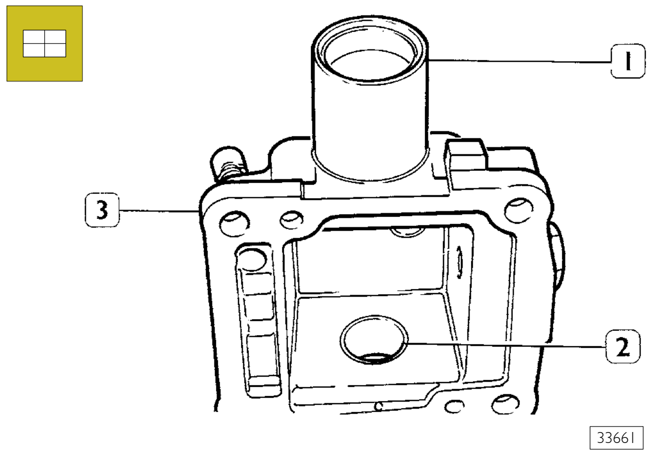
Figure 83



Extract, from the control box (3), sealing gasket (1) and bushes (2) with a suitable beater.

EXTERNAL CONTROL BOX ASSEMBLY

Figure 84



Assemble, in control box (3), sealing gasket (1) and bushes (2) with a suitable beater.

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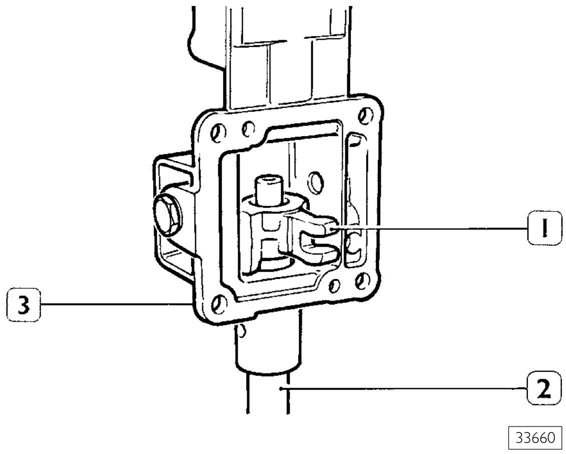
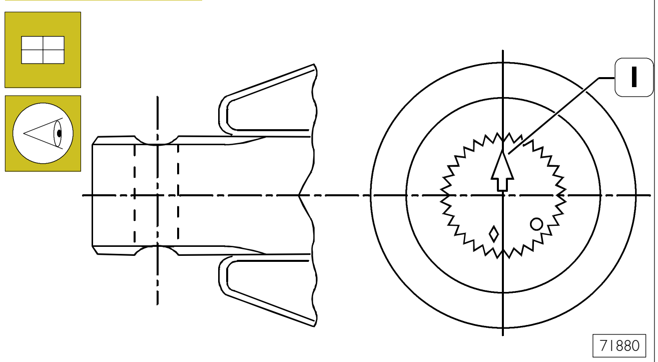
Figure 85



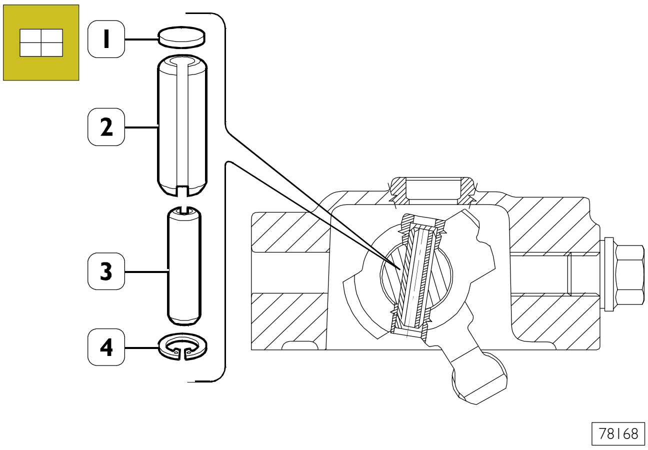
Tighten control shaft (2) in a clamp and assemble thereon box (3) and control selector (1).

Figure 86



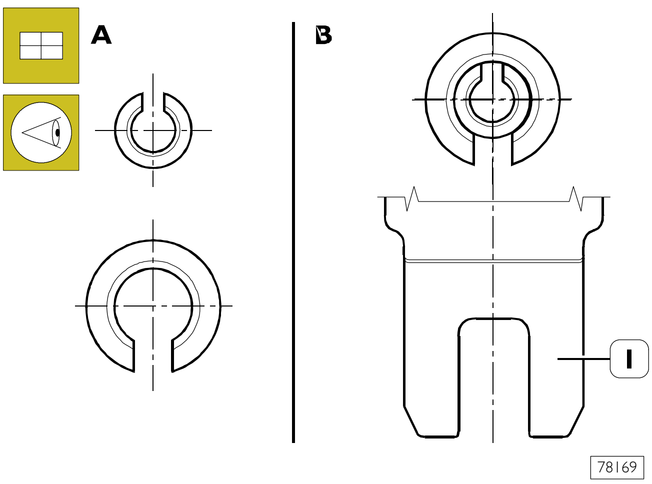
NOTE Upon assembling, the drive shaft must be assembled with the reference arrow (1) facing upwards.

Figure 87



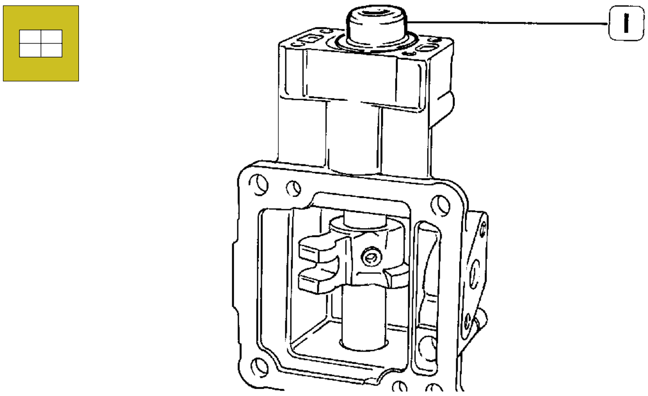
Insert the extraction washer (1) and use a punch tool having the right diameter to install the first plug (2). Install the second plug (3) and the snap ring (4).

Figure 88



NOTE During installation, plug cuts shall be opposed by 180° (see detail A).
The bigger plug cut shall face the control selector (1) milled area (see detail B).

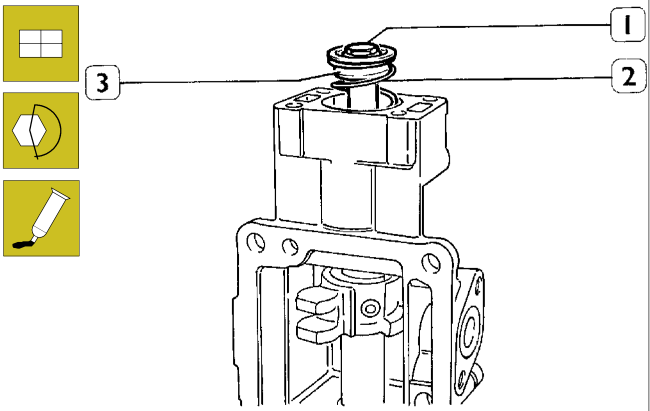
Figure 89



33663

Assemble lower cup (1).

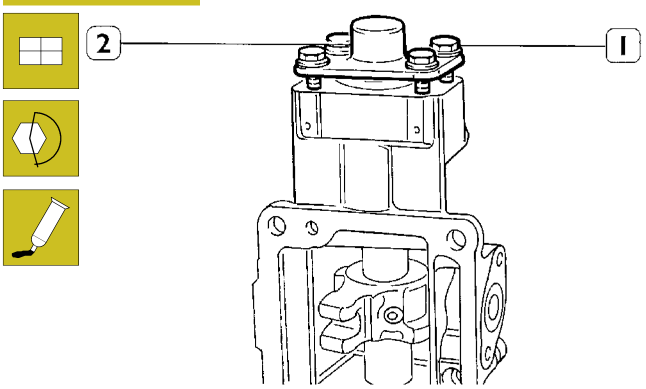
Figure 90



33658

Install the spring (2), the upper cap (3), the spacer and the screw (1) and apply threading sealer LOCTITE 270 on the screw itself.
Tighten the screw (1) to 30 Nm (3.1 kgm).

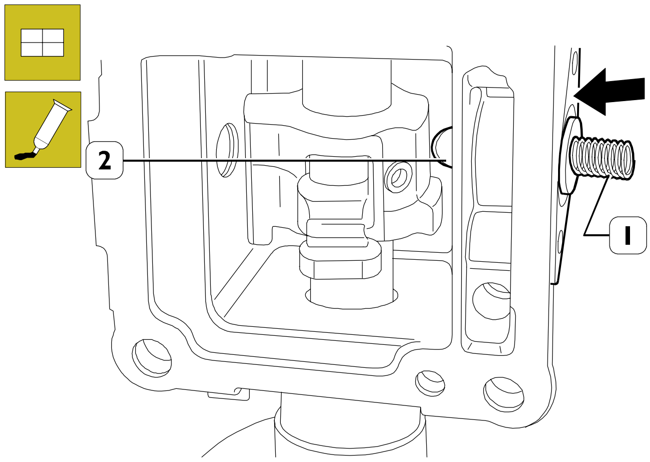
Figure 91



33657

Clean joining surfaces of control box and cover (2) and apply "LOCTITE 510" adhesive on one of the two components. Assemble cover (2) and tighten screws (1) at a torque of 36.5 Nm (3.7 kgm).
Apply threading sealer LOCTITE 270 on the screws (1).

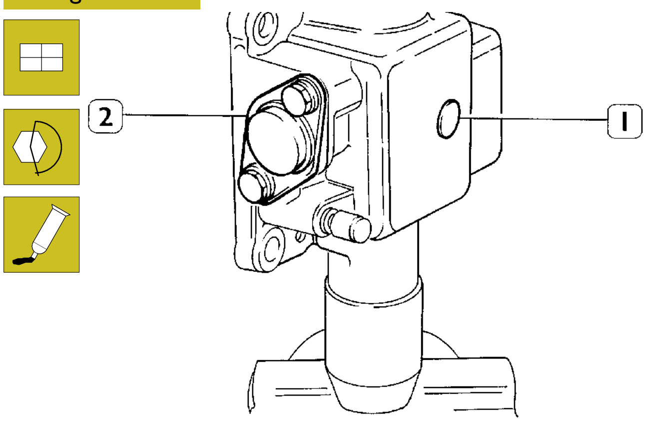
Figure 92



78170

Install the pin (2), the spring (1) and apply sealer "LOCTITE 518" (→).

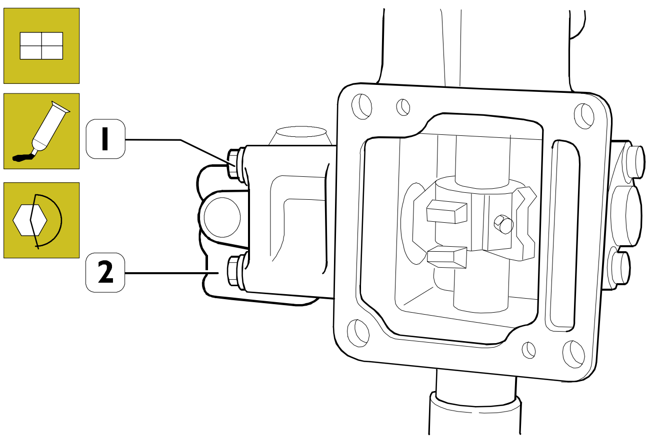
Figure 93



33655

Install the cover (2) and tighten the screws to 19 Nm (1.9 kgm). Apply sealer "LOCTITE 675" and refit the plug (1).

Figure 94



79445

Apply "LOCTITE 519" sealant, mount epicyclic reduction unit control valve (2), screw down screws (1) and tighten them with rated torque.

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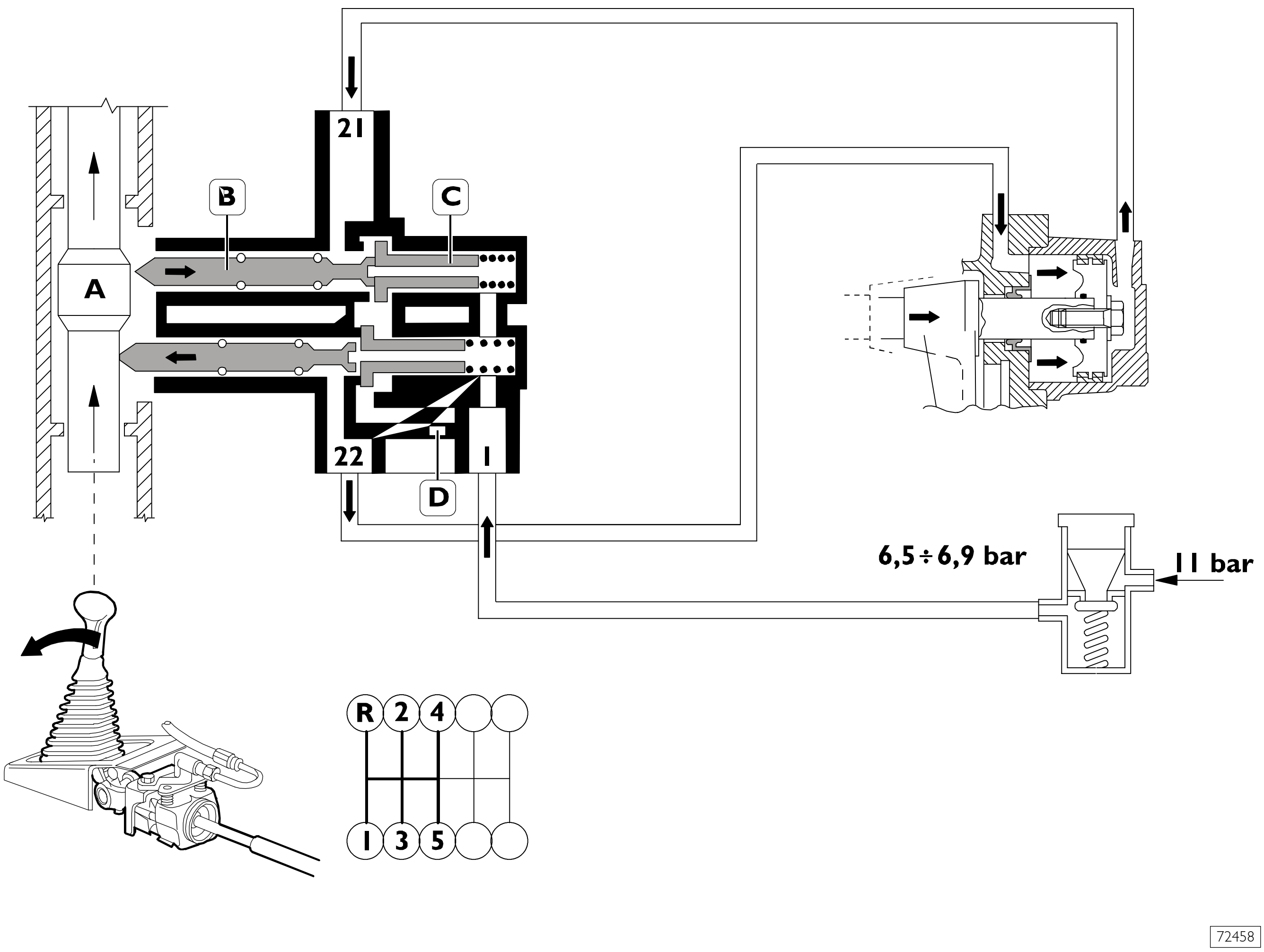
533010 EPICYCLIC REDUCTION GEAR ASSEMBLY

Operating diagrams about pneumatic epicyclic reduction gear drive circuit

Figure 95



SLOW GEAR ENGAGEMENT (1st – 2nd – 3rd – 4th – 5th AND REVERSE GEAR)

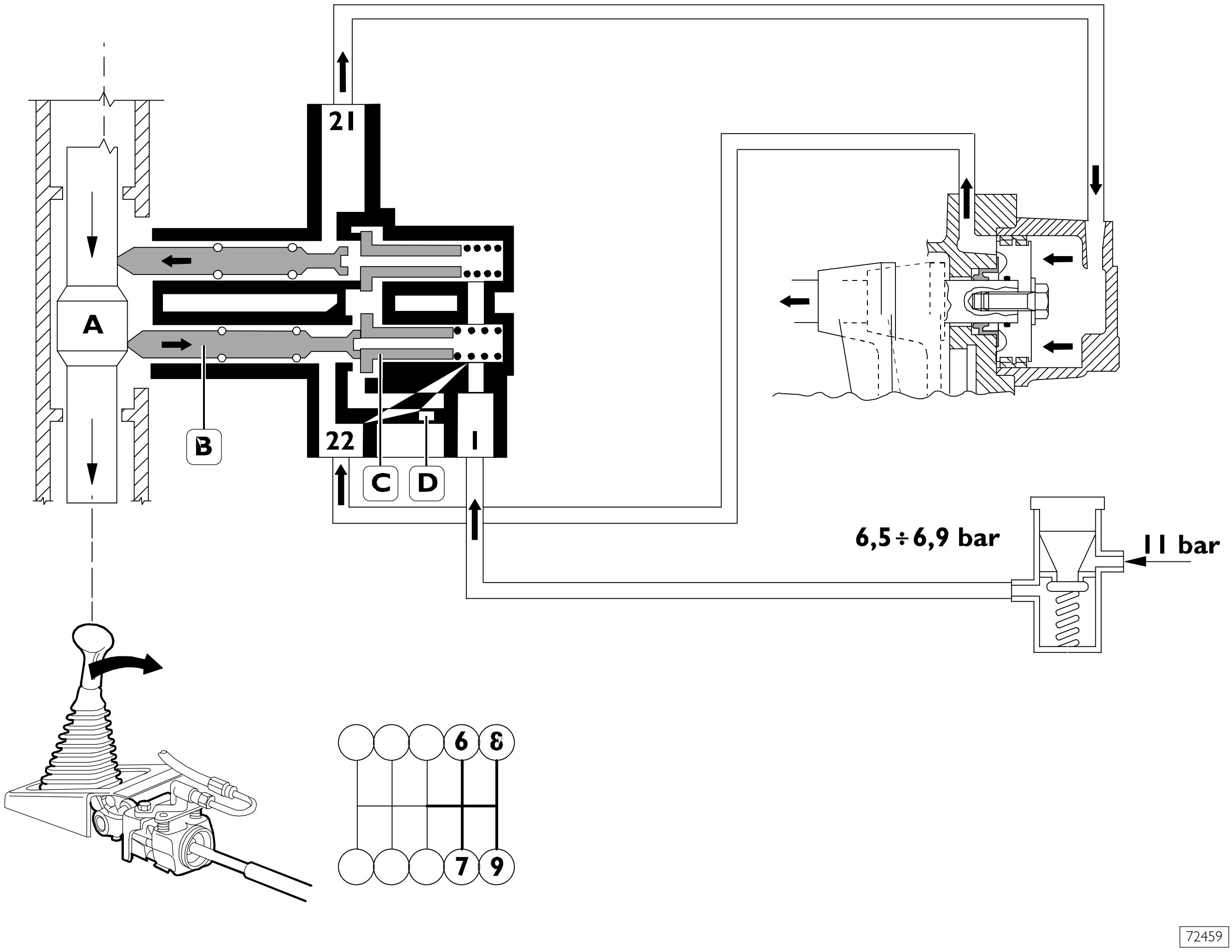
Air coming from services tank, passing through a reduction gear, is reduced to the pressure of 6.5 to 6.9 bars and reaches consent valve at union **1**.

By pressing the clutch, operate on the gearbox lever to engage a gear (1–2–3–4–5–RG); cam (A) is moved upwards and pushes pin (B) leftwards.

The pin abuts on piston (C) valve and by lifting it, closes the supply to union **21**.

By discharging air contained into the cylinder through the vent hole (D), air will then go out of union **22** thereby keeping gearbox piston in slow gears.

Figure 96



QUICK GEARS (6th – 7th – 8th – 9th) ENGAGEMENT

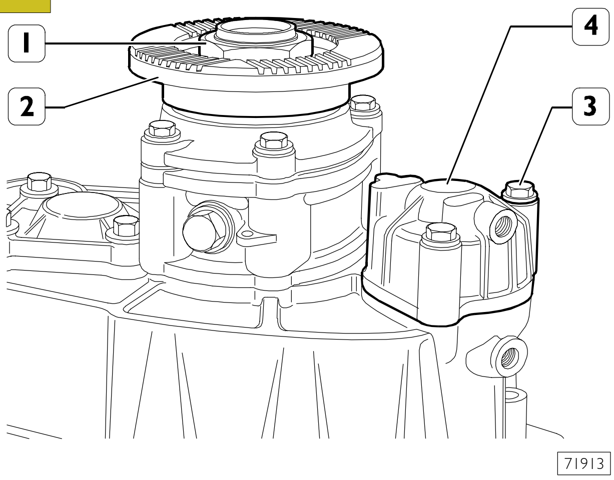
By going with lever into second “H”, cam (A) moves downwards and pushes pin (B) leftwards.

The pin abuts on piston (C) valve and, by lifting it, closes the supply to union **22** discharging air contained into the cylinder through vent hole (D).

Air will then go out of union **21** pushing the piston in reverse and allowing to insert quick gears.

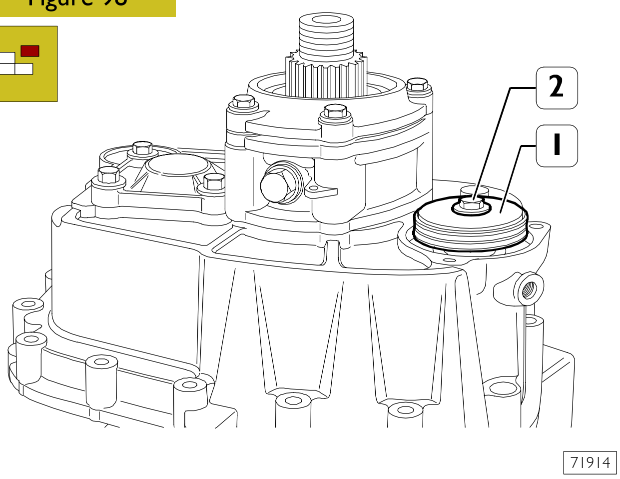
DISASSEMBLY

Figure 97



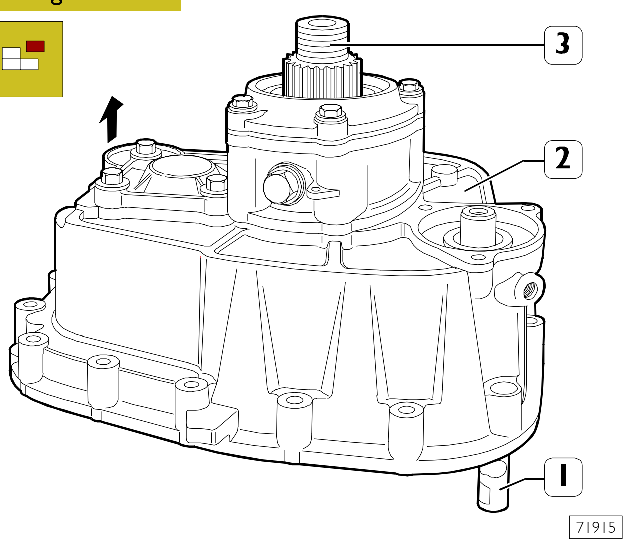
Abut epicyclic reduction gear assembly on a bench, unscrew nut (1) and remove flange (2). Unscrew screws (3) and remove cylinder (4).

Figure 98



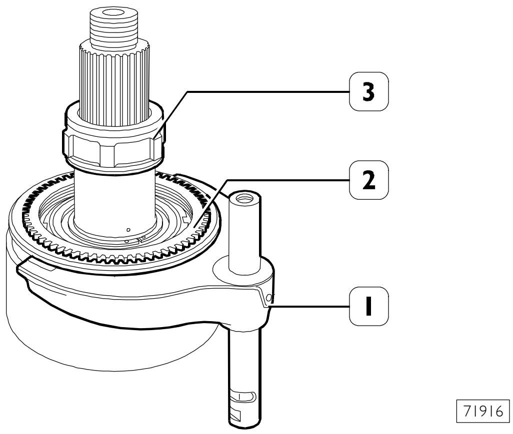
Unscrew screw (2) and remove piston (1).

Figure 99



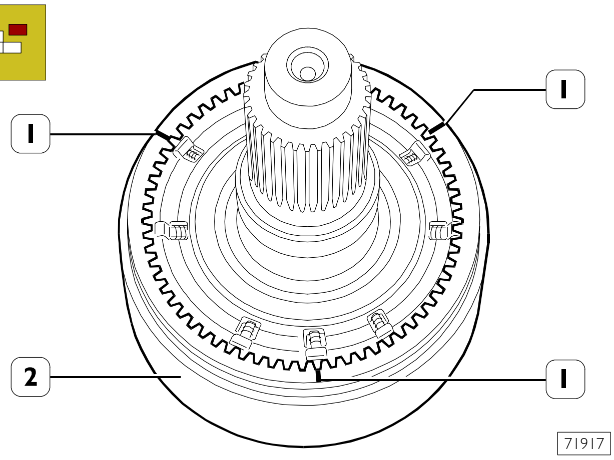
Lift case (2) in order to free outlet shaft (3) and rod (1) for synchronising drive fork.

Figure 100



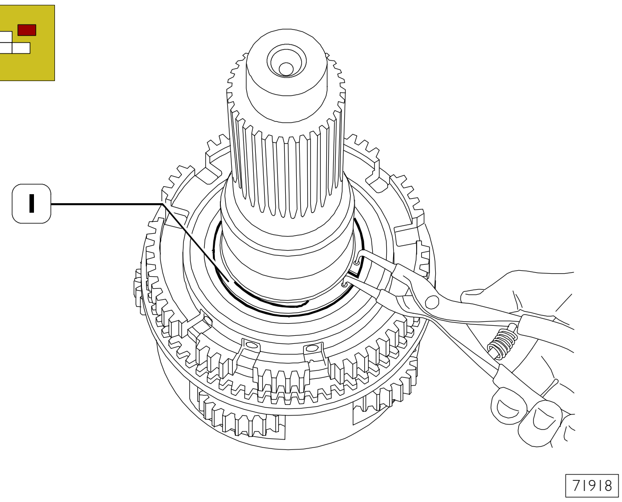
Remove rod with fork (1), withdraw phonic wheel (3) and remove synchronising ring (2).

Figure 101



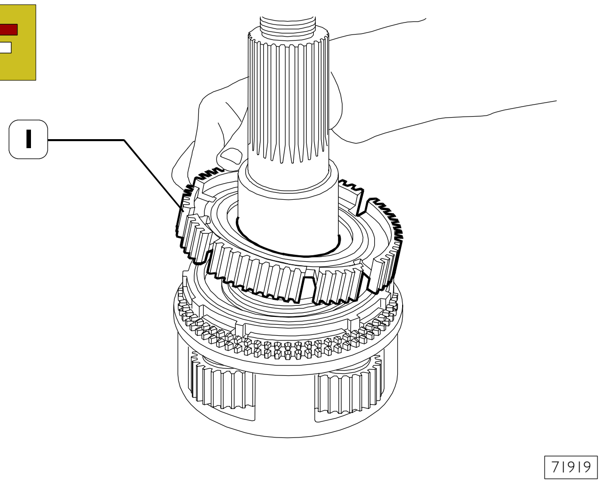
Make three reference marks (1) on sliding sleeve–crown assembly (2) next to the three central seats, on fixed hub, for positioning rollers.
Manually lift complete crown (2) and remove it, recovering rollers, pins and springs.

Figure 102



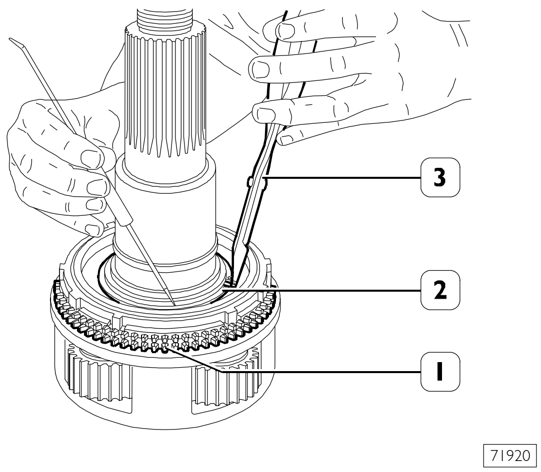
Through suitable pliers, remove elastic ring (1).

Figure 103



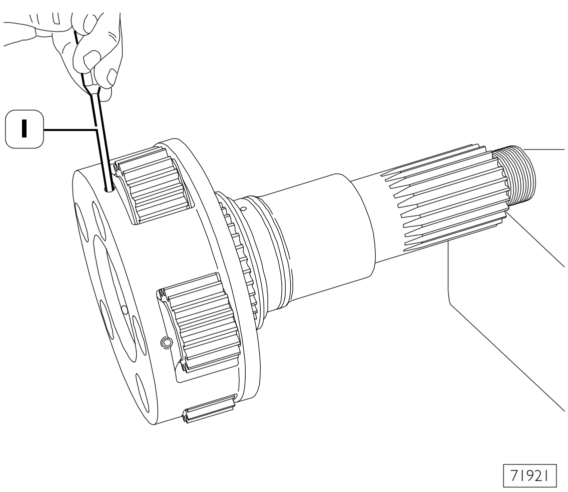
Withdraw synchroniser fixed hub (1).

Figure 104



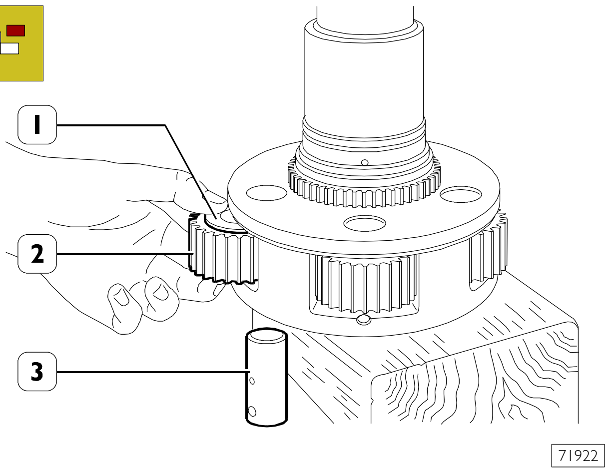
Through pliers 99381125 (3), remove elastic ring (2) and withdraw synchroniser (1).

Figure 105



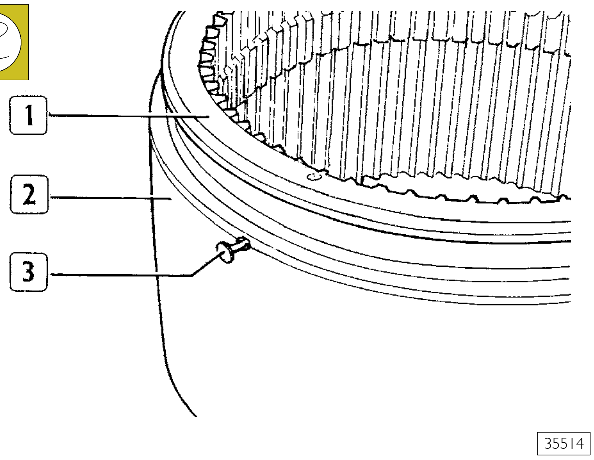
Through a punch (1) with a suitable diameter, push the elastic peg inwards till it abuts.

Figure 106



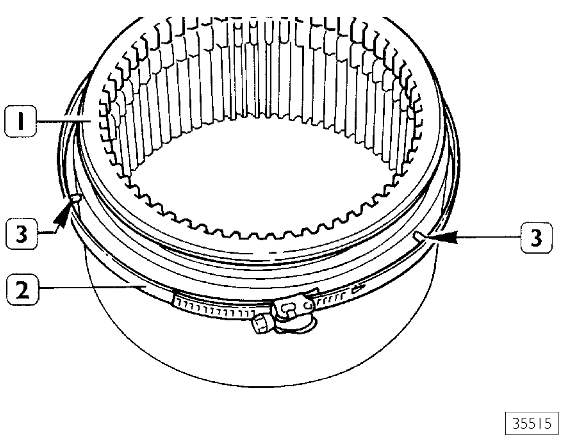
Through a suitable beater, push away pin (3) and withdraw gear (2) completed with shoulder rings (1) and shims.
Recover all rollers composing the bearing.

Figure 107



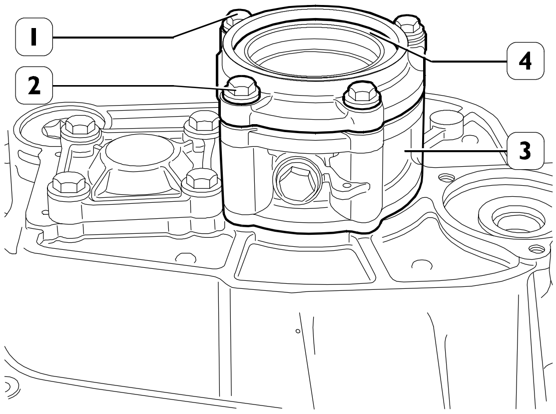
In order to remove sliding sleeve (1) from crown (2), use small pins (3) with diameter 2 to 2.3 mm and a length of 10 mm.

Figure 108



Apply a strap (2), tighten it in order to compress pins (3): in such a way, the internal check ring is detached; then, withdraw sliding sleeve (1).

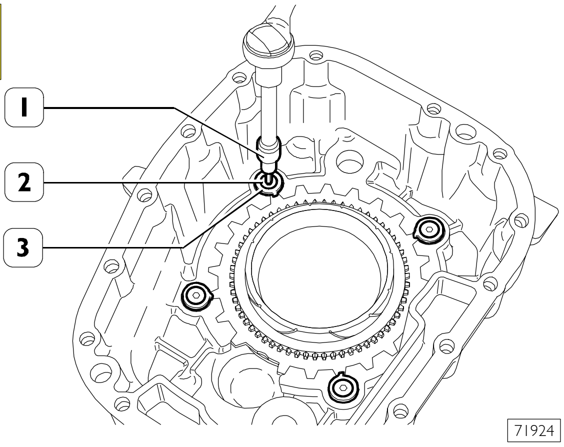
Figure 109



71923

Extract sealing gasket (4) from cover (2), unscrew screws (1) and disassemble cover (2) and support (3).

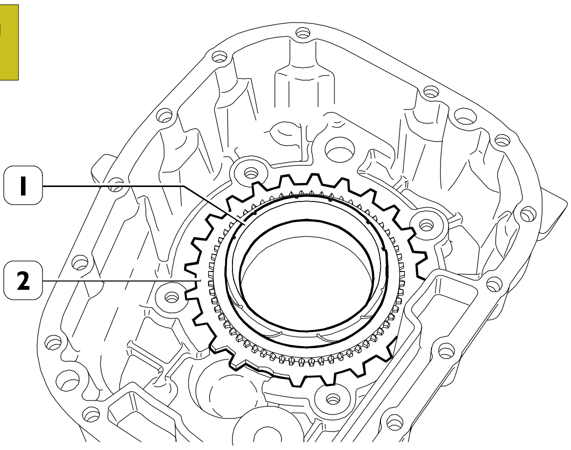
Figure 110



71924

Through a suitable wrench (1), unscrew screws (2) and remove check washers (3).

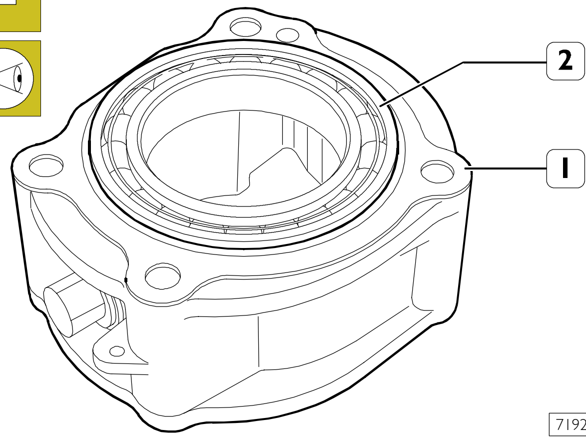
Figure 111



71925

Withdraw synchronising ring (1), reaction ring (2) and recover the spacer ring below.

Figure 112



71926

Check that ball bearing (2), when rotating along the two directions, does not show roughness or noise when sliding. In case of a replacement of the bearing itself, slightly heat support (1) seat before disassembling it.

Checks

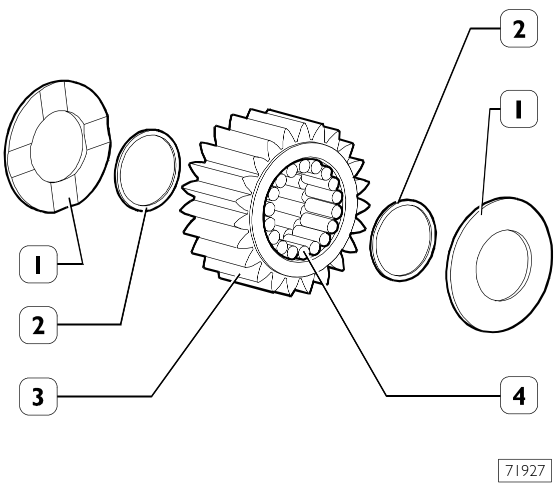
Check that all parts composing the epicyclic reduction gear assembly do not shown traces of excessive wear, seizures or breakages.

Replace the affected parts.

NOTE Upon assembling, the following must always be replaced: rings, sealing gaskets and springs for sliding sleeves positioning rollers.

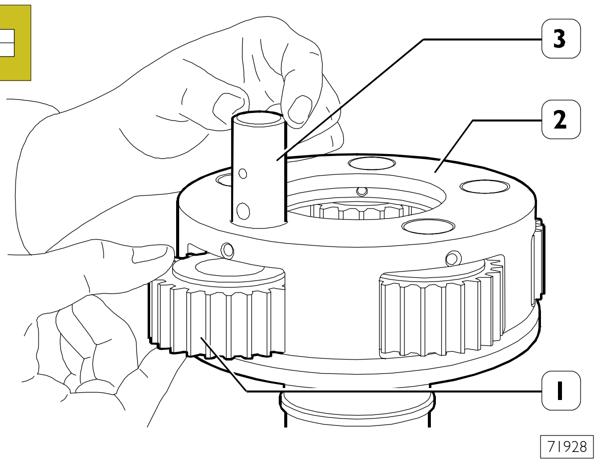
ASSEMBLY

Figure 113



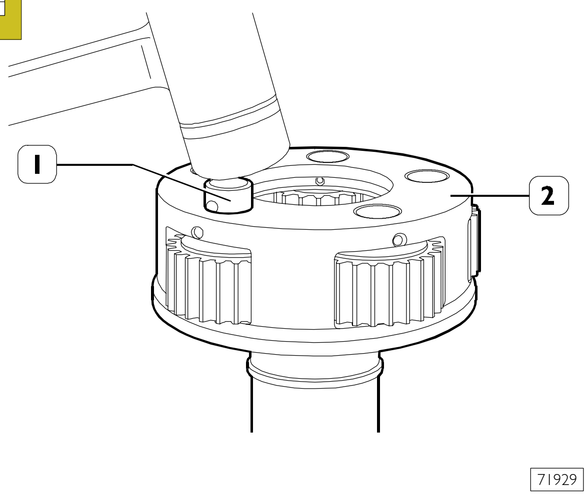
By using grease, pre–assemble rollers (4), shims (2) and shoulder rings (1) into planetary gear (3).

Figure 114



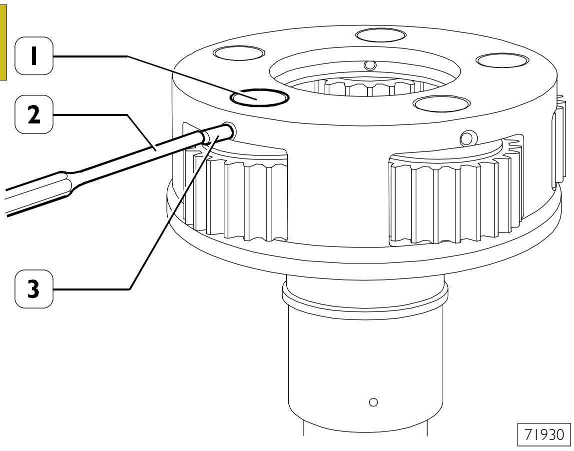
Assemble complete planetary gear (1) into planetary gear–holder shaft (2) and key–in pin (3).

Figure 115



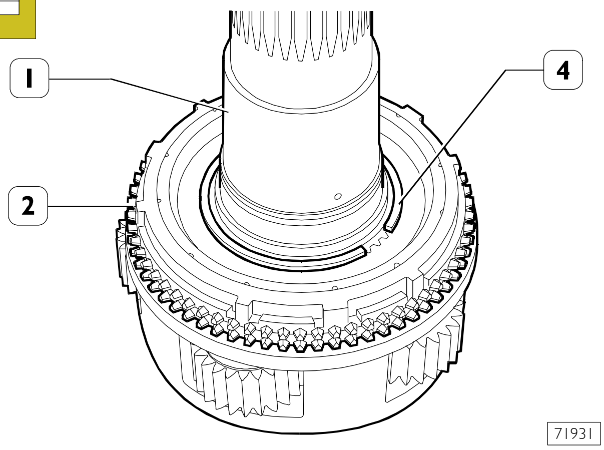
Settle pin (1) on planetary gear–holder shaft (2) by using a plastic hammer.

Figure 116



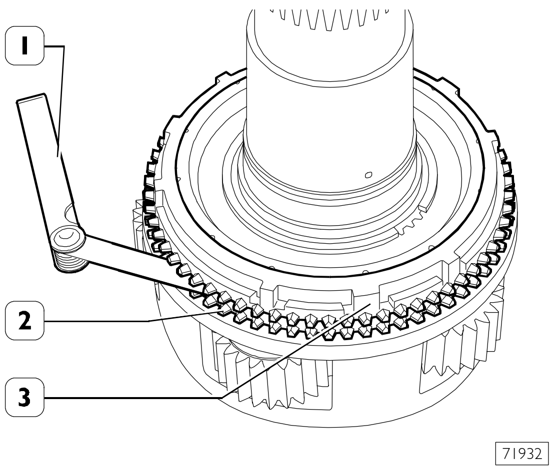
By using a punch (2), assemble elastic peg (2) checking pin (3).

Figure 117



Turn planetary gear–holder shaft (1) over, assemble synchronising rings (2) and arrange elastic check ring (4).

Figure 118



Through a feeler gauge (1), check the clearance between the two synchronising rings (2) and (3) that must be included between 0.5 and 1.9 mm. Otherwise, replace the synchronising rings.

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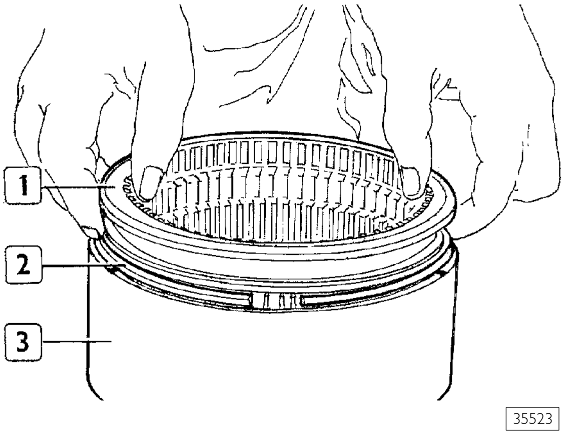
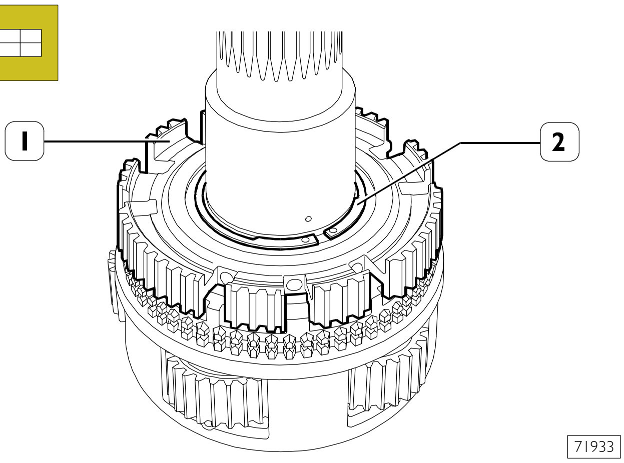
Figure 119



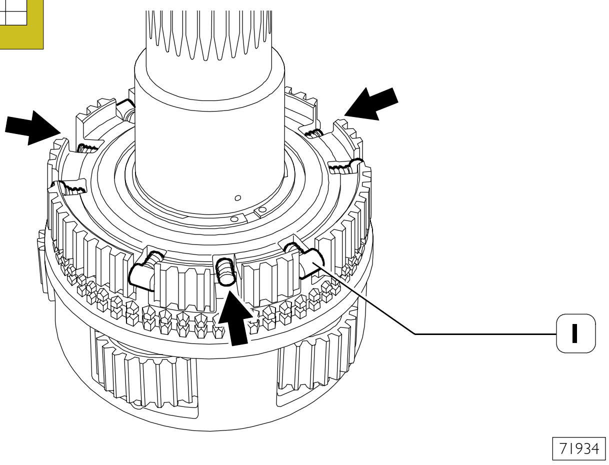
Key–in sliding sleeve (1) completed with check ring (2) on crown (3), then, by compressing ring (2), push sliding ring (1) into the crown till the check ring is hooked into its own seat.

Figure 120



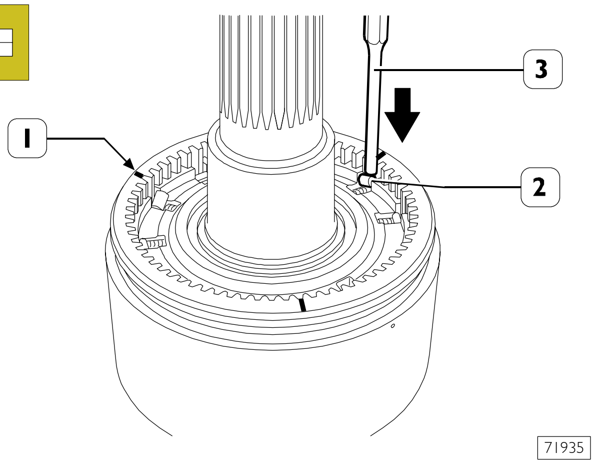
Assemble hub (1) on planetary gear–holder shaft and arrange elastic check ring (2).

Figure 121



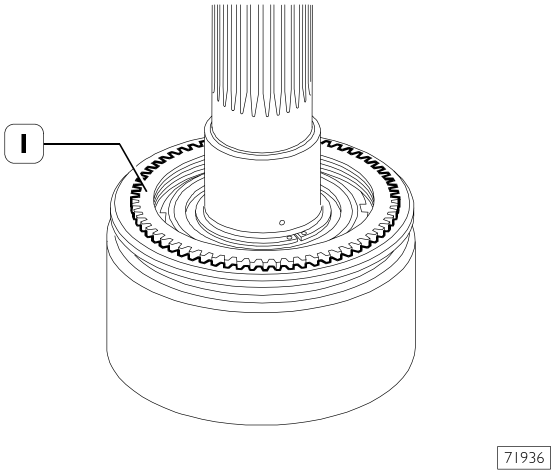
Arrange springs, pins and rollers (1), apart from the central ones (→), into the hub.

Figure 122



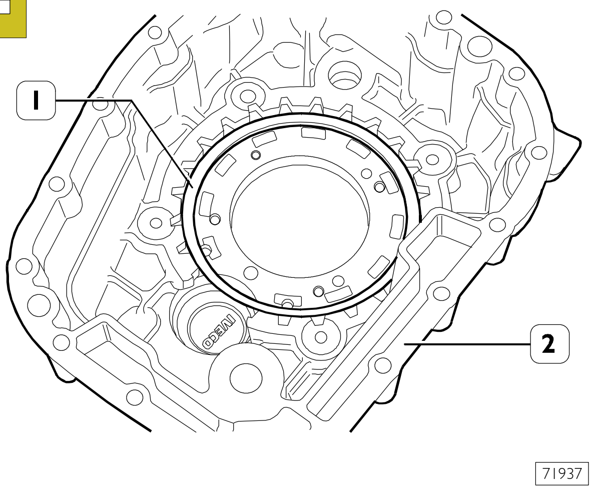
Key–in the crown, by placing it in a neutral position with marks (1) next to the seats without rollers. Arrange the three central rollers (2) and with a punch (3) push them into their seats.

Figure 123



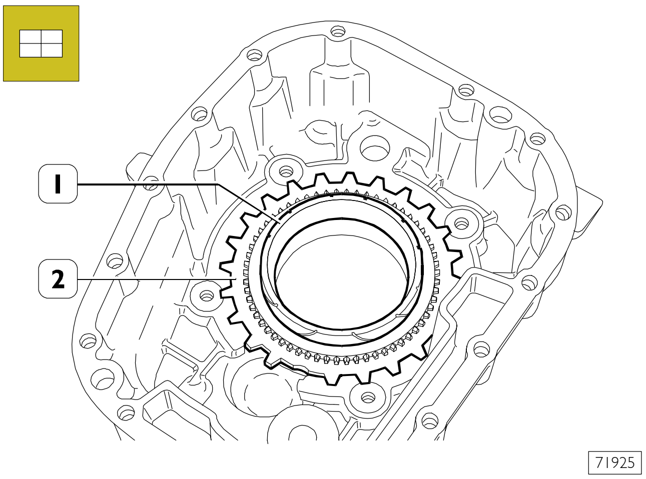
Key–in synchronising ring (1).

Figure 124



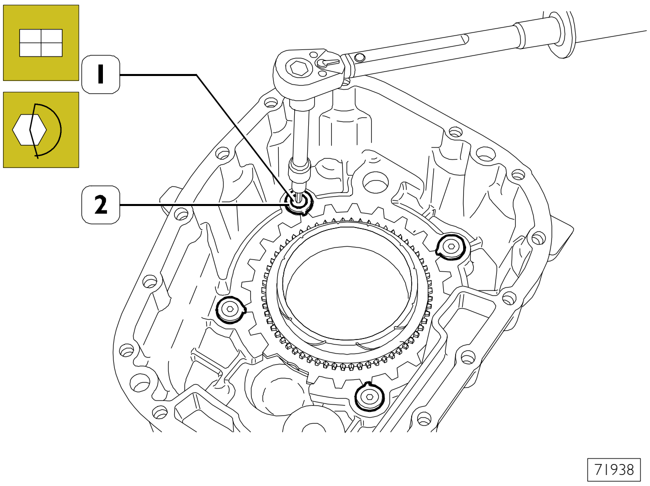
Insert spacer ring (1) into its seat in case (2).

Figure 125



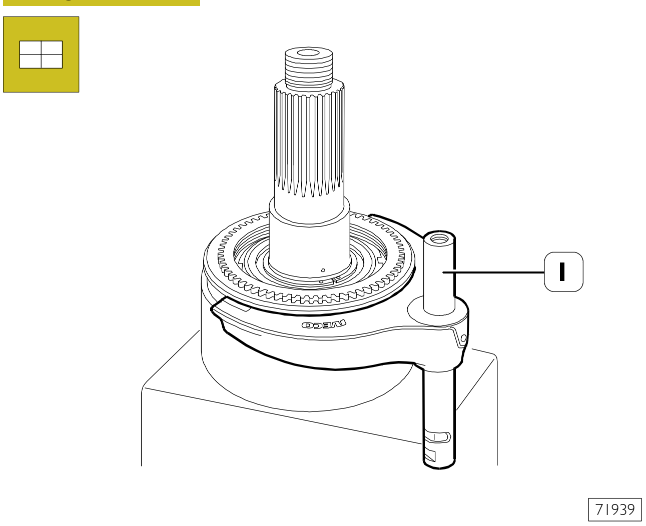
Assemble synchronising ring (1) and reaction ring (2).

Figure 126



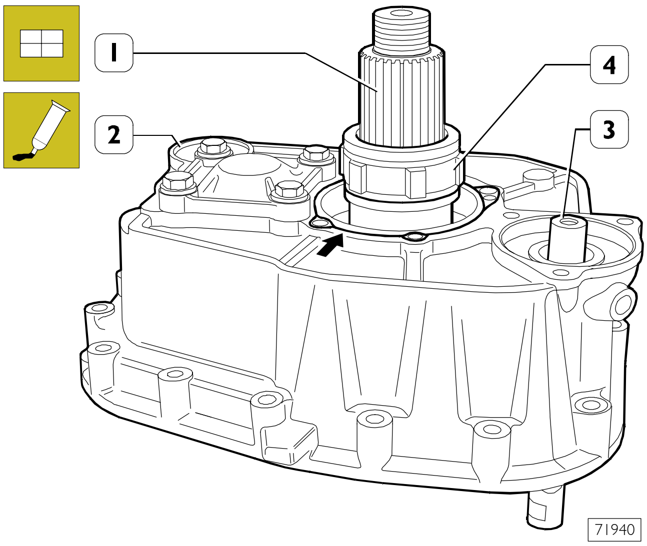
Assemble check washers (2), screw screws (1) and tighten them at the required torque.

Figure 127



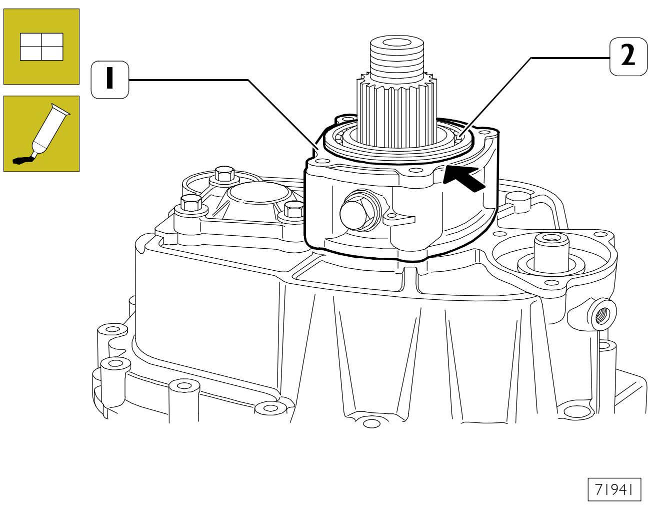
Place control fork (1) completed with rod as shown in the figure.

Figure 128



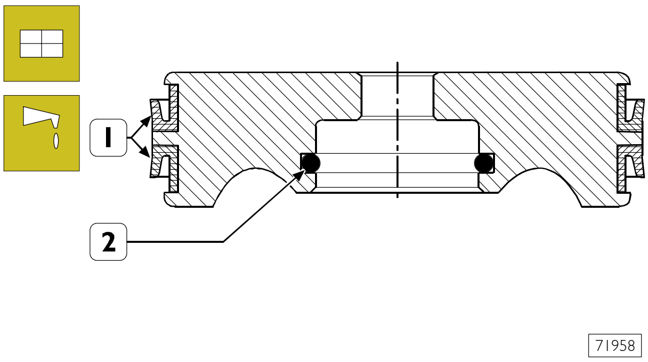
Key–in box (2) on planetary gear–holder shaft (1) and on rod for control fork (3). Key–in phonic wheel (4) on planetary gear–holder shaft (1).
Apply LOCTITE 510 sealant on contact surface (→) between case (2) and support.

Figure 129



Assemble support (1) completed with ball bearing (2).
Apply LOCTITE 510 sealant on contact surface (→) between support and cover.

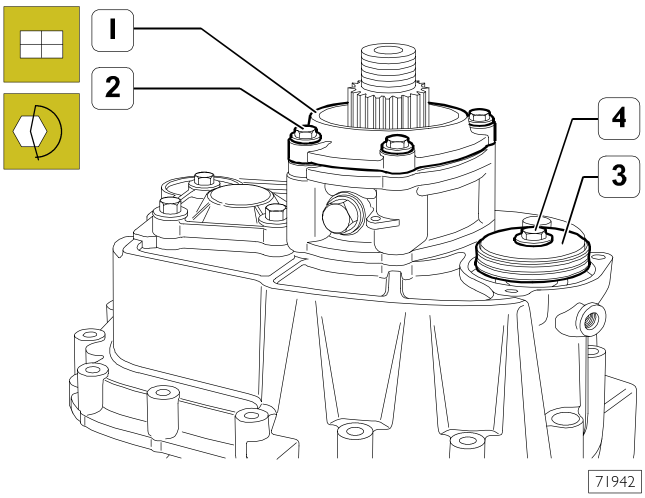
Figure 130



Abundantly pre–lubricate gaskets (1 and 2) of oil piston equal to the one used for gearbox and assemble them into their respective seats, using suitable toolings in order to guarantee a correct assembly.

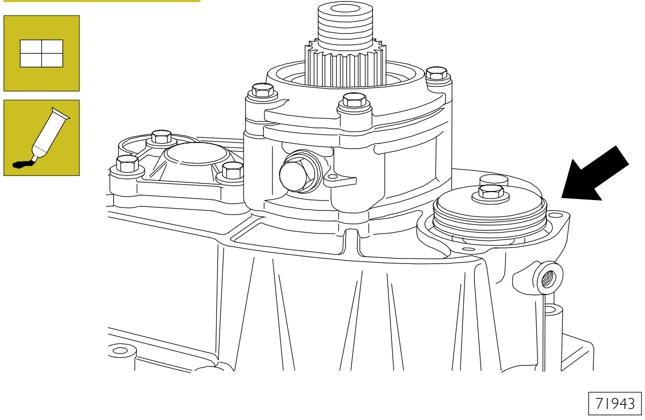
NOTE Pay attention to the correct assembly of sealing gaskets (1) placed on external piston diameter.

Figure 131



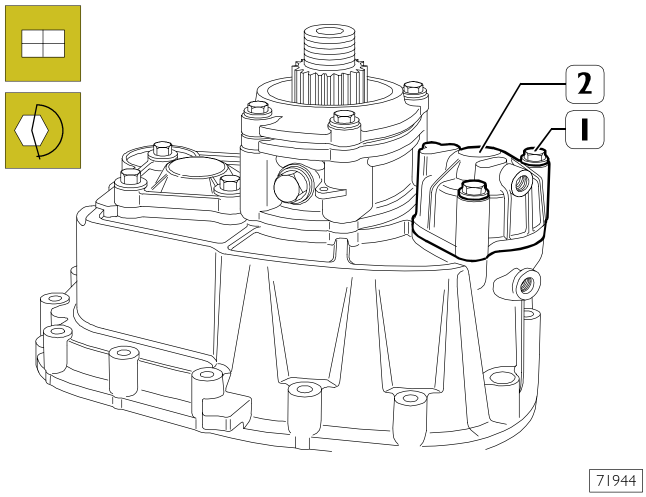
Assemble cover (1) and screw screws (2) tightening them at the required torque.
Assemble piston (3) completed with sealing rings, screw the screw (4) by tightening it at the required torque.

Figure 132



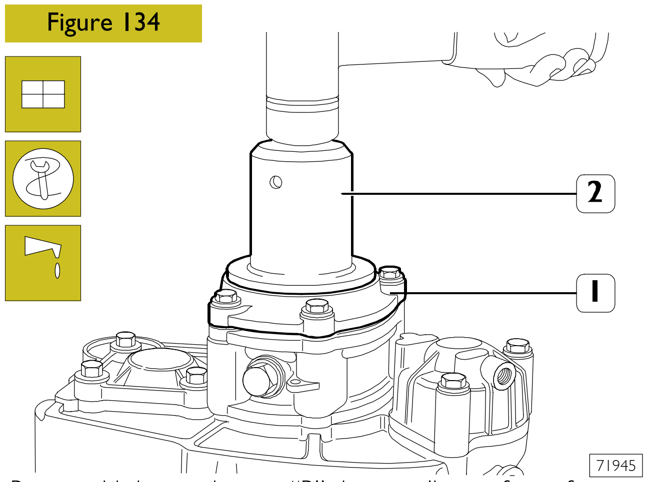
Apply LOCTITE 510 sealant on contact surface (→) between case and cylinder.

Figure 133



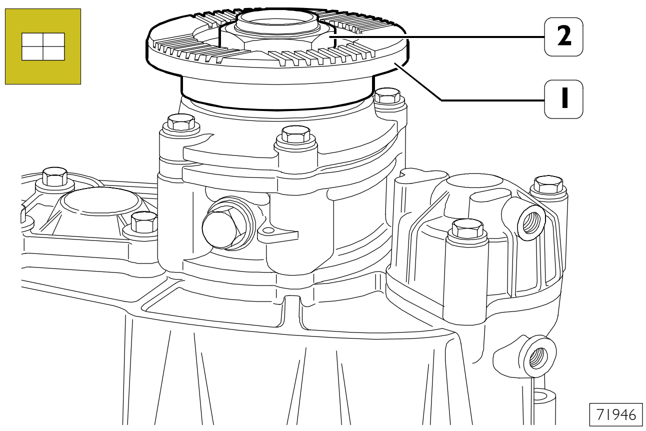
Assemble cylinder (2) and screw screws (1) tightening them at the required torque.

Figure 134



Butter with hermetic type "B" the coupling surface of cover (1) with sealing gasket and with keyer 99574229 (2), assemble the sealing gasket itself.

Figure 135



Key–in flange (1) and screw nut (2) without blocking it.

NOTE Nut (2) must be blocked at the required torque after having assembled the reduction gear onto the gearbox.

SECTION 5

Propeller shafts

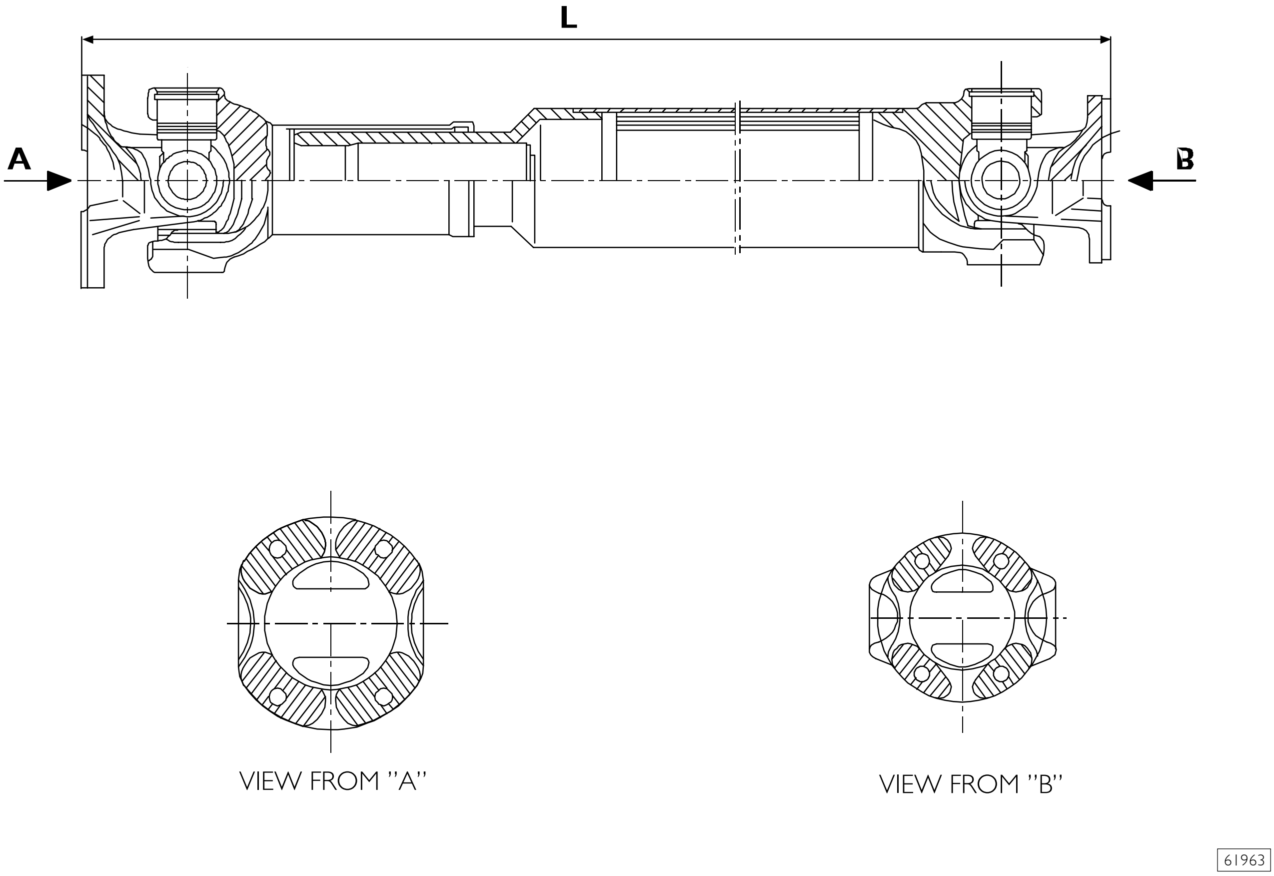
Page

DESCRIPTION

Motion transmission from engine–gearbox to rear axle occurs through a propeller shaft that is sliding in a single section or in two sections composed of a fixed front shaft and a sliding rear shaft.
The sliding shaft is connected to the sleeve keyed to the differential tapered pinion by means of cardan joints.

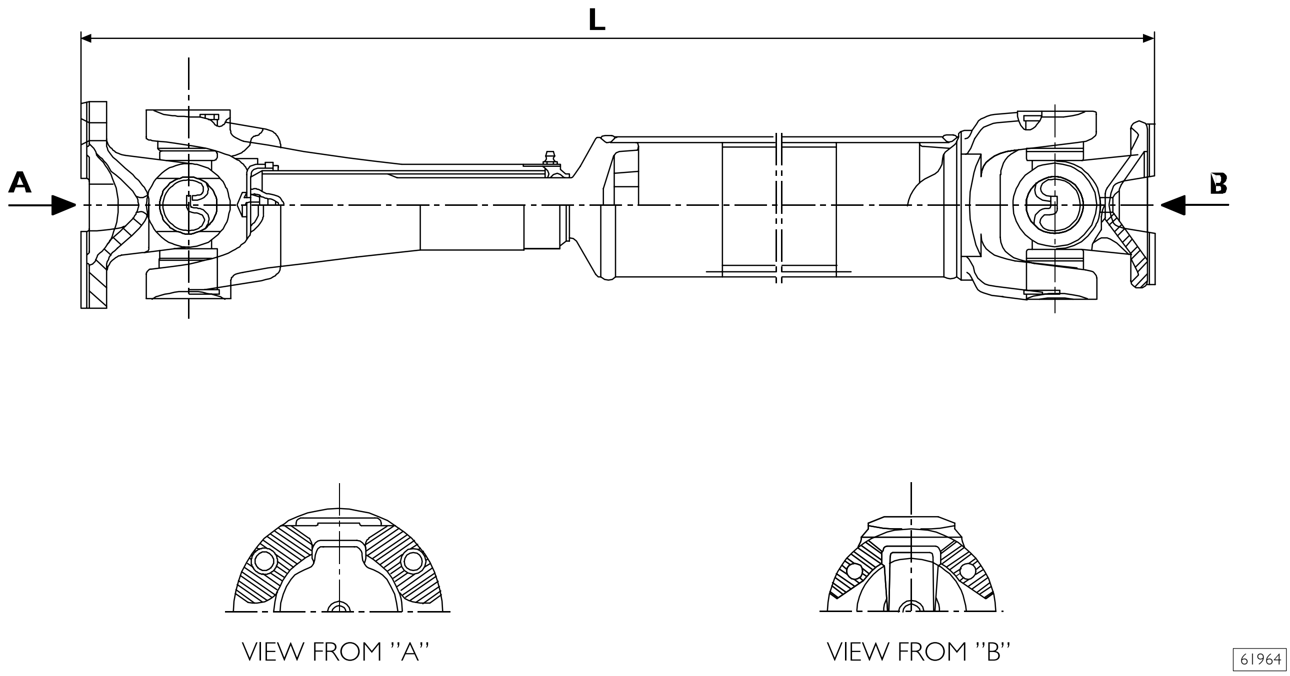
The front end of the sliding propeller shaft is composed, in addition to the cardan joint, of a moving grooved sleeve also, which allows the shaft to modify its length in order to dampen possible axial transmission displacements, due to rear axle oscillations.

Figure 1



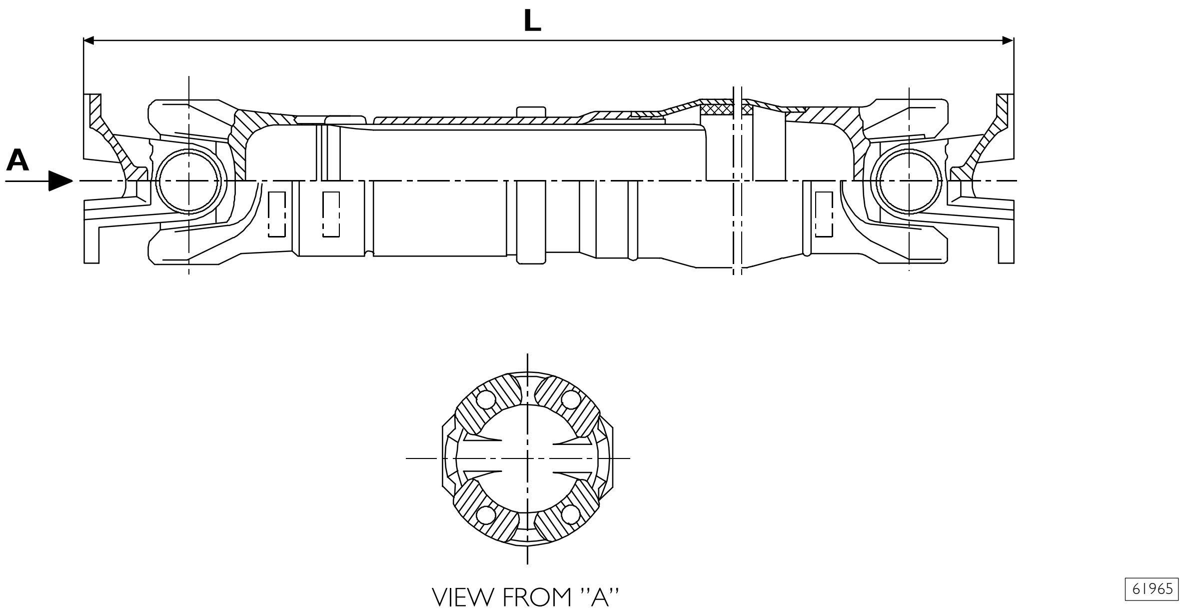
SLIDING PROPELLER SHAFT OF THE GKN TYPE

Figure 2



SLIDING PROPELLER SHAFT OF THE DANA TYPE

Figure 3



SLIDING PROPELLER SHAFT OF THE KLEIN TYPE

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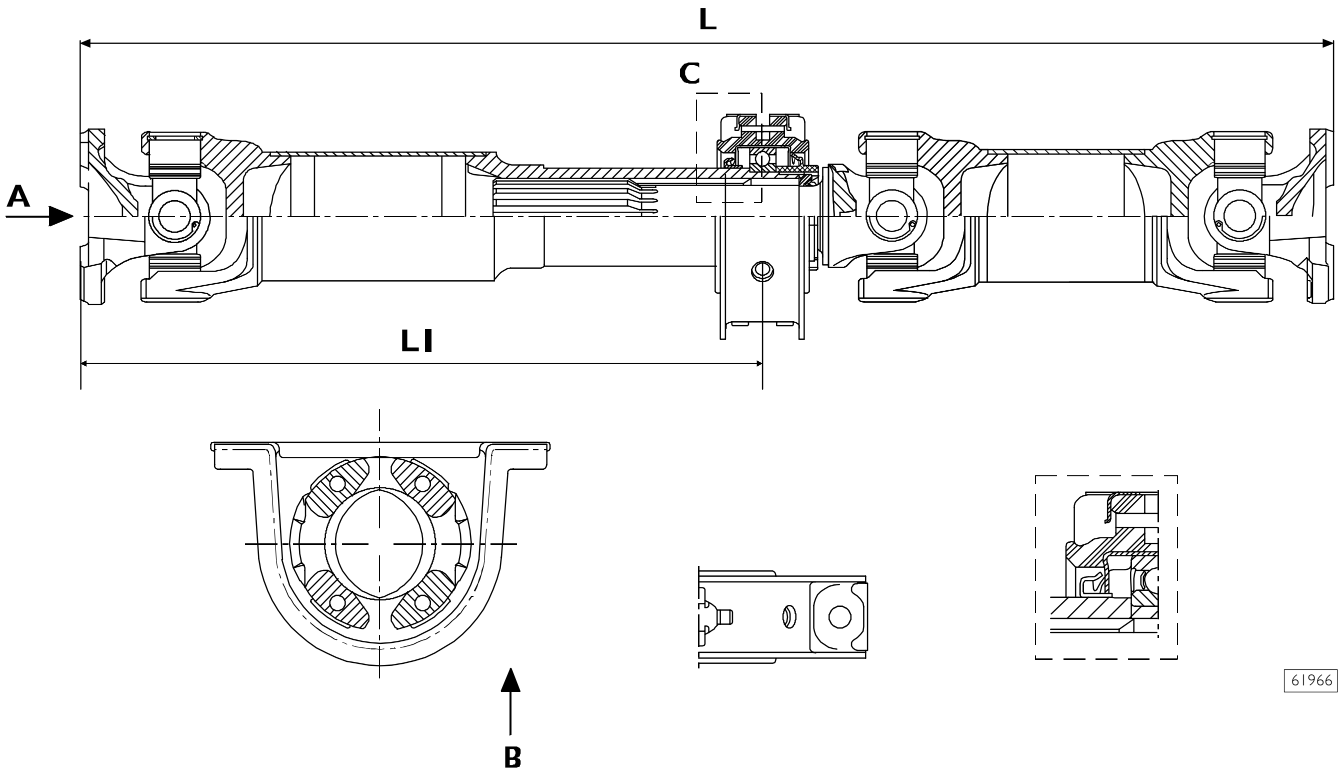
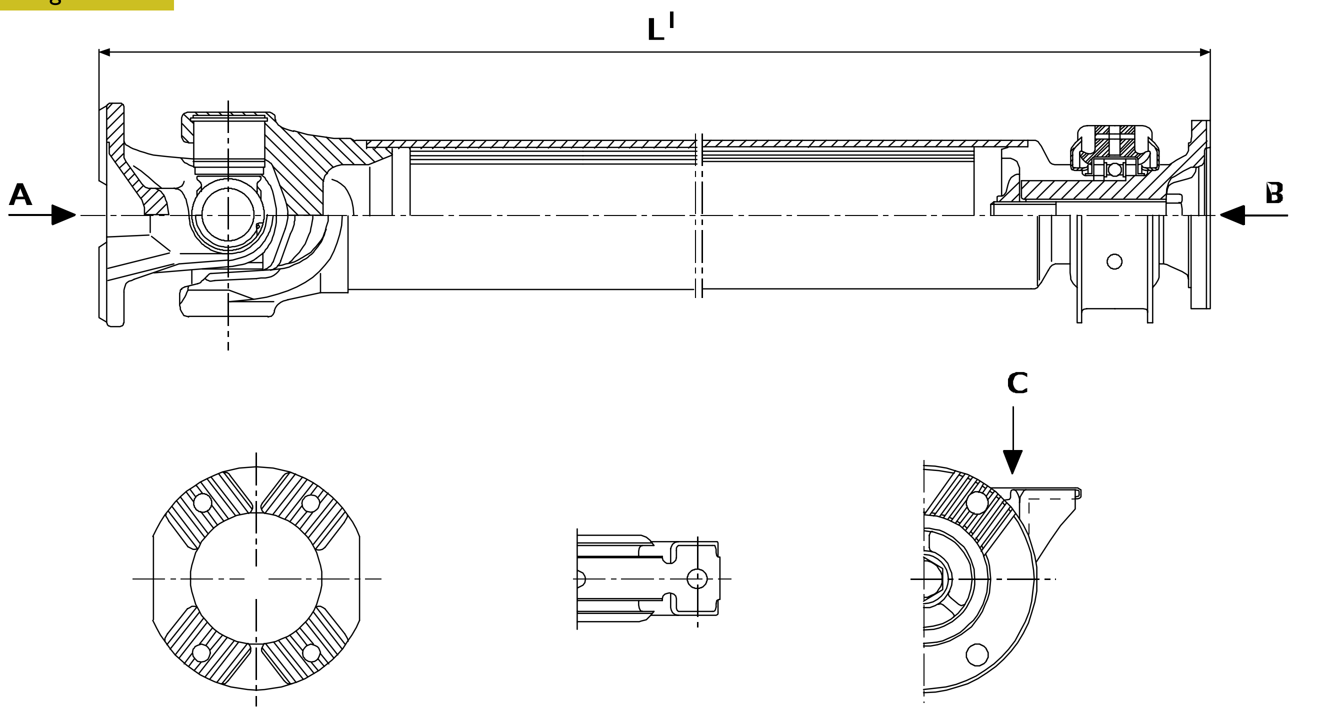
Figure 4



VIEW FROM "A" VIEW FROM "B" DETAIL "C"

SINGLE–SECTION PROPELLER SHAFT OF THE GKN TYPE

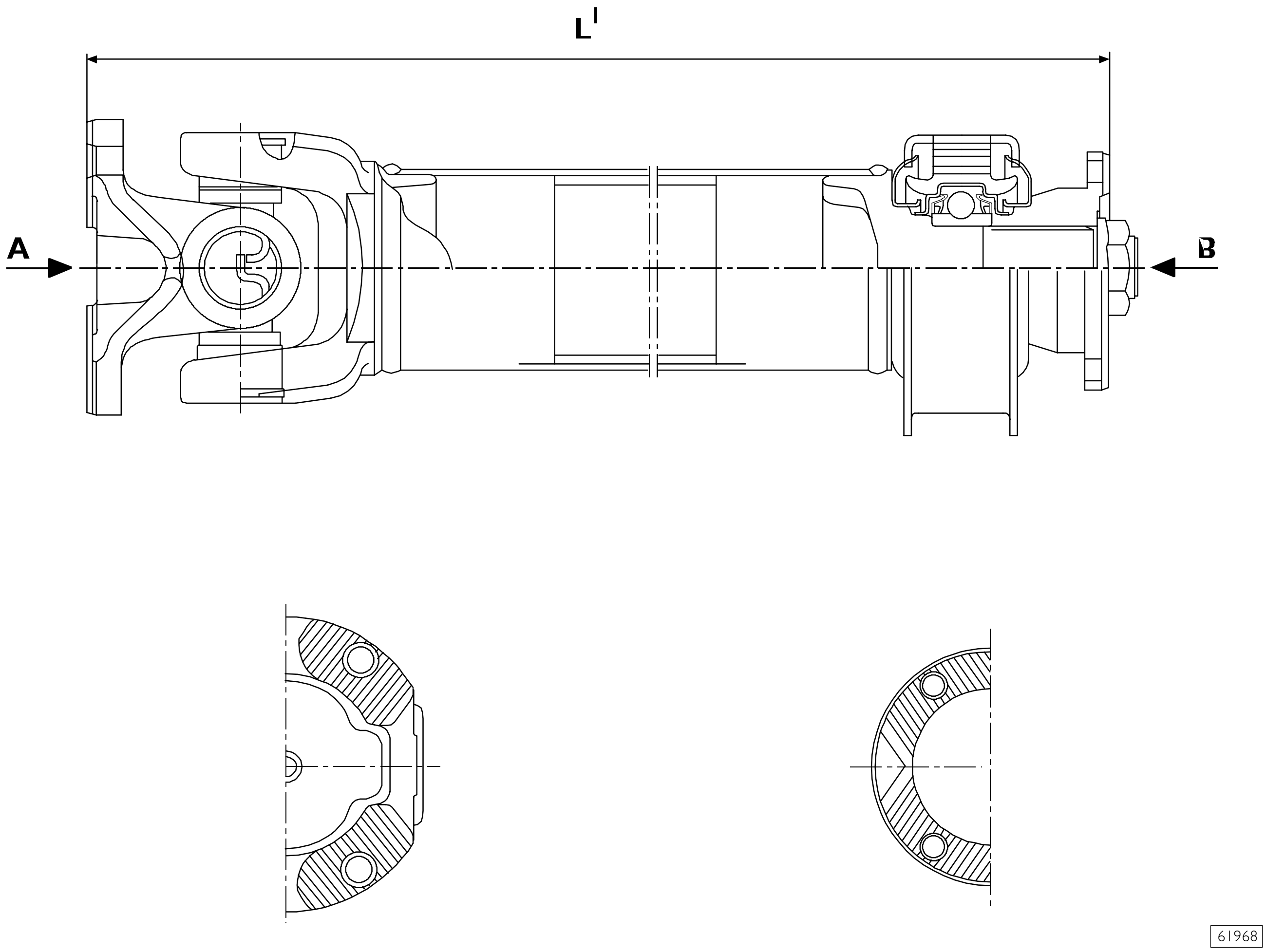
Figure 5



VIEW FROM "A" VIEW FROM "C" VIEW FROM "B"

FIXED PROPELLER SHAFT OF THE GKN TYPE

Figure 6



VIEW FROM "A" VIEW FROM "B"

FIXED PROPELLER SHAFT OF THE DANA TYPE

SPECIFICATIONS AND DATA FOR ”FIXED” AND ”SLIDING” PROPELLER SHAFTS

		PITCH	2700	3105	3330	3690		4185		4455		4815	
			L mm	L mm	L mm	L1 mm	L mm	L1 mm	L mm	L1 mm	L mm	L1 mm	L mm
MODEL	ENGINE	GEARBOX TYPE	min max	min max	min max		min max		min max		min max		min max
ML 60E..	4 cylinders	2855.5/2855.6	1340 to 1440	1720 to 1830	–	–	–	–	–	–	–	–	–
ML 65E..	4 cylinders	2855.5/2855.6	1340 to 1440	1720 to 1830	–	–	–	–	–	–	–	–	–
ML 75E13–15	4 cylinders	2855.5/2855.6	1340 to 1440	1720 to 1830	–	–	–	–	–	–	–	–	–
ML 75E17	4 cylinders	2855.5/2855.6	1340 to 1440	1720 to 1830	–	–	–	–	–	–	–	–	–
ML 75E18	6 cylinders	2855.5/2855.6	1220 to 1330	1630 to 1740	1850 to 1960	–	–	–	–	–	–	–	–
ML 80EL..	4 cylinders	2855.5/2855.6	1330 to 1440	1720 to 1830	–	–	–	–	–	–	–	–	–
ML 80E..	4 cylinders	2855.6	1360 to 1460	1760 to 1870	–	–	–	–	–	–	–	–	–
ML 80E..	4 cylinders	2870.9	1600 to 1270	1560 to 1660	1790 to 1900	1180	960 to 1070	1180	1450 to 1560	1180	1720 to 1830	1610	1650 to 1760
ML 80E..	6 cylinders	2855.6	1250 to 1360	1650 to 1760	1850 to 1960	–	–	–	–	–	–	–	–
ML 80E..	6 cylinders	2865.6	1200 to 1310	1600 to 1710	1830 to 1940	1235	960 to 1070	1235	1450 to 1560	1235	1720 to 1830	1662	1650 to 1760
ML 80E..	6 cylinders	2870.9	1040 to 1150	1440 to 1550	1660 to 1770	1070	960 to 1070	1070	1450 to 1560	1070	1720 to 1830	1500	1650 to 1760
ML 90E..	4 cylinders	2855.6	1360 to 1460	1760 to 1870	–	–	–	–	–	–	–	–	–
ML 90E..	4 cylinders	2870.9	1160 to 1270	1560 to 1660	1790 to 1900	1180	960 to 1070	1180	1450 to 1560	1180	1720 to 1830	1610	1650 to 1760
ML 90E..	6 cylinders	2855.6	1250 to 1360	1650 to 1760	1850 to 1960	–	–	–	–	–	–	–	–
ML 90E..	6 cylinders	2865.6	1200 to 1310	1600 to 1710	1830 to 1940	1235	960 to 1070	1235	1450 to 1560	1235	1720 to 1830	1662	1650 to 1760
ML 90E..	6 cylinders	2870.9	1040 to 1150	1440 to 1550	1660 to 1770	1070	960 to 1070	1070	1450 to 1560	1070	1720 to 1830	1500	1650 to 1760
ML 100E..	4 cylinders	2855.6	1360 to 1460	1760 to 1870	–	–	–	–		–	–	–	–
ML 100E..	4 cylinders	2870.9	1160 to 1270	1560 to 1660	1790 to 1900	1180	960 to 1070	1180	1450 to 1560	1180	1720 to 1830	1610	1650 to 1760
ML 100E..	6 cylinders	2855.6	1250 to 1360	1650 to 1760	1850 to 1960	–	–	–	–	–	–	–	–
ML 100E..	6 cylinders	2865.6	1200 to 1310	1600 to 1710	1830 to 1940	1235	960 to 1070	1235	1450 to 1560	1235	1720 to 1830	1662	1650 to 1760
ML 100E..	6 cylinders	2870.9	1040 to 1150	1440 to 1550	1660 to 1770	1070	960 to 1070	1070	1450 to 1560	1070	1720 to 1830	1500	1650 to 1760

SPECIFICATIONS AND DATA FOR "SINGLE–SECTION" PROPELLER SHAFTS

		PITCH	3330		3690		4185		4455		4815	
			L1 mm	L mm	L1 mm	L mm	L1 mm	L mm	L1 mm	L mm	L1 mm	L mm
MODEL	ENGINE	GEARBOX TYPE		min max		min max		min max		min max		min max
ML 60E..	4 cylinders	2855.5/2855.6	875	1965 to 2065	1280	2335 to 2345	1280	2830 to 2930	1262	3090 to 3190	1637	3450 to 3550
ML 65E..	4 cylinders	2855.5/2855.6	875	1965 to 2065	1280	2335 to 2345	1280	2830 to 2930	1262	3090 to 3190	1637	3450 to 3550
ML 75E13–15	4 cylinders	2855.5/2855.6	875	1965 to 2065	1280	2335 to 2345	1280	2830 to 2930	1262	3090 to 3190	1637	3450 to 3550
ML 75E17	4 cylinders	2855.5/2855.6	875	1965 to 2075	1262	2320 to 2430	1262	2815 to 2925	1262	3080 to 3190	1637	3440 to 3550
ML 75E18	6 cylinders	2855.5/2855.6	–	–	1167	2215 to 2325	1167	2710 to 2820	1167	2970 to 3080	1527	3330 to 3440
ML 80EL15	4 cylinders	2855.5/2855.6	875	1965 to 2075	1262	2320 to 2430	1262	2815 to 2925	1262	3090 to 3190	1637	3450 to 3550
ML 80EL17	4 cylinders	2855.6	–	–	–	–	–	–	1262	3080 to 3190	1637	3440 to 3550
ML 80E..	4 cylinders	2855.6	910	1980 to 2090	1317	2340 to 2450	1317	2840 to 2950	1372	3100 to 3210	1632	3460 to 3570
ML 80E..	6 cylinders	2855.6	–	–	1207	2225 to 2335	1207	2720 to 2830	1262	3000 to 3100	1622	3340 to 3450
ML 90E..	4 cylinders	2855.6	910	1980 to 2090	1317	2340 to 2450	1317	2840 to 2950	1372	3100 to 3210	1632	3460 to 3570
ML 90E..	6 cylinders	2855.6	–	–	1207	2225 to 2335	1207	2720 to 2830	1262	3000 to 3100	1622	3340 to 3450
ML 100E..	4 cylinders	2855.6	910	1980 to 2090	1317	2340 to 2450	1317	2840 to 2950	1372	3100 to 3210	1632	3460 to 3570
ML 100E..	6 cylinders	2855.6	–	–	1207	2225 to 2335	1207	2720 to 2830	1262	3000 to 3100	1622	3330 to 3440

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DIAGNOSTICS

Main propeller shaft transmission anomalies:

1 — Transmission noises and vibration

1	TRANSMISSION NOISES AND VIBRATION

Anomaly		Remedy
Shaft distortion	YES →	Proceed with replacing the shaft.
NO ↓		
Unbalanced shaft.	YES →	Carry out balancing check and determine the points where balancing plates must be welded.
NO ↓		
Excessive clearance between grooved profiles.	YES →	Replace the shaft.
NO ↓		
Loosening of screws and nuts for securing shaft to gearbox sleeves or on rear axle.	YES →	Take care, after an accurate check, of completely tightening those screws and nuts that are loosened, and possibly replace damaged parts.
NO ↓		
Seized or excessively worn propeller shaft cardan joints.	YES →	Revise or replace the cardan joints.
NO ↓		
Insufficient lubrication for the various parts.	YES →	Proceed with the lubrication by operating on suitable greasers.

TIGHTENING TORQUES

PART	TORQUE	
	Nm	(kgm)
M10 screw for securing transmission flanges	63.5 ± 6.5	(6.4 ± 0.6)
M12 screw for securing transmission flanges	101 ± 10	(10.3 ± 1)
Nut for screw for securing elastic support	82 ± 8	(8.3 ± 0.9)

SINGLE–SECTION PROPELLER SHAFT DISENGAGEMENT – RE–ENGAGEMENT

Disengagement

Set the vehicle under safety conditions and operate as described below:

- rotate locking rivets for dampening guard (6) under the gearbox and remove it;
- position an hydraulic jack equipped with support 99370618 under the propeller shaft and suitably constrain it;
- unscrew the four securing bolts (2) and detach propeller shaft (1) from rear axle;
- unscrew the four securing bolts (5) and detach propeller shaft from gearbox;
- unscrew the two securing bolts (3) and detach intermediate support (4) from cross–member;
- lower the hydraulic jack and remove propeller shaft (1) from the vehicle.

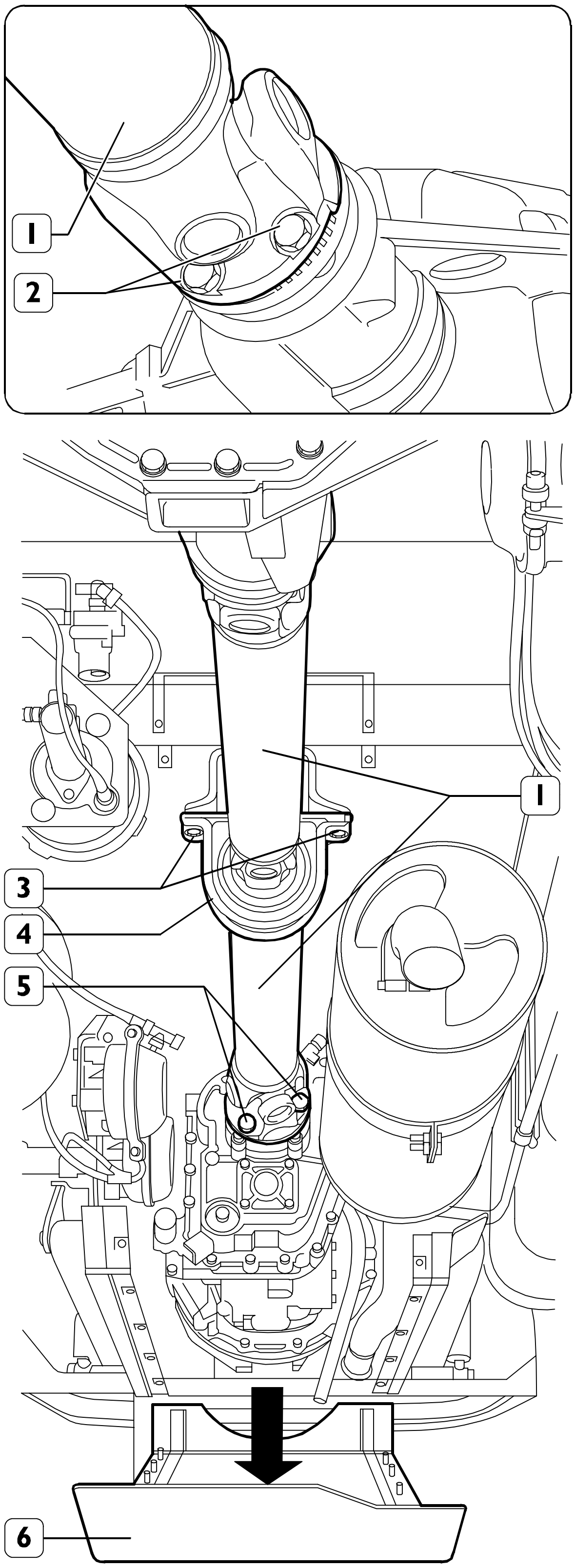
Re–engagement

IVECO PARTS

For the re–engagement, carry out in reverse order the operations described for the disengagement, complying with the following warnings:

Self–locking nuts must always be replaced and tightened at the required torque.

Figure 7



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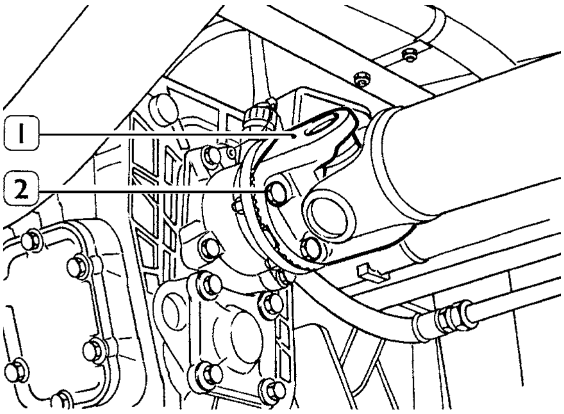
505620 SLIDING PROPELLER SHAFT DISENGAGEMENT – RE–ENGAGEMENT

Disengagement

Figure 8

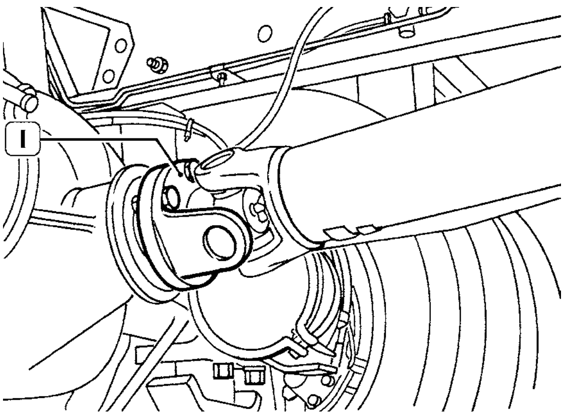


33700

Set the vehicle under safety conditions and operate as described below:

- ❑ rotate locking rivets for dampening guard (6) under the gearbox and remove it;
- ❑ position an hydraulic jack equipped with support 99370618 under the propeller shaft and suitably constrain it;
- ❑ unscrew the four securing bolts (2) and detach propeller shaft (1) from gearbox;

Figure 9



33702

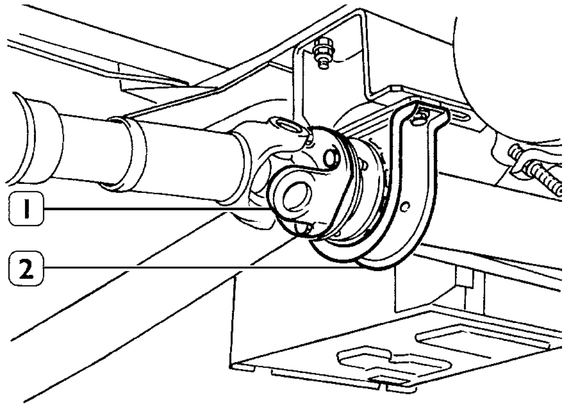
- ❑ unscrew the four securing bolts and detach propeller shaft (1) from rear axle;
- ❑ lower the hydraulic jack and remove propeller shaft from vehicle.

Re–engagement

For the re–engagement, carry out in reverse order the operations described for the disengagement, complying with the following warnings:
Self–locking nuts must always be replaced and tightened at the required torque.
Check that the arrows included in the sliding part and on the shaft are aligned.

TWO–SECTION PROPELLER SHAFT DISENGAGEMENT – RE–ENGAGEMENT

Figure 10



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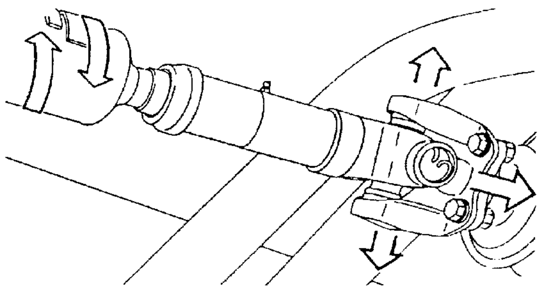
Disengagement/re–engagement of these propeller shafts is similar to the sliding one, apart from the presence of a central support (2) on the fixed shaft, that must be detached from the chassis after having unscrewed the four securing bolts and detached the sliding propeller shaft (1) from the fixed one.

CHECK OF VEHICLE PROPELLER SHAFTS

Figure 11



Propeller shafts are provided by the manufacturer as assemblies ready for being assembled.
They are statically and dynamically balanced.
The welded plates to propeller shafts are balancing plates.
In case of lack of plates, it is necessary to balance the shaft again.
By operating on the propeller shaft and simultaneously, in reverse order, on the sliding sleeve, check that there is no excessive clearance among grooved parts.
By operating on sleeve forks, check that spiders are not worn; otherwise, replace them.

SECTION 6

Rear axles 4517 and 4521

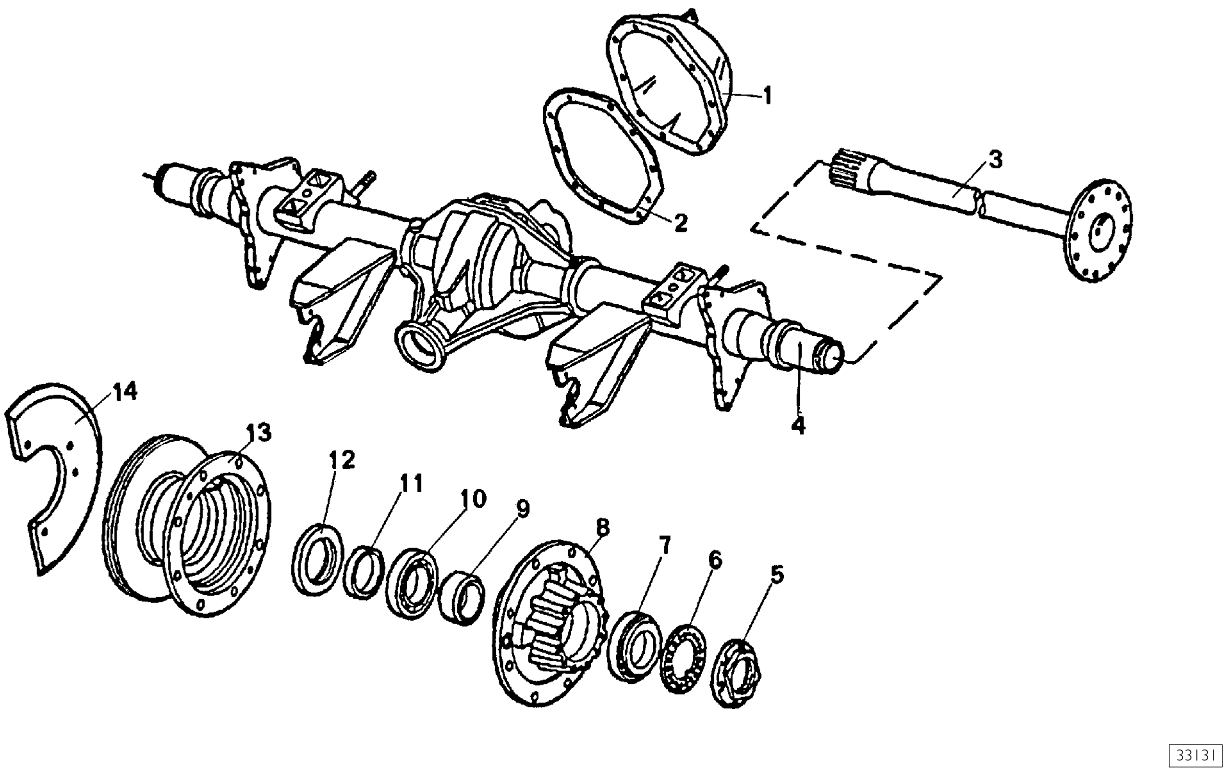
Page

DESCRIPTION

The rear axle is of the carrier type with simple reduction and is composed of a suitably reinforced case made of pressed steel plate. The differential gear is characterised by a set of helical toothed gears. The bevel pinion is supported by two tapered roller bearings (for rear axle 4517) and two tapered roller bearings and one pilot roller bearing (for rear axle 4521). The adjustment of the bevel pinion is carried out by modifying the thickness between fixed differential gear and front bearing. Moreover, it is possible to adjust the bevel pinion position with respect to the bevel crown, modifying the adjustment ring thickness interposed between rear axle case and external ring for bevel pinion rear bearing.

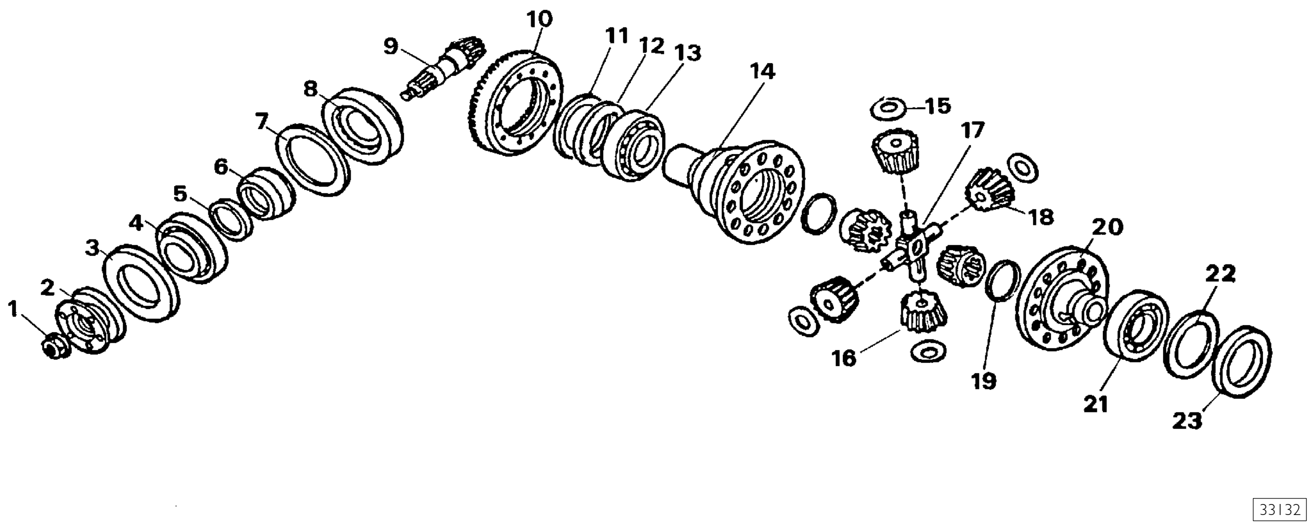
The gearing case is supported by two tapered roller bearings and can be axially adjusted through adjustment rings placed between rear axle case and external rings for support bearings. The gearing case rolling torque can further be modified by changing the adjustment ring thickness. Wheel hubs are supported by two tapered roller bearings placed on the barrel.

Figure 1



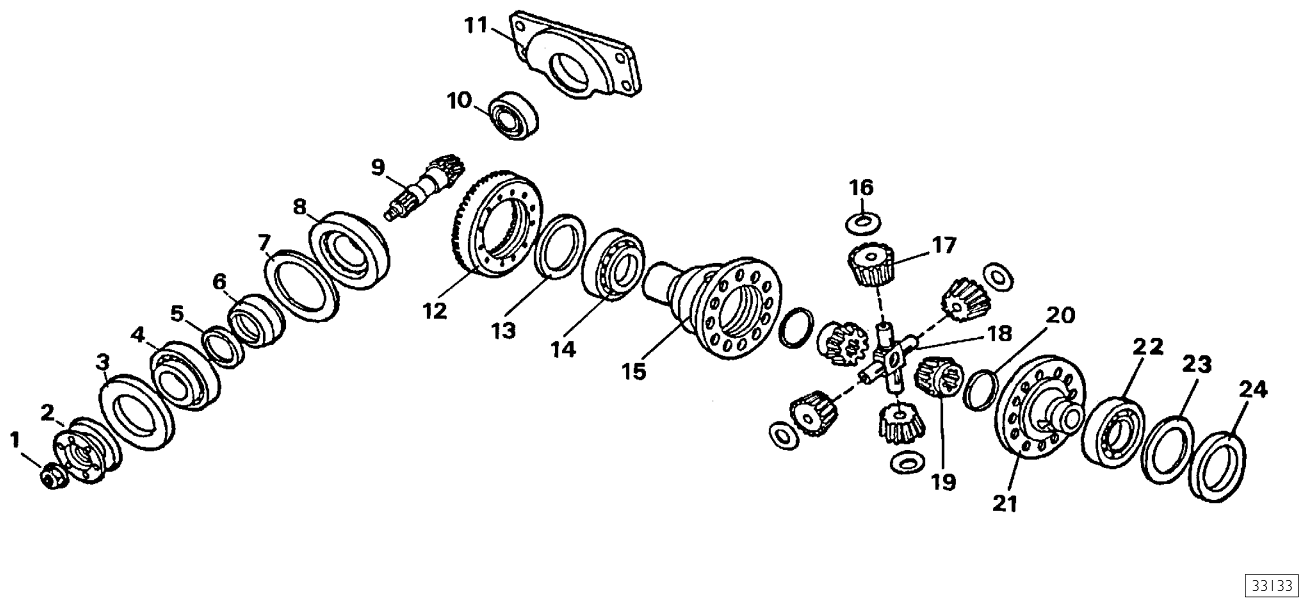
PARTS COMPOSING WHEEL HUBS FOR REAR AXLES 4517 AND 4521
1. Gearing inspection cover – 2. Gasket – 3. Half–shaft – 4. Rear axle – 5. Adjustment nut – 6. Safety washer – 7. Bearing – 8. Wheel hub – 9. Spacer – 10. Bearing – 11. Gasket resting ring – 12. Sealing ring – 13. Brake disk – 14. Plate

Figure 2



PARTS COMPOSING THE DIFFERENTIAL ASSEMBLY FOR REAR AXLE 4517
1. Check nut – 2. Flange – 3. Sealing ring – 4. Bearing – 5. Adjustment shim – 6. Fixed spacer – 7. Adjustment shim – 8. Bearing – 9. Bevel pinion – 10. Crown – 11. Fixed spacer – 12. Adjustment ring – 13. Bearing – 14. Gearing half–case – 15. Shoulder washer – 16. Planetary gear – 17. Spider – 18. Crown wheel – 19. Shoulder washer – 20. Gearing half–case – 21. Bearing – 22. Adjustment ring – 23. Fixed spacer.

Figure 3



PARTS COMPOSING THE DIFFERENTIAL ASSEMBLY FOR REAR AXLE 4521
1. Check nut – 2. Flange – 3. Sealing ring – 4. Bearing – 5. Adjustment shim – 6. Fixed spacer – 7. Adjustment shim – 8. Bearing – 9. Bevel pinion – 10. Pilot bearing (with cylindrical rollers) – 11. Support – 12. Crown – 13. Adjustment ring – 14. Bearing – 15. Gearing half–case – 16. Shoulder washer – 17. Planetary gear – 18. Spider – 19. Crown wheel – 20. Shoulder washer – 21. Gearing half–case – 22. Bearing – 23. Adjustment ring – 24. Fixed spacer.

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SPECIFICATIONS AND DATA

Rear axle type Simple–reduction carrier type	**4517**	**4521**
DIFFERENTIAL ASSEMBLY Bevel torque reduction ratio	1/3.15 (13/41) 1/3.31 (13/43) 1/3.58 (12/43) 1/3.90 (11/43) 1/4.30 (10/43) 1/4.55 (9/41) 1/5.125 (8/41) 1/5.57 (7/39)	1/3.21 (14/45) 1/3.38 (13/44) 1/3.73 (11/41) 1/4.10 (10/41) 1/4.55 (9/41) 1/4.88 (8/39) 1/5.57 (7/39)
Bevel pinion bearings	2 with tapered rollers	2 taper roller bearings and 1 needle bearing
Bevel pinion rolling torque (bearing pre–load) Nm (kgm)	2.2 to 3 (0.22 to 0.3)	2.6 to 3.4 (0.26 to 0.34)
Bevel pinion bearing pre–load adjustment	Through adjustment rings (supplied in kit)	
Clearance between pinion and crown mm	0.15 to 0.20	0.18 to 0.23 (with 14/45 and 13/44)
	0.18 to 0.23 (with 9/41; 8/41 and 7/39)	0.20 to 0.28
Clearance adjustment between pinion and crown	Through adjustment rings (supplied in kit)	
Gearing case bearings	2 with tapered rollers	
Total rolling torque Nm (kgm)	2.83 to 3.88 (with 13/41) (0.28 to 0.39) 2.80 to 3.84 (with 13/43) (0.28 to 0.38) 2.75 to 3.77 (with 12/43) (0.27 to 0.38) 2.71 to 3.71 (with 11/43) (0.27 to 0.37) 2.66 to 3.64 (with 10/43) (0.27 to 0.36) 2.64 to 3.61 (with 9/41) (0.26 to 0.36) 2.59 to 3.54 (with 8/41) (0.26 to 0.36) 2.55 to 3.55 (with 7/39) (0.26 to 0.36)	3.37 to 4.26 (with14/45) (0.34 to 0.43) 3.33 to 4.22 (with 13/44) (0.33 to 0.43) 3.26 to 4.14 (with 11/41) (0.33 to 0.42) 3.20 to 4.08 (with 10/41) (0.33 to 0.41) 3.14 to 4.01 (with 9/41) (0.32 to 0.41) 3.11 to 3.97 (with 8/39) (0.32 to 0.40) 3.04 to 3.90 (with 7/39) (0.31 to 0.40)
Rolling torque adjustment (differential case bearings pre–load)	Through adjustment rings (supplied in kit)	

	4517	4521
Clearance between crown wheels and planetary gears mm	0.20 to 0.28	
Clarance adjustment between crown wheels and planetary gears	Through adjustment rings	
WHEEL HUBS		
Wheel hub bearings	2 with tapered rollers	
Axial hub bearings clearance mm	max 0.16	
Hub bearings rolling torque Nm (kgm)	max 4 (0.40)	max 4.5 (0.45)
Wheel hubs clearance	through a nut	
Rear axle oil	Tutela W 140/M DA	
Differential quantity Liters (kg)	2.65 (2.4)	5 (4.5)
Quantity for single hubs Liters (kg)	0.2 (0.18)	0.2 (0.18)

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DIAGNOSTICS

Main rear axle operating anomalies:
1 – Wheel hubs noises;
2 – Rear axle noises;
3 – Noises upon release;
4 – Noises when pulling;
5 – Noises in a curve.

1 WHEEL HUB NOISES

Check		Action
Not deteriorated or not worn wheel hub bearings.	NO →	Proceed with disassembling the hub and performing the necessary replacements.
YES ↓		
Adjusted wheel hub bearings.	NO →	Carry out bearing adjustment.
YES ↓		
Sufficient lubrication.	NO →	Restore the level and check that no leakages occur from gaskets or rear axle case.

2 REAR AXLE NOISES

Check		Action
Undamaged coupling grooves for half–shafts with differential crown wheels.	NO →	Revise the rear axle and replace worn or damaged parts.
YES ↓		
Exact wheel bearings clearance adjustment	NO →	Carry out bearings clearance adjustment.

(continued)

Check		Action
Exact adjustment or lack of deterioration of differential assembly gears or bearings.	NO →	Locate the inconvenience and carry out the assembly revision.
YES ↓		
Sufficient lubricanting oil level.	NO →	Restore the level and check that no leakages occur from gaskets or rear axle case.

3 NOISES UPON RELEASE

Check		Action
Exact coupling clearance between pinion and bevel crown.	NO →	Detach gearings inspection cover and carry out the clearance adjustment between pinion and crown.

4 NOISES WHEN PULLING

Check		Action
Adjusted or not deteriorated gearings case bearings.	NO →	Proceed with the assembly revision.
YES ↓		
Exact teeth contact between pinion and bevel crown.	NO →	Proceed with the contact adjustment.
YES ↓		
Sufficient lubrication.	NO →	Restore the level and check that no leakages occur from gaskets or rear axle case.

5 NOISES IN A CURVE

Check		Action
Exact clearance for crown wheels planetary assembly.	NO →	Revise or replace the assembly.

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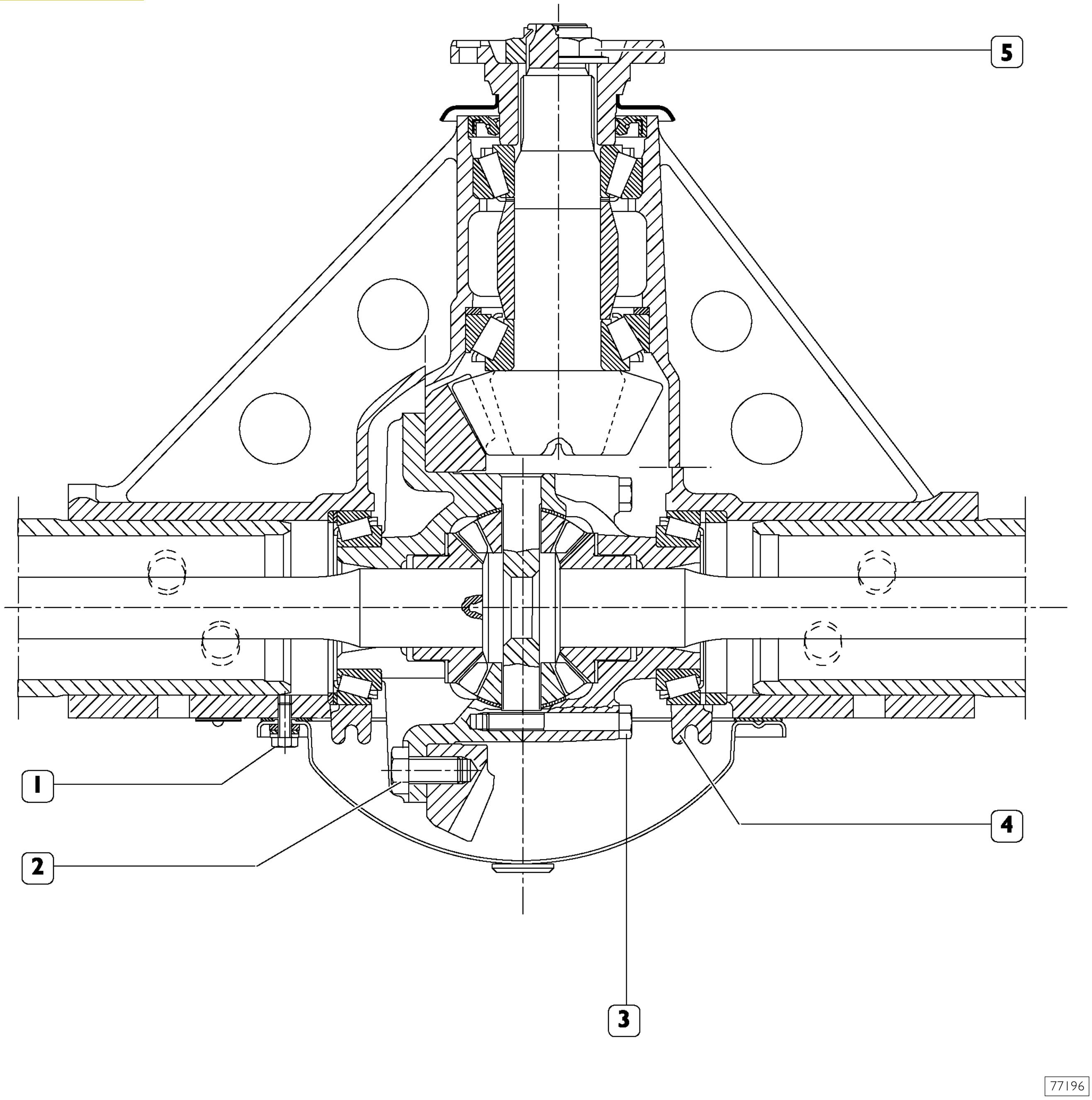
TIGHTENING TORQUES

Figure 4

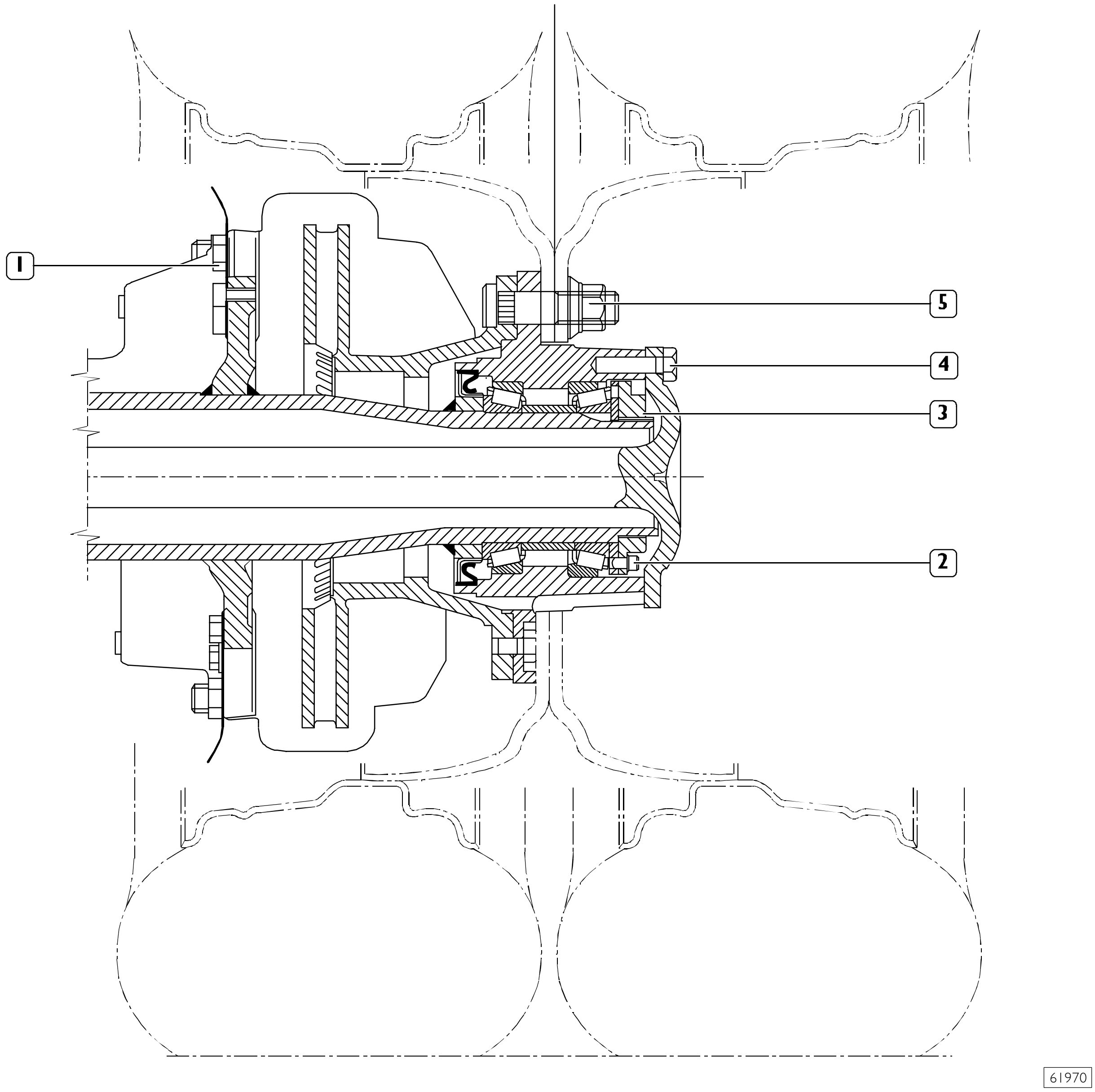


SECTION ON REAR AXLE 4517 DIFFERENTIAL GEAR

	PART	TORQUE	
		Nm	(kgm)
1	Flanged screw for securing oil sump to case	29 ± 3	(2.9 ± 0.3)
2	Screw for securing bevel crown to differential 12R DAC5 half–cases	326.5 ± 16.5	(32.6 ± 1.7)
2	Screw for securing bevel crown to differential 10R DAC5* half–cases	280 ± 14	(28 ± 1.4)
3	Self–locking screw for securing differential half–cases	67.5 ± 6.5	(6.8 ± 0.6)
4	Flanged screw for securing cap to case	107.5 ± 10.5	(10.8 ± 1)
5	Flanged nut for securing flange on bevel pinion	561 ± 28	(56.1 ± 2.8)

* Before screwing the screws, apply some drops of “LOCTITE TYPE 270” sealant to their threaded holes.

Figure 5



SECTION ON REAR AXLE 4517 HUB

	PART	TORQUE	
		Nm	(kgm)
1	Self–locking screw for securing brake calipers	107.5 ± 10.5	(10.8 ± 1)
2	Screw for locking wheel bearings securing ring nut	9.1 ± 0.9	(0.9 ± 0.1)
3	Ring nut for securing wheel bearings	490.5 ± 49.5	(49 ± 5)
4	Self–locking screw for securing half–shaft to wheel hub*	62.5 ± 6.5	(6.2 ± .,7)
5	Wheel securing nut	400^{+50}_{-20}	(40^{+5}_{-2})
–	Screw for securing sensor support**	6 ± 1	(0.6 ± 0.1)

* Butter the joining surface between half–shaft and wheel hub with adhesive type “B”. Apply “LOCTITE TYPE 222” sealant on thread of screws (4) operating as plug

** Upon assembling the sensor support securing screws, apply some drops of “LOCTITE TYPE 243” thread–braker on the thread of holes corresponding to the bracket welded on rear axle arm.

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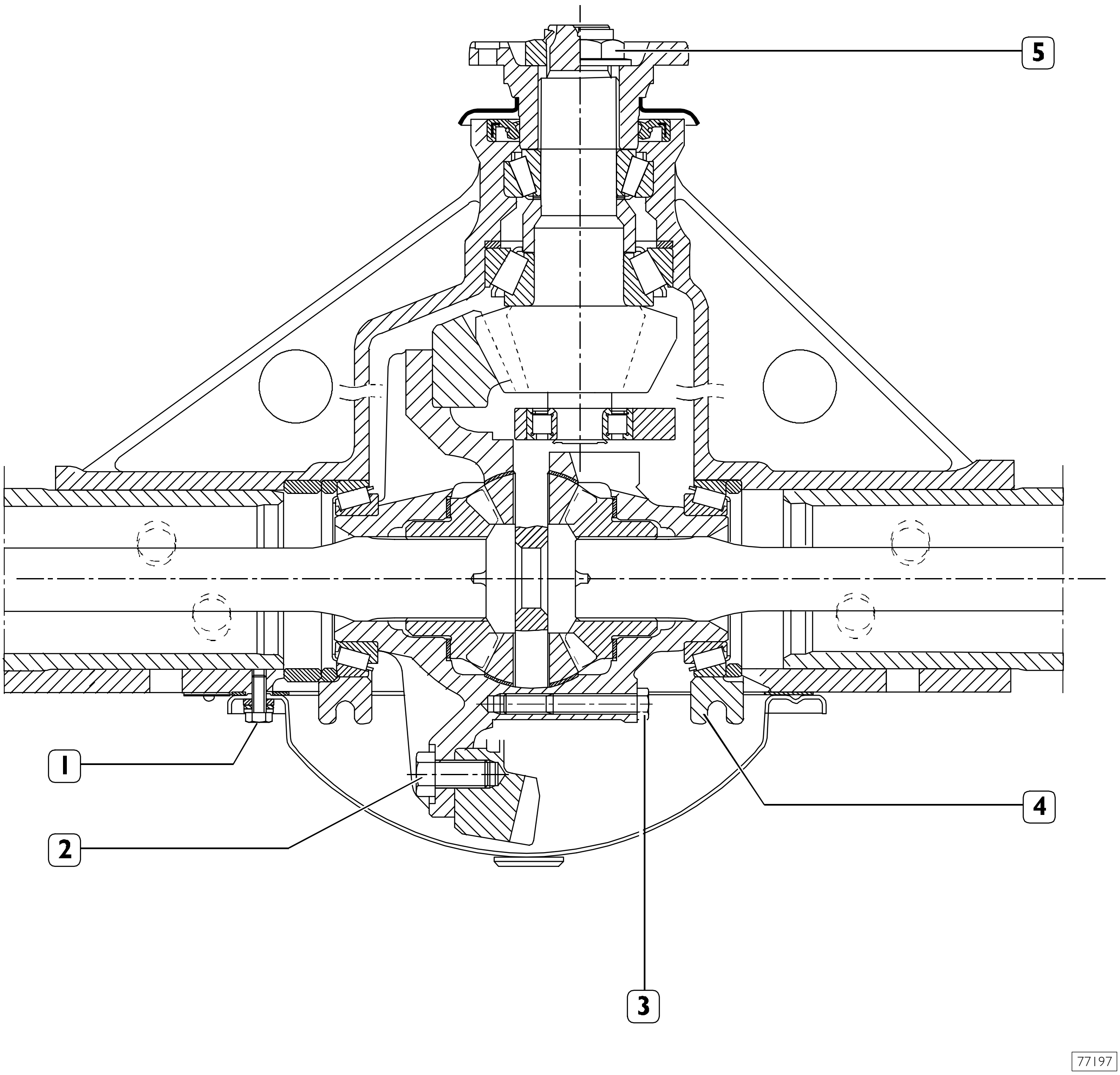
Figure 6

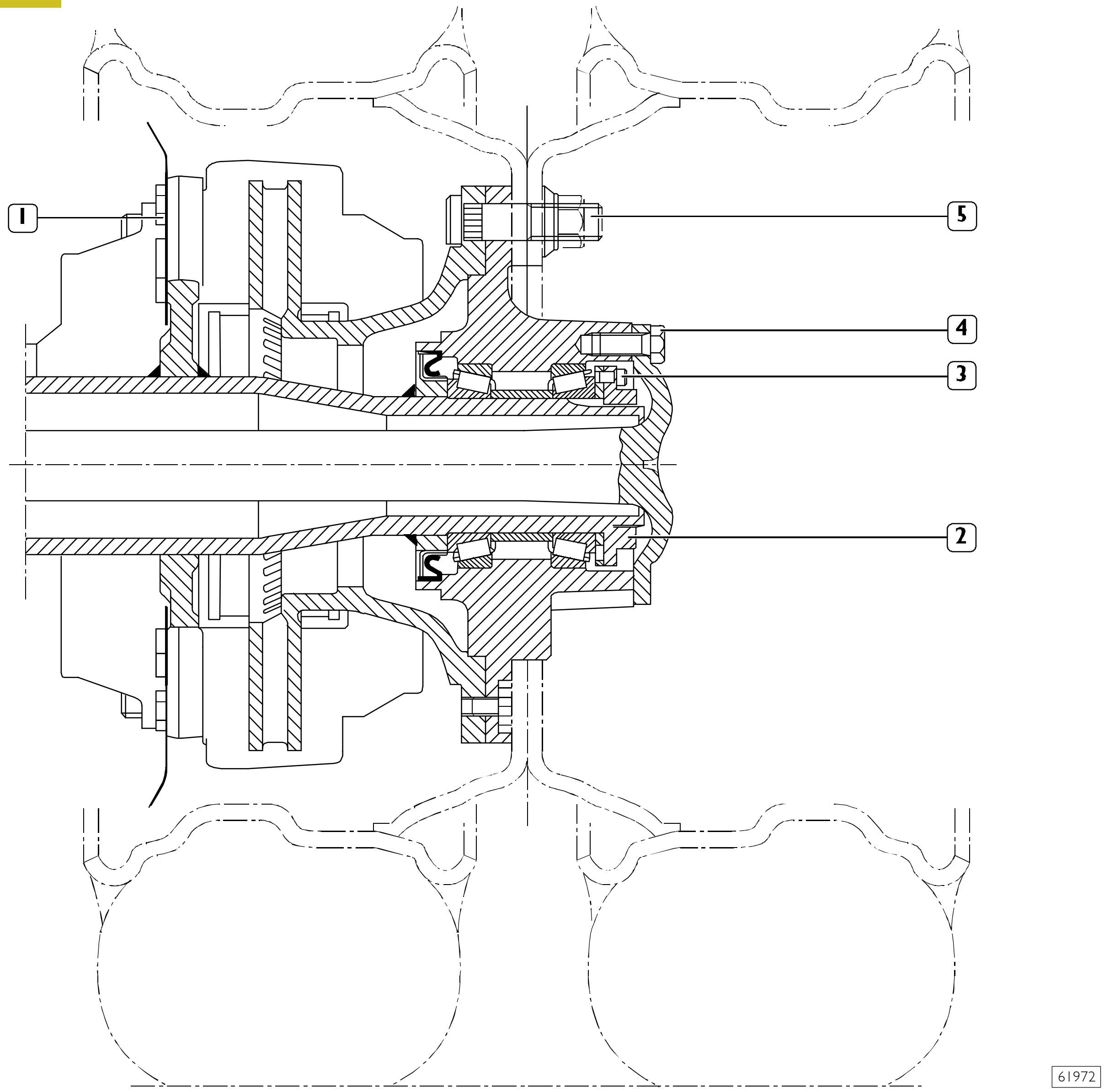


SECTION ON REAR AXLE 4521 DIFFERENTIAL GEAR

	PART	TORQUE	
		Nm	(kgm)
1	Flanged screw for securing oil sump to case	29 ± 3	(2.9 ± 0.3)
2	Screw for securing bevel crown to differential 12R DAC5 half–cases	326.5 ± 16.5	(32.6 ± 1.7)
2	Screw for securing bevel crown to differential 10R DAC5* half–cases	280 ± 14	(28 ± 1.4)
3	Self–locking screw for securing differential half–cases	112 ± 11	(11.2 ± 1.1)
4	Flanged screw for securing cap to case	167.5 ± 8.5	(16.7 ± 0.9)
5	Flanged nut for securing flange on bevel pinion	561 ± 28	(56.1 ± 2.8)
–	Self–locking screw for securing pilot bearing seat cross–member to case	267.5 ± 26.5	(26.7 ± 2.7)

* Before screwing the screws, apply some drops of "LOCTITE TYPE 270" sealant to their threaded holes.

Figure 7

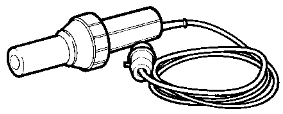
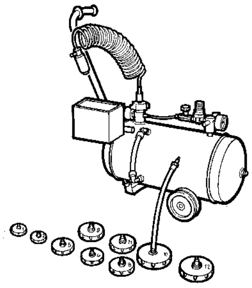
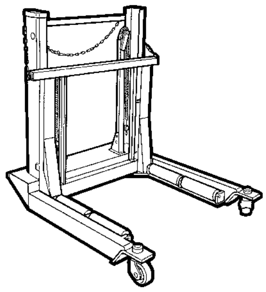
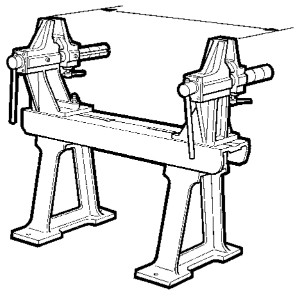
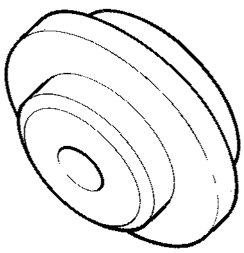
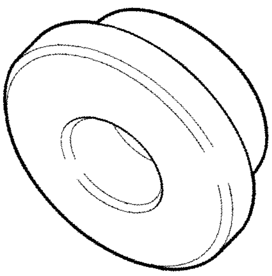


SECTION ON REAR AXLE 4521 HUB

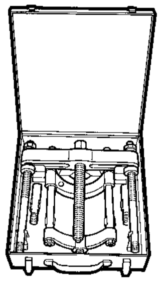
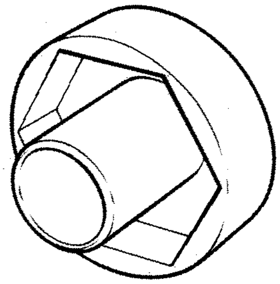
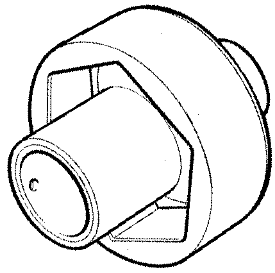
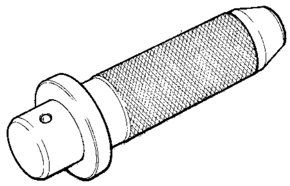
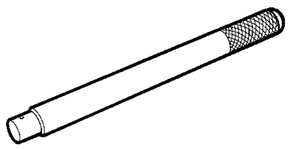
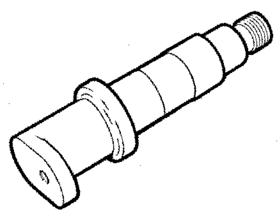
	PART	TORQUE Nm	TORQUE (kgm)
1	Self–locking screw for securing brake calipers	163.5 ± 13.5	(16.7 ± 1.4)
2	Ring nut for securing wheel bearings	463.5 ± 46.5	(0.9 ± 0.1)
3	Screw for locking wheel bearings securing ring nut	9.1 ± 0.9	(49 ± 5)
4	Self–locking screw for securing half–shaft to wheel hub*	103 ± 10	(602 ± 0.7)
5	Wheel securing nut	500^{+50}_{-20}	(50^{+5}_{-2})
–	Screw for securing sensor support**	6 ± 1	(0.6 ± 0.1)

* Butter the joining surface between half–shaft and wheel hub with adhesive type "B". Apply "LOCTITE TYPE 222" sealant on thread of screws (4) operating as plug

** Upon assembling the sensor support securing screws, apply some drops of "LOCTITE TYPE 243" thread–braker on the thread of holes corresponding to the bracket welded on rear axle arm.

TOOLS		
TOOLS N.		DENOMINATION
99305121		Hot–air apparatus
99306010		Air drain apparatus for brakes and clutch system
99321024		Hydraulic trolley for wheel disconnection and reconnection
99322215		Stand for revising rear axles and front axles
99345053		Reaction block for extractors (for rear axle 4521)
99345056		Reaction block for extractor (for rear axle 4517)

TOOLS

TOOLS N.		DENOMINATION
99348001		Extractor with locking device
99357071		Wrench for wheel hub bearing adjustment nut (for rear axle 4521)
99357080		Wrench for wheel hub bearing adjustment nut (for rear axle 4517)
99370006		Handle for interchangeable beaters
99370007		Handle for interchangeable beaters
99370294		Tool to measure bevel pinion adjustment thicknesses (use with 99395728 for rear axle 4521)

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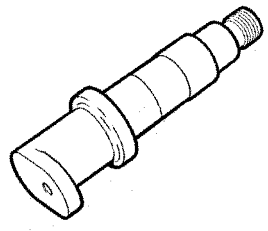
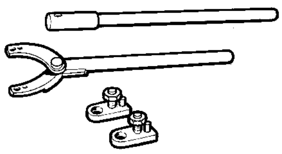
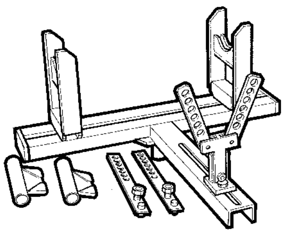
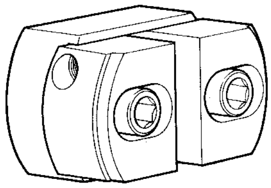
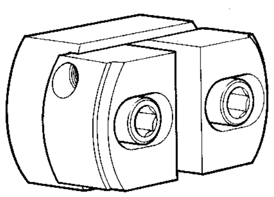
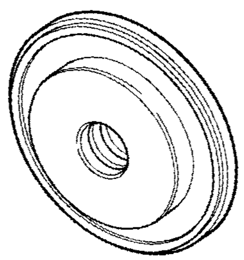
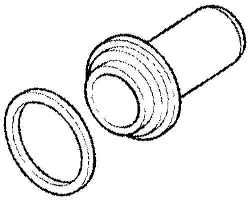
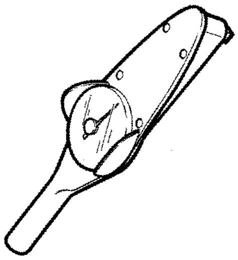
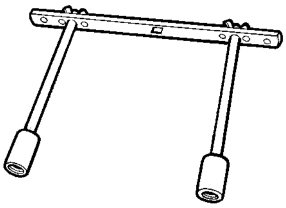
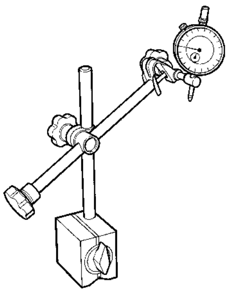
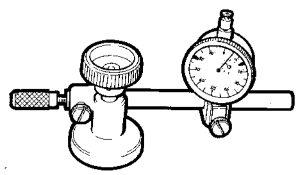
TOOLS

TOOLS N.		DENOMINATION
99370296		Tool to measure bevel pinion adjustment thicknesses (use with 99395728 for rear axle 4517)
99370317		Reaction lever with flanges check extension
99370617		Universal support for rear axle bearing during disengagement and re–engagement
99374092		Beater for assembling external bearings (69 – 91) races (use with 99370007) (for rear axle 4521)
99374093		Beater for assembling external bearings (91 – 134) races (use with 99370007)
99374132		Keyer for assembling internal wheel hub gasket (use with 99370006)

TOOLS

TOOLS N.		DENOMINATION
99374201		Keyer for assembling gasket on differential bevel pinion support
99389819		0–0.9 kgm dynamometric wrench with square ¼ connection
99395026		Tool for checking hub rolling torque (use with dynamometric wrench)
99395684		Comparator with magnetic pedestal
99395728		Comparator with support to be used with tools to measure bevel pinion adjustment thickness

REAR AXLE DISENGAGEMENT/RE–ENGAGEMENT
(with mechanical suspensions)

Before carrying out disengagement/re–engagement operations, disconnect battery cables and place the vehicle under safety conditions.

Disengagement

Place the vehicle on a plane ground, lock front wheels and proceed as follows:

- loosen securing nuts for rear wheels, lift the vehicle from the rear and place it on supporting stands;
- place hydraulic trolley 99321024 under rear wheels, remove securing nuts and detach the wheels
- unscrew securing bolts (9) and disconnect propeller shaft (8) from rear axle;
- disconnect electric connections (1) for brake wear signals, electric connections (4) for ABS revolutions sensors and free wiring from various check clamps;
- disconnect air supply pipings (5) next to fitting (7);
- disconnect brake oil delivery piping (2), unscrew nut (11) and detach piping (10) from supporting bracket;
- unscrew securing bolts (19) to disconnect stabilizing bar (13) and securing nuts (18) for disconnecting shock–absorbers (6) from rear axle;

NOTE In vehicles equipped with differential locking, it is necessary to remove this latter one in order to be able to place tool 99370617 under the rear axle.

- disconnect electric connection (17), air piping (16), unscrew securing screws (15) and detach differential locking assembly;
- place an hydraulic jack equipped with support 99370617 under the rear axle;
- unscrew securing nuts (2) and remove stands (3), lowering the jack, and remove rear axle from below the vehicle.

Re–engagement

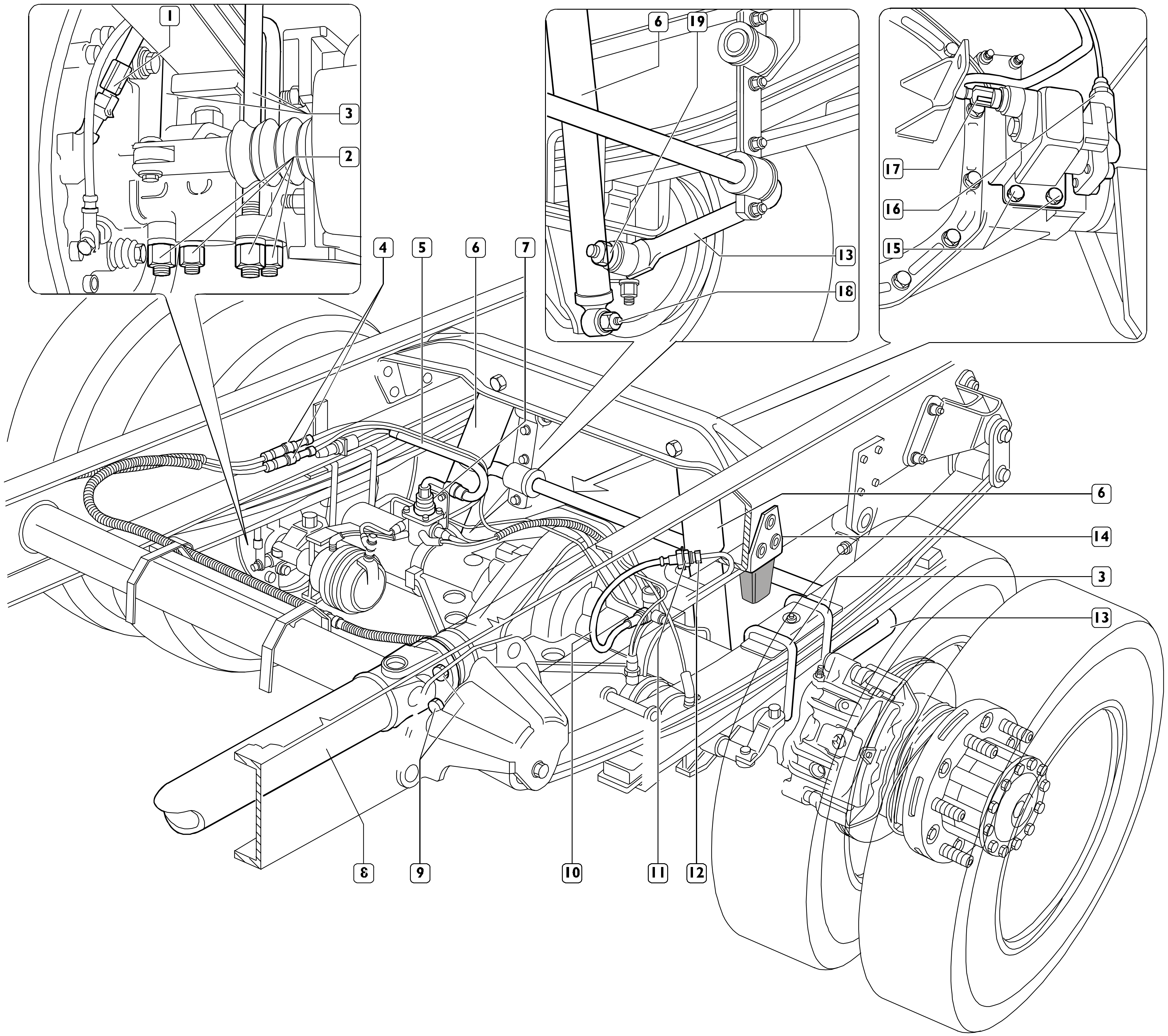
Suitable revert the operations carried out for the disengagement and tighten at the required torque securing screws and nuts.

Self–locking nuts must always be replaced and tightened at the required torque.

Verify that:

- check stand (3) threading; when detecting anomalies, adjust the threading or replace the stands;
- carry out the brake system air drain as described in the related section;
- check conditions of elastic pads (14); when detecting them as worn, replace them;
- check that the lubricating oil in rear axle case is at level; otherwise, refill it.

Figure 8



REAR AXLE DISENGAGEMENT/RE–ENGAGEMENT
(with pneumatic suspensions)

Before carrying out disengagement/re–engagement operations, disconnect battery cables and place the vehicle under safety conditions.

Disengagement

Place the vehicle on a plane ground, lock front wheels and proceed as follows:

- loosen securing nuts for rear wheels, lift the vehicle from the rear and place it on supporting stands in the marked point (→);
- place hydraulic trolley 99321024 under rear wheels, remove securing nuts and detach the wheels
- unscrew securing bolts (9) and disconnect propeller shaft (8) from rear axle;
- disconnect electric connections (1) for brake wear signals, electric connections (5) for ABS revolutions sensors and free wiring from various check clamps;
- disconnect air supply piping (25) next to fitting (26);
- disconnect brake oil delivery piping (12), unscrew nut (11) and detach piping (10) from supporting bracket;

NOTE In vehicles equipped with differential locking, it is necessary to remove this latter one in order to be able to place tool 99370617 under the rear axle.

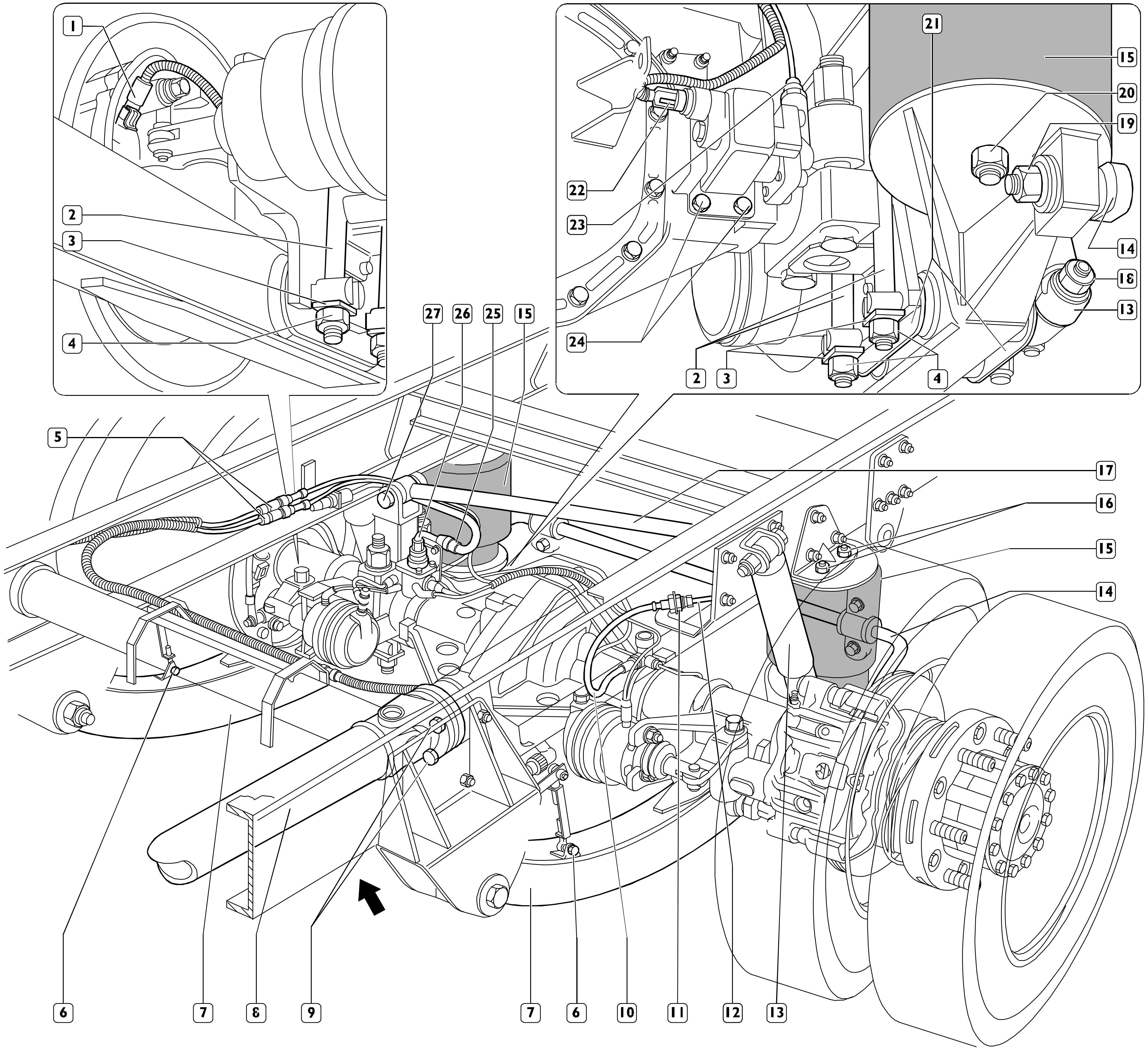
- disconnect electric connection (22), air piping (23), unscrew securing screws (24) and detach differential locking assembly;
- place an hydraulic jack equipped with support 99370617 under the rear axle and put it under suspension;
- unscrew securing bolts (19) to disconnect stabilizing bar (14) and securing nuts (18) for disconnecting shock–absorbers (13) from rear axle;
- exhaust air from air springs, disconnect supply pipings, unscrew securing bolts (16 and 20) and slightly lowering the rear axle detach air springs (15);
- unscrew securing nuts (4), recover plates (3) and remove stands (2), unscrew securing bolts for spacers (21), lower the jack and remove the rear axle from below the vehicle.

Re–engagement

Suitable revert the operations carried out for the disengagement and tighten at the required torque securing screws and nuts.
Self–locking nuts must always be replaced and tightened at the required torque.
Verify that:

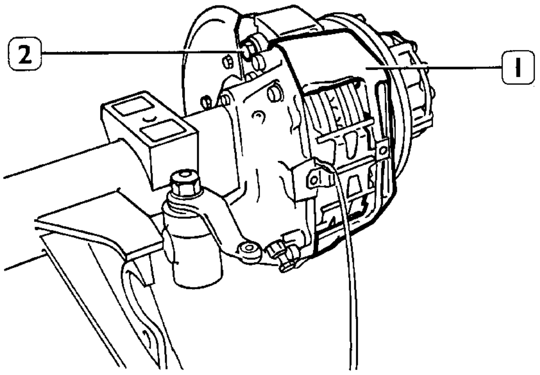
- check stand (2) threading; when detecting anomalies, adjust the threading or replace the stands;
- carry out the brake system air drain as described in the related section;
- check that the lubricating oil in rear axle case is at level; otherwise, refill it.

Figure 9



 Print 603.93.381

Figure 10



33049

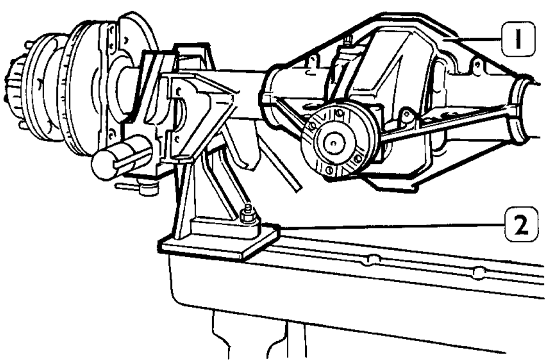
Unscrew screws (2) and disassemble complete brake calipers (1)

NOTE The following operations can be carried out also with assembly assembled on the vehicle:

- ❑ disengagement/re–engagement of brake calipers and disks;
- ❑ disengagement/re–engagement of wheel hubs;
- ❑ disengagement/re–engagement of half–shafts;
- ❑ disengagement/re–engagement of air vent.

525010 REAR AXLE ASSEMBLY REVISION

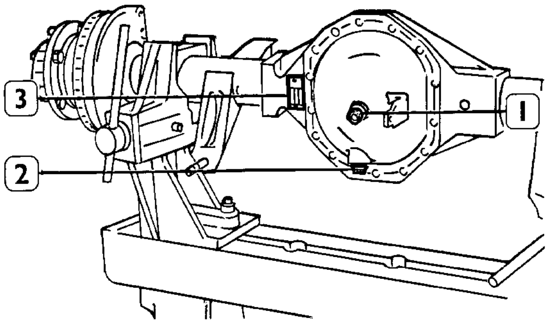
Figure 11



33050

Place rear axle (1) on revision stand 99322215 (2).

Figure 12



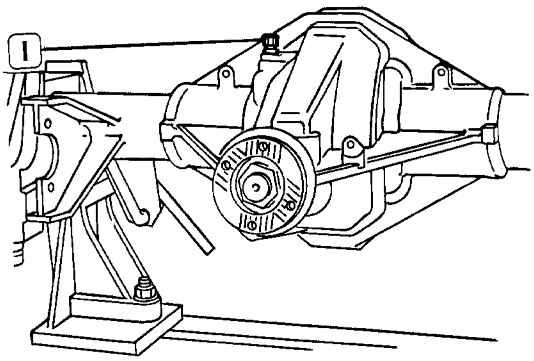
33051

Discharge oil from plug (2). Remove oil filling plug (1).

NOTE Identification data about rear axle assembly are included in nameplate (3) secured to connection plane to gearings inspection cover.

525013 AIR VENT DISENGAGEMENT – RE–ENGAGEMENT

Figure 13



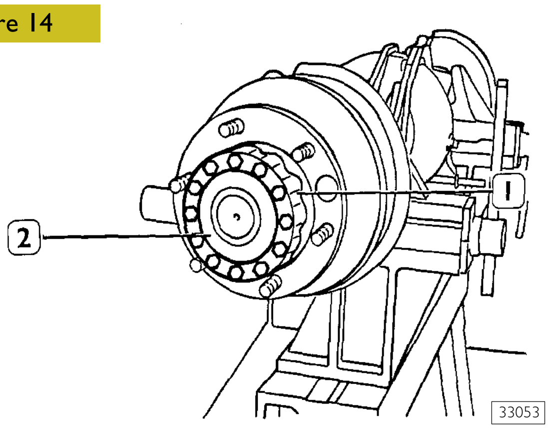
33052

Check that air vent (1) in rear axle case is not clogged, otherwise disassemble it, accurately clean it and reassemble it.

525030 WHEEL HUB REVISION

Disassembly

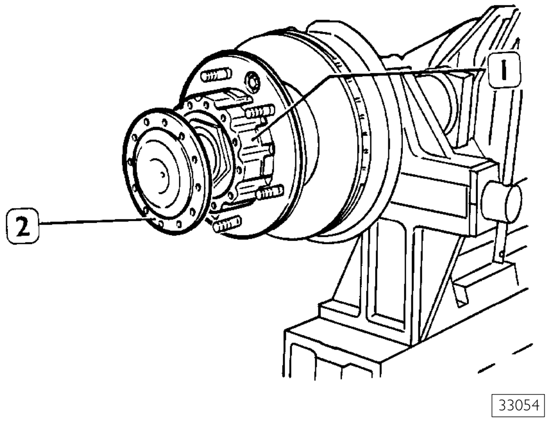
Figure 14



Place a vessel under the wheel hub to recover oil.

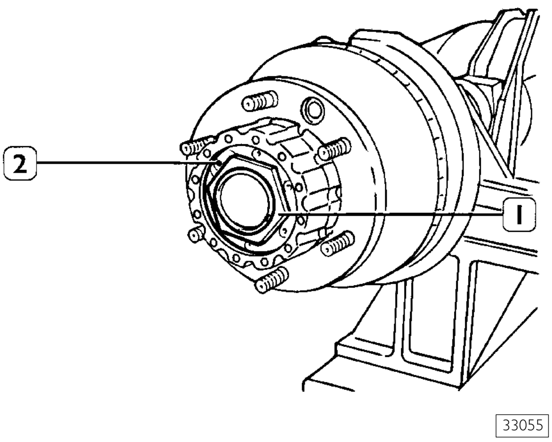
Move downwards one of the two screws, marked with OIL, remove them and completely discharge oil from wheel side. Remove the other screws for securing half–shaft (2) to wheel hub (1).

Figure 15



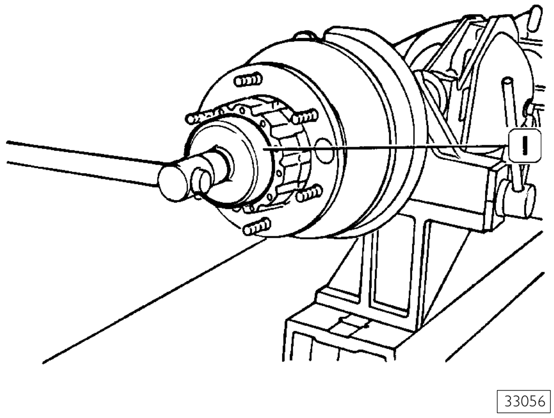
Remove half–shaft (2) from wheel hub (1).

Figure 16



Remove safety screw (2) of adjustment nut (1).

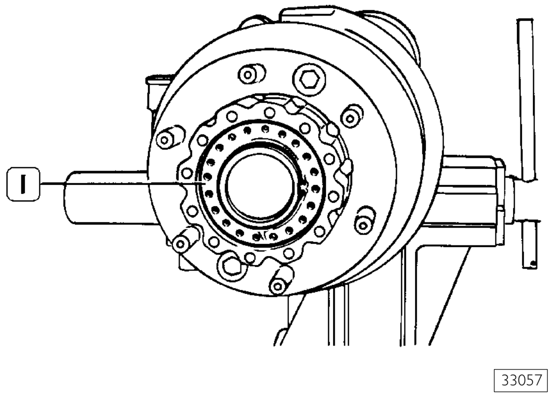
Figure 17



Unscrew bearings adjustment nut.

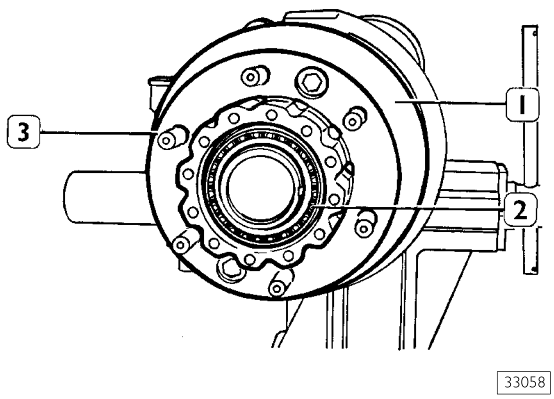
NOTE With wrench 99377080 (1) for rear axle 4517 with wrench 99357071 (1) for rear axle 4521.

Figure 18



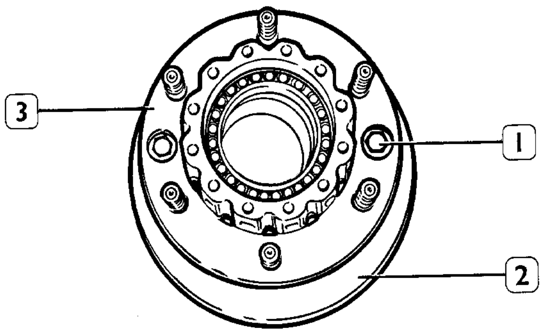
Remove safety washer (1).

Figure 19



Remove wheel hub (3), completed with brake disk (1), front (2) and rear bearings, from sealing and spacer ring.

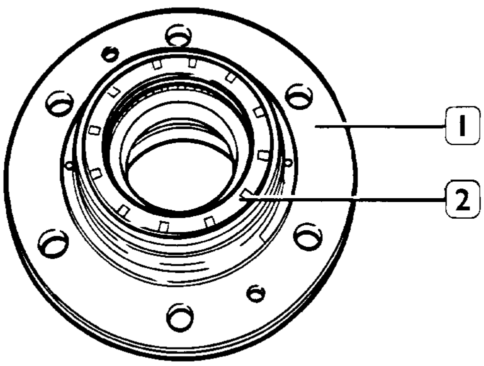
Figure 20



33060

Remove front bearing and spacer. Remove screws (1) and detach brake disk (2) from wheel hub (3).

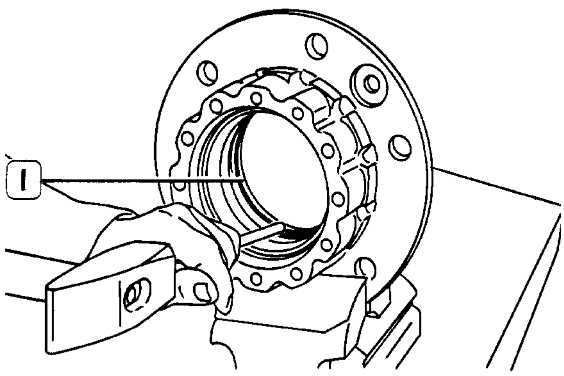
Figure 21



33061

Remove, from wheel hub (1), sealing ring (2) and rear bearing below it.

Figure 22



33062

Extract rear tapered roller bearing external race (1) with a suitable punch. Repeat the previously–described operation for extracting the front tapered roller bearing external race.

NOTE Upon reassembling, do not revert the external races for tapered roller bearings.

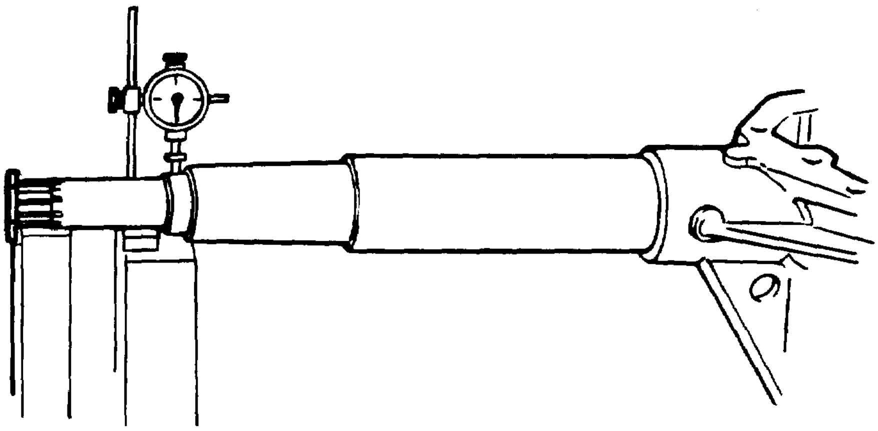
Check of parts composing wheel hubs

Accurately clean single pieces composing the wheel hub. Examine half–shafts and check that they do not show distortions, otherwise replace them.
Check wheel securing risers; if they show distortions or threading damages, replace them, operating with a press for their extraction.
Lubricate the bearings and freely rotate the roller–holding cage; the rotation must be regular and must not have hardenings.
Check threadings for wheel hub bearings adjustment nuts and threadings at the end of the rear axle case; if necessary, replace the ring nuts.
Check the gasket abutting ring; if it is worn and damaged, replace it.
Replace the sealing ring.

Rear axle case check

It is necessary to check the rear axle case alignment, since possible distortions generate anomalous stresses and make the assembly noisy.

Figure 23

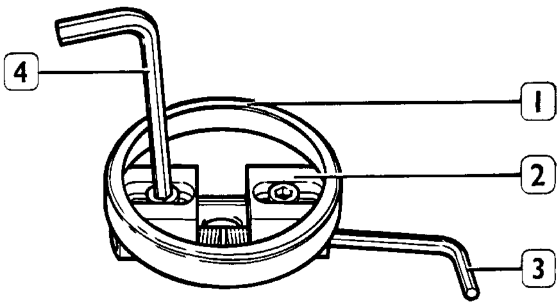


18409

Arrange two parallel lines on a suitable striker plane, rest the rear axle case thereon, taking care of protecting the threading on barrels with their own ring nuts.
Place a comparator with magnetic base, rest the rod on a ground part of the barrel and, making the rear axle case rotate around its own axis, check that it has not been subjected to distortions.

Assembly

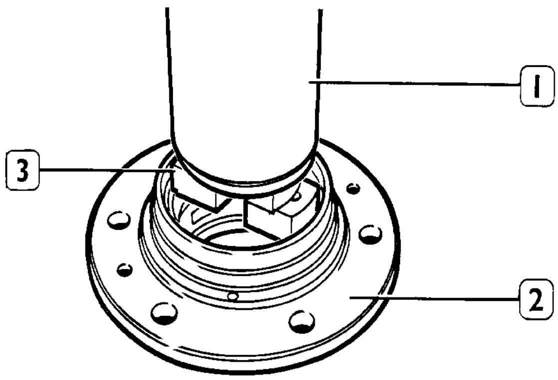
Figure 24



33063

Center external races (1) of tapered roller bearings on extendable beater 99374093 (2), adjusted with setscrew wrench (3). Lock beater with setscrew wrench (4).

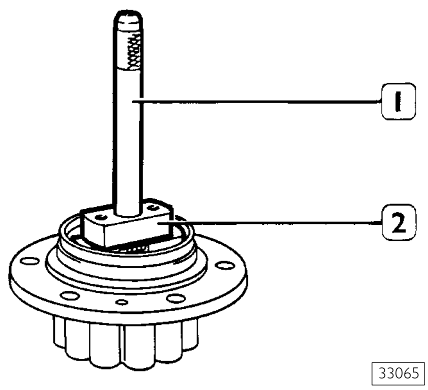
Figure 25



33064

Place, in wheel hub (2) seat, the rear tapered roller bearing and assemble it with beater 99374093 (3) and with the help of a press (1), avoiding to abut. Turn wheel hub over and assemble external ring of front tapered roller bearing.

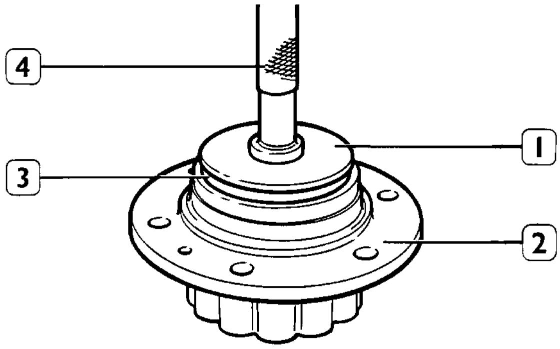
Figure 26



33065

Set external races of tapered roller bearings, after having assembled them under a press, with some hammer strikes on handle 99370007 (1) applied to beater 99374093 (2).

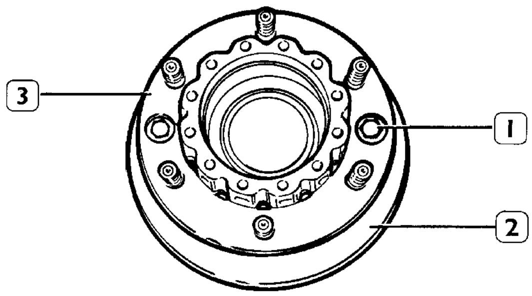
Figure 27



33066

Lubricate rear tapered roller bearing with SAE W140 MDA oil and assemble it on wheel hub (2). Assemble sealing ring (3) with keyer 99374132 (1), equipped with handle 99370006 (4).

Figure 28



33068

Assemble brake disk (2) on wheel hub (3), completely tightening securing screws (1).

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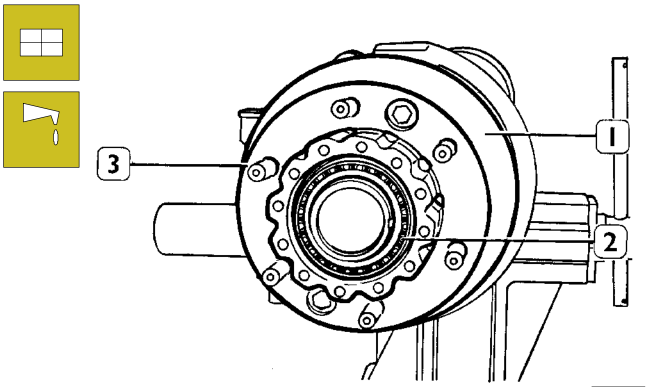
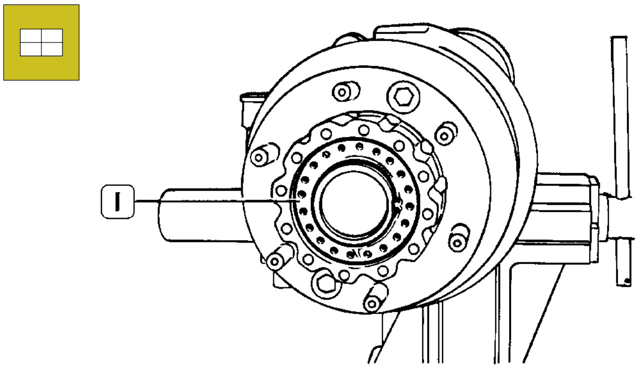
Figure 29



33058

Assemble, on rear axle case barrel, wheel hub (3), completed with brake disk (1), and assemble the spacer.
Lubricate front tapered roller bearing (2) with SAE W140 MDA oil and assemble it in its own seat on wheel hub (3).

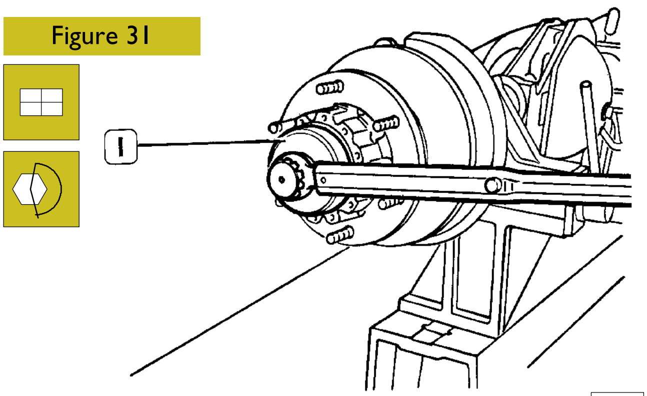
Figure 30



33057

Assemble safety washer (1) so that the clip is correctly guided into the grooved space of rear axle case barrel.

Figure 31

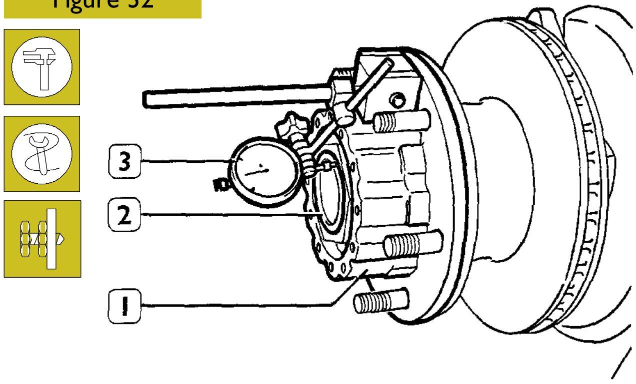


33071

Screw wheel hub bearings adjusting nut:

NOTE With wrench 99357080 (1) and tighten at a torque of 490.5 Nm (50 kgm), for rear axle 4517; with wrench 99357071 (1) and tighten at a torque of 463.5 Nm (47.3 kgm), for rear axle 4521.

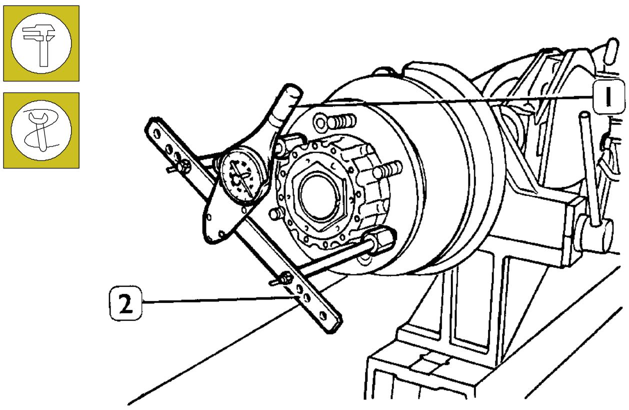
Figure 32



33072

Place comparator with magnetic base 99395684 (3) on wheel hub (1) and rest the rod onto barrel (2). Check that axial wheel hub clearance is included between 0 and 0.16 mm.

Figure 33

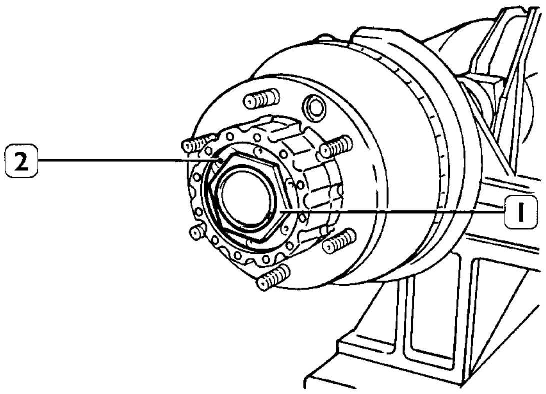


33073

Check, with tool 99395026 (2) and with a dynamometric wrench 99389819 (1), that the wheel hub rolling torque is:

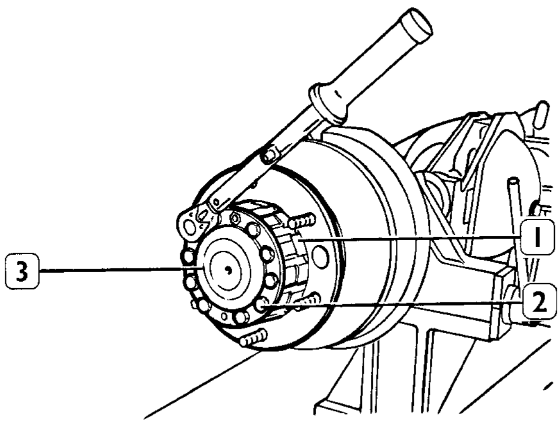
NOTE Included between 0 and 4 Nm (0 and 0.41 kgm) for rear axle 4517;
included between 0 and 4.5 Nm (0 and 0.46 kgm) for rear axle 4521.

Figure 34



After having obtained wheel hub rolling torque and axial clearance, check that one of the holes obtained on adjustment nut (1) coincides with one of the holes placed on safety washer, otherwise progressively unscrew adjustment nut (1) till safety screw (2) is able to be inserted. Tighten adjustment nut safety screw (2) at a torque of 9.1 Nm (0.9 kgm).

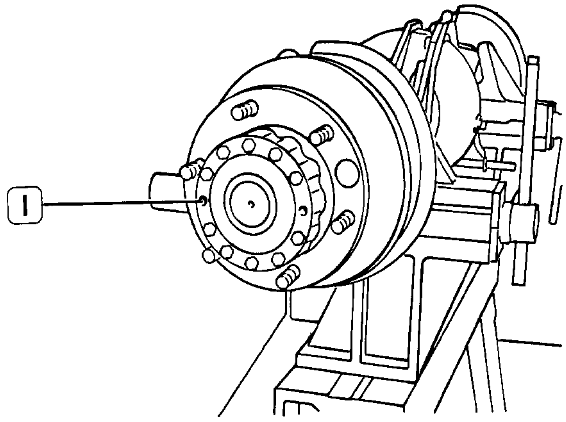
Figure 35



Butter with adhesive type "B" the contact surface between half–shaft (3) and wheel hub (1).
Assemble half–shaft (3), insert securing screws (2), apart from those marked with OIL, and tighten them:

NOTE At a torque of 62.5 Nm (6.4 kgm), for rear axle 4517;
at a torque of 103 Nm (10.5 kgm), for rear axle 4521.

Figure 36



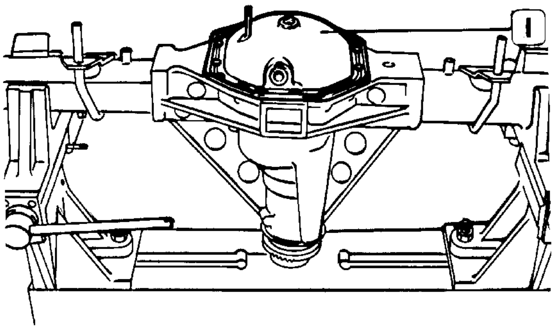
Place the two holes (1), marked with "OIL", horizontally with respect to ground, as shown in the figure, and insert into them 0.2 l of oil type W140 MDA, on every wheel side. Apply on threaded part some screws whose function is plugging the sealant type 222 LOCTITE and tighten them:

NOTE At a torque of 62.5 Nm (6.4 kgm), for rear axle 4517;
at a torque of 103 Nm (10.5 kgm), for rear axle 4521.

525010 DIFFERENTIAL GEAR REPAIR

NOTE Before carrying out the differential gear repair, it is necessary to take care of discharging oil and disassembling half–shafts as respectively shown in figures 14 and 15.

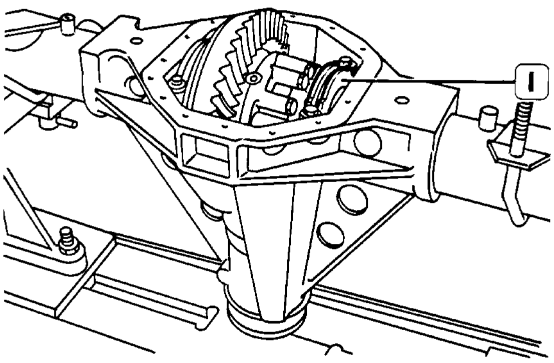
Figure 37



33077

Remove gearings inspection cover (1), complete with gasket.

Figure 38

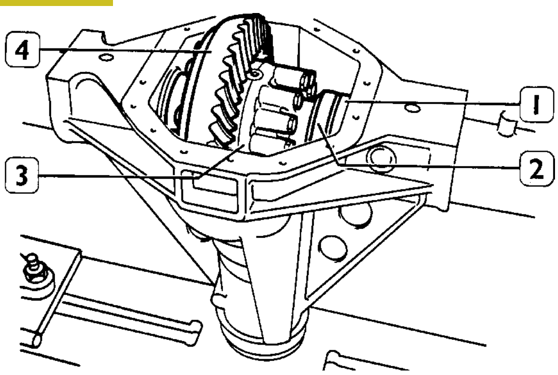


33078

Remove caps (1), after having marked them.

Disassembly pertaining to rear axle 4517

Figure 39



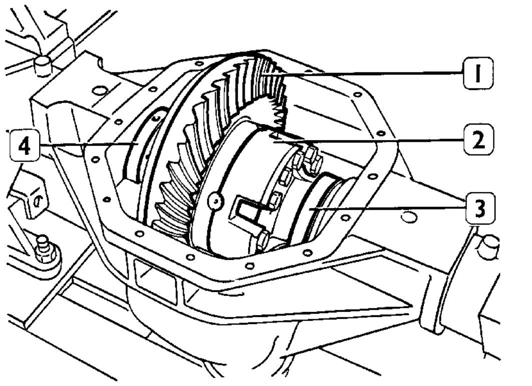
33079

Remove spacer (1) and extract gearing case (3), completed with crown (4) and external rings (2) for support bearings. Remove the other spacer and the adjustment rings.

NOTE Do not revert external races of gearing case support bearings.

Disassembly pertaining to rear axle 4521

Figure 40



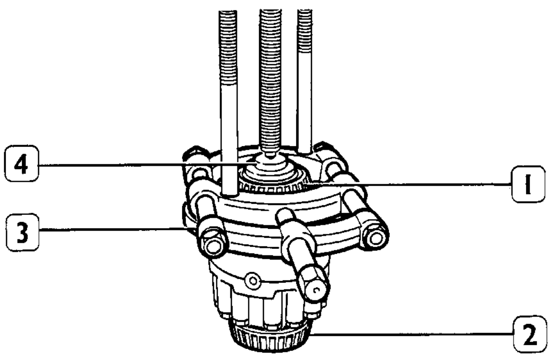
33080

Remove spacer (1) and extract gearing case (3), completed with crown (4) and external rings (2) for support bearings. Remove the adjustment rings.

NOTE Do not revert external races of gearing case support bearings.

Gearing case disassembly

Figure 41

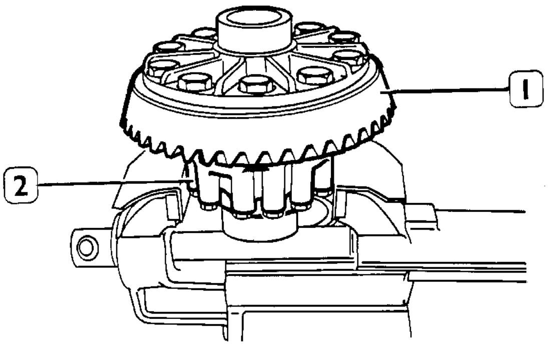


33081

Extract gearing case support bearings (1 and 2) with:

NOTE Extractor 99348001 (3) and reaction block 99345056 (4), for rear axle 4517;
extractor 99348001 (3) and reaction block 99345053 (4), for rear axle 4521.

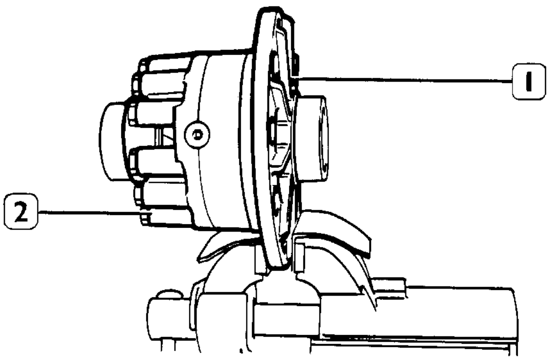
Figure 42



33082

Tighten gearing case (2) in a vice and remove bevel crown (1) from gearing case.

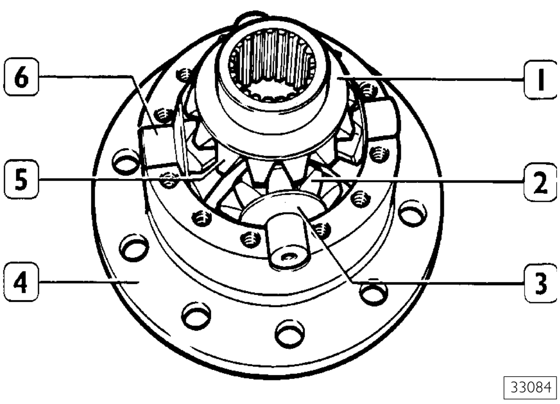
Figure 43



33083

Mark gearing half-cases (1 and 2), loosen securing screws and, positioning gearing case on a bench, detach the two half-cases.

Figure 44

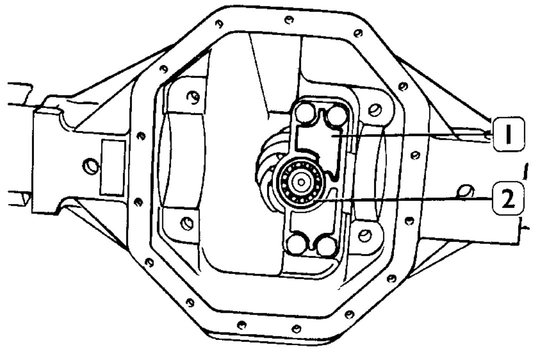


33084

Remove crown wheels (5) and planetary gears (2), completed with spider (6), from gearing half-case (4). Recover shoulder washers (1 and 3).

Disassembly of bevel pinion assembly

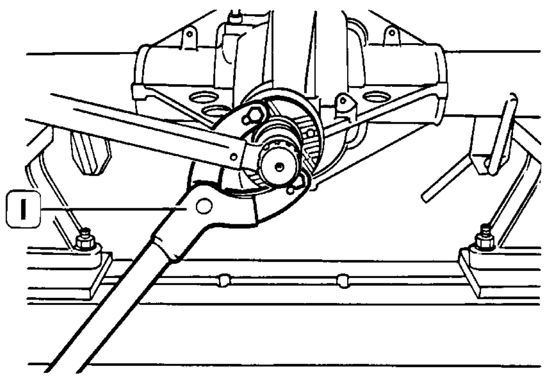
Figure 45



33085

Disassemble support (1) of bevel pinion pilot bearing (2).

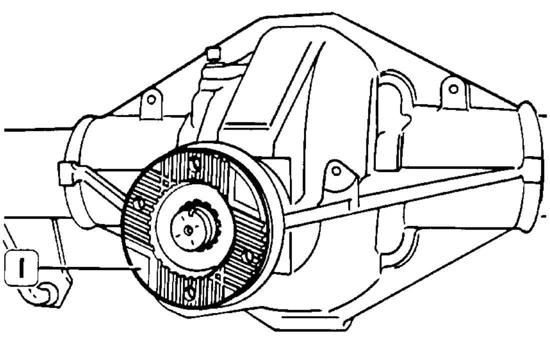
Figure 46



33086

Remove safety notch of bevel pinion check nut and unscrew the nut itself by locking flange rotation with reaction lever 99370317 (1).

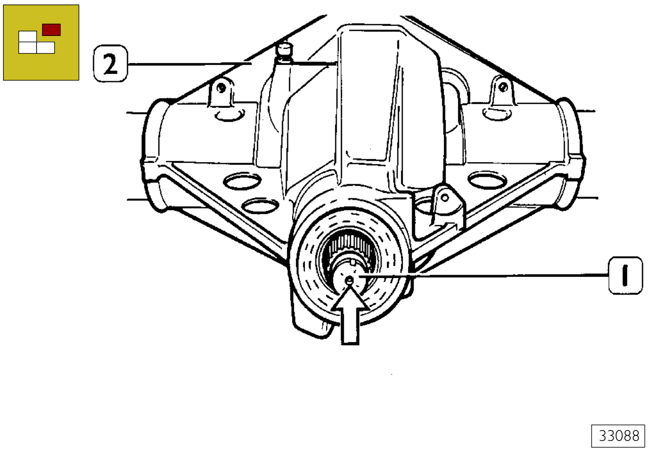
Figure 47



33087

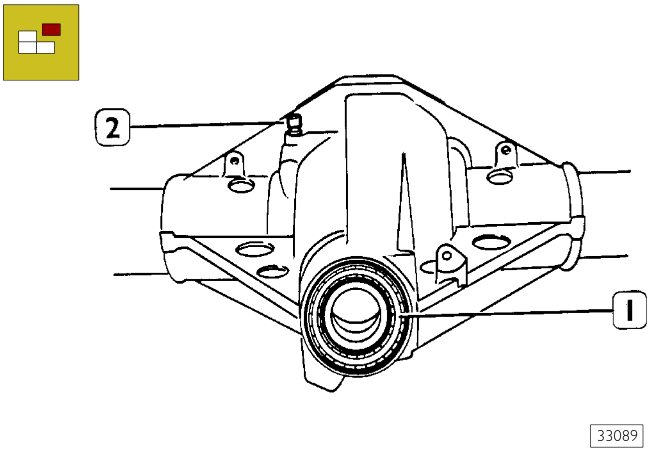
Remove transmission connection flange (1).

Figure 48



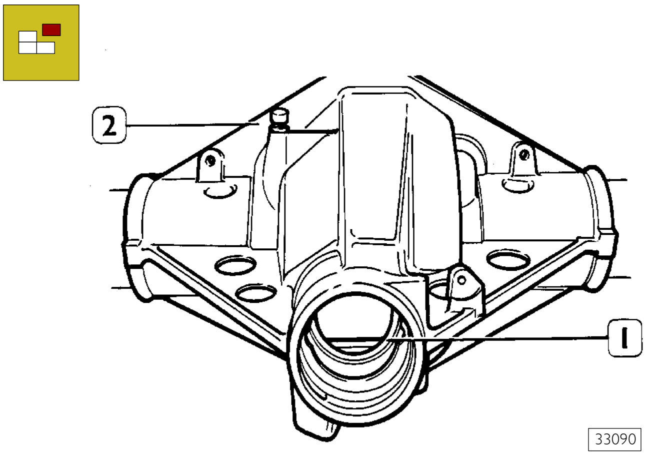
Beat, by means of a bronze beater, in the direction shown by the arrow, and remove from rear axle case (2), the bevel pinion (1) completed with rear bearing, fixed spacer and adjustment rings.

Figure 49



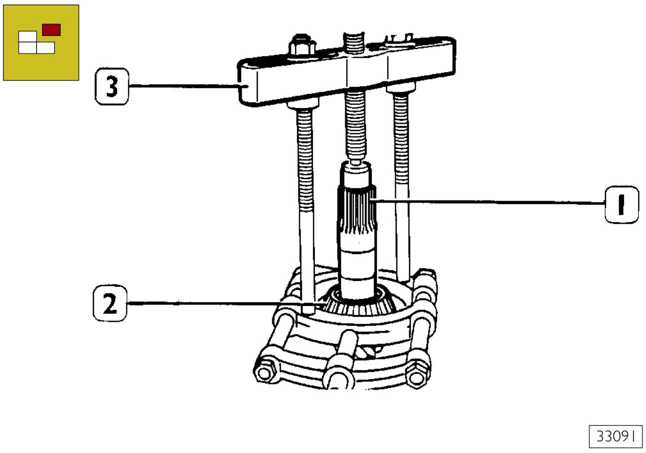
Extract sealing ring (1) and front tapered roller bearing from rear axle case (2). Extract external ring of front tapered roller bearing with a bronze beater.

Figure 50



Extract external ring (1) of rear tapered roller bearing from rear axle case (2), with a bronze beater.

Figure 51



Extract rear tapered roller bearing (2) from bevel pinion (1), with extractor 99348001 (3).

NOTE Extract pilot bearing, if necessary using appropriate means (destructive operation), for rear axle 4521.

Check of parts composing the differential gear

Accurately clean the single pieces composing the differential gear.
Lubricate bearings and freely rotate the roller-holding cage; the rotation must be regular and not show hardenings. Check bearing surfaces of bevel crown and half-case abutting plane so that the crown perfectly adheres thereto; distortions of these planes would create vibrations in crown securing screws, compromising the correct assembly operation.

NOTE Accurately clean all threadings in order to obtain exact adjustments and accurate tightening torques.

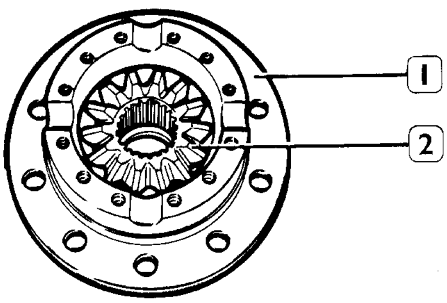
Check that the grooved section for flange keying on pinion has no excessive wears; in such case, replace the pinion.

NOTE Should crown or pinion have to be replaced, it is necessary to replace both since the parts are supplied coupled as spares.

Check crown wheels with related shoulder washers.
Replace with new parts all sealing members, the check nut for bevel pinion and the adjustment nut for gearing case bearings.

Gearing case assembly

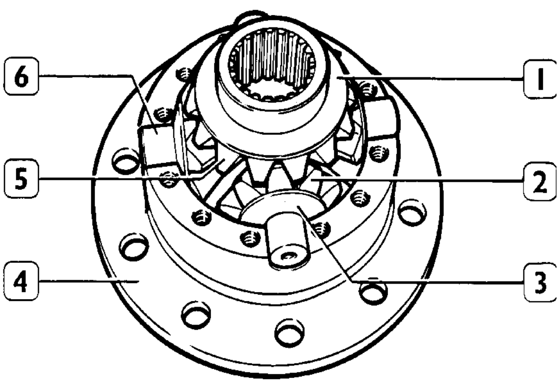
Figure 52



33092

Assemble, in gearing half-case (1), crown wheel (2) with its shoulder washer below.

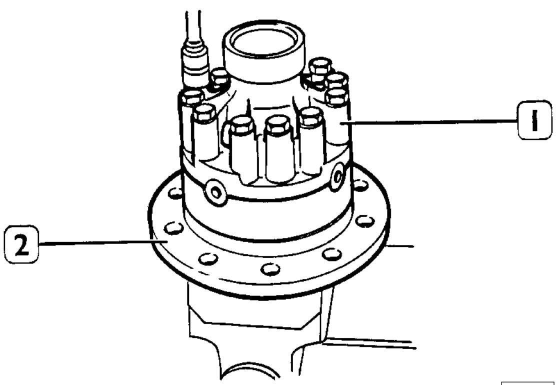
Figure 53



33084

Assemble, on gearing half-case (4), planetary gears (2) with shoulder washers (3), together with spider (6) and crown wheel (5) with shoulder washer (1).

Figure 54

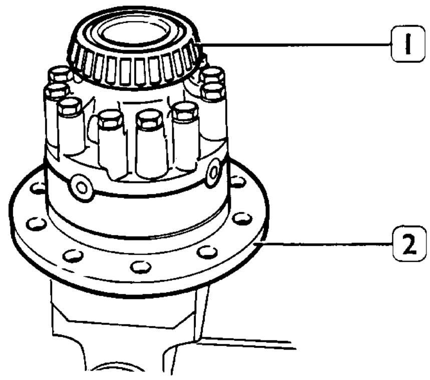


33094

Mutually assemble half-cases (1 and 2) and tighten securing screws:

NOTE At a torque of 67.5 Nm (6.8 kgm), for rear axle 4517;
at a torque of 112 Nm (11.2 kgm), for rear axle 4521.

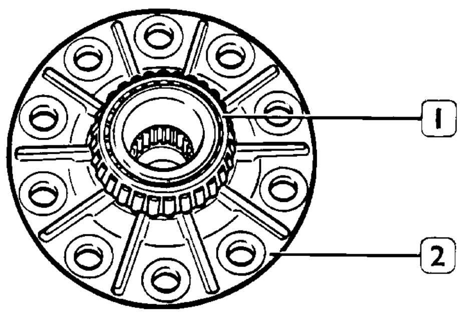
Figure 55



33095

Heat, in an air-circulation oven, at the temperature of 100°C for about 15', the taper roller bearing (1) supporting the toothing side, assemble it on gearing case (2) and settle it till its abutment.

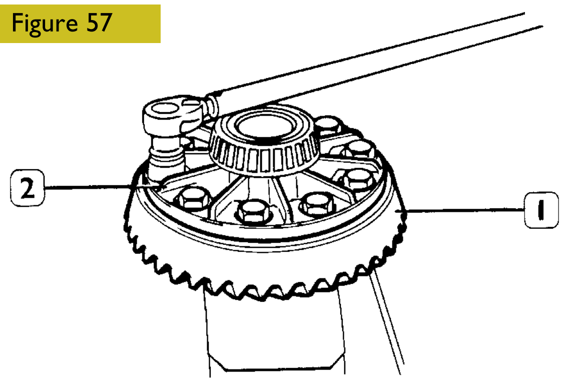
Figure 56



33096

Heat, in an air-circulation oven, at the temperature of 100°C for about 15', the taper roller bearing (1) supporting the toothing opposed side, assemble it on gearing case (2) and settle it till its abutment.

Figure 57

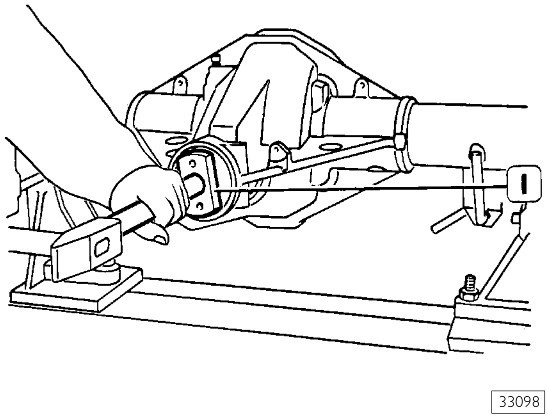


33097

Dispense into crown (1) holes some drops of LOCTITE type 270, assemble crown (1) on gearing case (2) and tighten the securing screws at the required torque.

Assembly of bevel pinion assembly

Figure 58

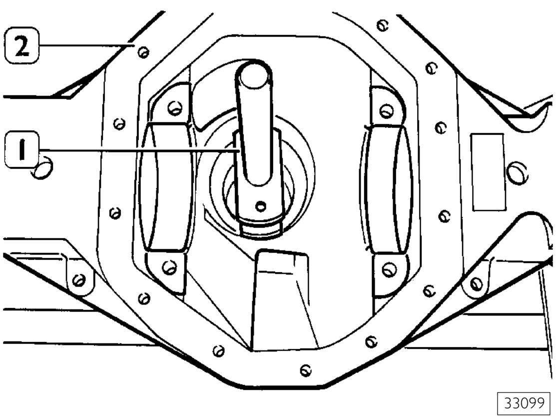


Assemble external ring of front tapered roller bearing on rear axle case (2):

NOTE With beater 99374093 (1) for rear axle 4517; with beater 99374092 (1) for rear axle 4521.

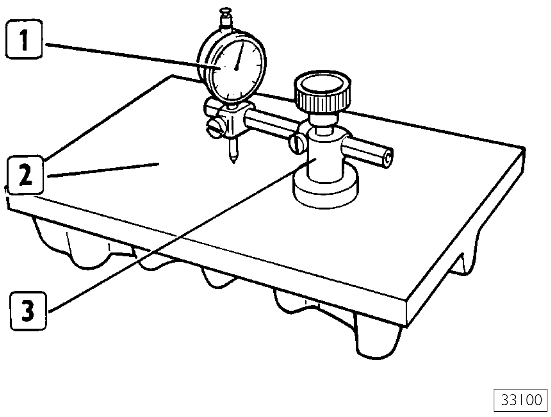
(See Figure 24 for extendable beater adjustment on external bearing ring.)

Figure 59



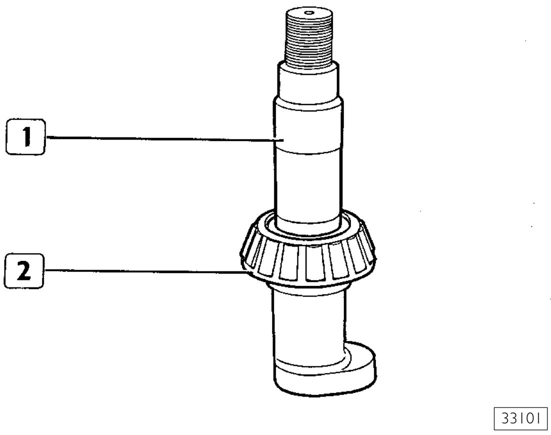
Assemble external ring of rear tapered roller bearing in rear axle case (2), without adjustment ring with beater 99374093 (1). (See Figure 24 for extendable beater adjustment on external bearing ring.)

Figure 60



Reset, on a striker plane (2), comparator 99395728 (1), placed on support (3), and slightly pre-load it.

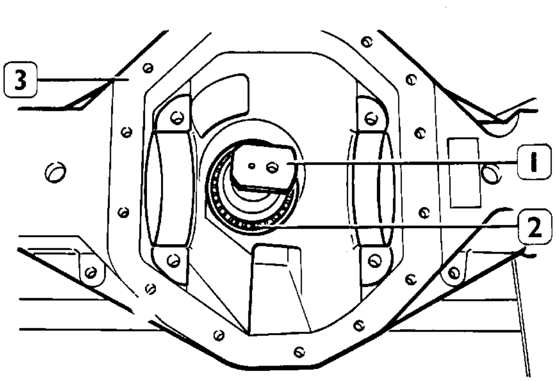
Figure 61



Assemble rear bearing (2):

NOTE On dummy pinion 99370296 (1) for rear axle 4517;
on dummy pinion 99370294 (1) for rear axle 4521.

Figure 62



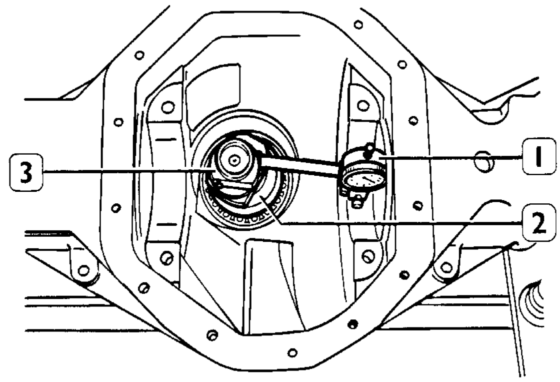
33102

Place, in its own set on rear axle case (3):

NOTE Dummy pinion 99370296 (1), completed with rear bearing (2), for rear axle 4517;
dummy pinion 99370294 (1), completed with rear bearing (2), for rear axle 4521.

Assemble front bearing, transmission connecting flange, bevel pinion check nut and tighten it in order to cancel the axial clearance and at the same time allow the dummy pinion rotation.

Figure 63



33103

Assemble comparator 99395728 (1), completed with support (3), on dummy pinion (2).
Rotate the previously-reset comparator (see Figure 60) in order to place the rod on the lowest part of the seat for the gearing case supporting bearing.

Repeat the same operation in the other bearing seat and take note of the values for both measures.
The adjustment ring thickness for pinion positioning is obtained by applying the following formula:

$$S = \frac{A_1 + A_2}{2} - (\pm B)$$

Where "S" is the thickness for the adjustment rings to be inserted between rear bearing external ring for bevel pinion and rear axle case.
"A_1" shows the value measured on right seat
"A_2" shows the value measured on left seat
"B" shows the value etched on bevel pinion (see Figure 64).

Example:

$$S = \frac{3.90 + 4.10}{2} - (\pm 0.05)$$

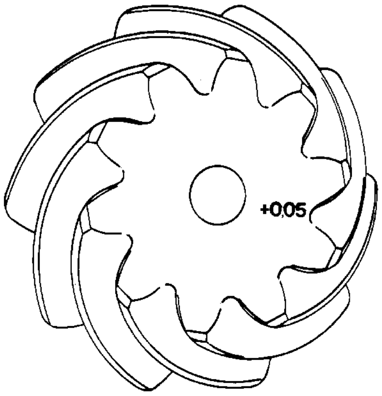
$$S = \frac{8.00}{2} - 0.05$$

$$S = 4.00 - 0.05$$

$$S = 3.95$$

The adjustment ring thickness will therefore have to be 3.95 mm.

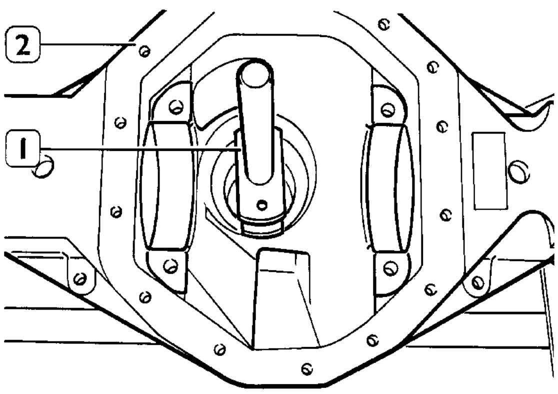
Figure 64



33104

NOTE If the value etched on the pinion is preceded by the positive sign (+), it must be subtracted from the value obtained by the sum of the seats divided by two, while it must be added thereto if it is preceded by the negative sign (-).

Figure 65

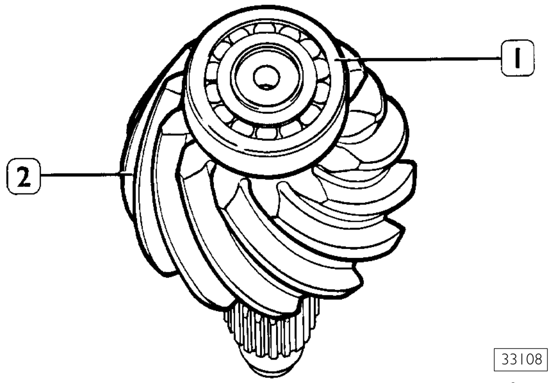


33099

Choose an adjustment ring having the exact thickness obtained by applying the formula described in Figure 63 and assemble it in the rear axle case after having removed the external ring of the previously-assembled rear tapered roller bearing.
Definitely assemble external ring of rear tapered roller bearing into rear axle case (2), with beater 99374093 (1).
(See Figure 24 for extendable beater adjustment on external bearing ring.)

Assembly pertaining to rear axle 4521

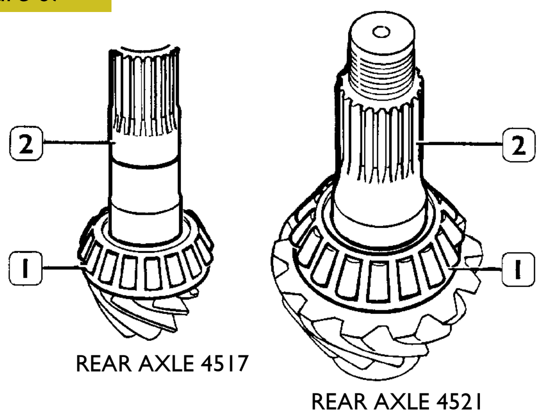
Figure 66



33108

Heat, in an air-circulation oven, at the temperature of 100°C for about 15', the pilot bearing (1) and assemble it till its abutment on bevel pinion (2). Lock the bearing by carrying out 6 or 8 notches on bevel pinion with a plate punch with rounded bit.

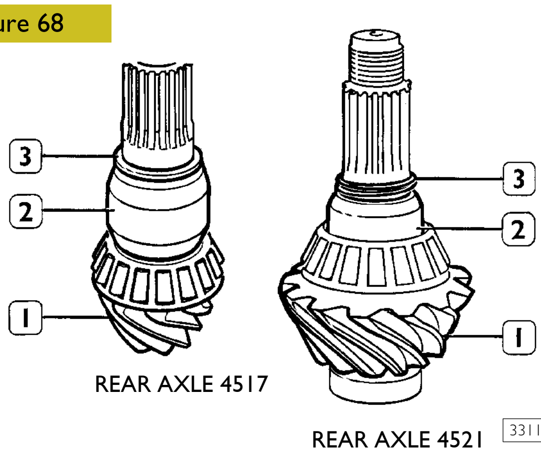
Figure 67



33109

Heat, in an air-circulation oven, at the temperature of 100°C for about 15', the rear bearing (1) and assemble it till its abutment on bevel pinion (2).

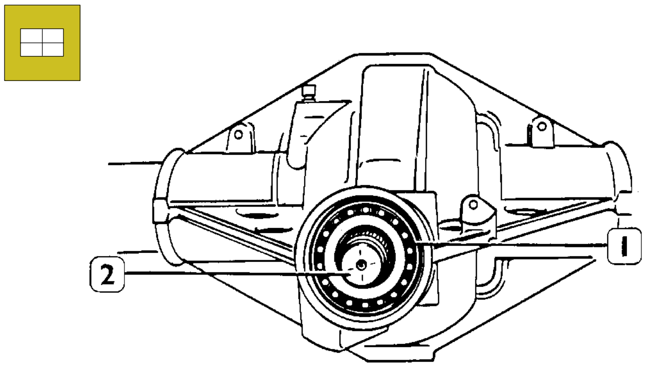
Figure 68



33110

Place, on bevel pinion (1), previously-used fixed spacer (2) and adjustment rings (3) to obtain the required rolling torque.

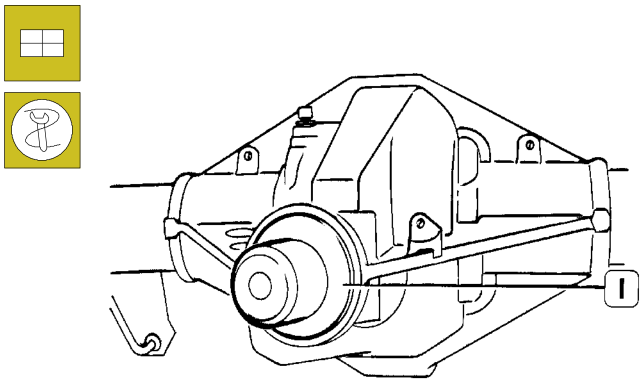
Figure 69



33111

Place complete bevel pinion into rear axle case. Heat, in an air-circulation oven, at the temperature of 100°C for about 15', the front bearing (1) and assemble it till its abutment on bevel pinion (2).

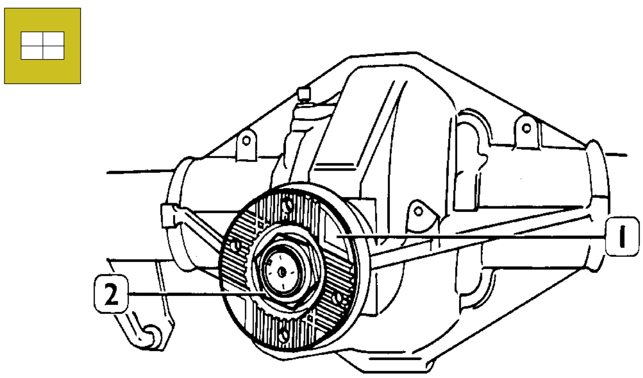
Figure 70



33112

Definitely assemble, in its own seat on rear axle case, the sealing ring with keyer 99374201 (1).

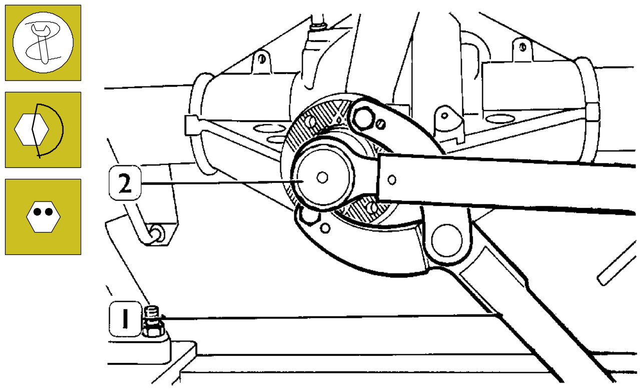
Figure 71



33113

Assemble transmission connecting flange (1) and check nut (2) for bevel pinion.

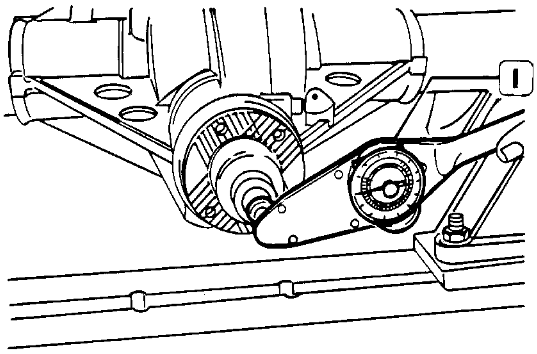
Figure 72



33114

Tighten bevel pinion check nut, with lever 99370317 (1) and with dynamometric wrench (2), at the torque of 561 Nm (57.2 kgm). Settle the bearings and check, with dynamometer 99389819, the bevel pinion rolling torque.
Then carry out, through a punch, a safety notch for the check nut.

Figure 73



33107

Rotate pinion and measure, by using dynamometric wrench 99389819 (1), the rolling torque that must be included within:

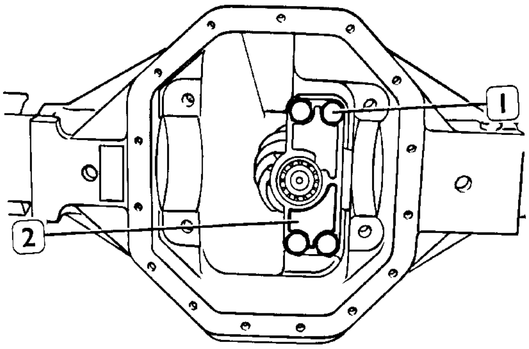
NOTE 2.2 to 3 Nm (0.2 to 0.25 kgm) for rear axle 4517;
2.6 to 3.4 Nm (0.25 to 0.29 kgm) for rear axle 4521.

If the measured value does not fall within the required limits, change the adjustment ring placed on fixed spacer till the required value is reached.

NOTE The rolling torque must be obtained with sealing ring and bearings lubricated with W140 MDA oil.

Assembly pertaining to rear axle 4521

Figure 74

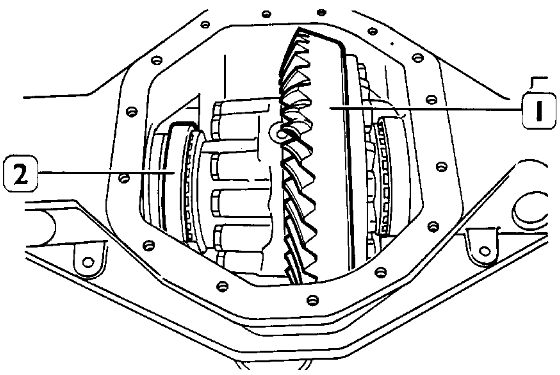


33115

Assemble pilot bearing support (2) for bevel pinion and tighten nuts (1) at a torque of 267.5 Nm (27.3 kgm).

Gearing case assembly on rear axle case

Figure 75

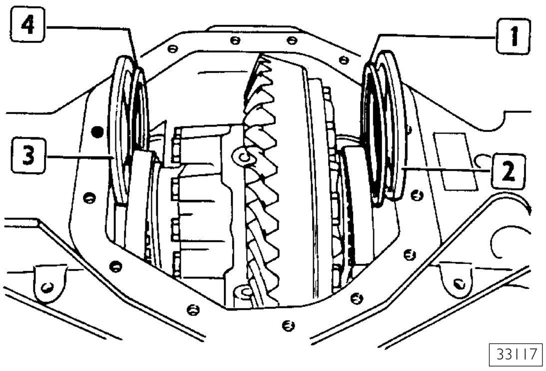


33116

Assemble external rings (2) for gearing case support bearings and then place the previously-assembled gearing case (1) into rear axle case.

Assembly pertaining to rear axle 4517

Figure 76

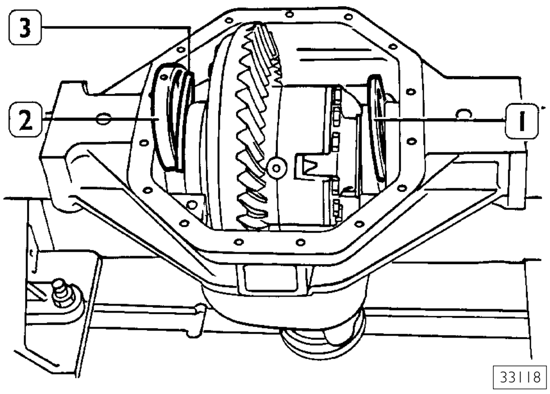


33117

Insert spacer (2), adjustment shim (1), adjustment shim (4) and then assemble spacer (3).

Assembly pertaining to rear axle 4521

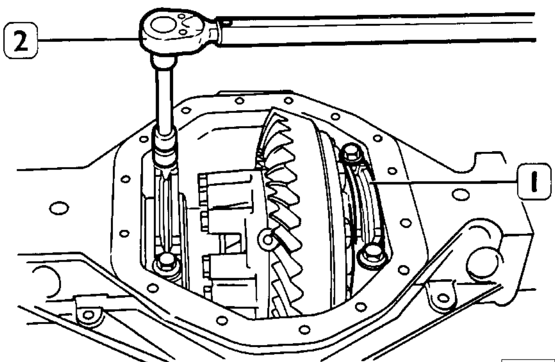
Figure 77



33118

Insert spacer (2) and adjustment shims (1 and 3).

Figure 78



33119

Assemble caps (1) taking into account the marks obtained when disassembling. Tighten securing screws, with dynamometric wrench (2):

NOTE at the torque of 107.5 Nm (11 kgm) for rear axle 4517;
at the torque of 167.5 Nm (17.1 kgm) for rear axle 4521.

Set gearing case support bearings and check the total rolling torque.
Such torque changes according to the applied reduction ratio on rear axle and is computed through the following formula:

$$Ct = Cp + (\frac{Cd}{R} \times 0.99)$$

Ct = total rolling torque.

Cp = rolling torque for bevel pinion bearings

Cd = 2 ÷ 2.8 Nm (0.2 to 0.29 kgm) for rear axle 4517
Cd = 2.5 ÷ 2.8 Nm (0.25 to 0.29 kgm) for rear axle 4521

Cd = 2 ÷ 2.8 Nm (0.2 to 0.29 kgm)

R = rear axle reduction ratio

Example:

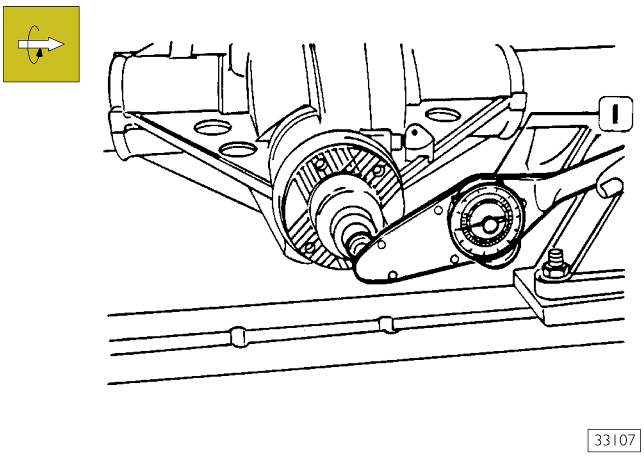
$$Ct = 3 + (\frac{2.8}{5.57} \times 0.99)$$

Ct = 35 + 0.50

Ct = 3.50 Nm (0.36 kgm)

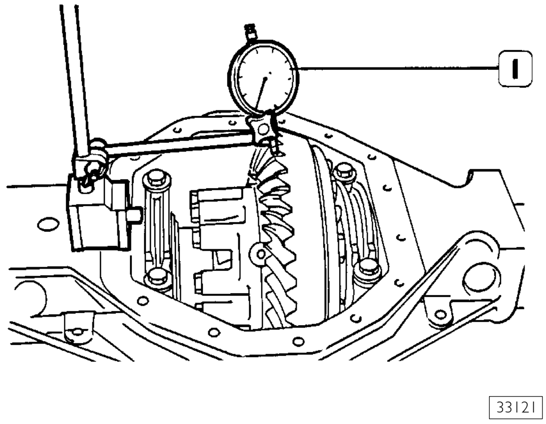
NOTE The example takes into account the maximum values for rear axle 4517.

Figure 47



Carry out the total rolling torque check, with dynamometric wrench 99389819 (1).
If the measured value does not coincide with the value obtained through the formula, modify the thicknesses.

Figure 48

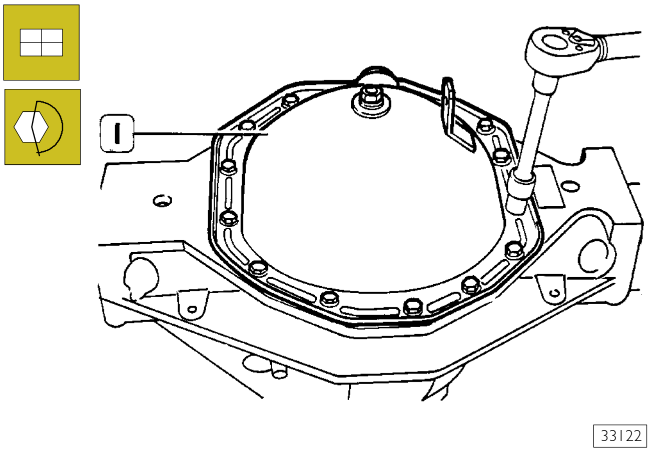


Lock the bevel pinion rotation with reaction lever 99370317. Place magnetic–based dial gauge 99395684 (1) and measure clearance between the pinion and the crown (see specifications and data on page 5).

Otherwise, increase and decrease previously–computed adjustment thicknesses by the same measure, in order to keep the rolling torque value unaltered.

Apply, with a brush, a thin layer of lead oxide (minium) on crown teeth. Rotate the pinion and detect the pinion teeth contact imprint on crown teeth.
On page 37 systems are shown to obtain an exact contact adjustment for bevel torque toothings.

Figure 49

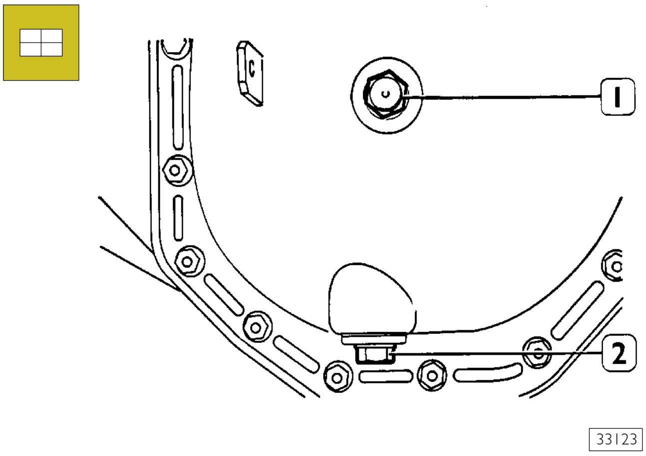


Place a new sealing gasket on gearing inspection cover connection plane. Assemble cover (1) and tighten the securing rings, with a dynamometric wrench, at the torque of 23.5 Nm (2.4 kgm).

NOTE Do not tighten the screws at a greater torque than the value shown, since sealing would be impaired for the gasket placed between connection plane and gearing inspection cover.

Carry out half–shafts assembly as shown in fig.s 35 and 36.

Figure 50



Assemble oil discharge plug (2).
Insert through the suitable hole:

NOTE 2.65 l of oil type W140 MDA for rear axle 4517;
5 l of oil type W140 MDA for rear axle 4521.

Assemble check and filling plug (1).

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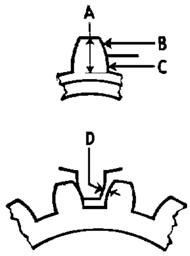
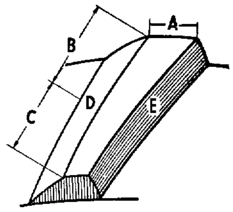
Figure 51

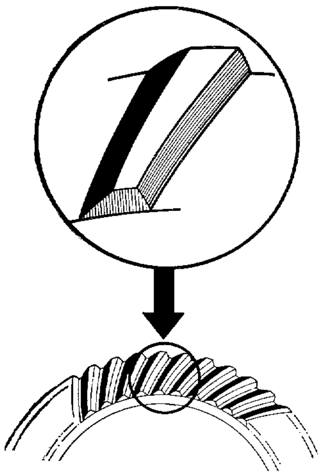
A = Meshing depth
B = Ridge
C = Flank
D = Clearance

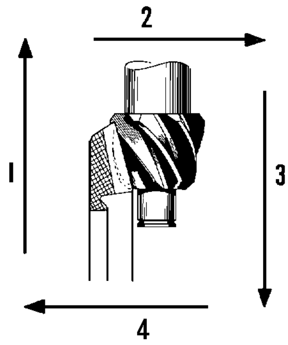




A = Longer base
B = Heel
C = Bit
D = Contact surface
E = Side surface

Correct contact.
If the bevel torque adjustment is correctly carried out, the toothing surfaces contact will be regular.

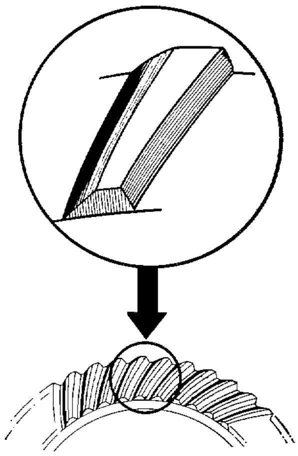


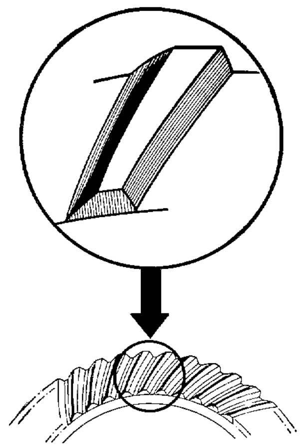


Displacement for corrections.
1. Displace pinion to correct contact 1 – 2. Displace crown to correct contact 2 – 3. Displace pinion to correct contact 3 – 4. Displace crown to correct contact 4

1

Excessive contact on lower tooth flank.
Remove pinion from crown and then approach crown to pinion to adjust the clearance.



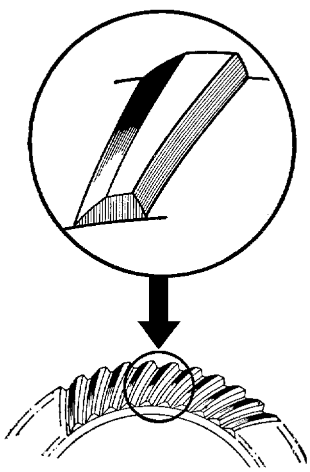


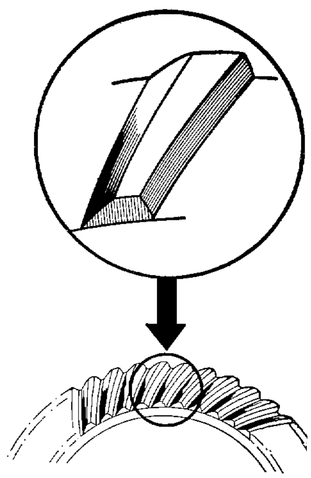
3

Excessive contact in tooth upper part or ridge.
Approach pinion to crown and then remove crown from pinion to adjust the clearance.

2

Excessive contact on tooth heel.
Approach crown to pinion and then remove pinion from crown to adjust the clearance.





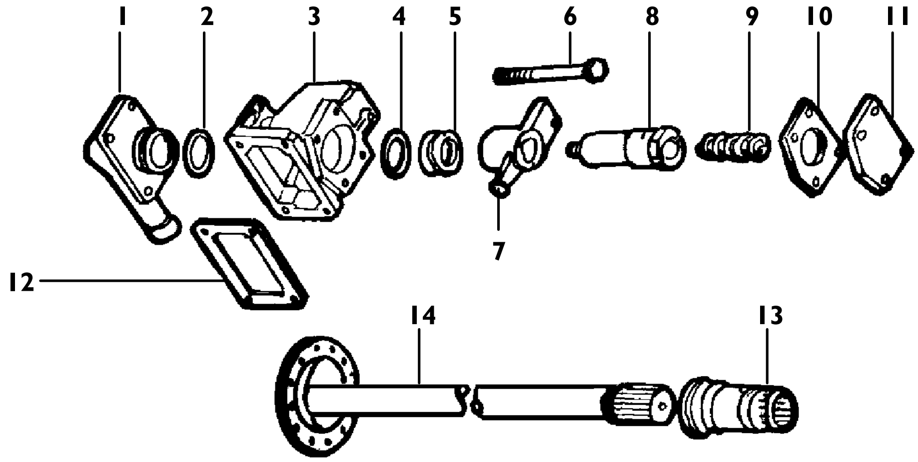
4

Excessive contact on tooth bit.
Remove crown from pinion and then approach pinion to crown to adjust the clearance.

13526

VARIATION WITH DIFFERENTIAL LOCKING

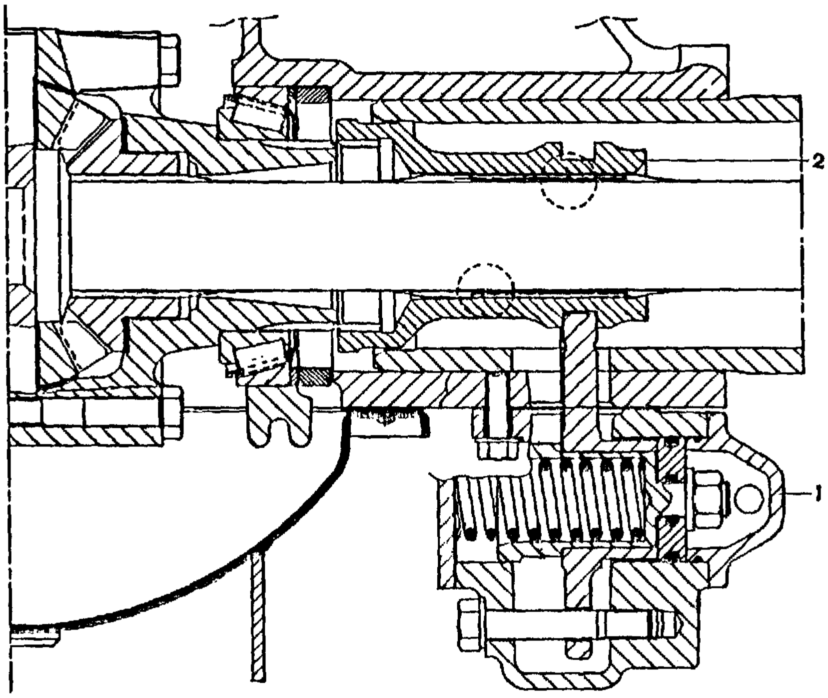
Figure 52



33433

PARTS COMPOSING THE DIFFERENTIAL LOCKING
1. Cover – 2. Sealing ring – 3. Case – 4. Sealing ring – 5. Plunger – 6. Guide screw – 7. Lever – 8. Operating cylinder – 9. Spring – 10. Gasket – 11. Cover – 12. Gasket – 13. Sleeve – 14. Half–shaft

Figure 53



33434

SECTION ON DIFFERENTIAL GEAR WITH VARIATION WITH DIFFERENTIAL LOCKING

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Disassembly

In order to disassemble the differential locking, remove half–shaft, disassemble locking control (1, Figure 53), extract gearing box (see 525010 DIFFERENTIAL GEAR REPAIR) and afterwards remove sleeve (2, Figure 53) from rear axle case.

Checks

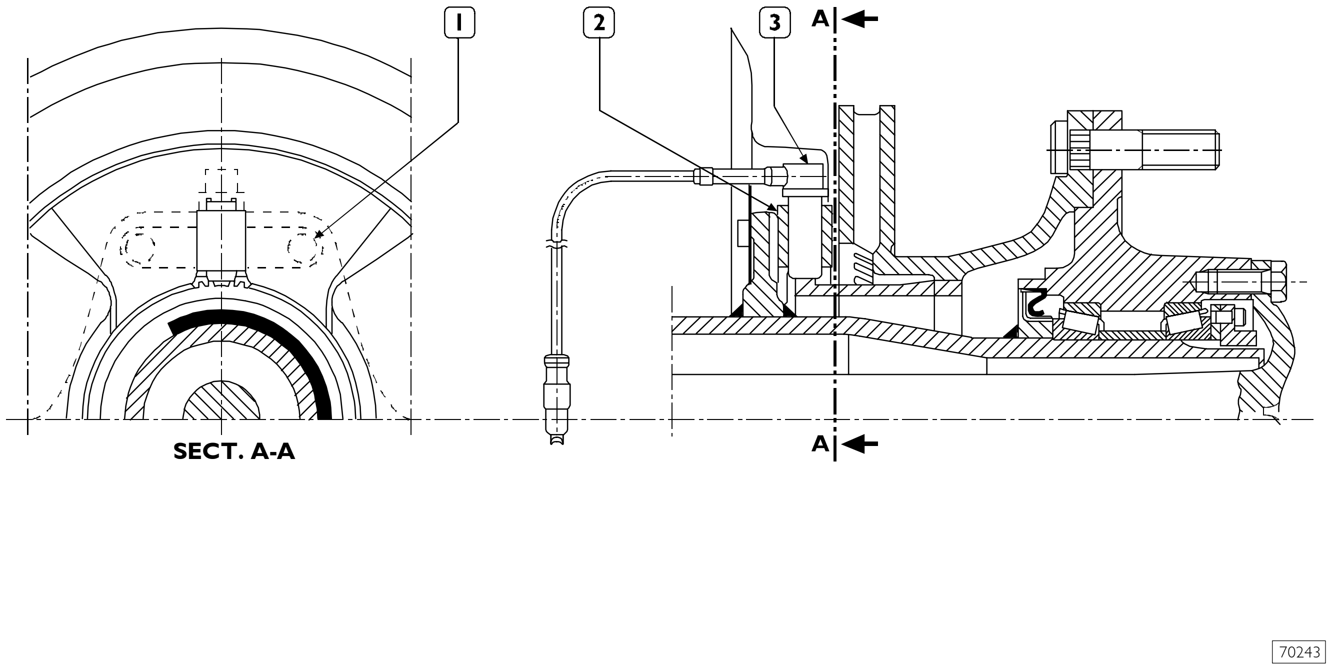
Insert air on operating cylinder at a pressure of about 6 bars and check that the engagement lever performs a 15–mm stroke, otherwise replace worn parts.

Assembly

In order to assemble the differential locking, insert sleeve (2, Figure 53) into rear axle case, assemble gearing case (see GEARING CASE ASSEMBLY ON REAR AXLE CASE), assemble locking control (1, Figure 53) and afterwards insert the half–shaft.

ANTISKID DEVICE SENSOR

Figure 54



SECTION ON HUB WITH ANTISKID DEVICE

Assembly

Assemble sensor (3) on support (2) by completely pushing it into its own seat.
Secure support (2) with screws (1). Upon assembling the screws (1), dispense some drops of thread–braking ”LOCTITE TYPE 243” on the thread of corresponding holes of the bracket welded on rear axle arm and tighten screws (1) with a torque of 5 to 7 Nm.
Assemble the disk hub assembly with driven phonic wheel. Push the sensor into its final position in contact with phonic wheel, through the suitable hole on brake plate.

SECTION 7

5206 Front axles 5833 – 5833/1

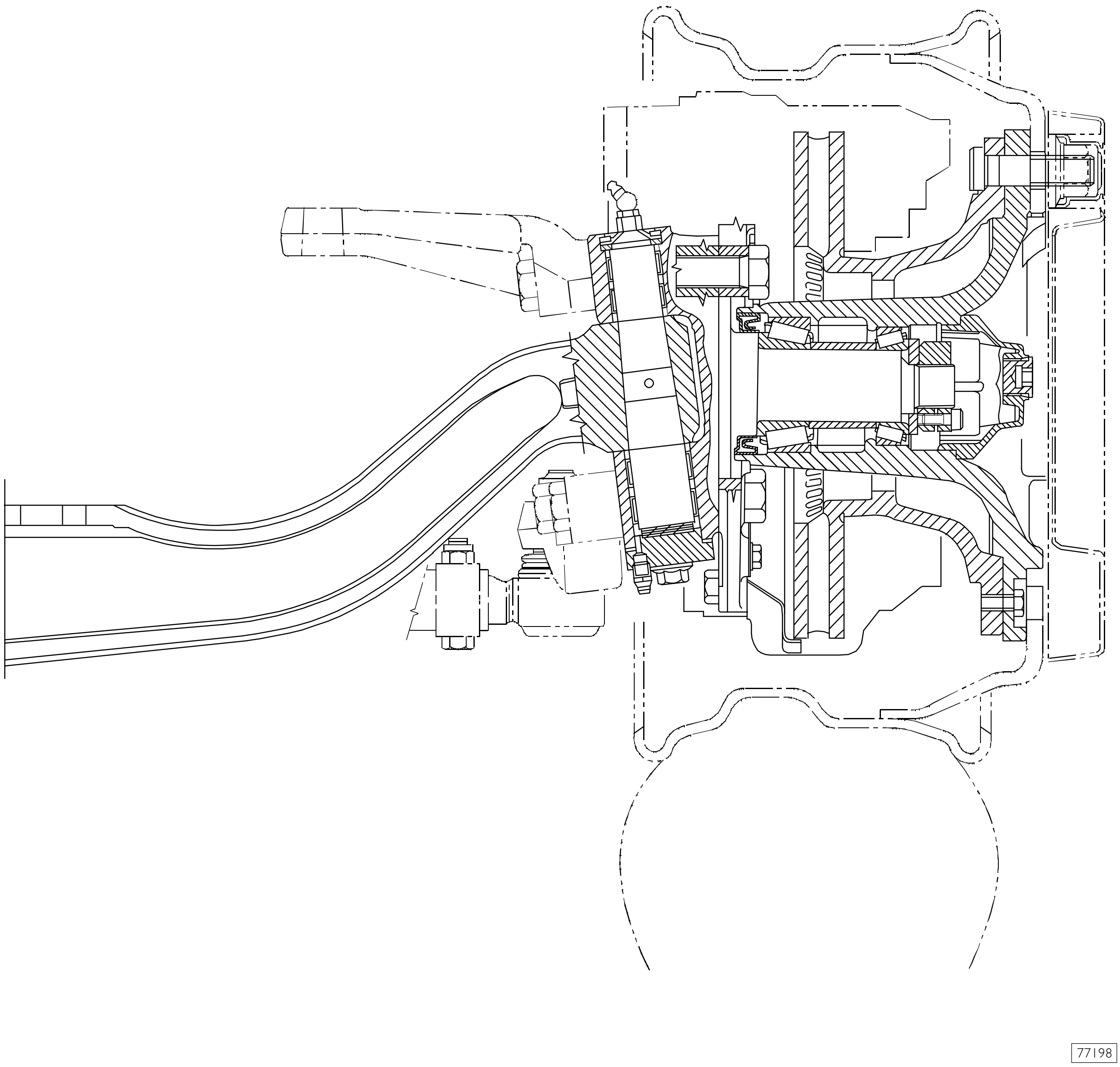
DESCRIPTION

Front axle

The front axle is made of a steel structure, with double–"T" section, at the end of which stub axles are articulated. The stub axle articulation is performed through pins that are integral with front axle body, and by means of four roller bearings driven by interference into stub axle projection holes.

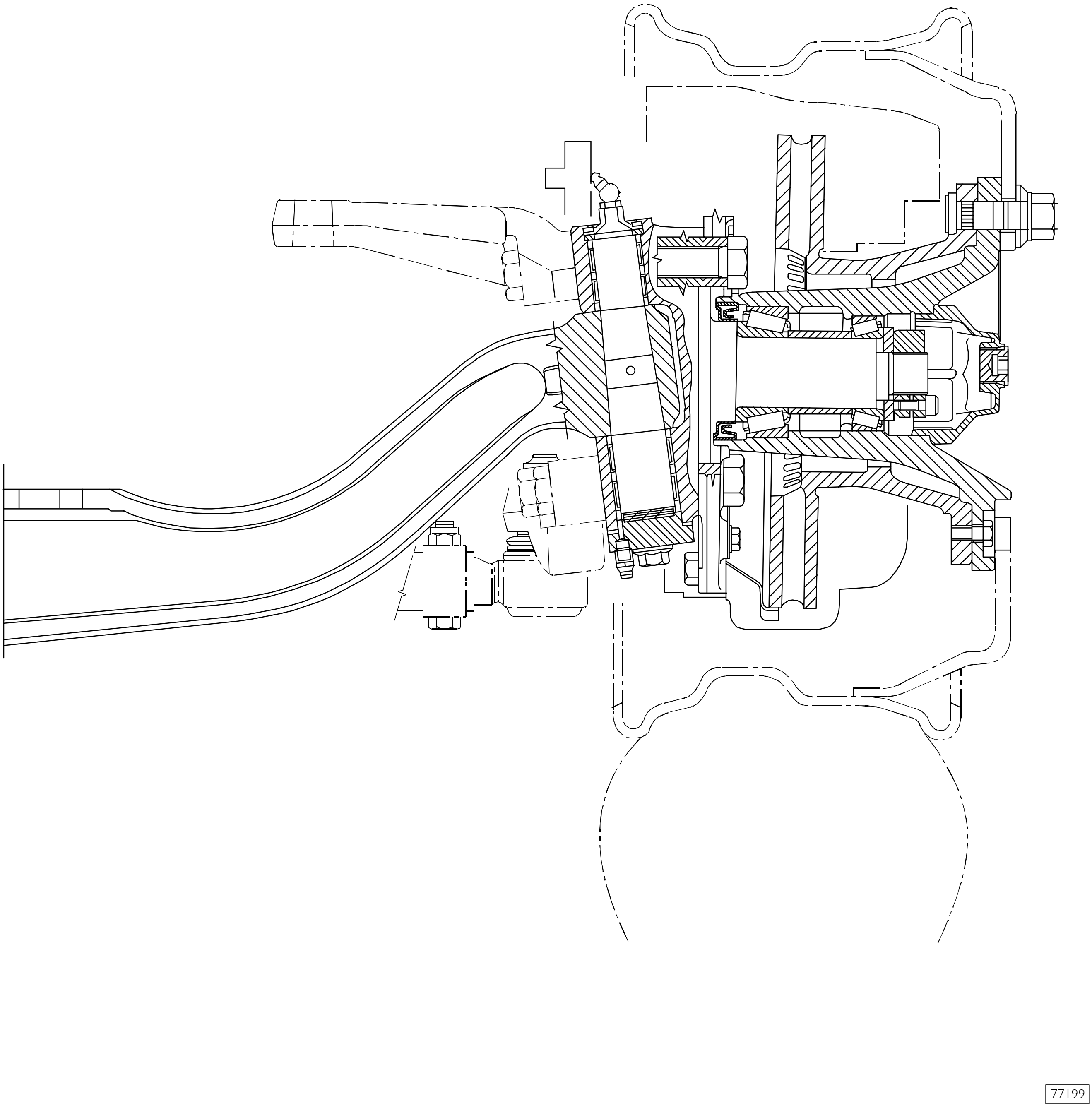
Wheel hubs are supported by two tapered roller bearings assembled on stub axle tang and adjustable through a threaded ring nut.

Figure 1



FRONT AXLE (5833) SECTION ON WHEEL SIDE

Figure 2



FRONT AXLE (5833/1) SECTION ON WHEEL SIDE

Characteristic angles

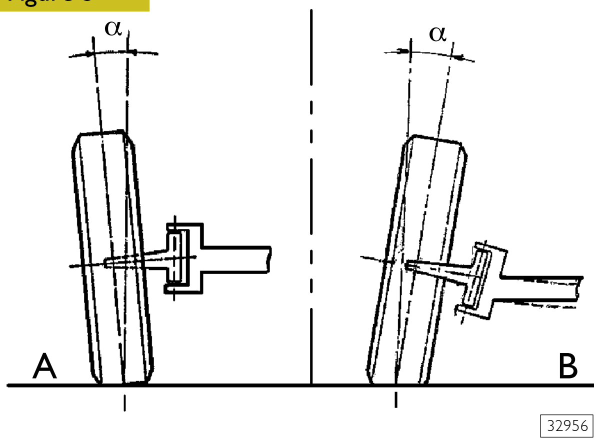
In order to have a good vehicle roadholding, a low tire consumption and to allow the driving wheels when steering to spontaneously return to their straight running, certain assembly angles are given to front wheels:

- wheel camber angle;
- king pin angle;
- caster angle;
- wheel toe–in.

These angles, suitably computed, allow the correct balance of those forces that are generated when the vehicle is moving, under different load conditions, that tend to modify the wheel position on the ground.

Wheel camber angle

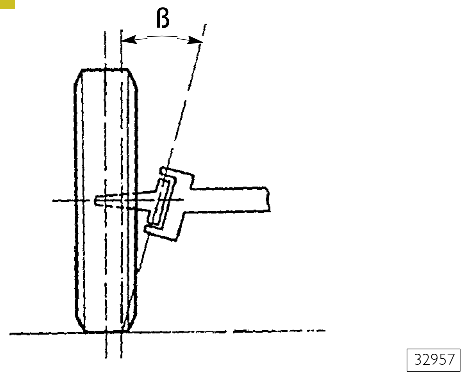
Figure 3



The wheel camber angle (α) is the angle formed by the axis passing through wheel center distance and the vertical line to the ground observing the vehicle from its front side.
Camber is positive (A) when the upper wheel part is outward–oriented; it is negative (B) when the upper wheel part is inward–oriented.

King pin angle

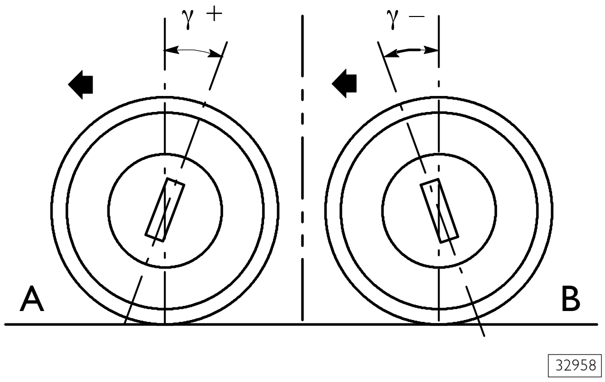
Figure 4



The king pin angle (β) is the angle composed of the axis passing through the pillar and the vertical line to the ground observing the vehicle from its front side.
When the pillar axis extension approaches the wheel in the contact point with the ground (contrary behaviour to wheel camber), the angle is positive; it is difficult, if not impossible, to have a negative king pin angle.
The wheel camber angle (α) and the king pin angle (β) allow wheel axis and pillar axis to approach as much as possible the tire bearing center on the ground.
A reduced tire consumption and a low steering torque value are thereby obtained.

Caster angle

Figure 5

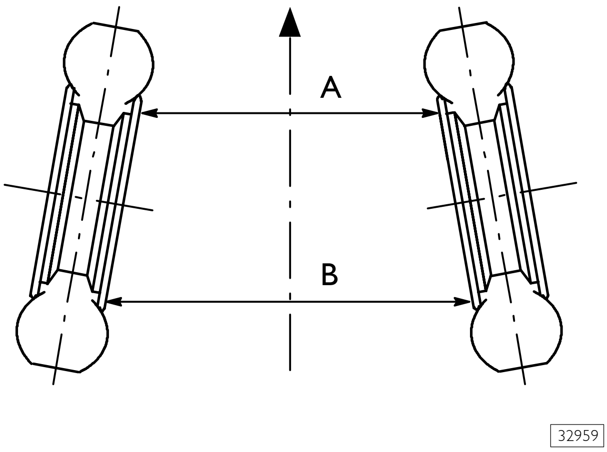


The caster angle (γ) is the angle formed by the pillar axis with the vertical line to the ground observing the vehicle on its side.
If the pillar axis extension falls over the wheel resting point to the ground, along the vehicle running direction, the caster angle is conventionally positive (A); it is negative (B) if it falls behind the wheel resting point to the ground; it is zero if it is perfectly vertical to the wheel resting point to the ground.

This angle allows keeping the front wheels straight when the vehicle is in a rectilinear drive and the spontanoeus return of the wheels, from the position assumed in a curve to the rectilinear drive position, as soon as the steering wheel is released by the driver.

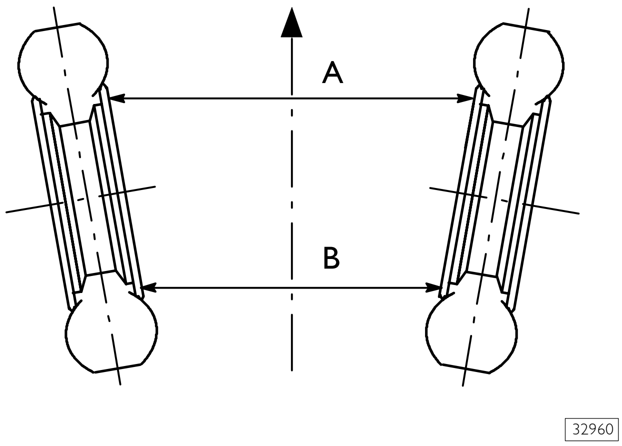
Vehicle toe–in

Figure 6



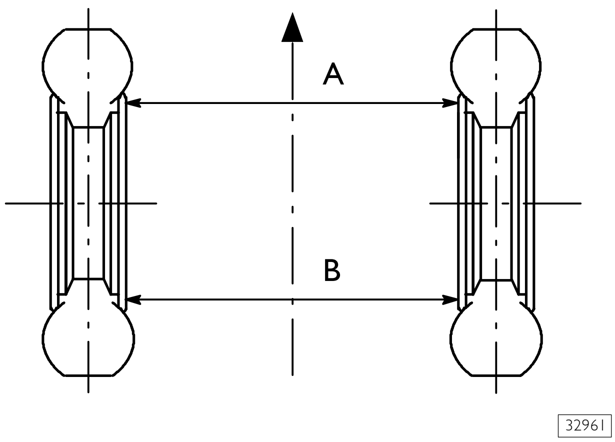
The vehicle toe–in is the result of the difference between distances A and B (value expressed in mm) measured on the horizontal rim axis, observing the vehicle from above.
A light driving and a low tire consumption are thereby obtained.
Toe–in is positive if B is greater than A.

Figure 7



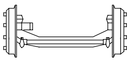
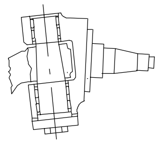
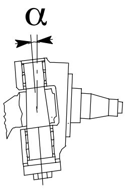
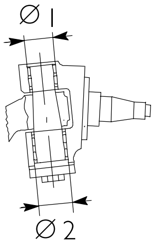
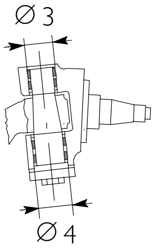
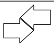
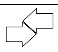
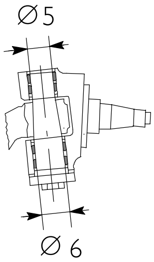
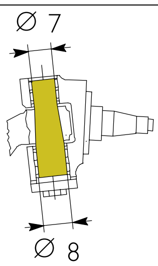
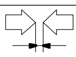
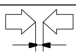
Toe–in is negative is B is less than A.

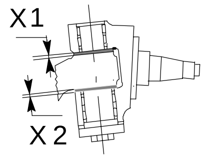
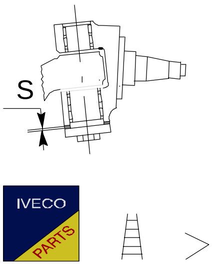
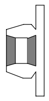
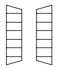
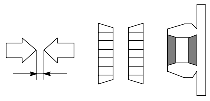
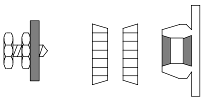
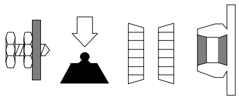
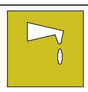
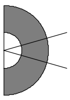
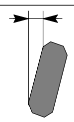
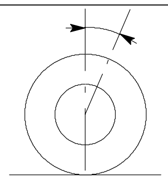
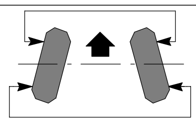
Figure 8



Toe–in will be zero if B is equal to A.

SPECIFICATIONS AND DATA

	Front axle type			**5833**	**5833/1**
	STUB AXLE PINS				
	Seat camber for stub axle pin			7°	
	Seat diameter for stub axle roller bearings: – upper seat – lower seat	 Ø 1 Ø 2	 mm mm	 41.972 to 41.988 51.967 to 51.986	
	External roller bearings diameter for stub axle: – upper bearings – lower bearings	 Ø 3 Ø 4	 mm mm	 42 52	
	Upper bearings – stub axle		mm	0.012 to 0.028	
	Lower bearings – stub axle		mm	0.014 to 0.033	
	Internal roller bearings diameter for stub axle: – upper bearings – lower bearings	 Ø 5 Ø 6	 mm mm	 35 43	
	Pin diameter for stub axle: – upper – lower	 Ø 7 Ø 8	 mm mm	 34.984 to 35.000 42.984 to 43.000	
	Upper bearings – pin		mm	0 to 0.016	
	Lower bearings – pin		mm	0 to 0.016	

			5833	5833/1
	Clearance between front axle and upper stub axle shim adjustment X1 Span between front axle and upper stub axle shim adjustment X2	mm mm	0.10 to 0. 35 ≥ 0.25	
	Adjustment plates X 1 ; X 2 mm 0.25 S	mm	from 0.50 to 1.75	
	**WHEEL HUBS**			
	Wheel hub bearings		2 with tapered rollers	
	Axial hub bearing clearance	mm	max 0.16	
	Wheel hub clearance		through a ring nut	
	Bearing pre–load		from Nm 0.23	
	Oil for wheel hub bearings Amount per hub	Liters (kg)	Tutela W 140/MDA 0.10 (0.09)	
	**WHEEL ATTITUDE**			
	Wheel camber (statically–loaded vehicle)		1°	
	Wheel caster (statically–loaded vehicle)		3°	
	Wheel toe–in (statically–loaded vehicle)	mm	0.5 to 1.5	

DIAGNOSTICS

Main operating anomalies on front axle:

1 – Steering wheel hardness;
2 – Wobble;
3 – Noises.

1	STEERING WHEEL HARDNESS

Perfectly–aligned front axle	NO	Restore the alignment and tighten at a torque the securing nuts for leaf springs brackets.
YES		
Regular wheel toe–in.	NO	Proceed with the exact adjustment of front wheels toe–in.
YES		
Regular tire pressure.	NO	Inflate the tires at the required pressure.
YES		
Sufficient articulation lubrication.	NO	Carry out an accurate articulation lubrication.
YES		
Exact adjustment between stub axle and front axle.	NO	Carry out an accurate clearance adjustment between stub axle and front axle.
YES		
Efficient members affected by stub axle rotation on pin	NO	Check and replace the parts that appear deteriorated.

2	**WOBBLE**

Condition		Action
Regular wheel caster.	– NO →	Check front axle assembly, repair or replace distorted parts.
YES ↓		
Perfectly aligned front axle.	– NO →	Restore the alignment and tighten at a torque bracket nuts for securing leaf springs on front axle.
YES ↓		
Regular wheel toe–in.	– NO →	Correctly adjust the toe–in.
YES ↓		
Efficient steering wheel tie–rod stub heads.	– NO →	Replace faulty parts.
YES ↓		
Regular clearance for wheel hub bearings.	– NO →	Adjust the axial clearance after having carried out possible replacements.
YES ↓		
Centered wheels: ❑ centered, not distorted rim ❑ correct tire assembly on rim	– NO →	Replace the anomalous rim. Deflate and center tire on rim.
YES ↓		
Balanced wheels.	– NO →	Carry out wheel balancing.

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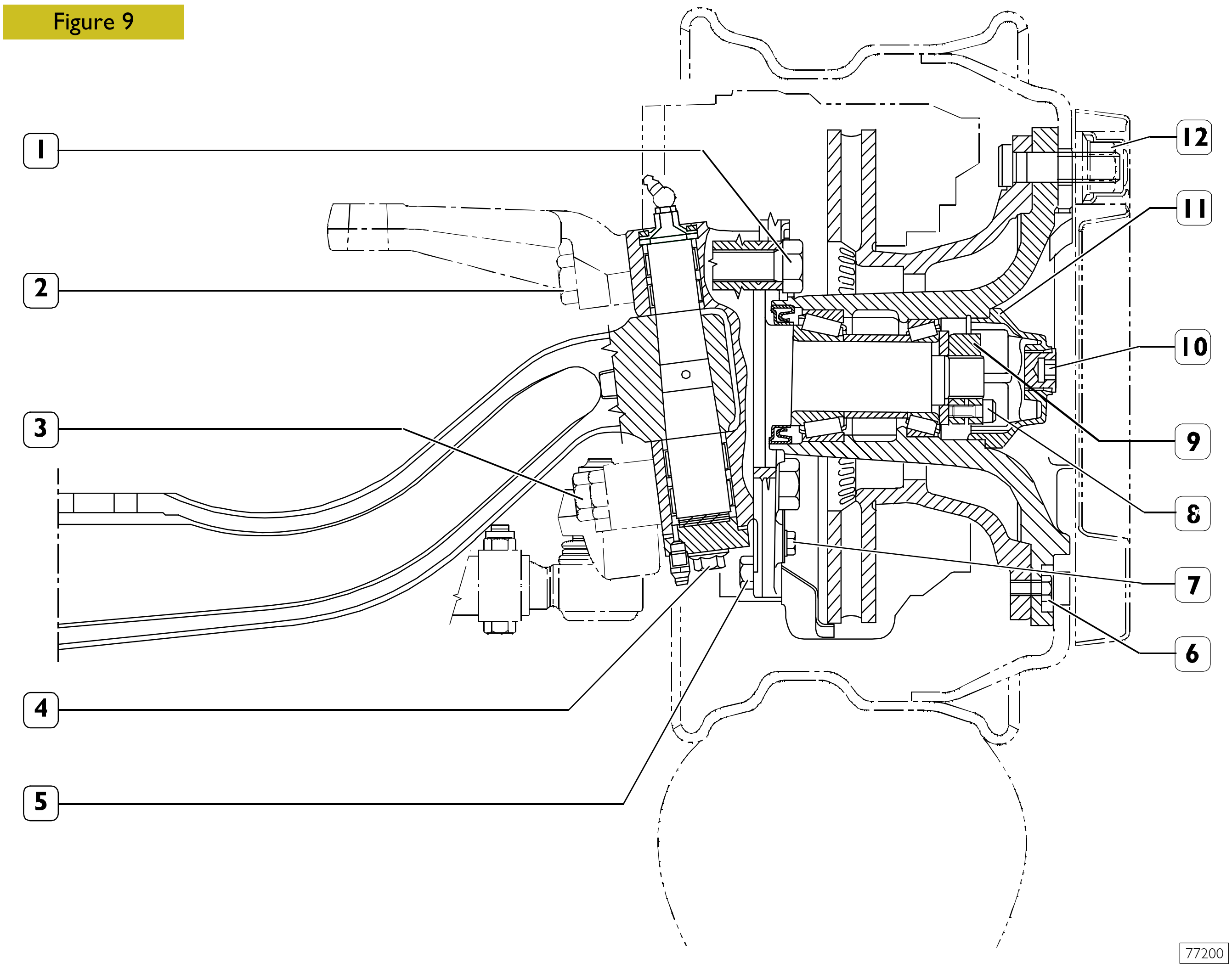
3	**NOISES**

Check		Action
Sufficient wheel hub bearings lubrication.	NO →	Restore oil level in wheel hubs.
↓ YES		
Efficient wheel hub bearings.	NO →	Replace deteriorated bearings and carry out axial clearance adjustment.
↓ YES		
Regular coupling between stub axle pin and roller bearings.	NO →	Check and replace worn parts.

TIGHTENING TORQUES

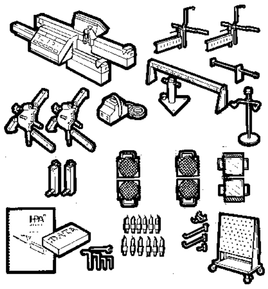
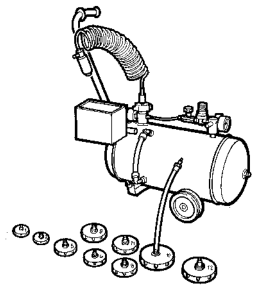
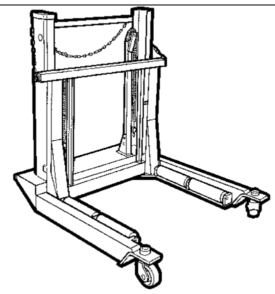
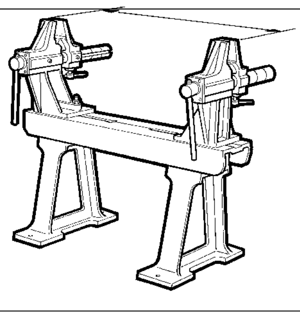
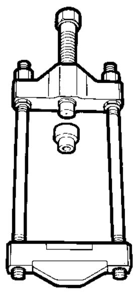
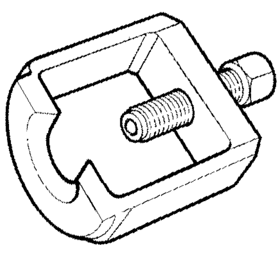
Figure 9



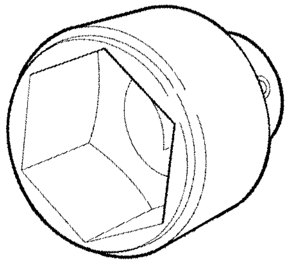
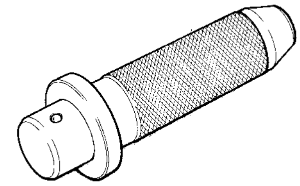
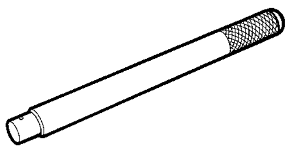
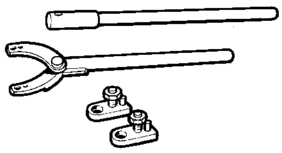
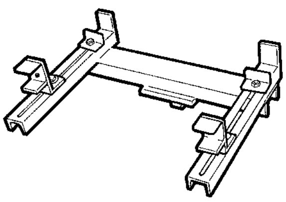
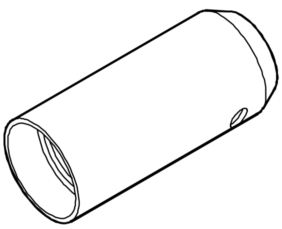
FRONT AXLE (5833/1) SECTION ON WHEEL SIDE

PART		TORQUE Nm	(kgm)
1	Self–locking hexagonal head screw for securing brake calipers support to stub axle	545 ± 25	(54.5 ± 2.5)
2	Self–braking hexagonal head screw for securing transverse tie–rod lever to stub axle	363 ± 20	(36.3 ± 2)
3	Self–braking hexagonal head screw for securing longitudinal lever to stub axle	363 ± 20	(36.3 ± 2)
4	Flanged hexagonal head screw for securing lower fifth wheel cover to stub axle	126.5 ± 6.5	(12.6 ± 6.7)
5	Self–locking hexagonal head screw for securing brake calipers	169.5 ± 16.5	(17 ± 1.6)
6	Hexagonal head screw for securing brake disk to wheel hub	40 ± 4	(4 ± 0.4)
7	Hexagonal head screw for securing heat guarding cover to brake calipers support	22.5 ± 2.5	(2.25 ± 0.25)
8	Cylindrical head screw with embedded hexagon for locking wheel bearings adjustment ring nut	27.5 ± 2.5	(2.75 ± 0.25)
9	Wheel bearings securing ring nut	279.5 ± 14.5	(2.8 ± 1.4)
10	Tapered threaded plug for wheel hub cover	57.5 ± 2.5	(5.9 ± 0.25)
11	Wheel hub cover	89 ± 9	(8.9 ± 0.9)
12	Wheel securing nuts models 60 to 75	400^{+50}_{-20}	(40^{+5}_{-2})
	Wheel securing nuts models 80 to 100	500^{+50}_{-20}	(50^{+5}_{-2})
–	Notch nut for stub axle pin	201 ± 51.5	(44 ± 54)

TOOLS

TOOLS No.		DENOMINATION
99305354		Portable optical apparatus for wheel attitude check
99306010		Brake system air drain apparatus
99321024		Hydraulic trolley for wheel connection and disconnection
99322215		Stand for rear and front axles revision
99347047		Standalone pin disassembling tool
99347068		Extractor for steering wheel tie–rod head pins

TOOLS

TOOLS No.		DENOMINATION
99355038		Wrench (65 mm) for disassembling and re–assembling front wheel hub casings (use with 99370317)
99370006		Handle for interchangeable beaters
99370007		Handle for interchangeable beaters
99370317		Reaction lever with flange checking extension
99370628		Support for front axle disengagement and re–engagement
99370713		Wheel hub assembling guide

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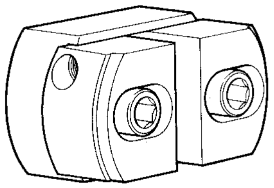
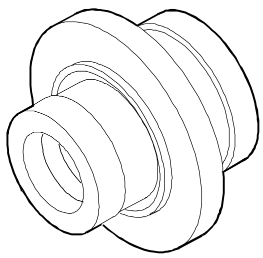
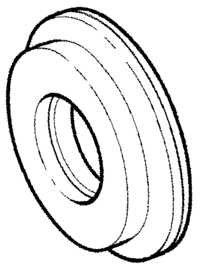
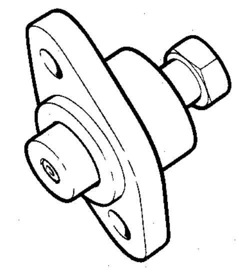
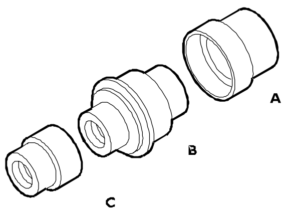
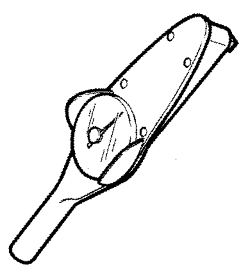
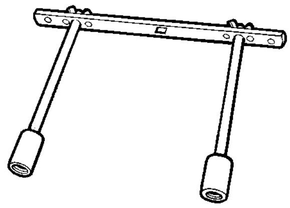
TOOLS

TOOLS No.		DENOMINATION
99374092		Beater for assembling external bearing race (69–91) (use with 99370007)
99374172		Keyer for assembling fixed pin gaskets (use with 99370007)
99374370		Keyer for assembling internal wheel hub gasket (use with 99370006)
99374401		Stub axle pin driving tool
99374528		Beater for disassembling and reassembling standalone pin bearings (use with 99370007)
99389819		Dynamometric wrench (0 – 10) with square 1/4" connection

TOOLS

TOOLS No.		DENOMINATION
99395026		Tool for checking hub rolling torque (use with 99389819).

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FRONT AXLE DISENGAGEMENT/RE–ENGAGEMENT
(with mechanical suspensions)

Before carrying out disengagement/re–engagement operations, disconnect battery cables and place the vehicle under safety conditions.

Disengagement

Place the vehicle on a plane ground, lock front wheels with chocks and proceed as follows:

- ❑ loosen securing nuts for front wheels, lift the vehicle and place it on supporting stands;
- ❑ place hydraulic trolley 99321024 under the wheels, remove securing nuts and detach the wheels;
- ❑ place an hydraulic jack equipped with support 99370628 under the front axle;
- ❑ disconnect electric connections (10) for brake wear signals, electric connections (3) for ABS revolutions sensors (on the right side it is necessary to remove the heat guard) that are placed inside the longitudinal members and free wiring from various check clamps;
- ❑ detach rigid piping (8), unscrew securing screws (9) and detach brake pipings support bracket (7).

NOTE Adequately secure the brake pipings in a high position in order to avoid that oil is discharged from the braking system.

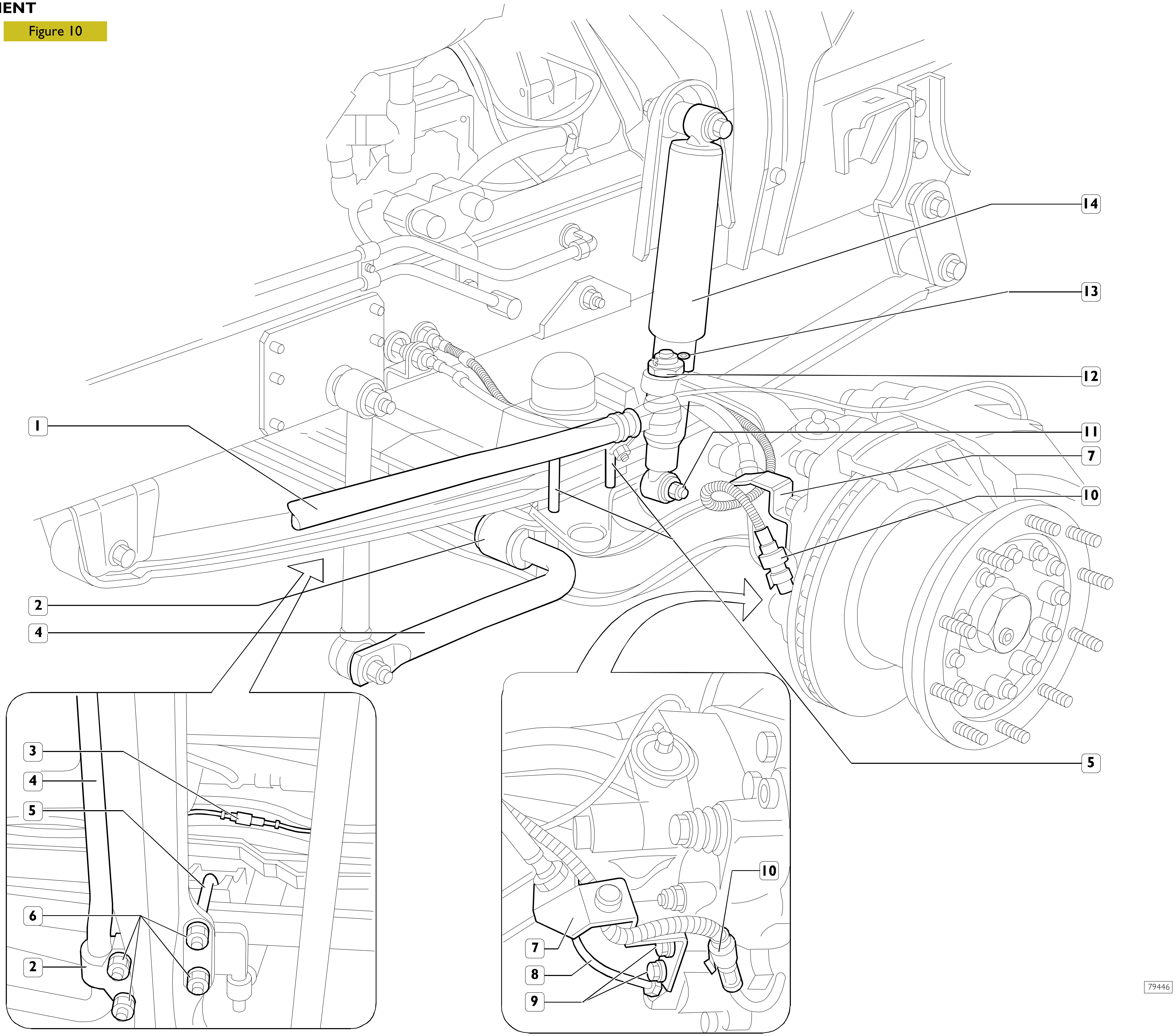
- ❑ remove split pin (13) and unscrew securing nut (12) for steering wheel tie–rod (1);
- ❑ through tool 99347068, detach steering wheel tie–rod (1) head from wheel hub lever;
- ❑ unscrew lower securing nuts (11) for shock absorbers (14) and detach them from front axle support;
- ❑ unscrew securing nuts (6) for stands (5), detach supports (2) of torsion bar (4) and remove the stands themselves;
- ❑ lower the hydraulic jack and remove the front axle from below the vehicle.

Re–engagement

Suitable revert the operations carried out for the disengagement and tighten at the required torque securing screws and nuts.
Self–locking nuts must always be replaced and tightened at the required torque.
Verify that:

- ❑ check stand (5) threading; when detecting anomalies, adjust the threading or replace the stands;
- ❑ carry out the brake system air drain as described in the related section;
- ❑ check that the braking system lubricating oil is at level; otherwise, refill it;
- ❑ check elastic pads conditions; when detecting them as worn, replace them.

Figure 10



FRONT AXLE DISENGAGEMENT/RE–ENGAGEMENT
(with pneumatic suspensions)

Before carrying out disengagement/re–engagement operations, disconnect battery cables and place the vehicle under safety conditions.

Disengagement

Place the vehicle on a plane ground, lock front wheels with chocks and proceed as follows:

- loosen securing nuts for front wheels, lift the vehicle and place it on supporting stands;
- place hydraulic trolley 99321024 under the wheels, remove securing nuts and detach the wheels;
- place an hydraulic jack equipped with support 99370628 under the front axle;
- disconnect electric connections (16) for brake wear signals, electric connections (6) for ABS revolutions sensors (on the right side it is necessary to remove the heat guard) that are placed inside the longitudinal members and free wiring from various check clamps;
- detach rigid piping (14), unscrew securing screws (15) and detach brake pipings support bracket (13).

NOTE Adequately secure the brake pipings in a high position in order to avoid that oil is discharged from the braking system.

- remove split pin (19) and unscrew securing nut (18) for steering wheel tie–rod (3);
- through tool 99347068, detach steering wheel tie–rod (3) head from wheel hub lever;
- unscrew lower securing nuts (17) for shock absorbers (20) and detach them from front axle support;
- on the right side of the vehicle, unscrew securing nut (2) and detach tie–rod (1) for the leveling valve;
- unscrew securing nut (8) for stands (7), detach supports (4) of torsion bar (5) and remove the stands themselves recovering the supports (11 and 12);
- lower the hydraulic jack and remove the front axle from below the vehicle.

Re–engagement

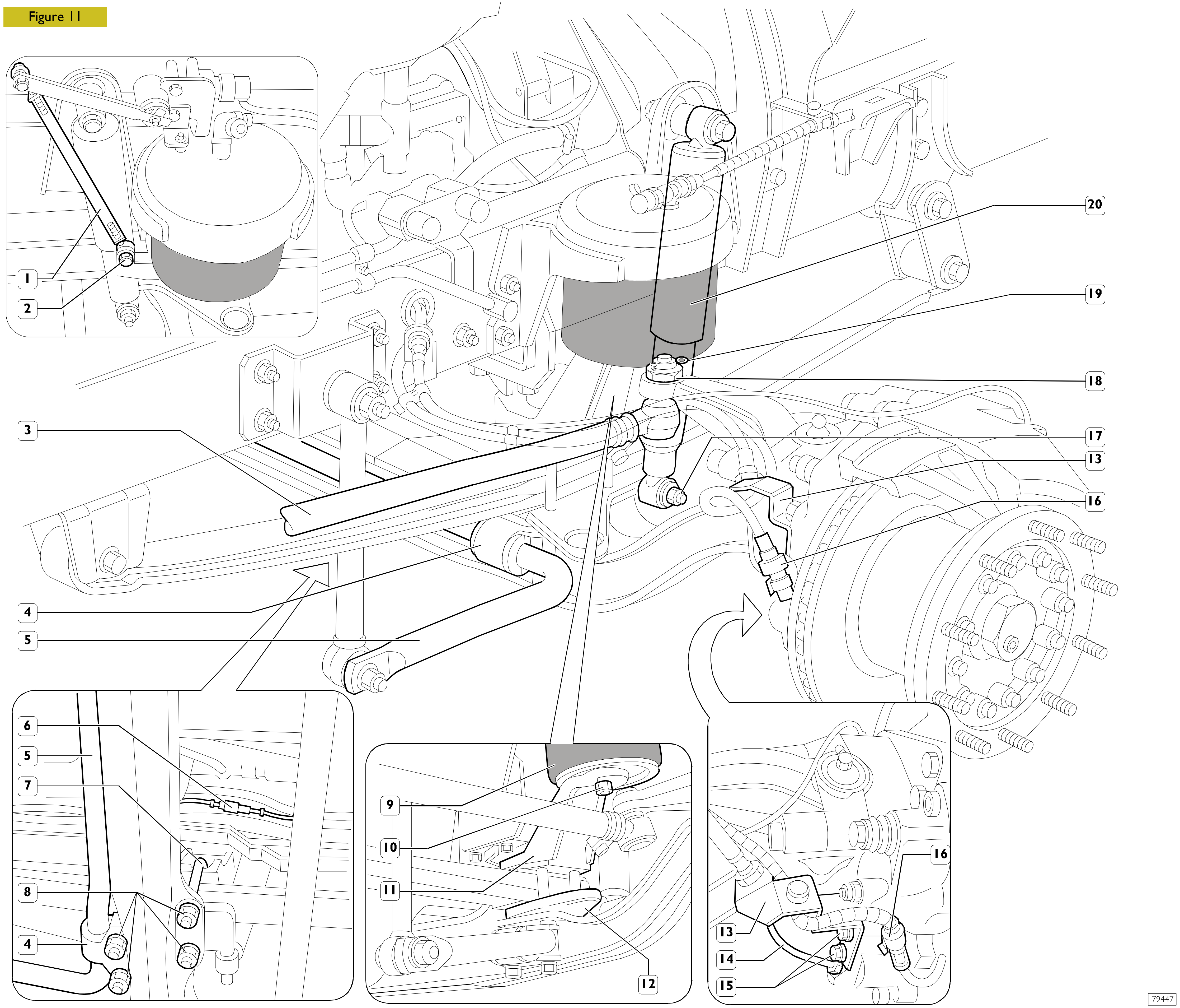
Suitable revert the operations carried out for the disengagement and tighten at the required torque securing screws and nuts.

Self–locking nuts must always be replaced and tightened at the required torque.

Verify that:

- check stand (7) threading; when detecting anomalies, adjust the threading or replace the stands;
- carry out the brake system air drain as described in the related section;
- check that the braking system lubricating oil is at level; otherwise, refill it.

Figure 11



FRONT WHEEL ATTITUDE

Before proceeding with the checks, it is necessary to carry out a preliminary inspection for some vehicle members, which can affect the attitude; when detecting some anomalies, these must be removed in order to avoid unaccurate measures.

The checks to be carried out are as follows:

- ❑ tire pressure;
- ❑ wheel hub bearings clearance;
- ❑ clearance between steering wheel tie–rod pins and stub axle levers;
- ❑ shock absorbers efficiency;
- ❑ that wheel rims have no untolerable distortions.

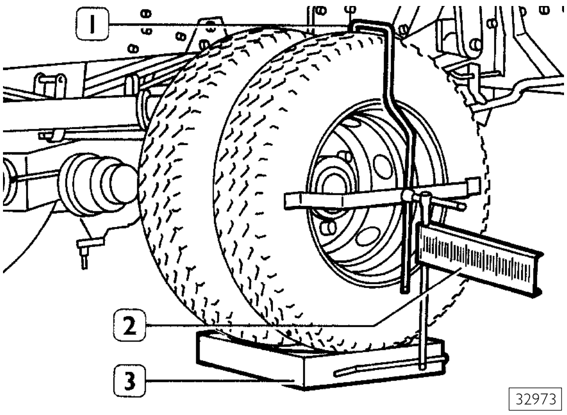
Carry out the wheel attitude check by means of apparatus 99305354.

NOTE Checks and possible interventions on wheel attitude must be carried out with statically–loaded vehicle.

Periodically make sure about the perfect calibration of optical assemblies of apparatus 99305354.

Claws and projectors placement

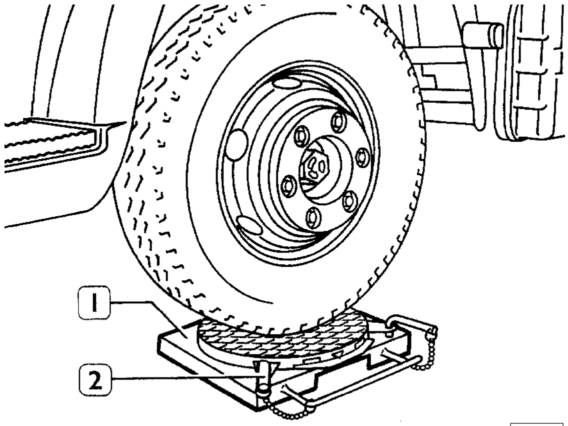
Figure 12



32973

Arrange the vehicle with wheels in rectilinear running position on a plane surface. Lift the rear vehicle part and place footboards (3) under the wheels. Lower the vehicle, brake rear wheels and apply hook (1) with straightedge (2).

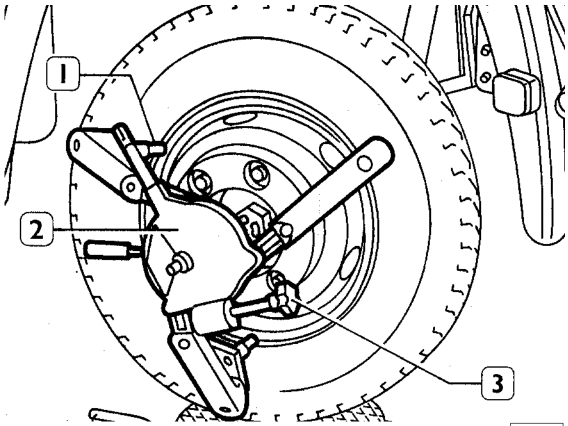
Figure 13



32974

Lift the front vehicle part and place oscillating plates (1) under the wheels locking them with suitable stops (2).

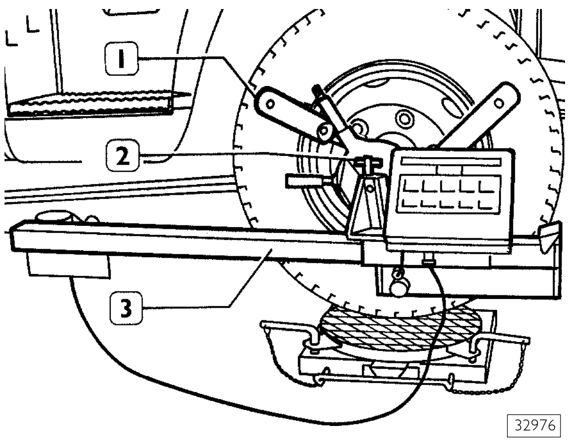
Figure 14



32975

Place on wheel rim the self–centering claw (2) equipped with suitable securing pins (1). By operating on handle (3) lock the claw on the wheel, making sure about the perfect anchoring thereof.

Figure 15

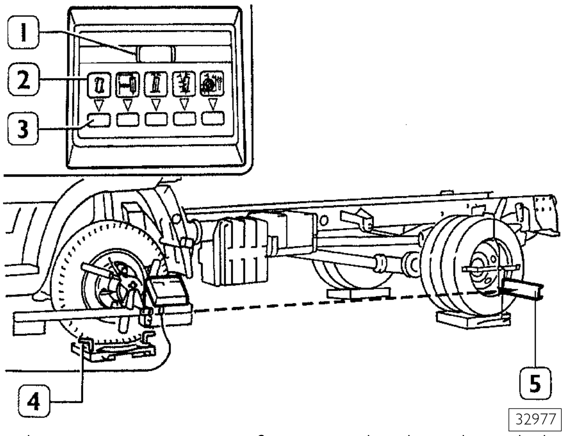


32976

Assemble measuring unit (3) on claws (1) and constrain it through screws (2). Repeat the operations on the other wheel.

Electronic rim misalignment compensation

Figure 16

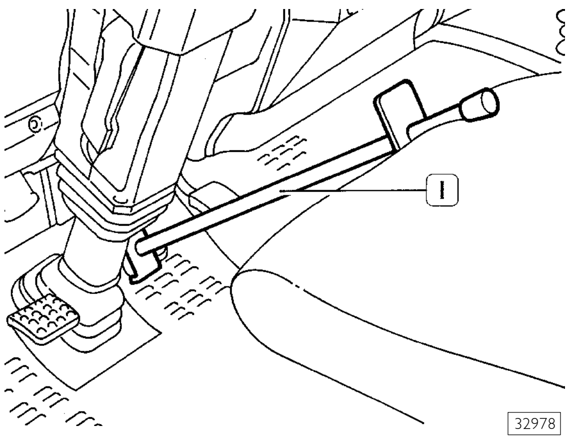


Connect detectors pegs to transformer and activate its switch; loosen detector locking screw and lift objective guard. Press ”misaligned” push–button (3) for at least two seconds: five lines appear on the digital display (1).
Slowly manually rotate the wheel and project the light signal on the corresponding straightedge (5) scale.
Measure and take note of the minimum and maximum light signal excursion: ex. 12 and 8.
Compute the mean excursion value: 12 + 8 = 20 : 2 = 10 and place the wheel on the mean computed value marking its position.
Press ”misaligned” push–button (3) again till wheel camber LED (2) turns on and a dummy value appears on digital display (1).
Repeat the operations on the other wheel.

Pay attention so that the laser ray does not strike people’s eyes: it would severely damage their sight.

Lower the vehicle so that the wheels, in the marked position, completely rest at the center of oscillating plates, and free these latter ones from the related bases, withdrawing pins (4).

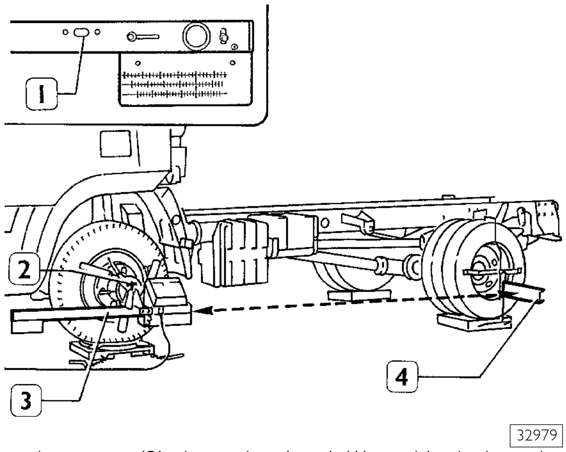
Figure 17



Press the brake pedal and lock it in position through the suitable tool (1) placed against the seat, thereby keeping the vehicle braked for the whole measuring cycle.

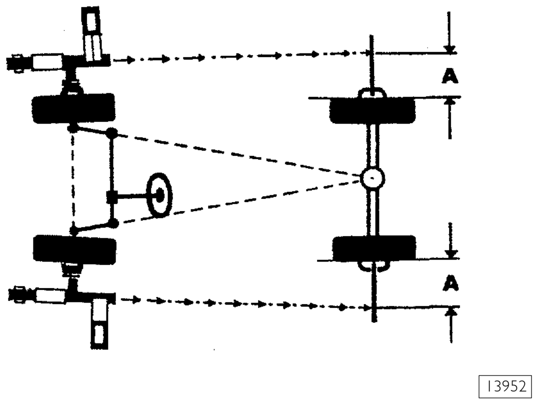
Wheel alignment

Figure 18



Level the detectors (3) through a level (1) and lock them in position through screw (2).
Move the straightedges (4) till they are centered by the light signal emitted from the detector and take note of the shown values.

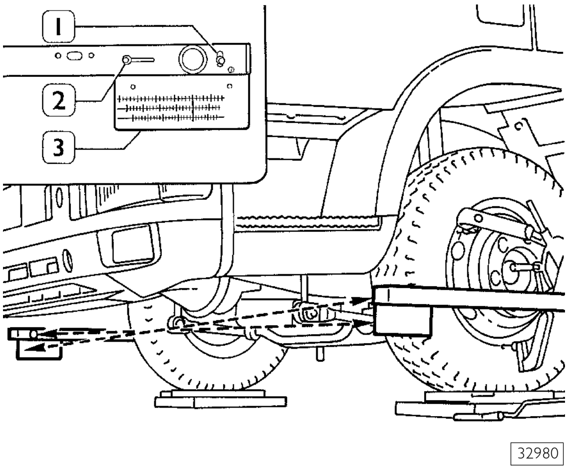
Figure 19



If the values are unequal, steer the wheels till the light signal indexes are arranged on two equal values (A) and exactly the mean value of the two previously–performed readings. In this way a perfect wheel alignment is obtained.

Wheel toe–in check

Figure 20

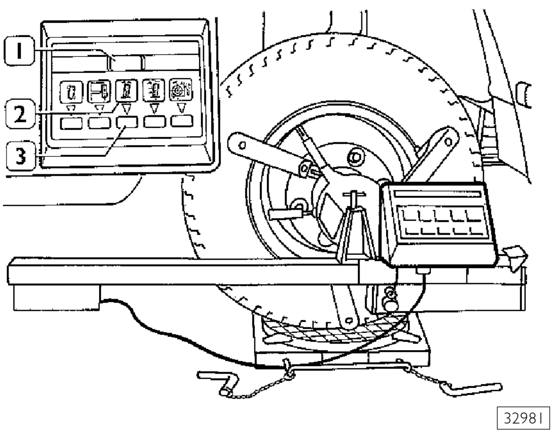


With always–levelled detectors and perfectly aligned wheels, through lever (1) move the objective guard.
Operate on lever (2) and orient the light signal index onto the straightedge (3) millimeter scale corresponding to rim diameter.
Repeat the same operations on the opposite detector and measure by reading on millimeter scales the toe–in value expressed in mm.
The algebraic sum of the two thereby measured values must be 0 to 1 mm with static load.

Toe–in adjustment is carried out by operating on the transverse tie–rod, in order to have a 0 to 0.5 mm toe–in for every wheel.

Wheel camber check

Figure 21

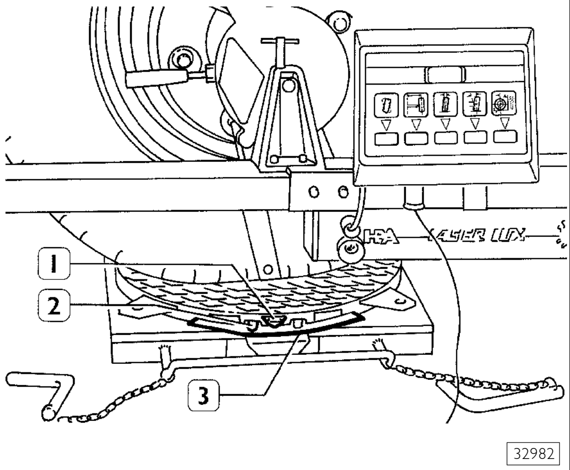


Under the condition with front wheels aligned with rear wheels and with levelled detectors, press wheel camber key (3); LED (2) turns on and the camber angle value appears on digital display (1): such angle has to be 1°.

NOTE The wheel camber angle is a fixed unadjustable value.
Therefore, when measuring a different value from the required one, detach and disassemble the front axle and carry out the related checks and possible replacements.

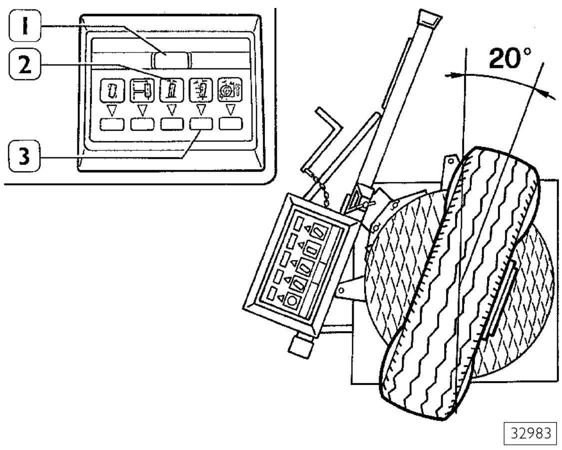
King pin and caster angle check

Figure 22



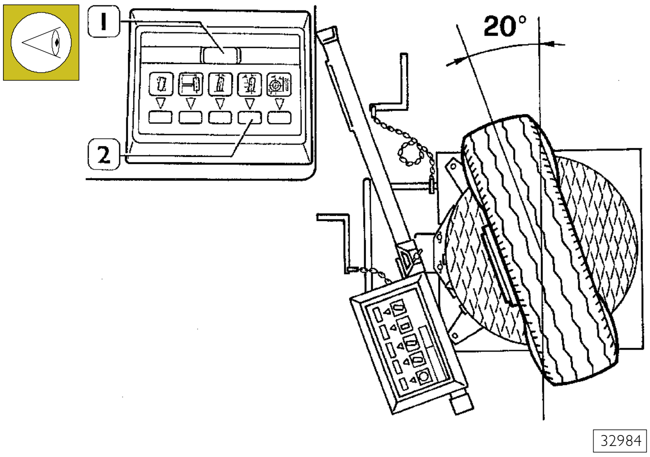
Always under the condition with front wheels aligned with rear wheels, loosen knurled knobs (2) and reset graduated sector (3) on oscillating plate index (1).

Figure 23



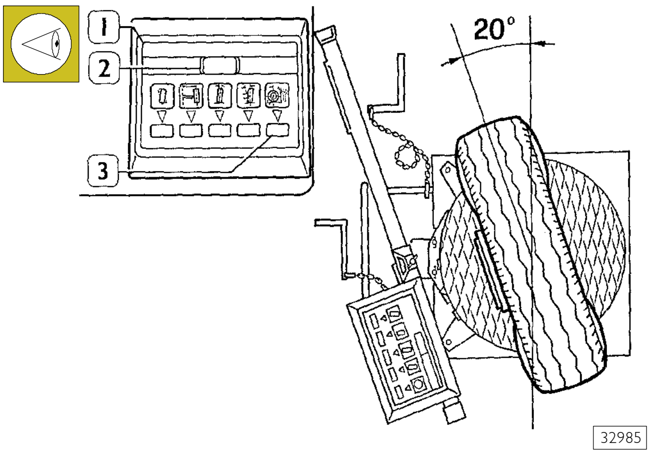
Inwardly steer the wheels by 20° and press king pin key (3) twice; LED (2) turns on and nine horizontal lines appear on digital display (1).

Figure 24



Outwardly steer the wheels by 20° and press king pin key (2) again; the king pin angle value appears on digital display (1) and must be 7°.

Figure 25

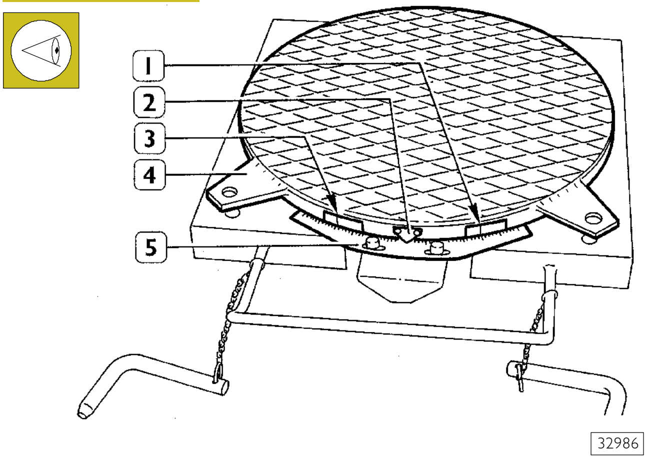


Without moving the wheel, press caster angle key (3). LED (1) turns on and the caster angle value appears on digital display (2) and must be 2°30'.

NOTE King pin and caster angles are fixed unadjustable values.
Therefore, when measuring a different value from the required one, detach and disassemble the front axle and carry out the related checks and possible replacements.

Steering angles check

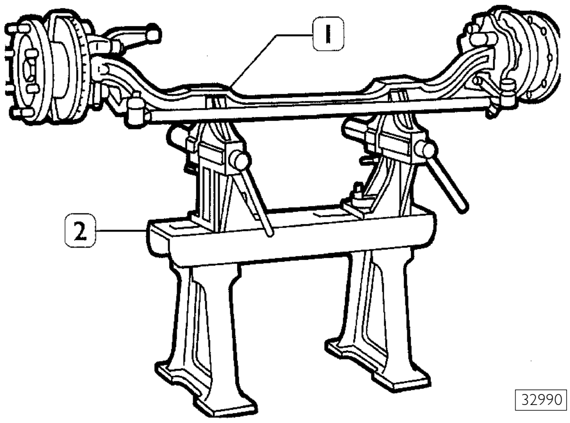
Figure 26



With straight running wheels, reset graduated sectors (5) on oscillating plates (4) index (2).
If the steering angles to be measured are greater than 30°, it is necessary to use as "0°" reference indexes the 20° mark (1) placed on the oscillating plate and the corresponding one in the graduated sector.
Steer the internal wheel by the required value and measure that the external wheel angle corresponds to the required value, taking into account that the 20° mark (3) placed on the oscillating plate and the corresponding one in the graduated sector must be used, when reading, as "0°" reference indexes.
Repeat the same operations and check the opposite wheel steering.

520610 FRONT AXLE ASSEMBLY REVISION

Figure 27

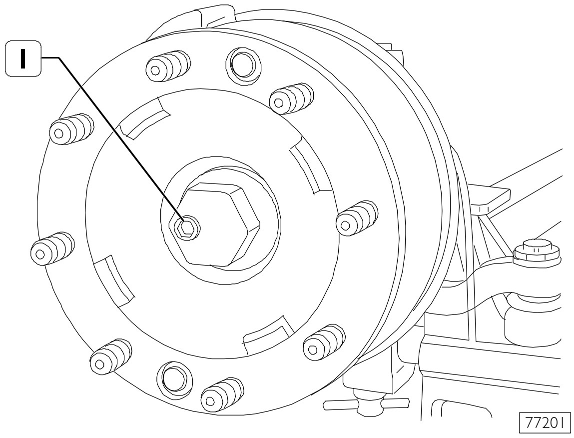


Through a lifting device, place and secure front axle assembly (1) on stand for revision 99322215 (2).

520620 WHEEL HUBS DISENGAGEMENT AND RE–ENGAGEMENT

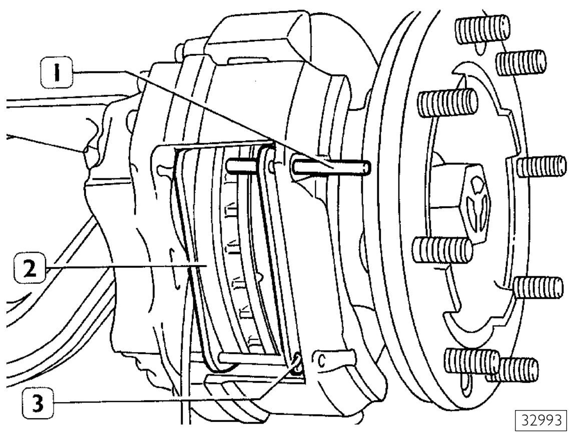
Disengagement

Figure 28



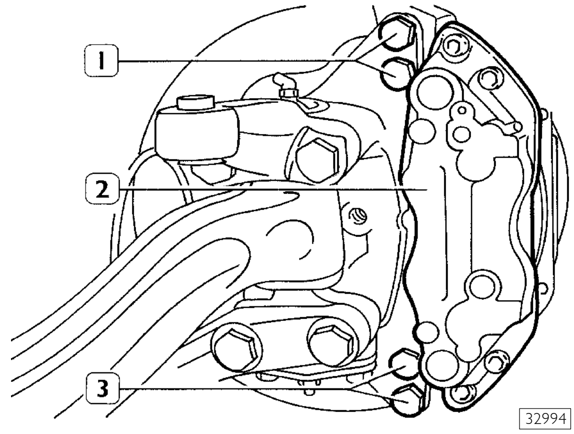
Turn the wheel hub so that the screw plug (1) faces downwards; release the plug and drain oil into the appropriate container.

Figure 29



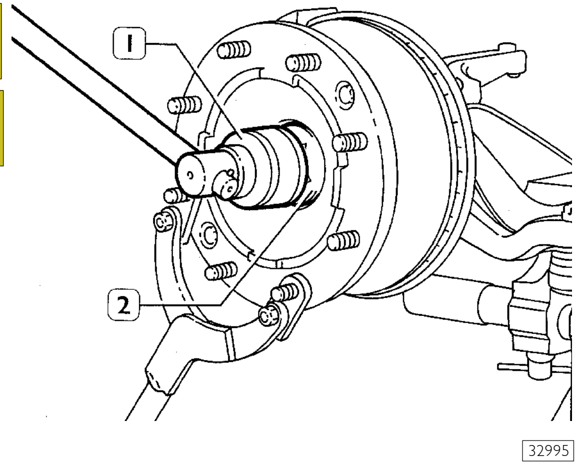
Remove stops (3), unscrew pins (1) and extract braking gaskets (2).

Figure 30



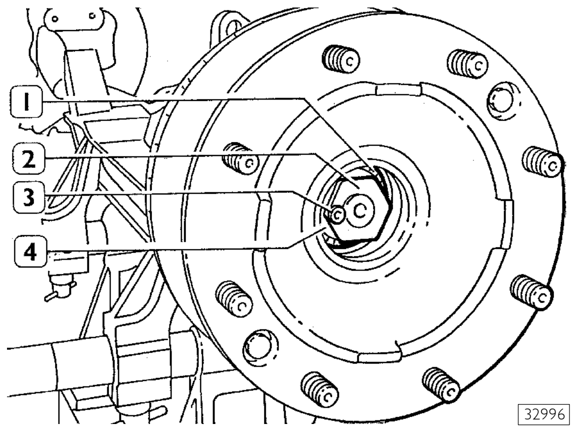
Unscrew screws (1 and 3) and detach brake calipers (2).

Figure 31



Block the wheel hub rotation and use reaction lever 99370317 and wrench 99344038 (1) to unscrew the sump (2) while draining oil into the appropriate container.

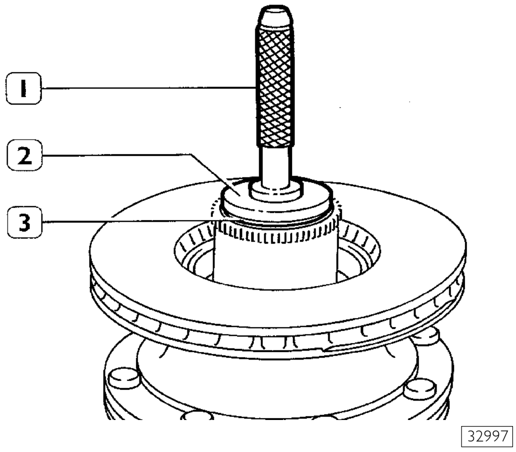
Figure 32



Unscrew screw (3), adjustment ring nut (2), withdraw washer (4), external bearing (1) and detach complete wheel hub.

Sealing ring replacement

Figure 33

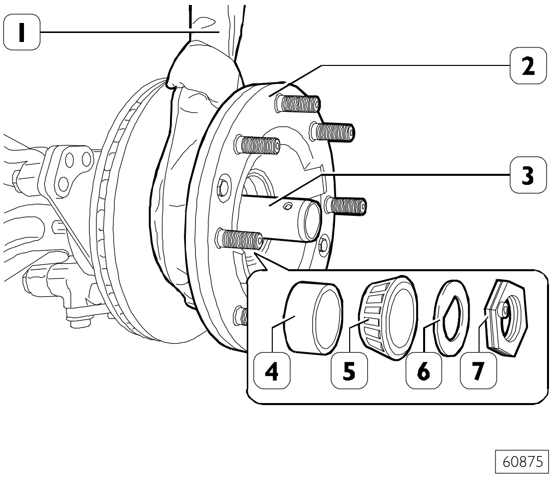


With generic means, extract sealing ring (3).
Moisten the layout with oil and butter the external part of the new sealing ring with adhesive type "B".
With keyer 99360423 (2) and handle (1), assemble the sealing ring into its own wheel hub seat.

Wheel hubs re–engagement

Make sure that the surfaces of all parts inside the hub are accurately clean, free from slags and burrs.

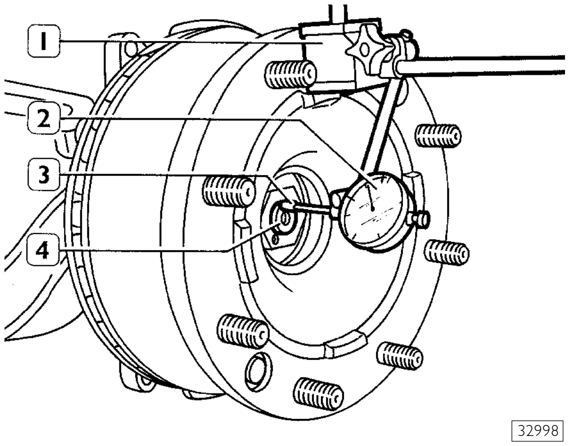
Figure 34



Screw on stub axle pin tool 99370713 (3) and lubricate its external surface with TUTELA W140/M–DA oil.
Sling with a rope (1) the wheel hub (2) and support it with the lifting device. Carefully key wheel hub (2) on stub axle pin, in order not to damage the sealing ring.
Assemble spacer (4), internal ring (5) of the tapered roller bearing.
Unscrew tool 99370713 (3).
Key washer (6) and screw adjustment ring nut (7) at the required closing torque.

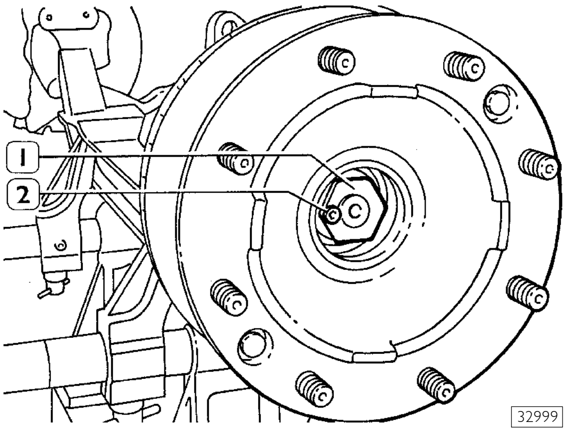
Axial clearance adjustment for wheel hub bearings

Figure 35



Axially strike some mallet blows on wheel hub, rotate it in both directions to free bearing rollers.
Apply magnetic base (1) completed with comparator (2) to wheel hub.
Arrange comparator rod (3) perpendicular to stub axle tang (4).
Reset the comparator with a 1.5 – 2 mm pre–load.
Axially move the wheel hub, with the help of a lever, and measure axial clearance that must be 0.16 mm (maximum value).
If the measured value does not correspond to the required one, replace bearings assembly and proceed with a new adjustment operation.

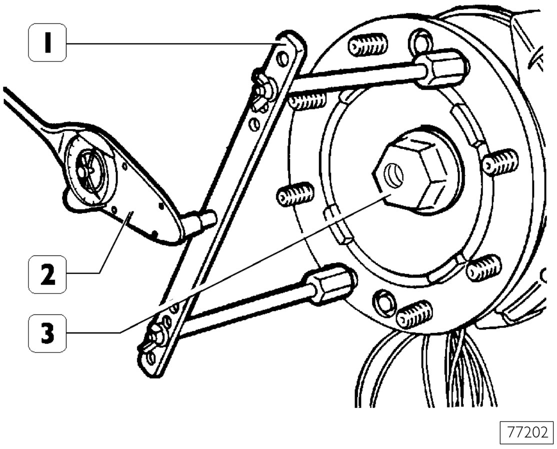
Figure 36



After having obtained the required axial clearance, lock check screw (1) of adjustment ring nut (2) at the required torque.

Rolling torque measure

Figure 37

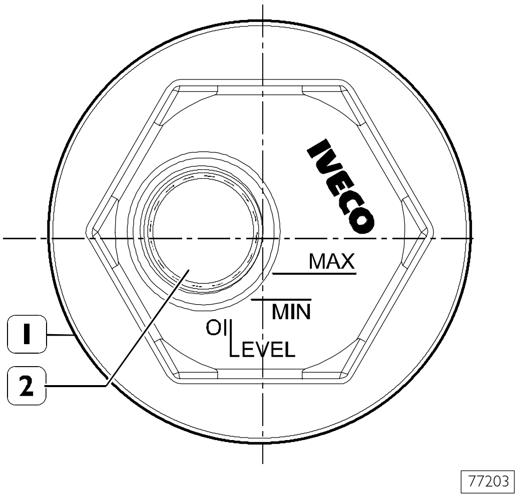


Apply on wheel hub risers tool 99395026 (1) and through dynamometer 99389819 (2), check that the wheel hub rolling torque is 0.23 daNm.

Deposit a sealant seam (Loctite type 574) exclusively on hub cover abutment surface protecting its threaded part.

Torque–screw the hub cover.

Figure 38



Turn the wheel hub until the wheel hub cover (1) reaches the illustrated position.
Refill the prescribed oil quantity (0.10 litres) through the filling hole (2).
Tighten the plug on the wheel hub cover (1) to the prescribed torque.

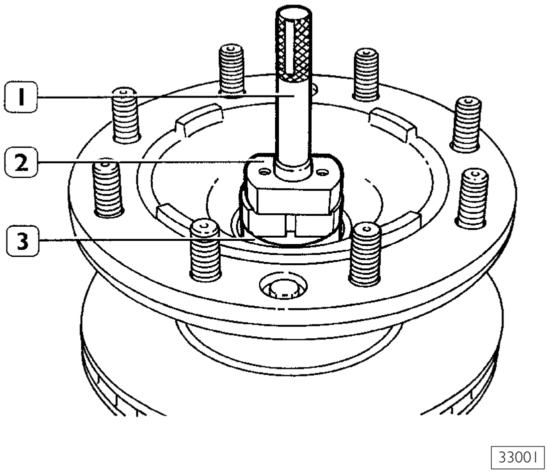
520621 WHEEL HUB BEARINGS REPLACEMENT

Detach the wheel hub.

Extract sealing ring and withdraw the bearing from internal wheel hub space.
With a suitable beater, undrive external bearing rings from wheel hub.

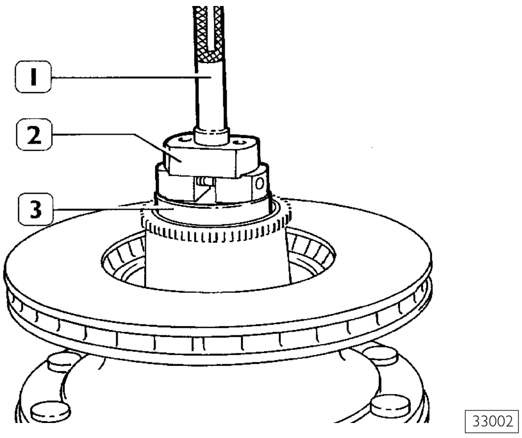
Check that external bearing ring seats in wheel hub do not show dents due to the undriving operation.

Figure 39



Place external bearing external ring (3) into its seat and through keyer 99374092 (2) and beater 99370007 (1) carry out its driving.

Figure 40



Place internal bearing external ring (3) into its seat and through keyer 99374092 (2) and beater 99370007 (1) carry out its driving.

Lubricate internal bearing with SAE W140/MDA oil and place it into its own seat in wheel hub.

Assemble the sealing ring.

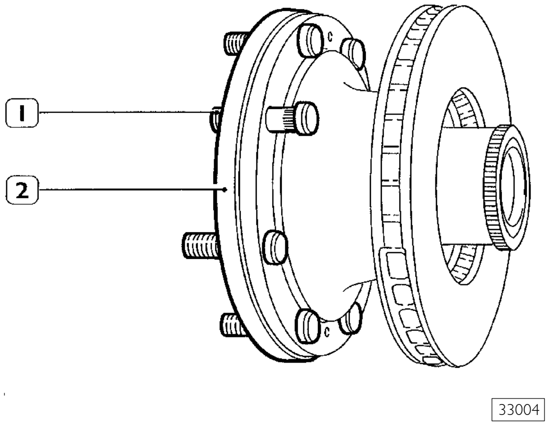
Carry out wheel hub re–engagement.

Adjust wheel hub axial clearance.

Check the rolling torque.

520625 WHEEL SECURING RISERS REPLACEMENT

Figure 41



With generic means, undrive risers (1) from brake disk (2). Make sure that the riser heads abutment plane is free from burrs.

Accurately drive the risers, applying on riser head a load that is not greater than 2300 kg.

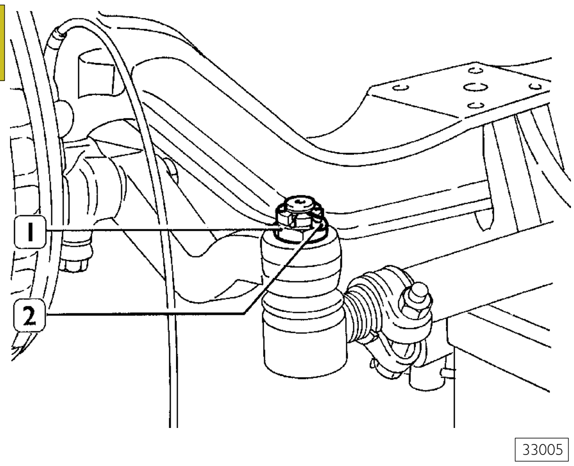
IVECO PARTS

After having ended the driving, check the absence of clearance between disk plane and under riser head.

520635 TRANSVERSE TIE–ROD DETACHMENT AND RE–ATTACHMENT

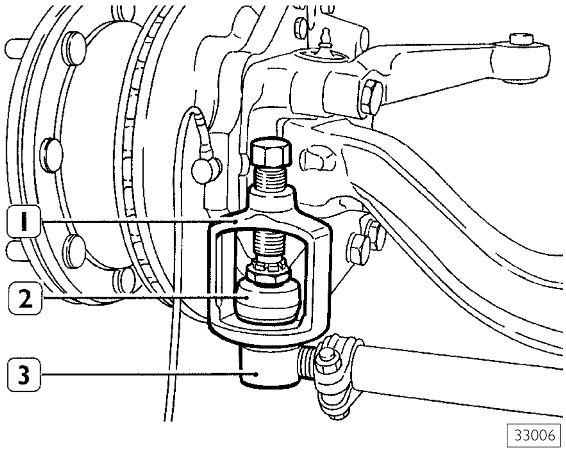
Detachment

Figure 42



Straighten and withdraw the split pin (1).
Unlock nut (2) and partially unscrew it in order to avoid tie–rod fall when detaching.

Figure 43



With extractor 99347068 (1), unlock stub head (3) from lever (2). Repeat the same operations on the opposite side, completely unscrew the nuts and detach the transverse tie–rod.

Re–attachment

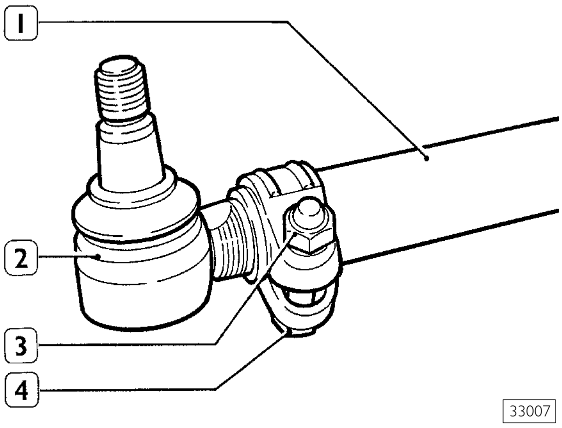
For re–attaching, carry out the detachment operations in reverse.

Tighten tapered pins securing nuts at the required torque.

NOTE Check notch positions on nuts so that they coincide with transverse tapered pin holes; if split pins are not inserted, progressively increase the nut tightening torque till the correct insertion is obtained (angle less than 60°).

520636 TRANSVERSE TIE–ROD STUB AXLE REPLACEMENT

Figure 44



Lock screw (4), loosen nut (3) and unscrew stub axle (2) from transverse tie–rod (1).
Screw stub axle in tie–rod and lock it in position by tightening the locking nut at the required torque.

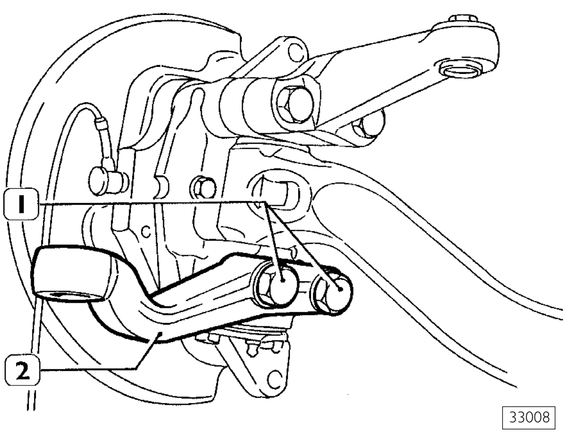
NOTE To facilitate the transverse tie–rod re–attachment and the following wheel toe–in adjustment, take note of the necessary number of revolutions to unscrew every single stub axle in order to screw the new ones with the same number of revolutions.

Re–attach the transverse tie–rod.

Proceed with the check and possible adjustment of front wheels toe–in, as described in operations 520610.

520631 TRANSVERSE TIE–ROD LEVERS DETACHMENT AND RE–ATTACHMENT

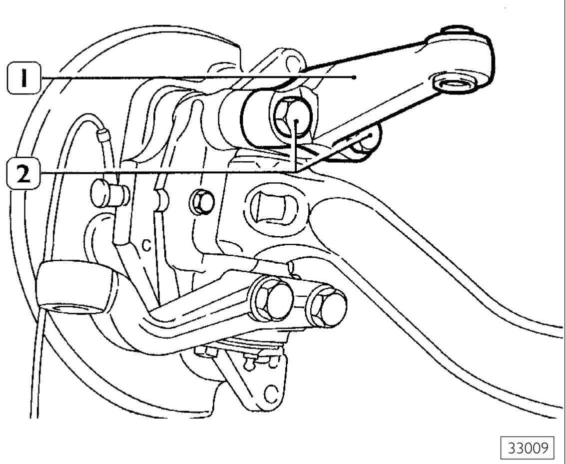
Figure 45



Unscrew screws (1) and remove lever (2). For re–attaching, carry out the reverse operations by torque–locking the securing screws.

520632 LONGITUDINAL TIE–ROD LEVER DETACHMENT AND RE–ATTACHMENT

Figure 46

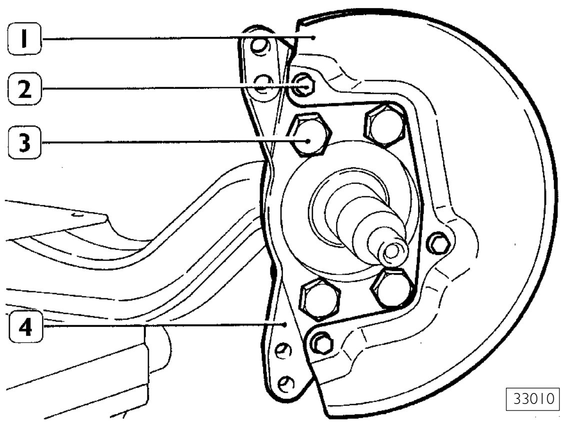


Unscrew screws (2) and remove lever (1). For re–attaching, carry out the reverse operations by torque–locking the securing screws.

520611 STUB AXLE PIN DETACHMENT AND RE–ATTACHMENT

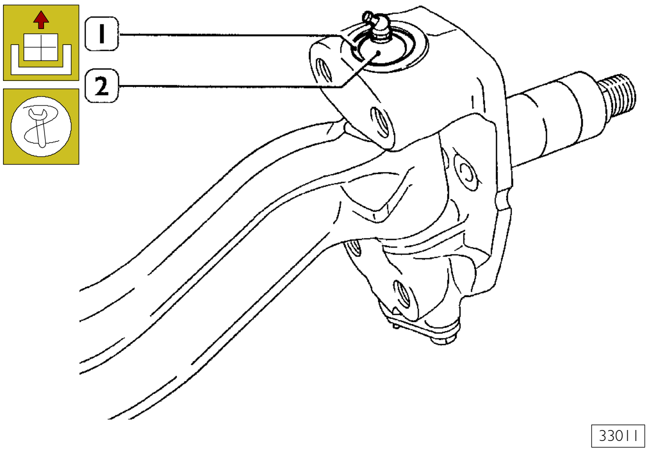
Detachment

Figure 47



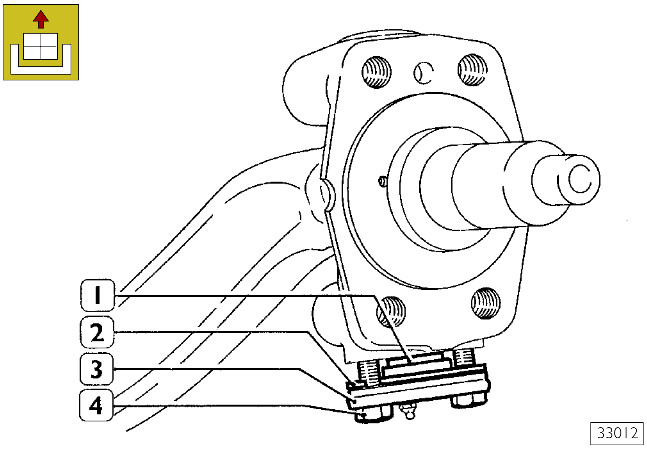
Unscrew screws (2) and remove dust–guarding disk (1).
Unscrew screws (3) and detach brake caliper support (4).

Figure 48



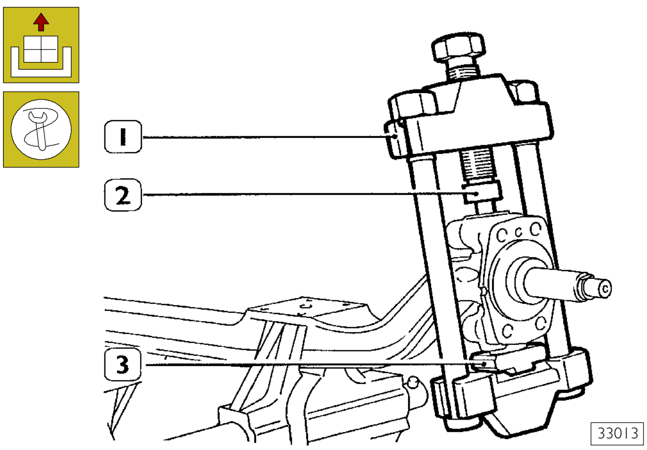
With suitable pliers, remove check ring (1) and withdraw cover (2) completed with greaser.

Figure 49



Unscrew screws (4) and remove lower cover (3), adjustment plate (2) and fifth wheel (1).

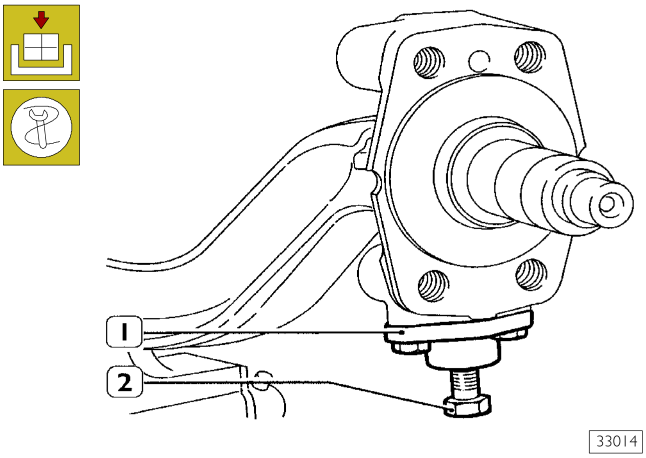
Figure 50



With tool 99347047 (1) and parts (2 and 3) unlock stub axle pin.
Remove the fixture and withdraw the pin.

Re–attachment

Figure 51

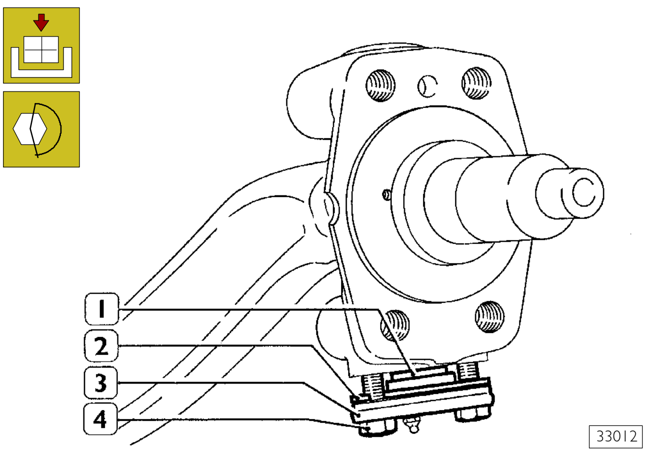


Apply the stub axle on front axle body and insert the pin in its own seat.
Place tool 99374401 (1) on stub axle and secure it using the same securing screws of the lower cover locking them at an adequate torque.
Drive the pin into the front axle tapered seat, screwing pressure screw (2) at a torque of 7 to 8 daNm (7 to 8 kgm).
Remove tool 99374401 from stub axle.

NOTE Before carrying out the pin driving, it is necessary to make sure that the tapered seat on front axle and the pin surface are perfectly clean and dry to avoid oil films that would facilitate the pin rotation into its seat during the driving operation.

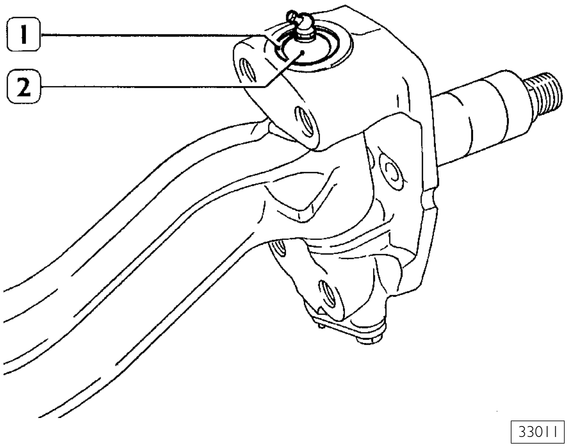
NOTE Before assembling, moisten the lower cover fifth wheel with Tutela MR2 grease.

Figure 52



Place lower cover (3) completed with fifth wheel (1) and adjustment shims (2); tighten securing screws (4) at the required torque.
Repeat the same operation for the opposite stub axle.

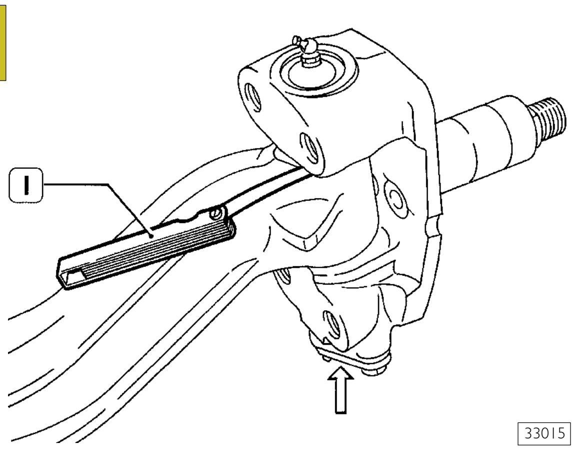
Figure 53



Insert upper cover (2) completed with related sealing gasket into its seat; place greaser as shown in the figure, then insert safety ring (1) making sure that ring expansion occurs correctly.

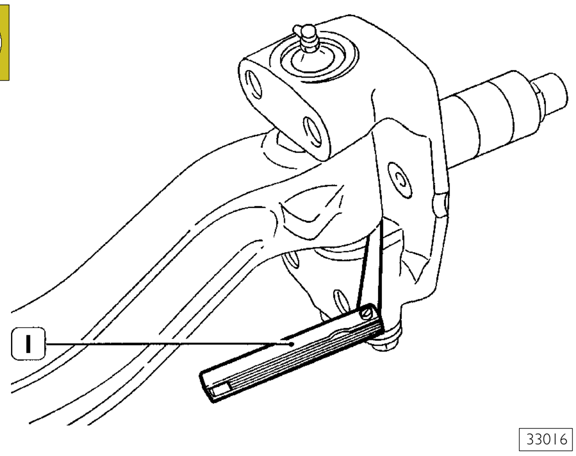
Check and adjustment of clearance between stub axle and front axle

Figure 54



Keep the stub axle lifted upward, and with a thickness meter (1) check clearance between upper stub axle shim adjustment and front axle that must be included between the values of 0.10 and 0.15 mm.

Figure 55



After having checked the clearance between upper stub axle shim adjustment and front axle, check, with a thickness meter (1) that, between lower stub axle shim adjustment and front axle shim adjustment, there is a space not less than 0.25 mm.

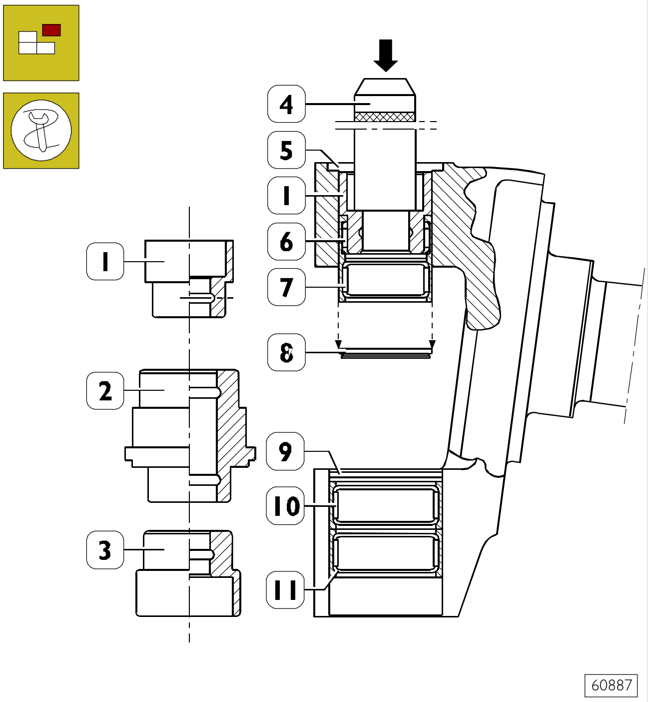
The possible clearance adjustment is obtained by replacing adjustment shims with other ones provided as spares having adequate thickness.

For spare rings thickness, see table "SPECIFICATIONS AND DATA" on page 8.

Grease complete lower and upper articulations with MR2 grease making sure that grease flows through the deflector gasket lip.

520615 STEERING KNUCKLE PIN BEARING REPLACEMENT

Figure 56

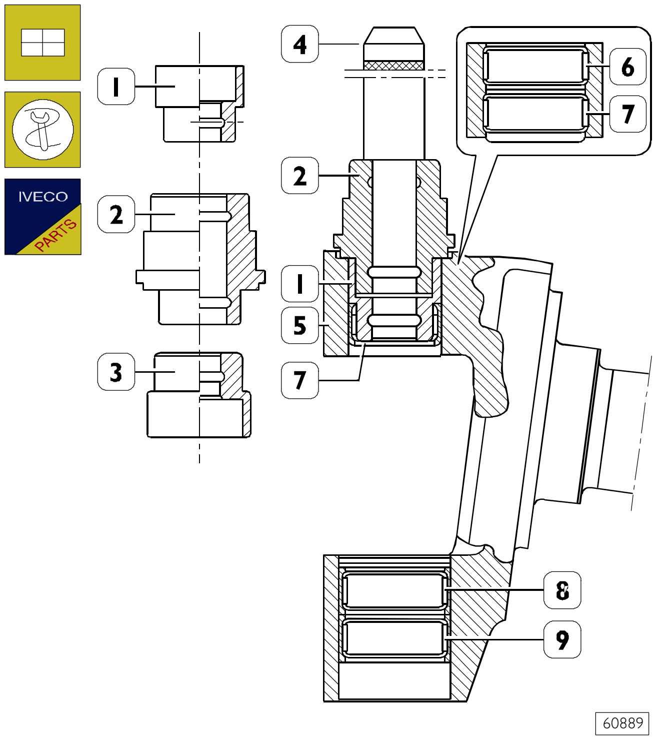


Steering knuckle bearing replacement (5) is made using for their disassembly and assembly beater's elements (1–2–3) 99374527 and handle 99370007 (4).

Use element (1) and handle (4) to disassemble the sealing ring (8) and the roller bearings (6–7) on the upper side.

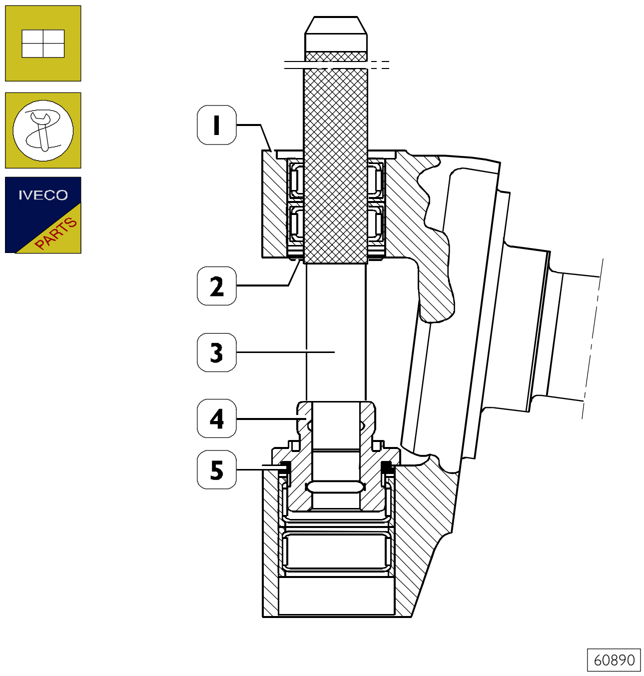
Use element (3) and handle (4) to disassemble the sealing ring (9) and the roller bearings (10–11) on the lower side.

Figure 57



Roller bearing assembly (7):
use element (1 and 2) and handle (4).
Roller bearing assembly (6):
use element (2) and handle (4).
Roller bearing assembly (8):
use elements (3 and 2) and handle (4).
Roller bearing assembly (9):
use element (2) and handle (4).

Figure 58



With beater 99374173 (4) and handle 99370007 (3), assemble sealing rings (2 and 5) in stub axle (1).

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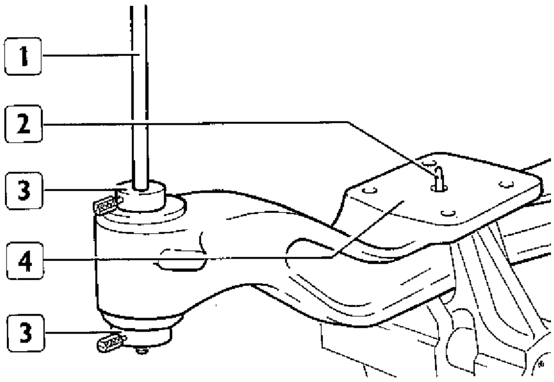
520618 FRONT AXLE BODY CHECKS AND MEASURES

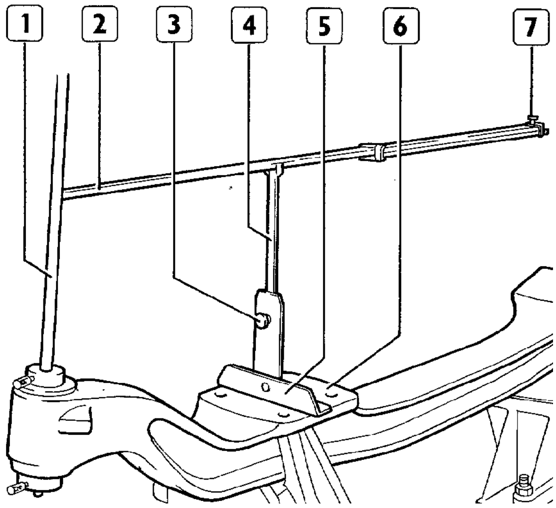
Planarity check of leaf springs bearing surfaces with respect to stub axle pin holes

Figure 59



Apply two rods (1) completed with cones (3) into stub axle pin holes; press the cones and lock them in position through suitable screws on rods.
Insert two centering dowels (2) into seats of leaf springs (4) bearing plane.

Figure 60

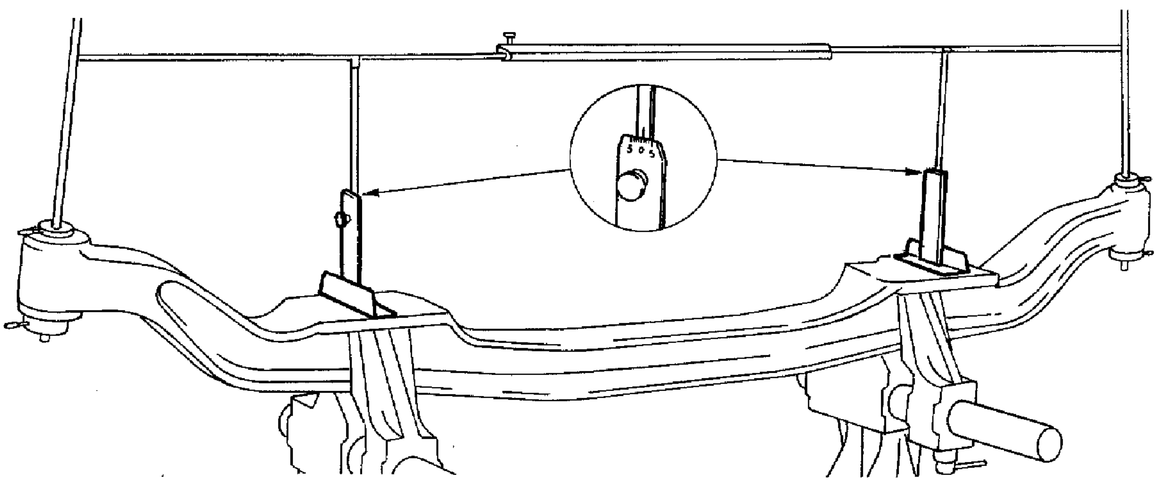


Apply two bases (5) with goniometers on planes (6) inserting them into centering dowels.

NOTE Before applying the bases with goniometer, make sure that the bearing planes have no traces of paint or projections.

Apply sliding bar (2) on goniometer rods (4) adjusting its length in such a way that the shaped ends are inserted in contact with rods (1).
Lock clamp (7) screw and screws securing goniometers (3) to rods (4).

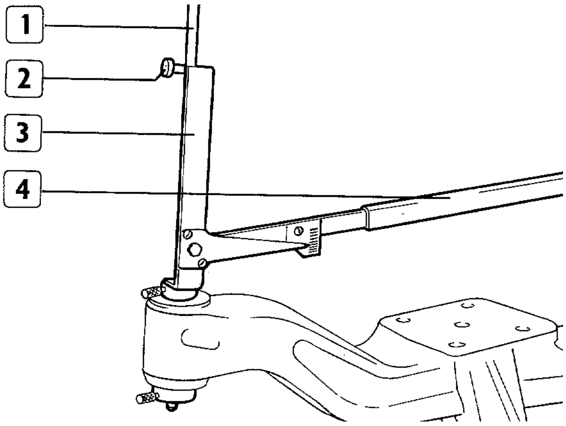
Figure 61



Check the possible distortion angle on graduated goniometer sectors marked by the arrows.
Obviously, the goniometer indexes do not measure any angular displacement, when the leaf springs bearing surfaces planarity, with respect to stub axle pin holes, is correct.
Remove sliding bar and bases with goniometer that have been used for the check.

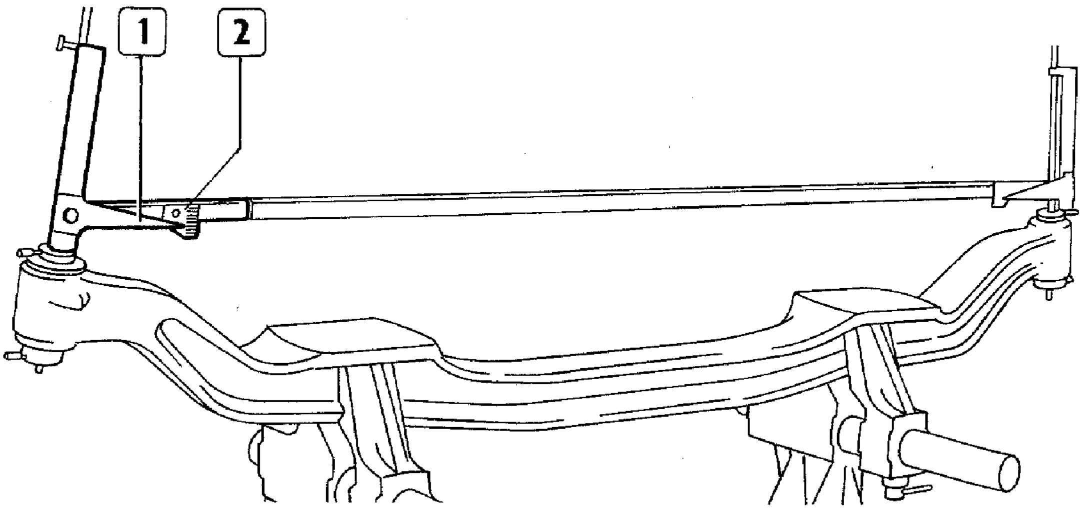
Check of stub axle pin holes camber

Figure 62



Apply to rods (1) the supports with goniometers (3) and screw screws (2) without locking them.
Insert connecting transverse tie–rod (4) and completely screw screws (2) securing supports in contact with rods (1).

Figure 63



Proceed with reading the camber angle of stub axle pin holes, on related graduated sectors (2), next to indicators (1).

The camber value for stub axle pin holes must be 7°.

SECTION 8

5004 Suspensions

Page

5004 Front and rear mechanical suspensions

Page

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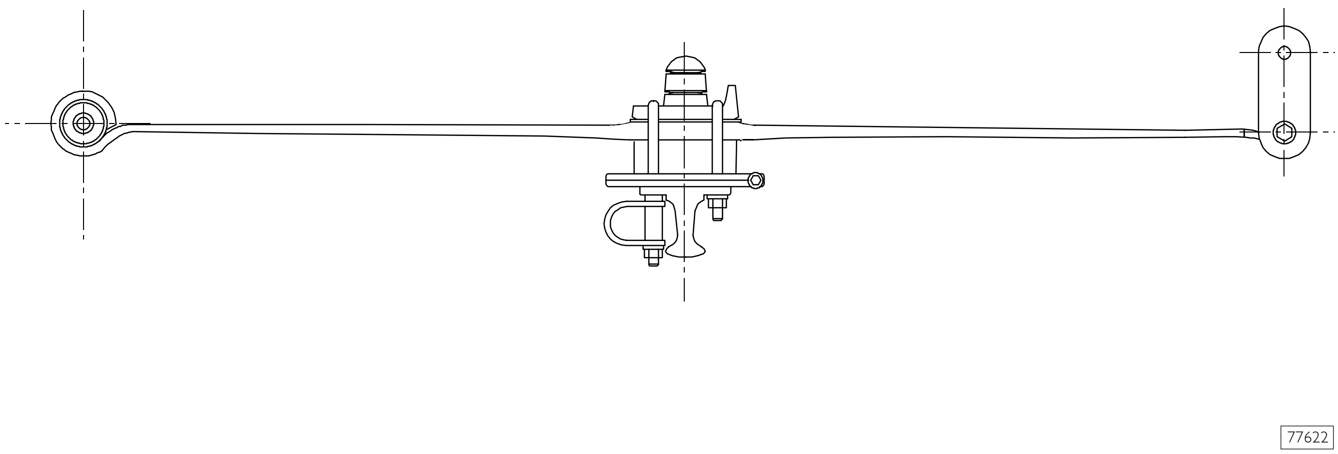
DESCRIPTION

The suspension consists of leaf springs, two double–acting telescopic shock absorbers and a sway bar.
The leaf springs can be semi–elliptical or parabolic.
Semi–elliptical leaf springs are very stiff because all the leaves have the same thickness, from one end to the other.
Furthermore, the leaves are arranged to create high internal friction, whereby limiting the leaf spring movements.
The parabolic leaf spring thickness is higher in the middle and thinner on the edges.The leaf particular shape makes the leaf spring "ofter" and therefore driving is more comfortable. riding comfort.
Double–acting telescopic shock absorbers counteract wheel movement upwards and downwards, ensuring excellent riding stability.
The sway bar keeps the wheel axle and chassis parallel, cancelling any load imbalance on the wheel on any one axle.

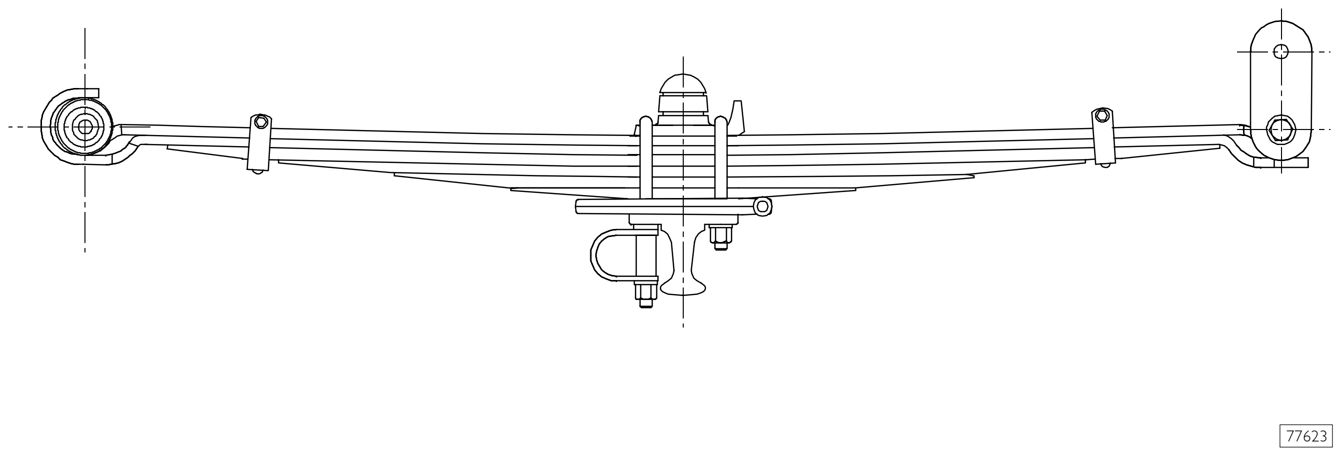
FRONT LEAF SPRINGS

Figure 1



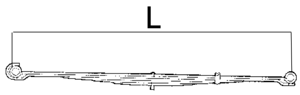
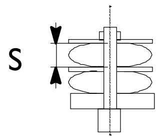
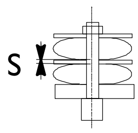
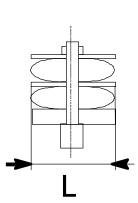
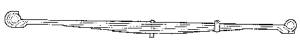
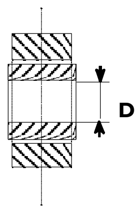
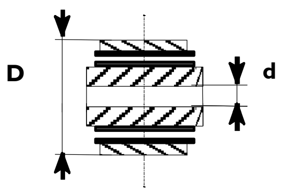
SINGLE–BLADE PARABOLIC LEAF SPRING ASSEMBLY

Figure 2



HALF–ELLIPTIC LEAF SPRING ASSEMBLY

FRONT PARABOLIC LEAF SPRING SPECIFICATIONS AND DATA
Models 60E.. – 100E.. with axle load up to 3400 kg

		mm
	Parabolic	N° 2
	Leaf length (measured at eyelet center)	1714 ± 3
	Leaf thickness (measured in center)	29
	Thickness between leafs	–
	Leaf width	70 ± 0.5
	CONTROL DATA WITH NEW SPRING: Free spring camber Static load flexibility	 142 8.8 ± 7% mm/kN
	Internal leaf eyelet diameter (bush seat)	45.5 ± 0.3
	D = external bush diameter d = internal bush diameter	$45^{+0.1}_{-0}$ $16.5^{+0.2}_{-0}$

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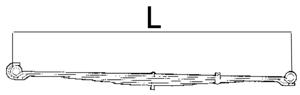
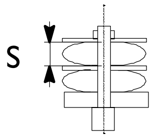
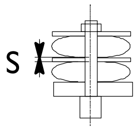
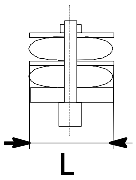
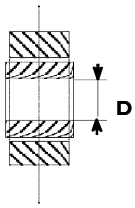
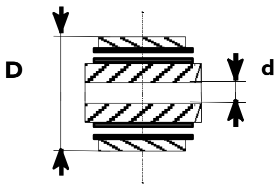
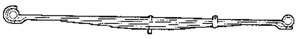
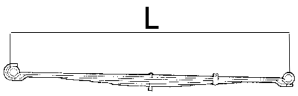
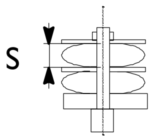
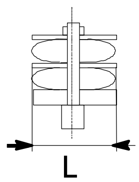
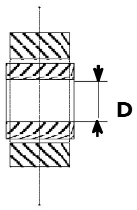
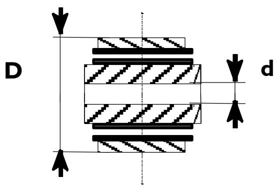
Models 65E.. – 100E.. with axle load over 3400 kg

		mm
	Parabolic	N° 2
	Leaf length (measured at eyelet center)	1714 ± 3
	Leaf thickness (measured in center)	29
	Thickness between leafs	–
	Leaf width	70 ± 0.5
	CONTROL DATA WITH NEW SPRING: Free spring camber Static load flexibility	142 7.9 ± 7% mm/kN
	Internal leaf eyelet diameter (bush seat)	45.5 ± 0.3
	D = external bush diameter d = bush inner diameter	$45^{+0.1}_{-0}$ $16.5^{+0.2}_{-0}$

FRONT HALF–ELLIPTIC LEAF SPRING SPECIFICATIONS AND DATA
Models 60E..K

		mm
	Half – elliptic	N° 2
	Leaf spring lenght (measured at eyelet center)	1714 ± 3
	Leaf thickness (1st – 2nd – 3rd – 4th and 5th)	13
	Leaf width	70 ± 0.5
	CONTROL DATA WITH NEW SPRING: Static load camber Free spring camber Dynamic load camber (max) Static load flexibility	18 – 72.6 10.9 mm/kN
	Internal master leaf eyelet diameter (bush seat)	$45.5^{+0.1}_{-0}$
	D = external bush diameter d = bush inner diameter	$45.5^{+0.27}_{-0}$ $16.5^{+0.2}_{-0}$

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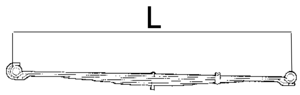
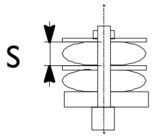
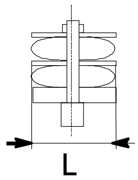
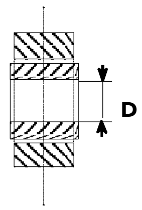
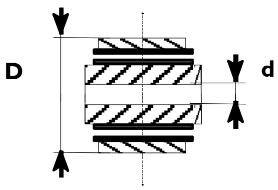
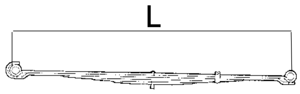
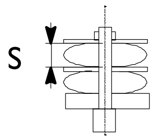
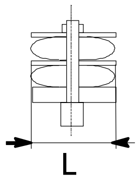
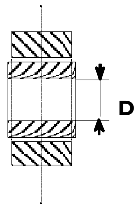
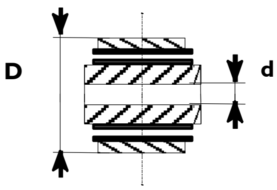
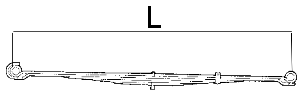
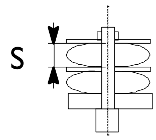
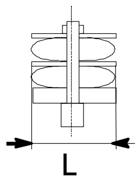
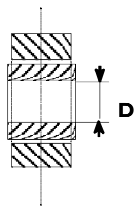
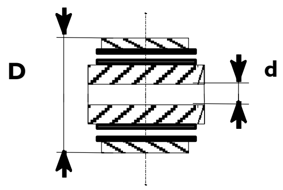
Models 65E..K – 75E..K

		mm
	Half – elliptic	N° 2
	Leaf lenght (measured at eyelet center)	1714 ± 3
	Leaf thickness (1st and 2nd) Leaf thickness (3rd – 4th – 5th and 6th) (measured in center)	12 13
	Leaf width	70 ± 0.5
	CONTROL DATA WITH NEW SPRING: Static load camber Free spring camber Dynamic load camber (max) Static load flexibility	15.5 – 71.1 9.21 mm/kN
	Internal master leaf eyelet diameter (bush seat)	$45.5^{+0.1}_{-0}$
	D = external bush diameter d = bush inner diameter	$45.5^{+0.27}_{-0}$ $16.5^{+0.2}_{-0}$

Models 75E15K

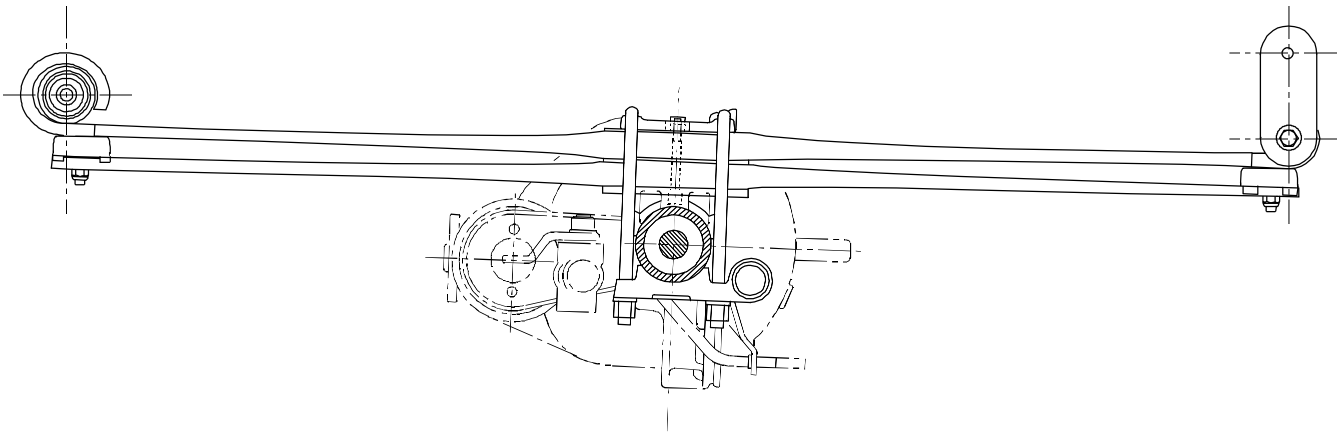
		mm
	Half – elliptic	N° 2
	Leaf length (measured at eyelet center)	1714 ± 3
	Leaf thickness (1st and 2nd) Leaf thickness (3rd – 4th – 5th and 6th) (measured in center)	12 13
	Leaf width	70 ± 0.5
	CONTROL DATA WITH NEW SPRING: Static load camber Free spring camber Dynamic load camber (max) Static load flexibility	16.8 – 74.4 8.92 mm/kN
	Internal master leaf eyelet diameter (bush seat)	$45.5 ^{+0.1}_{-0}$
	D = external bush diameter d = bush inner diameter	$45.5 ^{+0.27}_{-0}$ $16.5 ^{+0.2}_{-0}$

Models 80E..K – 100E..K

		mm
	Half – elliptic	N° 2
	Leaf length (measured at eyelet center)	1714 ± 3
	Leaf thickness (1st and 2nd – 3rd – 4th – 5th and 6th) (measured in center)	13
	Leaf width	70 ± 0.5
	CONTROL DATA WITH NEW SPRING: Static load camber Free spring camber Dynamic load camber (max) Static load flexibility	 24 – 97 7.72 mm/kN
	Internal master leaf eyelet diameter (bush seat)	$45.5^{+0.1}_{-0}$
	D = external bush diameter d = bush inner diameter	$45.5^{+0.27}_{-0}$ $16.5^{+0.2}_{-0}$

REAR LEAF SPRINGS

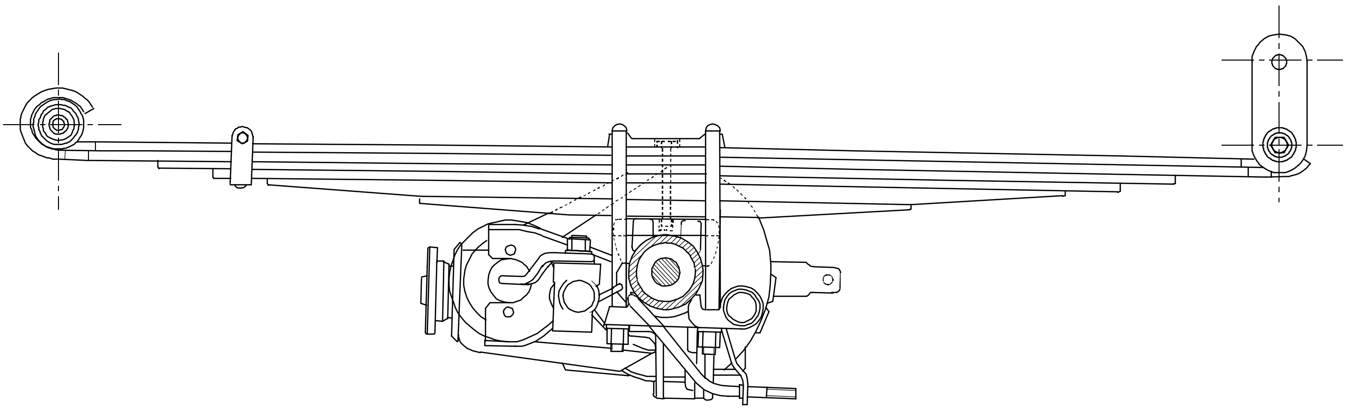
Figure 3



77624

SINGLE–BLADE PARABOLIC LEAF SPRING ASSEMBLY

Figure 4



77625

HALF–ELLIPTIC LEAF SPRING ASSEMBLY
MODELS 60E..K – 65E..K – 75E..K

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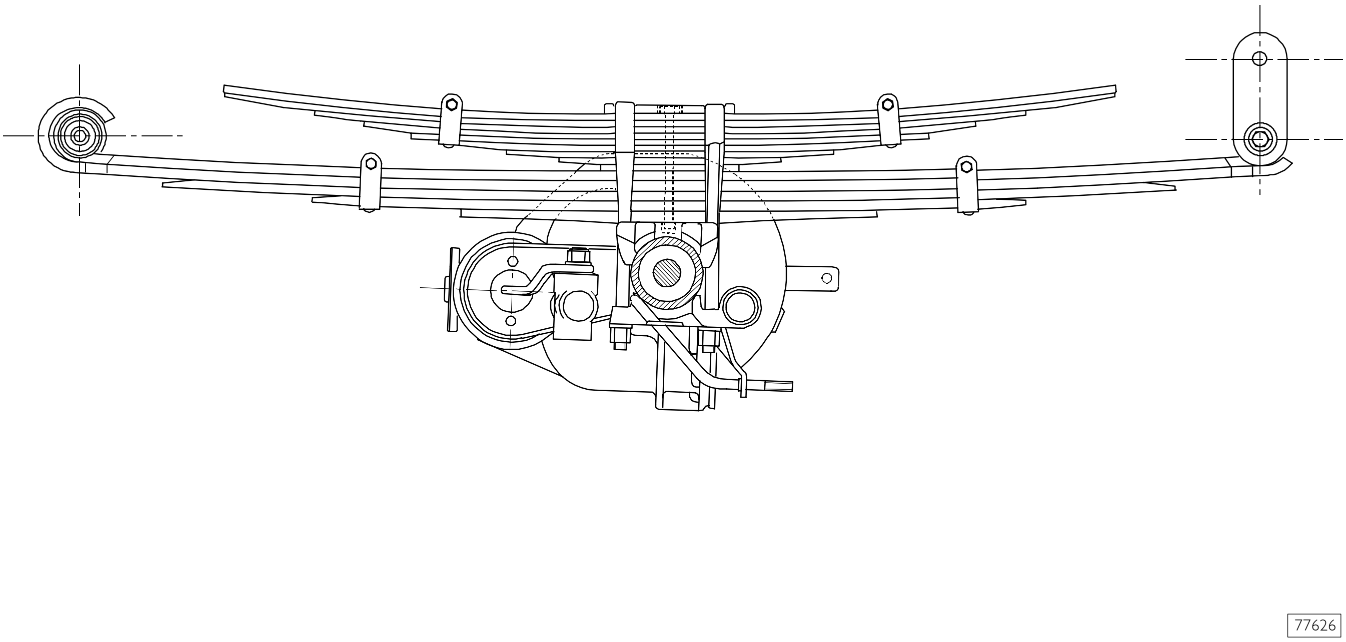
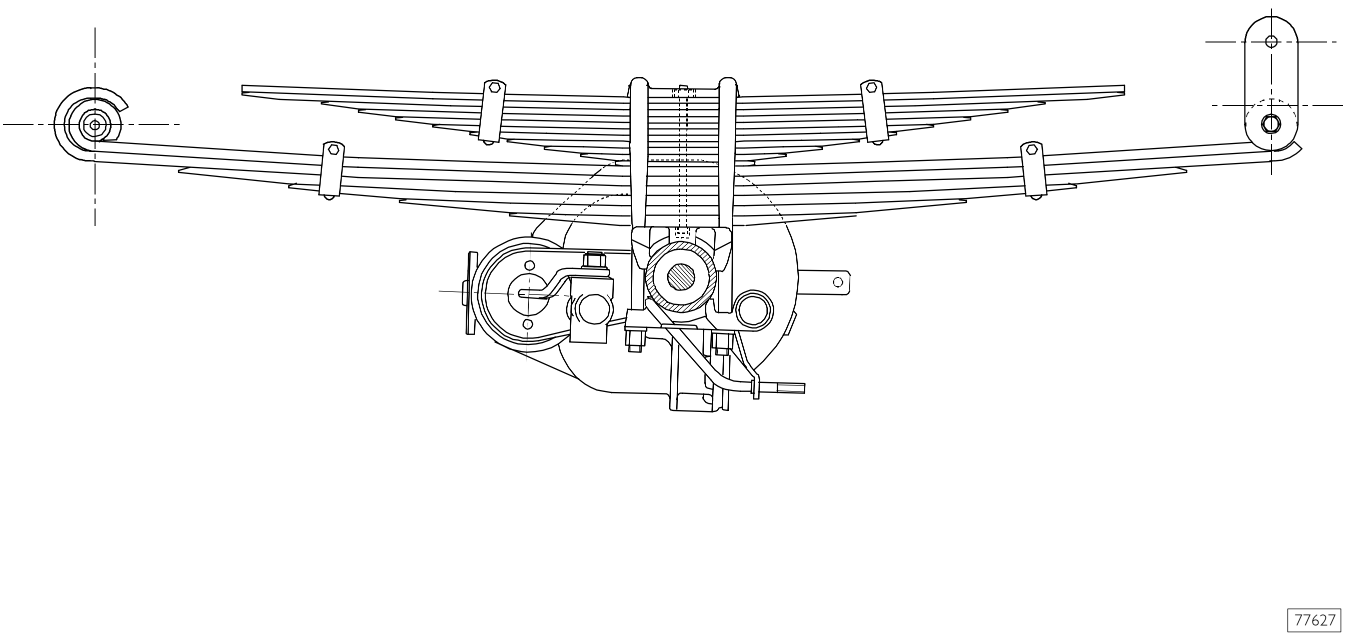
Figure 5



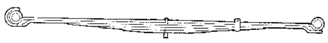
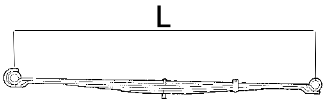
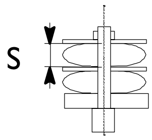
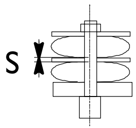
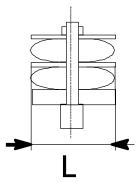
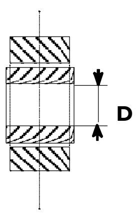
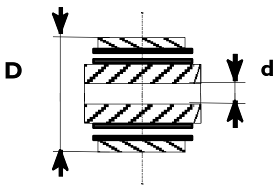
HALF–ELLIPTIC LEAF SPRING ASSEMBLY
MODELS 80E..K

Figure 6



SINGLE–BLADE PARABOLIC LEAF SPRING ASSEMBLY
MODELS 100E..K

REAR PARABOLIC LEAF SPRING SPECIFICATIONS AND DATA
Models 60E.. – 65E.. – 75E.. – 80E..

		mm
	Parabolic	N° 2
	Main leaf length (measured at eyelet center)	1670 ± 3
	Main leaf thickness (measured at centre) Auxiliary leaf thickness (measured in center)	29 33
	Thickness between leafs	3
	Leaf width	70 ± 0.5
	CONTROL DATA WITH NEW SPRING: Static load camber Free spring camber Static load flexibility	 * 147.8 3 mm/Kn
	Internal master leaf eyelet diameter (bush seat)	45.5 ± 0.3
	D = external bush diameter d = internal bush diameter	$45^{+0.1}_{-0}$ $16.5^{+0.2}_{-0}$

* Models: 60E..– 65E.. = 38.7 ± 3 mm
75E.. = 29.5 ± 3 mm
80E.. = 21 ± 3 mm

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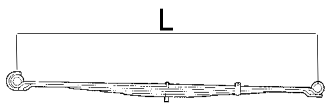
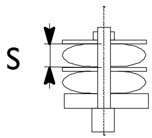
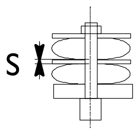
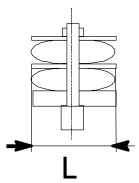
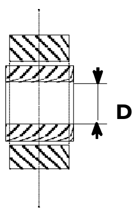
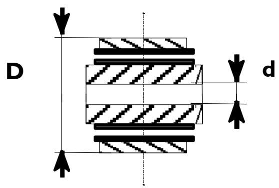
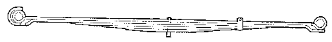
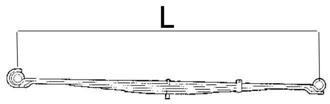
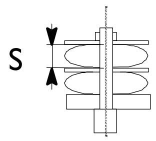
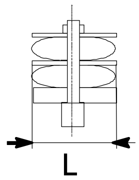
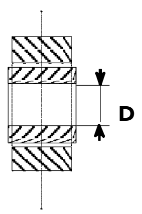
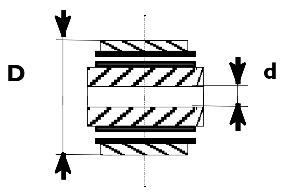
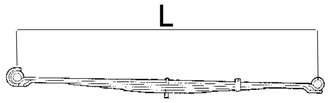
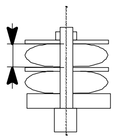
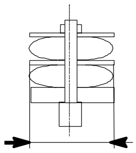
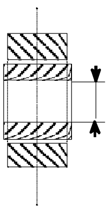
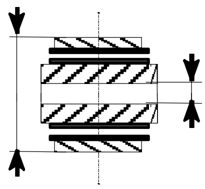
Models 100E..

		mm
	Parabolic	N° 2
	Main leaf length (measured at eyelet center)	1670 ± 3
	Main leaf thickness (measured at centre) Auxiliary leaf thickness (measured at cente)	29 36
	Thickness between leafs	3
	Leaf width	70 ± 0,5
	CONTROL DATA WITH NEW SPRING: Static load camber Free spring camber Static load flexibility for main leaf	 26.4 ± 3 147.8 2.55 mm/Kn
	Internal master leaf eyelet diameter (bush seat)	45.5 ± 45.6
	D = external bush diameter d = internal bush diameter	$45^{+0.1}_{-0}$ $16.5^{+0.2}_{-0}$

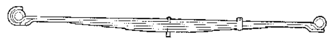
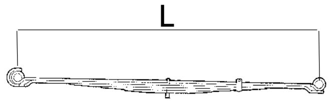
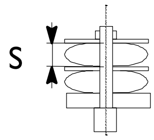
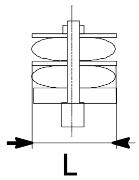
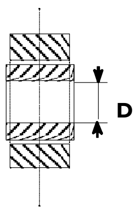
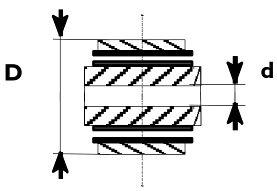
REAR HALF–ELLIPTIC LEAF SPRING SPECIFICATIONS AND DATA
Models 60E..K – 65E..K

		mm
	Half–elliptic	N° 2
	Main leaf length (measured at eyelet center)	1670 $^{0}_{-6}$
	Main leaf thickness (1st – 2nd – 3rd and 4th) (measured at centre) Auxiliary leaf thickness (5th and 6th)(measured in center)	12 23
	Leaf width	70 ± 0.5
	CONTROL DATA WITH NEW SPRING: Static load camber Dynamic load camber (max) Static load flexibility for main leaf Static load flexibility after auxiliary spring intervention	 22.75 63 11.78 mm/Kn 4.13 mm/Kn
	Internal master leaf eyelet diameter (bush seat)	45.5 $^{+0.1}_{-0}$
	D = external bush diameter d = internal bush diameter	45.5 $^{+0.27}_{-0}$ 16.5 $^{+0.2}_{-0}$

Models 75E..K

		mm
	Half–elliptic	N° 2
	Main leaf length (measured at eyelet center)	$1670^{\ 0}_{-6}$
	Main leaf thickness (1st – 2nd – 3rd and 4th) (measured at centre) Auxiliary leaf thickness (5th – 6th and 7th) (measured at centre)	12 22
	Leaf width	70 ± 0.5
	CONTROL DATA WITH NEW SPRING: Static load camber Dynamic load camber (max) Static load flexibility for main leaf Static load flexibility after auxiliary spring intervention	 22.75 71.5 11.73 mm/Kn 3.3 mm/Kn
	Internal master leaf eyelet diameter (bush seat)	$45.5^{+0.1}_{-0}$
	D = external bush diameter d = internal bush diameter	$45.5^{+0.27}_{-0}$ $16.5^{+0.2}_{-0}$

Models 80E..K

		mm
	Half–elliptic	N° 2
	Main leaf length (measured at eyelet center) Auxiliary leaf length (measured between the ends)	$1670^{\ 0}_{-6}$ 1254
	Main leaf thickness (measured at centre) Auxiliary leaf thickness (measured in center)	14 9
	Leaf width	70 ± 0.5
	CONTROL DATA WITH NEW SPRING: Static load camber Dynamic load camber (max) Static load flexibility for main leaf Static load flexibility after auxiliary spring intervention	 59 – 6.705 mm/Kn 2.93 mm/Kn
	Internal master leaf eyelet diameter (bush seat)	$45.5^{+0.1}_{-0}$
	D = external bush diameter d = internal bush diameter	$45.5^{+0.27}_{-0}$ $16.5^{+0.2}_{-0}$

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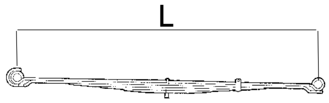
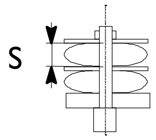
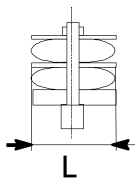
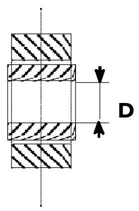
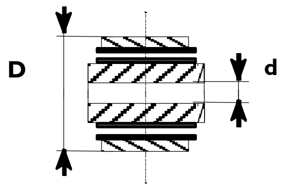
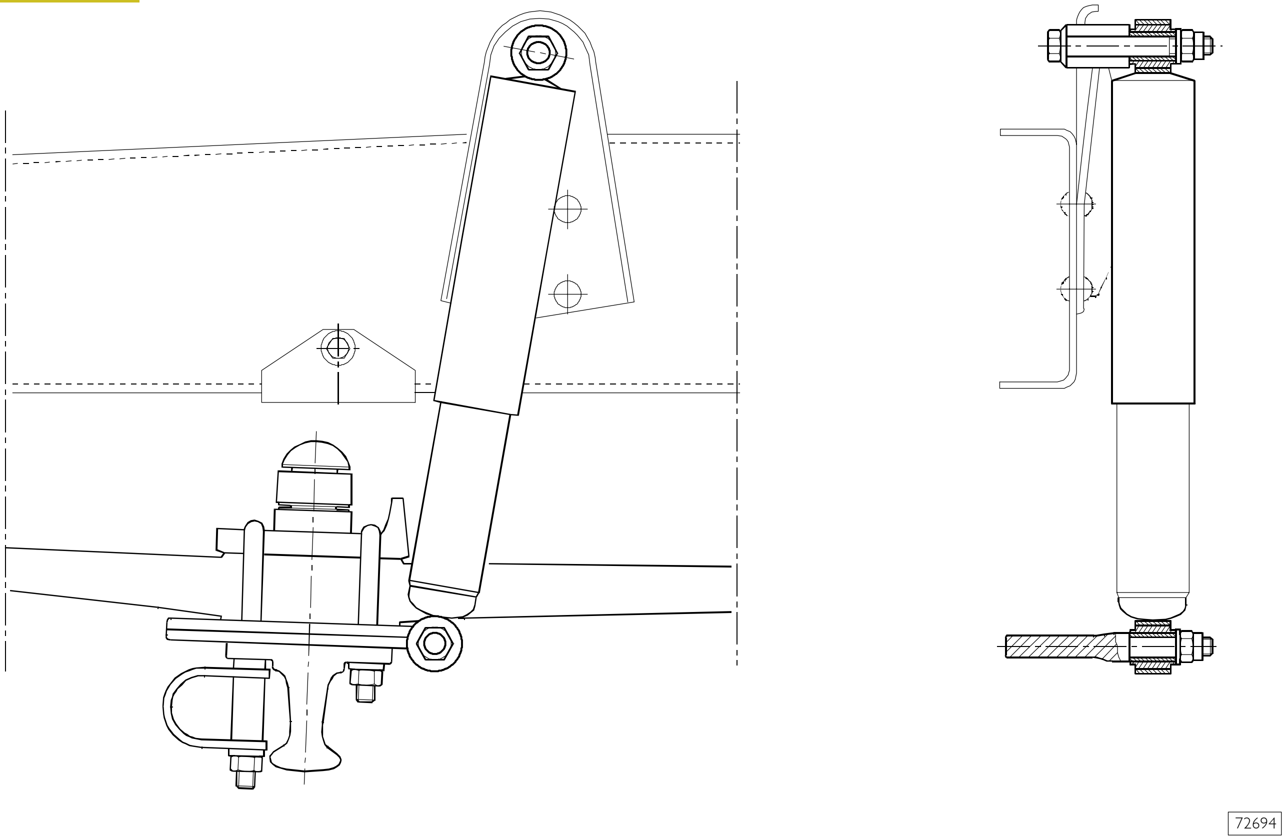
Models 100E..K

		mm
	Half–elliptic	N° 2
	Main leaf length (measured at eyelet center) Auxiliary leaf length (measured between the ends)	$1670\ ^{0}_{-6}$ 1254
	Main leaf thickness (measured at centre) Auxiliary leaf thickness (measured in center)	14 9
	Leaf width	70 ± 0.5
	CONTROL DATA WITH NEW SPRING: Static load camber Dynamic load camber (max) Static load flexibility for main leaf Static load flexibility after auxiliary spring intervention	 45 – 5.699 mm/Kn 2.414 mm/Kn
	Internal master leaf eyelet diameter (bush seat)	$45.5\ ^{+0.1}_{-0}$
	D = external bush diameter d = internal bush diameter	$45.5\ ^{+0.27}_{-0}$ $16.5\ ^{+0.2}_{-0}$

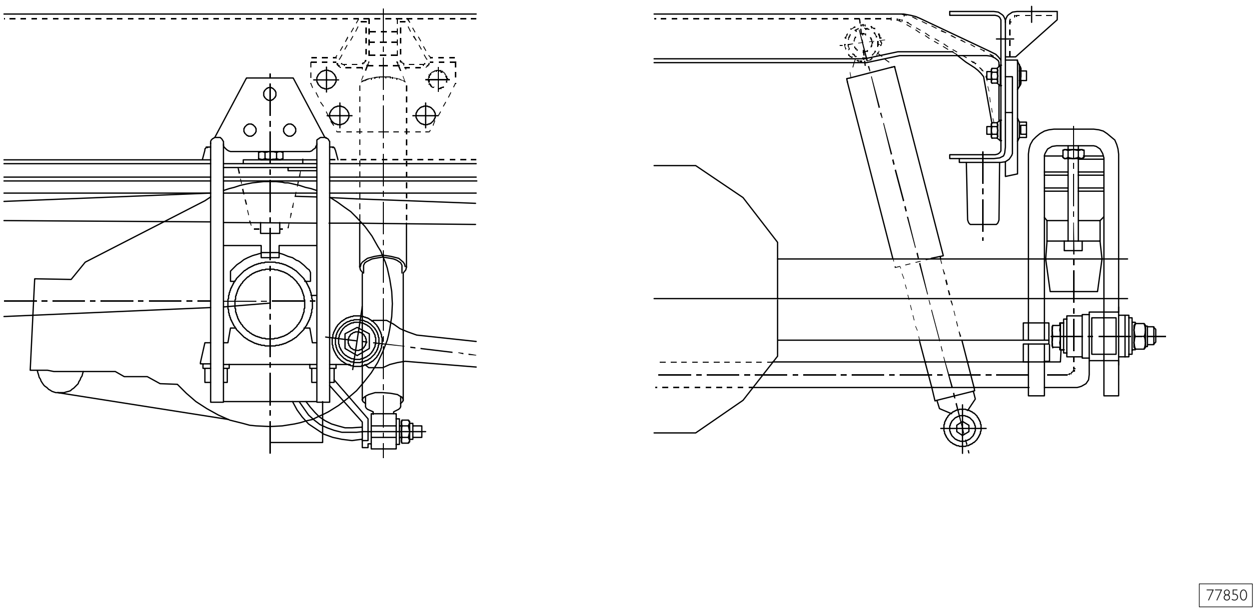
SHOCK ABSORBERS
Assembly diagrams

Figure 7



FRONT SHOCK ABSORBER MOUNTING ASSEMBLY

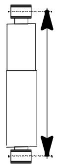
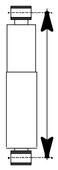
Figure 8



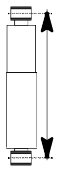
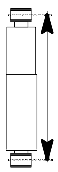
REAR SHOCK ABSORBER MOUNTING ASSEMBLY

SHOCK ABSORBER SPECIFICATIONS AND DATA

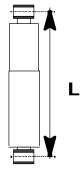
Front shock absorbers (with parabolic leaf springs)

SHOCK ABSORBERS		FICHTEL & SACHS	ARVIN MERITOR
 MODELS: 60E.. – 60E../P 65E.. – 65E../P 75E.. – 75E../P	Length between eyelet centers: Open (mm) Closed (mm) Stroke (mm)	 664 ± 3 394 ± 3 270	 662 ± 3 396 ± 3 266
SHOCK ABSORBERS		SACHS	ARVIN MERITOR
 MODELS: 80EL.. – 80EL../P 80E.. – 100E.. 80E../P – 100E../P	Length between eyelet centers: Open (mm) Closed (mm) Stroke (mm)	 618 ± 3 378 ± 3 240	 618 ± 3 378 ± 3 240

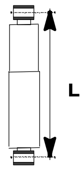
Front shock absorbers (with half–elliptic leaf springs)

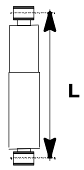
SHOCK ABSORBERS		FICHTEL & SACHS	ARVIN MERITOR
 MODELS: 60E..K – 75E..K	Length between eyelet centers: Open (mm) Closed (mm) Stroke (mm)	 664 ± 3 394 ± 3 270	 663 ± 3 396 ± 3 267
SHOCK ABSORBERS		FICHTEL & SACHS	
 MODELS: 80E..K – 100E..K	Length between eyelet centers: Open (mm) Closed (mm) Stroke (mm)	 664 ± 3 394 ± 3 270	

Rear shock absorbers (with parabolic leaf springs)

SHOCK ABSORBERS		SACHS	ARVIN MERITOR
 MODELS: 60E.. 65E.. 75E.. 80EL.. 80E.. 90E.. 100E..	Length between eyelet centers: Open (mm) Closed (mm) Stroke (mm)	 669 ± 3 404 ± 3 265	 669 ± 3 404 ± 3 265

Rear shock absorbers (with half-elliptic leaf springs)

SHOCK ABSORBERS		FICHTEL & SACHS	ARVIN MERITOR
 MODELS: 60E..K - 75E..K	Length between eyelet centers: Open (mm) Closed (mm) Stroke (mm)	 692 ± 3 422 ± 3 270	 692 ± 3 422 ± 3 270

SHOCK ABSORBERS		FICHTEL & SACHS
 MODELS: 80E..K - 100E..K	Length between eyelet centers: Open (mm) Closed (mm) Stroke (mm)	 669 ± 3 399 ± 3 290

The check of shock absorber braking capability is carried out through an adequate equipment, comparing the values with those included in the following tables:

DIAGNOSTICS

Main suspensions operating anomalies:

1 – Noisy suspension;
2 – Irregular or excessive tire wear;
3 – The vehicle tends to move to one part;
4 – The vehicle tends to one side;
5 – Excessive suspension flexibility;
6 – Squeal, rattles and noises in general.

1	NOISY SUSPENSION

Insufficient lubrication.	YES →	Carry out an accurate lubrication.
NO ↓		
Noisy or inefficient shock absorbers.	YES →	Revise the shock absorbers.
NO ↓		
Worn wheel bearings and with exact clearance.	YES →	Carry out an accurate check of the bearings and, if necessary, replace the damaged parts.
NO ↓		
Loosening of leaf springs supports securing.	YES →	Check supports and possibly replace nails for securing to chassis that are loosened.
NO ↓		
Loosening of leaf springs pack due to breaking of central securing pin.	YES →	Revise leaf springs and replace central pin and related self–locking nut.
NO ↓		
Loosening of leaf springs pack due to breaking of nails for securing spring locking brackets.	YES →	Revise leaf springs securing brackets and replace securing nails.

2 IRREGULAR OR EXCESSIVE TIRE WEAR

Condition	YES →
Wrong wheel camber.	Check camber angle and proceed with an accurate revision.
NO ↓ Wrong wheel toe–in.	Carry out the exact wheel toe–in adjustment.
NO ↓ Insufficient tire pressure.	Check and take back the pressure at the required value.
NO ↓ Sudden accelerations.	The acceleration must be progressively carried out.
NO ↓ Inadequate running speed on roads with gravelly roadbed.	Suitably match the speed to the roadbed.
NO ↓ Excessive wheel bearings clearance.	Adjust the clearance and lubricate bearings with TUTELA MR3 grease.
NO ↓ Loosening of leaf springs pack due to breakage of nails for securing spring locking brackets.	Check leaf spring securing brackets and replace securing nails.

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3 THE VEHICLE TENDS TO MOVE TO ONE PART

Low and irregular tire pressure.	YES →	Check and carry out a correct inflation at the required pressure.
NO ↓		
Wrong front wheels attitude.	YES →	Check and revise wheel attitude.
NO ↓		
Wrong clearance adjustment for front wheel bearings.	YES →	Carry out bearings clearance adjustment.
NO ↓		
Inefficient hydraulic shock absorbers.	YES →	Disassemble the shock absorbers and revise them or replace them.

4 THE VEHICLE TENDS TO ONE SIDE

Anomalous load arrangement.	YES →	Check the load and arrange it smoothly on the loading plane.
NO ↓		
Wrong pressure for all tires.	YES →	Check and carry out the inflation at the right pressure.
NO ↓		
Damaged leaf spring.	YES →	Revise the leaf spring performing the necessary replacements.

5 EXCESSIVE SUSPENSION FLEXIBILITY

Damaged central pin for joining leaf spring leafs.	YES →	Replace the piece and revise the spring.
NO ↓		
Leaf spring leafs yielding or breakage.	YES →	Revise the spring and replace unusable parts or, if necessary, the complete spring.

6 SQUEAL, RATTLES AND NOISES IN GENERAL

Loosening of leaf springs supports.	YES →	Check the supoprts and possibly replace chassis securing nails that are loosened.
NO ↓		
Loosening of leaf spring pack due to central securing pin breakage.	YES →	Revise leaf spring replacing central pin and related self–locking nut.
NO ↓		
Loosening of leaf spring pack due to breakage of nails for securing spring locking brackets.	YES →	Check leaf spring locking brackets and replace securing nails.
NO ↓		
Worn wheel bearings and with excessive clearance.	YES →	Carry out an accurate check of bearings and, if necessary, replace damaged parts. Adjust wheel bearings clearance.

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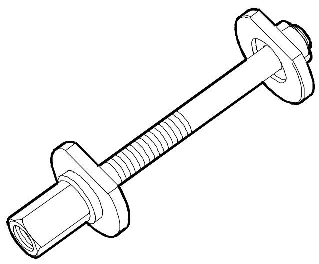
TIGHTENING TORQUES

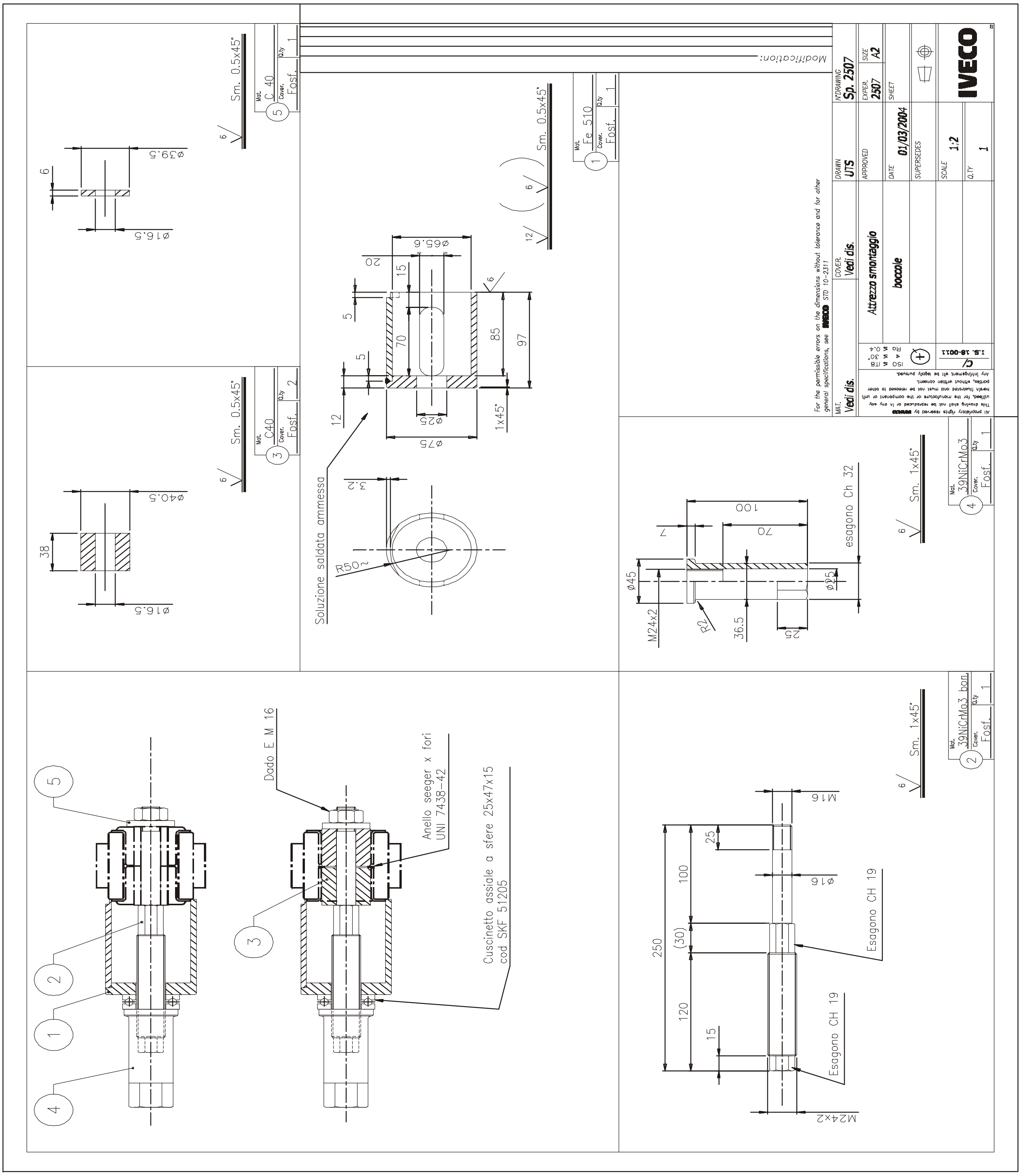
PART	TORQUE	
	Nm	(kgm)
FRONT SUSPENSION		
Leaf spring bracket securing nut	166.5 ± 16.5	(16.9 ± 1.7)
Screw to secure leaf spring to shackle	220 ± 20	(22.4 ± 2)
FRONT SUSPENSION (with parabolic leaf springs)		
Leaf spring bracket securing nut	463 ± 46.5	(47.2 ± 4.7)
Screw to secure leaf spring to shackle	220 ± 20	(22.4 ± 2)
Nut to secure leaf spring to front support	220 ± 20	(22.4 ± 2)
Screw to secure leaf spring to rear support	220 ± 20	(22.4 ± 2)
REAR SUSPENSION (with semi–elliptic leaf springs)		
Nut to secure leaf spring to bracket	277.5 ± 27.5	(28.3 ± 2.8)
Nut to secure leaf spring to front support	220 ± 20	(22.4 ± 2)
Screw to secure leaf spring to rear support	220 ± 20	(22.4 ± 2)
Nut for screw to secure stabiliser bar to rear axle support	300	(30.5)

TOOLS

TOOL No.		DENOMINATION
99346052		Tool for bushing mounting

EXPERIMENTAL TOOLS

In this chapter there are shown the construction technical drawings of the experimental tools (S.P.) that are used in overhauling the leaf-springs described in this section, which can be manufactured by the repair workshops themselves.



500410 FRONT MECHANICAL SUSPENSIONS DISENGAGEMENT – RE–ENGAGEMENT

Before carrying out disengagement/re–engagement operations, disconnect battery cables.

Disengagement

Arrange the vehicle on a plane ground, lock rear wheel with wedges and proceed as follows:

- Loosen front wheels securing nuts, lift the vehicle and place it on supporting stands.
- Place hydraulic trolley 99321024 under the wheels, remove securing nuts and detach the wheels.
- Unscrew nuts (1 and 3) and detach shock absorber (2).
- Unscrew securing nuts (7) for stands (6). Detach torsion bar supports (8) and remove the stands recovering plate (9).
- Unscrew the nut and withdraw the front pin for anchoring leaf spring (5) to chassis support (4).
- Unscrew the nut and withdraw the rear pin for anchoring leaf spring (5) to chassis support (10), lower the front axle and extract the complete leaf spring.

Re–engagement

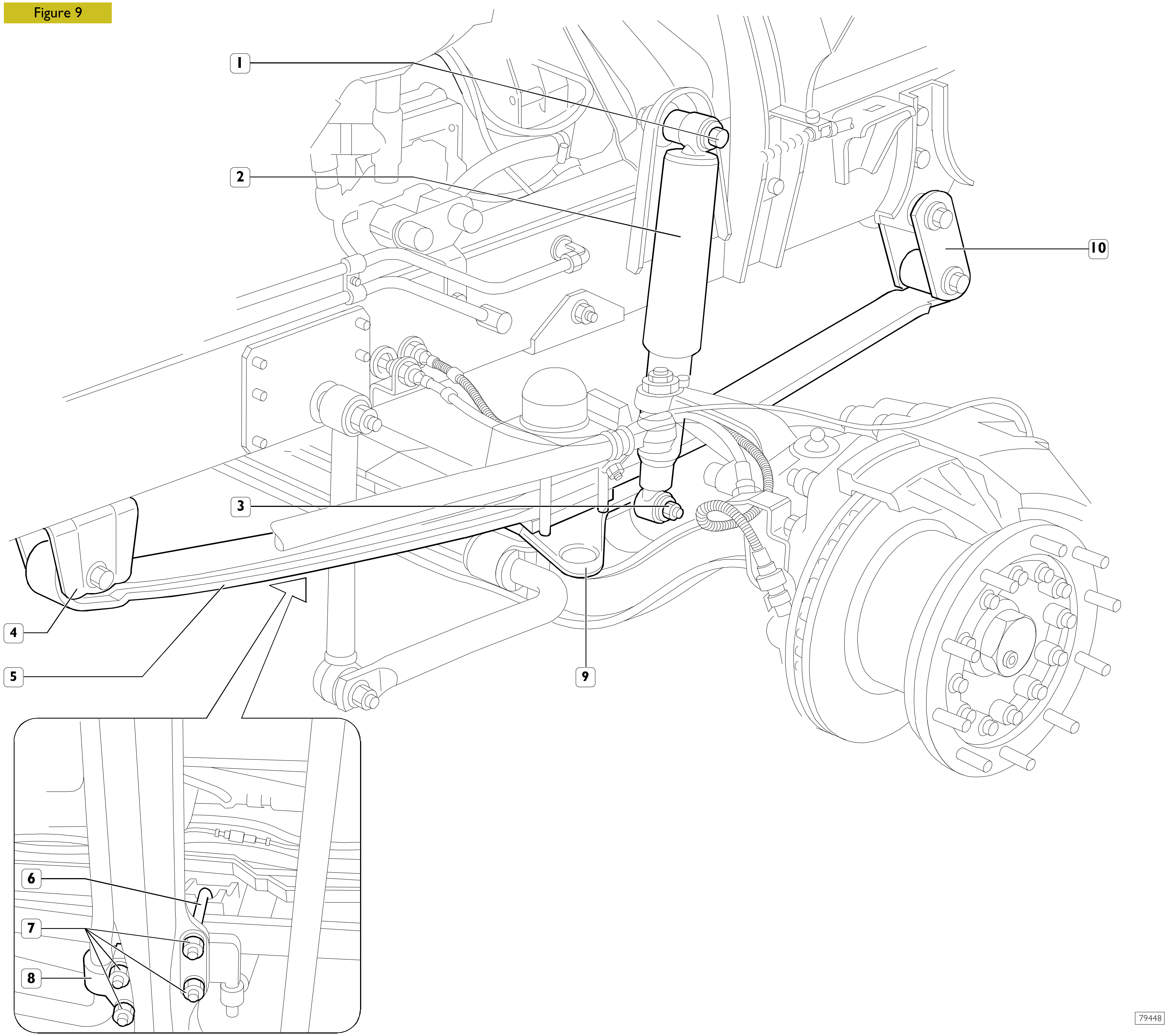
Suitably reverse the operations carried out for the disengagement and tighten at the required torque securing screws and nuts.

Self–locking nuts must always be replaced and tightened at the required torque.

Verify that:

- Check stand threading; when detecting anomalies, adjust the threading or replace them.

Figure 9



500450 REAR MECHANICAL SUSPENSIONS DISENGAGEMENT – RE–ENGAGEMENT

Before carrying out disengagement/re–engagement operations, disconnect battery cables.

Disengagement

Arrange the vehicle on a plane ground, lock rear wheel with wedges and proceed as follows:

- Loosen rear wheels securing nuts, lift the vehicle from behind and place it on supporting stands.
- Place hydraulic trolley 99321024 under rear wheels, remove securing nuts and detach the wheels.
- Unscrew nuts (2) and extract securing U–bolts (1).
- Unscrew the nut and withdraw the rear pin (4) for anchoring leaf spring (5) to chassis support (3).
- Unscrew the nut and withdraw the rear pin (6) for anchoring leaf spring (5) to chassis support (7), lower the front axle and extract the complete leaf spring.

Re–engagement

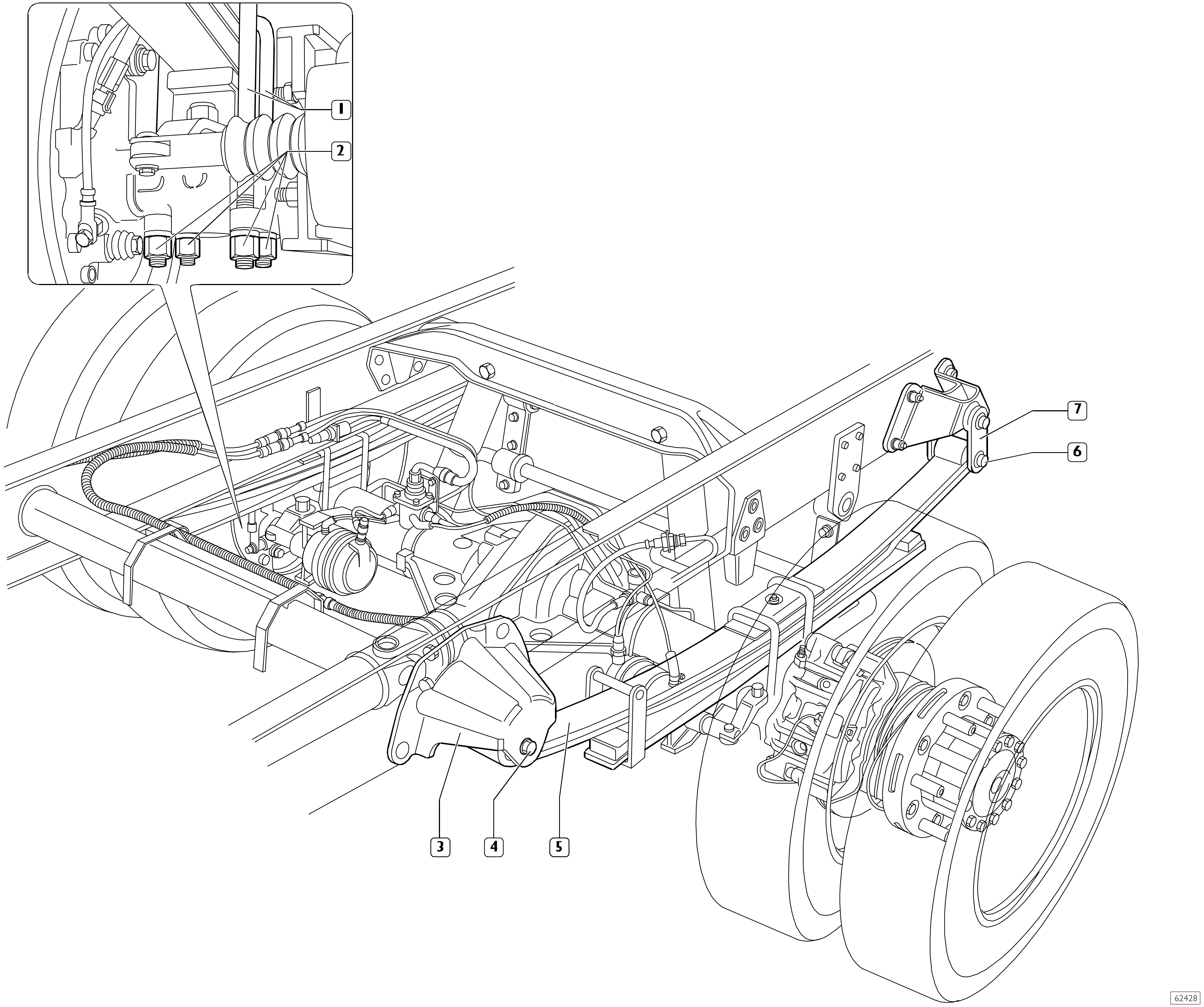
Suitably reverse the operations carried out for the disengagement and tighten at the required torque securing screws and nuts.

Self–locking nuts must always be replaced and tightened at the required torque.

Verify that:

- Check threading of stands (1); when detecting anomalies, adjust the threading or replace them.

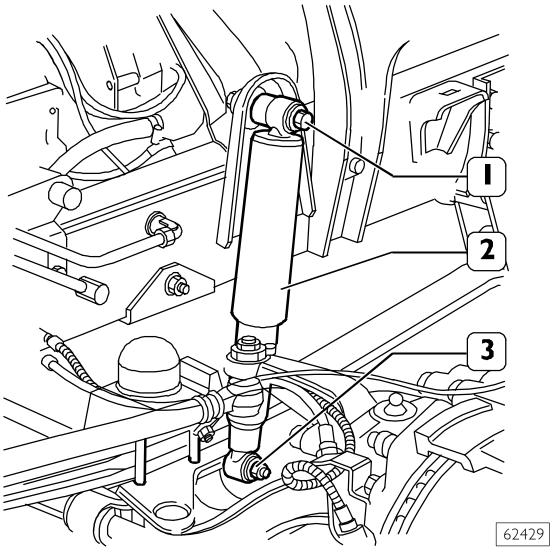
Figure 10



500910 FRONT SHOCK ABSORBERS

Disengagement

Figure 11



Unscrew screws (1 and 3) and disengage shock absorber (2).

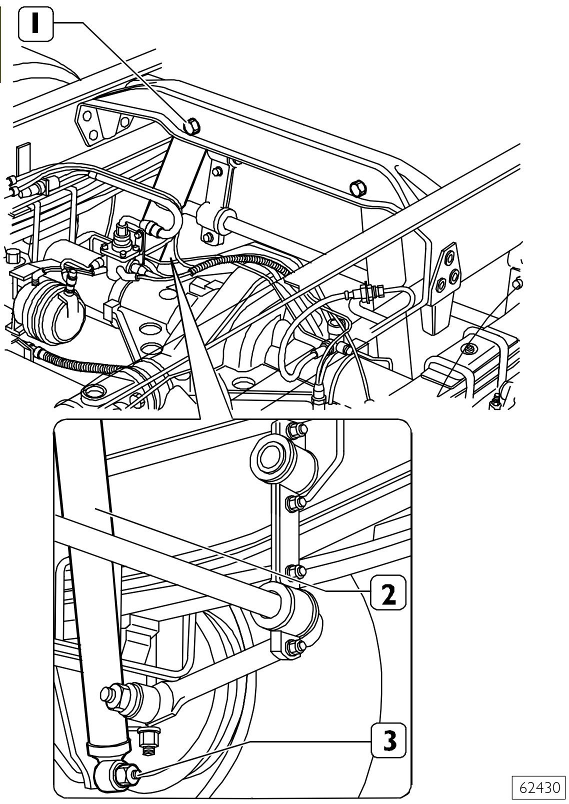
Re–engagement

For the re–engagement, reverse the operations carried out for disengaging and comply with the required tightening torques.

500940 REAR SHOCK ABSORBERS

Disengagement

Figure 12



Unscrew screws (1 and 3) and disengage shock absorber (2).

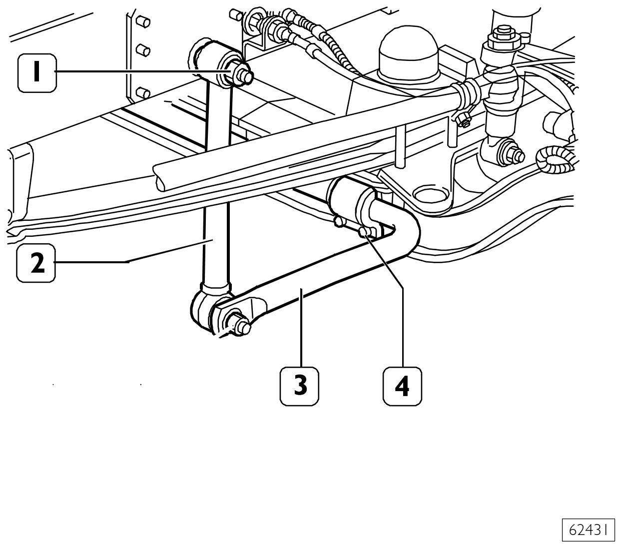
Re–engagement

For the re–engagement, reverse the operations carried out for disengaging and comply with the required tightening torques.

528930 FRONT STABILISING BAR

Disengagement

Figure 13



Unscrew screws (1 and 4) and remove stabilising bar (3) completed with anchoring bar (2).

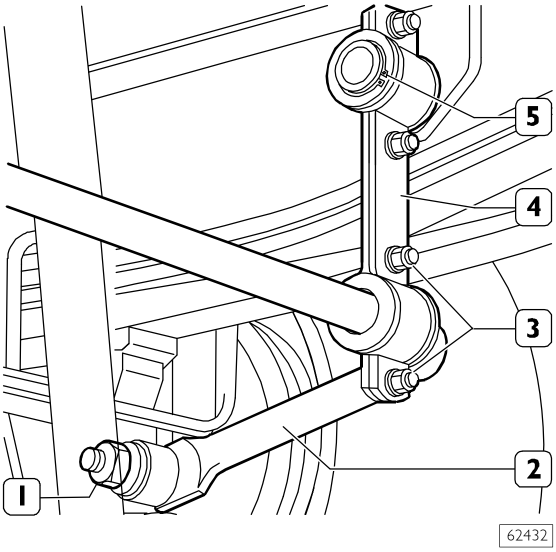
Re–engagement

For the re–engagement, reverse the operations carried out for disengaging and comply with the required tightening torques.

528960 REAR STABILISING BAR

Disengagement

Figure 14



Remove seeger (5), loosen, if necessary, nuts (3) and move the anchoring bracket (4) to free it from chassis support.
Unscrew nut (1), withdraw the screw and remove stabilising bar (2) completed with anchoring bracket (4).

Re–engagement

For the re–engagement, reverse the operations carried out for disengaging and comply with the required tightening torques.

REPAIR INTERVENTIONS

NOTE

- ❑ The replacement of blades is not allowed if more than one blade is broken.
- ❑ The replacement of blades is not allowed if the number of blades composing the faulty spring is less than threee.
- ❑ An exception for the previous point are the blades of auxiliary suspension springs, whose blades are composed of a main spring and an auxiliary spring; that is, there is no limit to its replacement even if the number of blades composing the auxiliary spring is less than three.
- ❑ Leaf springs composed of main blades and supplementary blades must be deemed as leaf springs composed of a main spring (main blades) and an auxiliary spring (supplementary blades) so that the replacement of main blades is possible if they are at least equal to three, while supplementary blades can anyway be replaced.
- ❑ The remaining, not replaced blades of the faulty spring must not show neither surface modifications that can be detected after a visual exam, nor shape modifications in general, such as to impair the compliance with the related constructive drawing.

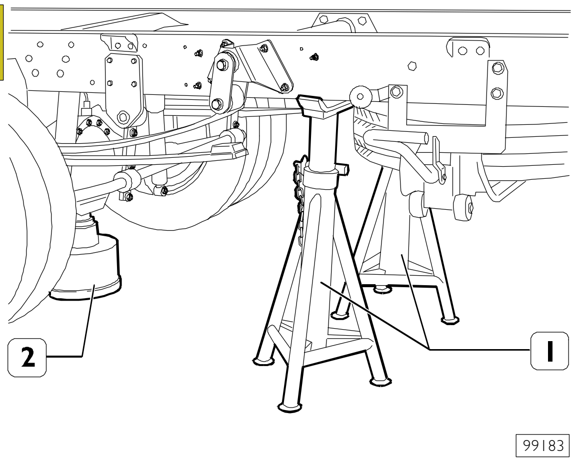
REPLACING LEAF–SPRING BUSHINGS (For vehicles with leaf–springs provided with bushings having a metal shell)

Arrange vehicle in safety conditions either on flat ground or elevator bridge.

DISCONNECTING AND RECONNECTING REAR LEAF–SPRING BUSHINGS

Suitably lock vehicle front wheels.

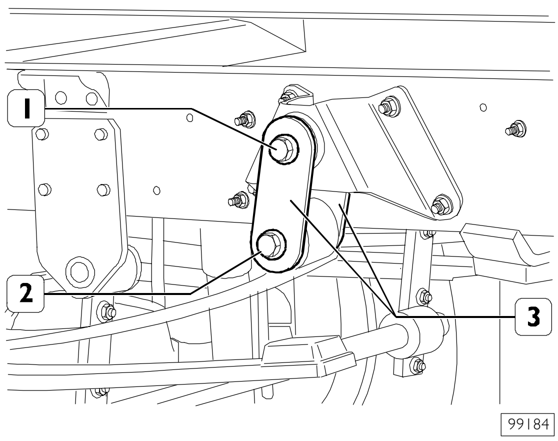
Figure 15



Lift rear axle by hydraulic jack (2) and position two stands (1) under the chassis in the area behind rear axle, as illustrated in figure.
By hydraulic jack (2), unload the weight of suspension from leaf–springs.

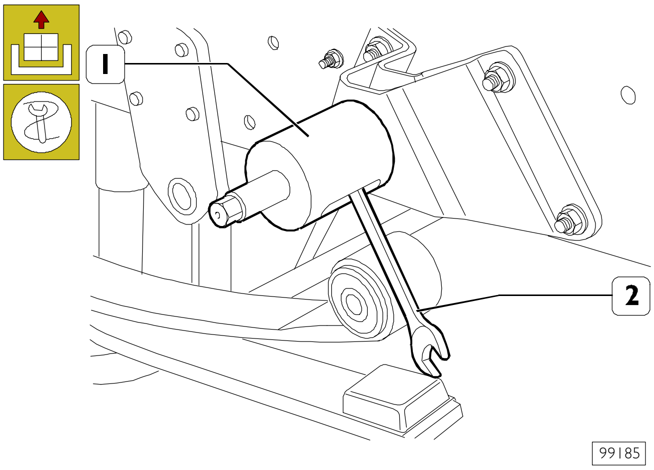
Disconnecting rear bushings

Figure 16



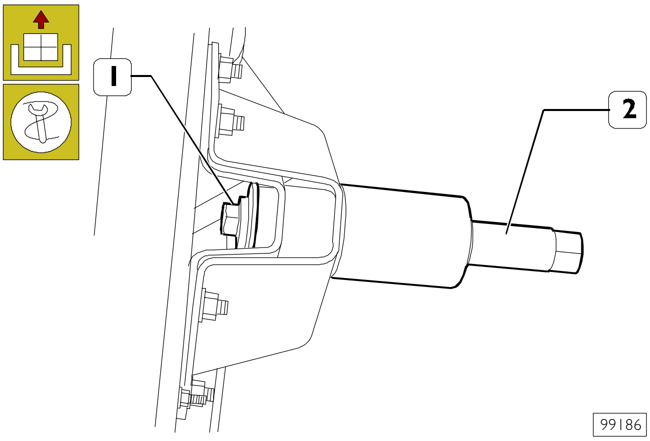
Unscrew bolts (1) and (2), unthread the screws, paying attention not to damage the thread, and recover shackles (3).
Repeat same procedure on vehicle opposite side.

Figure 17



Apply tool Sp 2507 (1), complete with 19 mm 12–point wrench (2), inserted from special slit and engaged into hexagonal section, that is present on the screw, to rear support bushing in order to stop possible rotation of the tool itself.

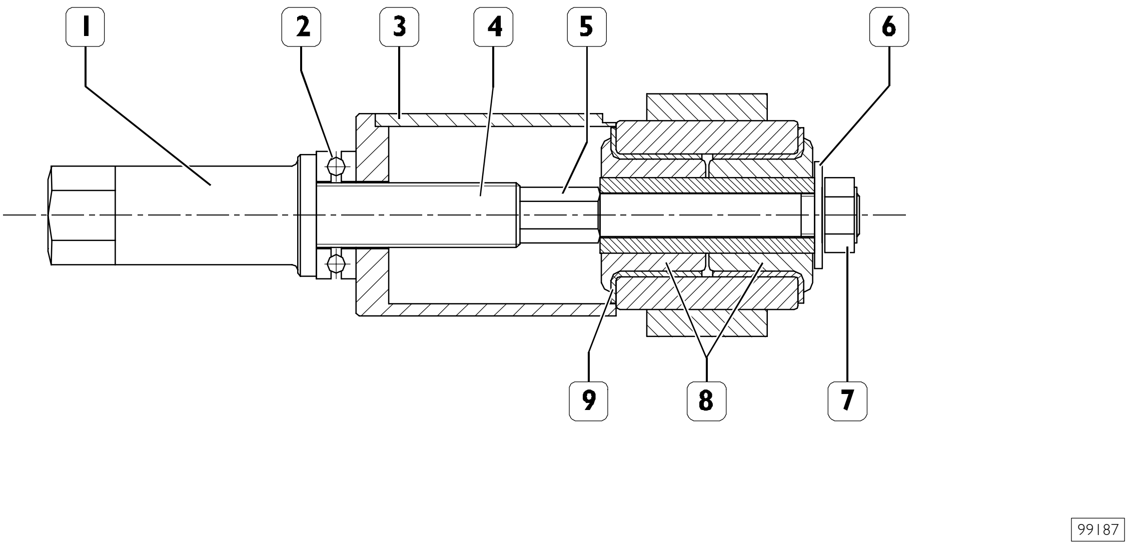
Figure 18



Screw up nut (1), as illustrated in figure.
Then, screw up special nut (2) in order to unthread spring bushing from support seat.

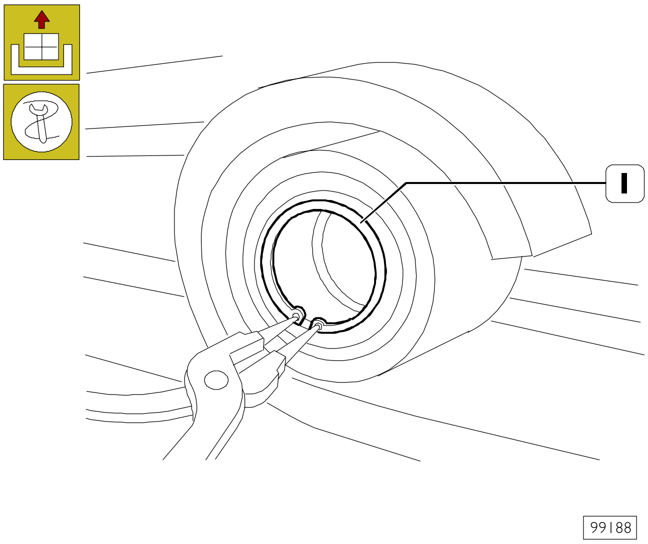
NOTE Next figure shows a section with the correct position of the components of tool SP 2507, that is complying with the dismounting of bushings.

Figure 19



1. Special nut
2. Thrust bearing
3. Bushing
4. Screw
5. Hexagonal section for 19 mm wrench.
6. Washer
7. Nut
8. Bushings
9. Bushing metal shell

Figure 20

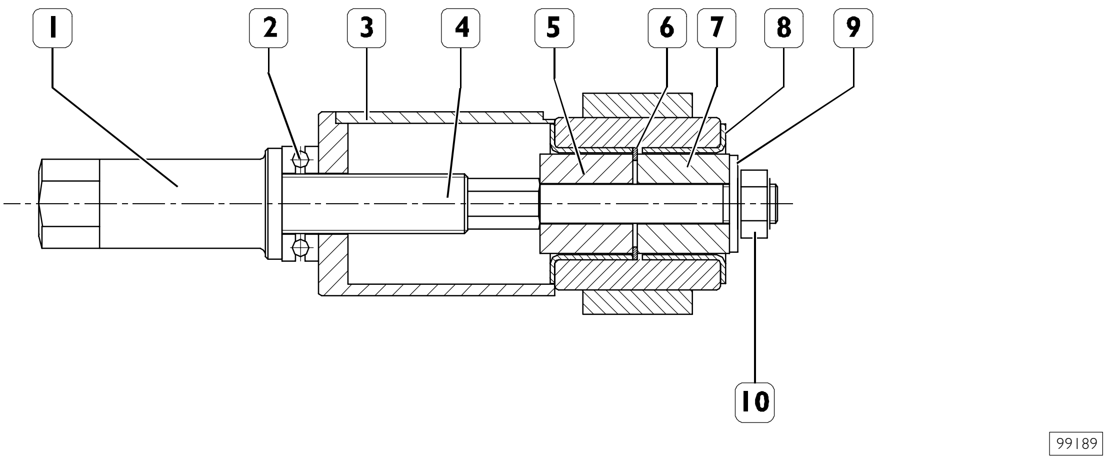


NOTE In the case of a missing extraction of the metal shell of outer bushing, below described procedure has to be performed.

Sandwich retaining spring ring (1) for 45.5 mm diameter holes between bushing metal portions.

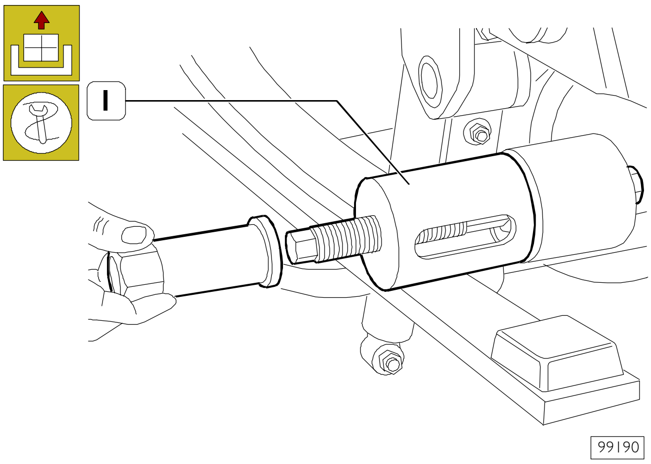
NOTE Next figure shows a section with the correct position of the components of tool SP 2507, that is complying with the dismounting of bushings.

Figure 21



1. Special nut
2. Thrust bearing
3. Bushing
4. Screw
5. Block
6. Retaining spring ring
7. Block
8. Bushing metal shell
9. Washer
10. Nut

Figure 22

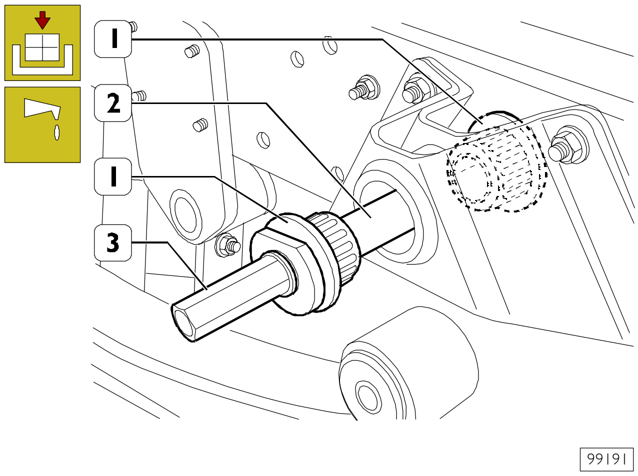


Apply tool SP2507 (1) complying as illustrated in last figure with the extraction of outer bushing metal shell.
Remove the tool and pull out the metal shell of remaining inner bushing by Ø 45 mm cylindrical beater.
Repeat described procedure on vehicle opposite side.

Reconnecting rear bushings

NOTE At reconnection, only new type spring bushings must be mounted.

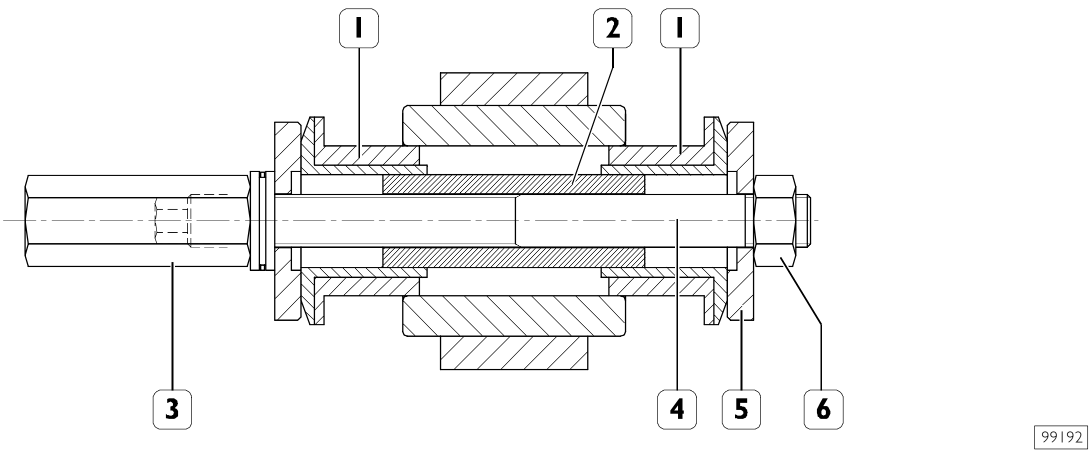
Figure 23



Apply either soaped water or vaseline grease both on spring bushing surfaces and into leaf–spring housing hole.
Position new spring bushings (1) and spacer (2), and apply tool 99346052.
Mount spring bushings by operating on nut (3).

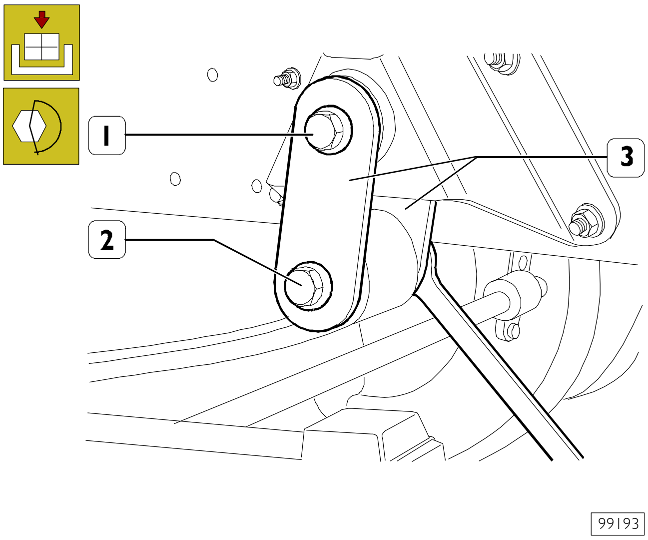
NOTE Next figure shows a section with the correct position of the components of tool 99346052 that is complying with the remounting of bushings.

Figure 24



1. Spring bushing
2. Spacer
3. Special nut
4. Screw
5. Washer
6. Nut

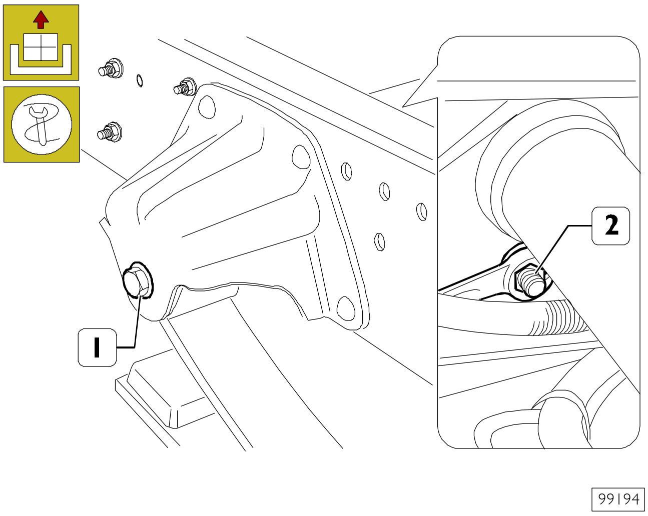
Figure 25



Position shackles (3), screw up securing bolts (1) and (2) and tighten at prescribed torque.
Repeat same procedure on vehicle opposite side.

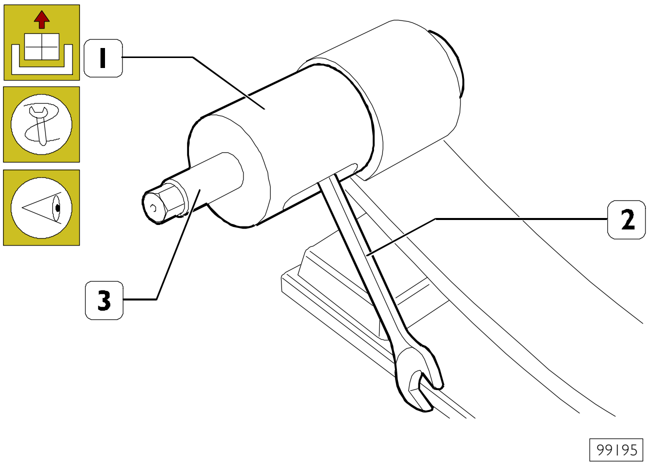
Disconnecting front bushings

Figure 26



Stop nut (1) located inside side member by a suitable wrench.
Unscrew screws (2) and unthread it, paying attention not to damage the thread.
Repeat same procedure on vehicle opposite side.
Then, lower the hydraulic jack in order to unthread the leaf–springs from the support.

Figure 27



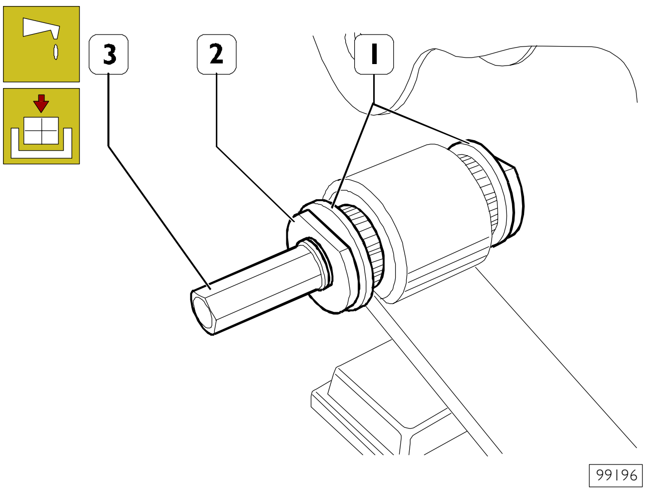
Apply tool Sp 2507 (1), complete with 19 mm 12–point wrench (2), inserted from special slit and engaged into hexagonal section, that is present on the screw, to front support bushing in order to stop possible rotation of the tool itself.
Then, unscrew special nut (3) in order to unthread the spring bushing from the housing.

NOTE In the case of a missing extraction of the metal shell of the bushings, above procedure described for rear spring bushings has to be performed.

Reconnecting front bushings

NOTE At reconnection, only new type spring bushings must be mounted.

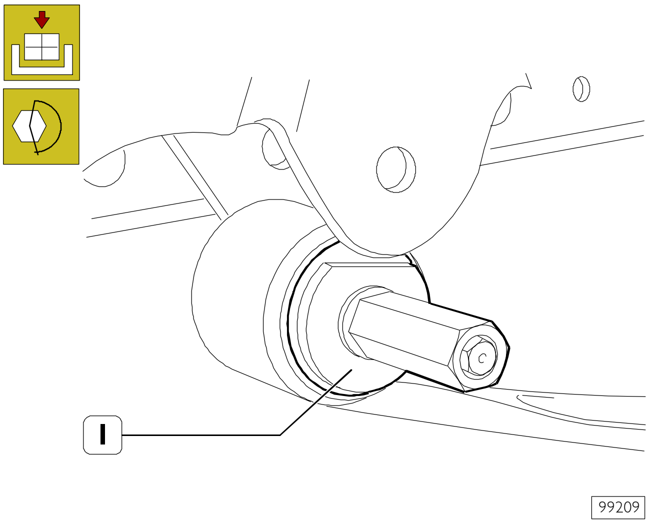
Figure 28



Apply either soaped water or vaseline grease both on spring bushing surfaces and into leaf–spring housing hole.
Position new spring bushings (1) and spacer (2), and apply tool 99346052 (2).
Mount spring bushings by operating on nut (3).
Repeat same procedure on vehicle opposite side.

Position compression plates (1) with the milling directed upwards as illustrated in figure to facilitate the insertion of the leaf–spring complete with spring bushings into the seat without risking to damage bushing edges.

Figure 29

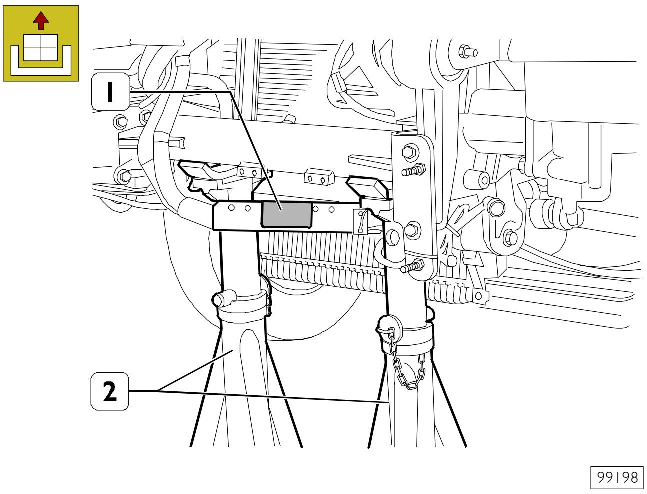


Cautiously lift the hydraulic jack and correctly position the leaf–springs in their seats on both vehicle sides.
Screw up securing bolt and tighten at prescribed torque.

DISCONNECTING AND RECONNECTING FRONT LEAF–SPRING BUSHINGS

Suitably lock vehicle rear wheels.

Figure 30

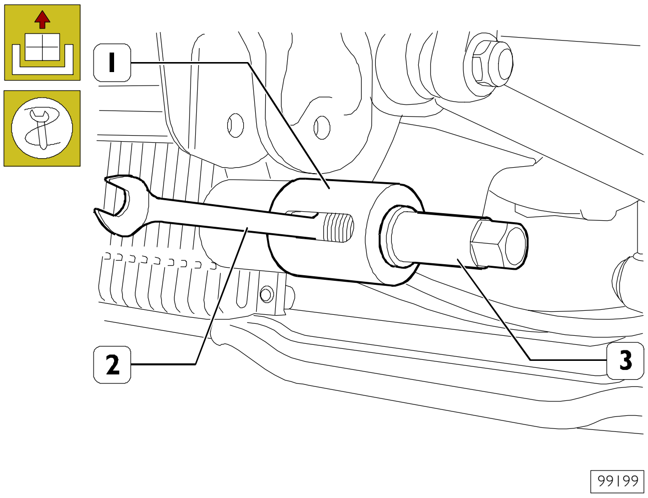


Remove front bumper, unscrew securing screws and disconnect cross member (1) supporting the wiring harness.
Lift front axle by a hydraulic jack and position two stands (2) as illustrated in figure under chassis front cross member.
Operate on front axle by the hydraulic jack until the weight of suspension is unloaded from leaf–springs.

Disconnecting front bushings

Unscrew securing bolt and unthread the screws, paying attention not to damage the thread.
Repeat same procedure on vehicle opposite side
Then, lower the hydraulic jack in order to unthread the leaf–springs from the support.

Figure 31



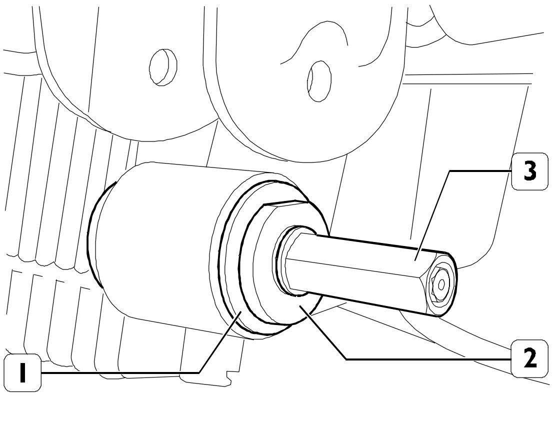
Apply tool Sp 2507 (1), complete with 19 mm 12–point wrench (2), inserted from special slit and engaged into hexagonal section, that is present on the screw, to front support bushing in order to stop possible rotation of the tool itself.
Then, unscrew special nut (3) in order to unthread the spring bushing from the housing.
Repeat same procedure on vehicle opposite side.

NOTE In the case of a missing extraction of the metal shell of the bushings, above procedure described for rear leaf–springs has to be performed.

Reconnecting front bushings

At reconnection, only mount new type spring bushings.
Position compression plates with the milling directed upwards as illustrated in figure to facilitate the insertion of the leaf–spring complete with spring bushings into the seat without risking to damage bushing edges.

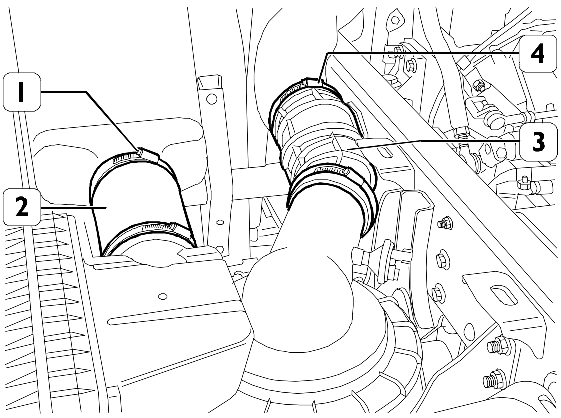
Figure 32



Apply either soaped water or vaseline grease both on spring bushing surfaces and into leaf–spring housing hole.
Position new spring bushings (1) and spacer (2), and apply tool 99346052 (2).
Mount spring bushings by operating on nut (3).
Cautiously lift the hydraulic jack, then correctly position the leaf–springs in their seats.
Screw up securing bolt and tighten at prescribed torque.
Repeat described procedure on vehicle opposite side.

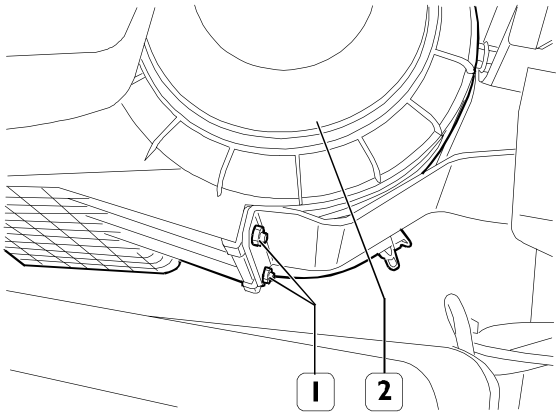
Disconnecting rear bushings

Figure 33



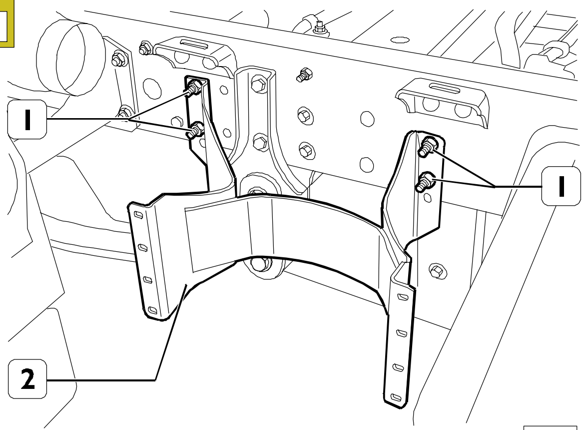
Operating on vehicle left side, loosen tightening clamps (1) and (4) and disconnect air intake spring sleeves (2) and (3).

Figure 34



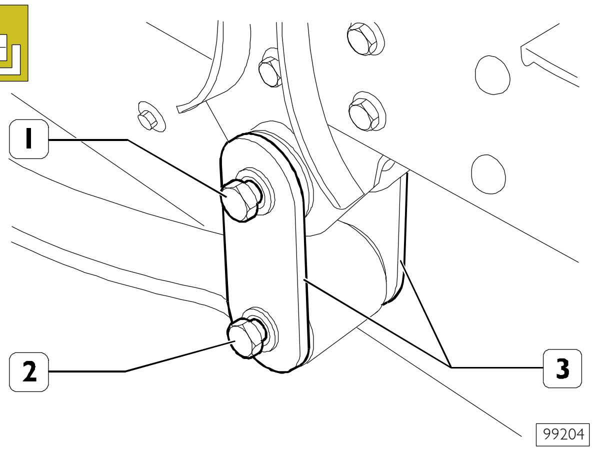
Operating on both sides, unscrew securing nuts (1) and remove air filter assembly (2).

Figure 35



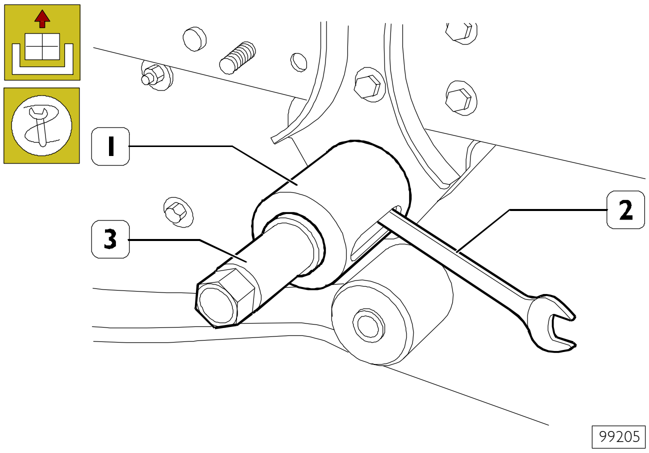
Unscrew securing nuts (1) and remove the support of air filter assembly (2).

Figure 36



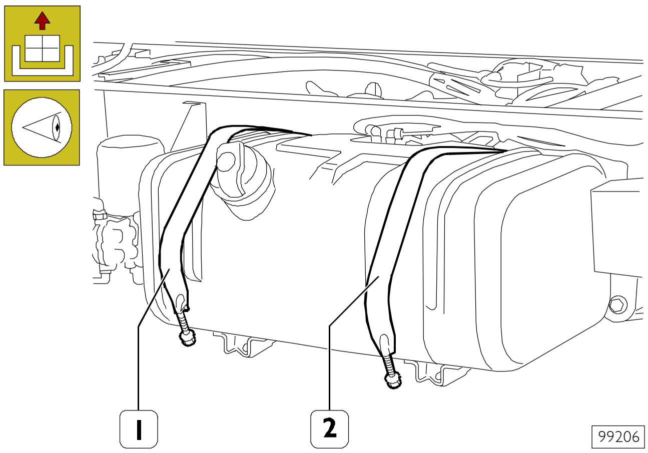
Unscrew bolts (1) and (2), unthread the screws, paying attention not to damage the thread, and recover shackles (3).

Figure 37



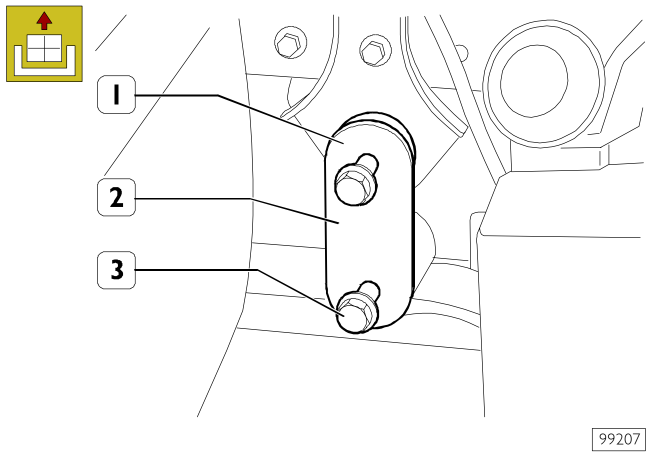
Apply tool Sp 2507 (1), complete with 19 mm 12–point wrench (2), inserted from special slit, on rear support bushings in order to stop possible rotation of the tool itself.
Repeat same procedure for leaf–spring bushings.
Operating on vehicle left side:
drain diesel oil from the tank into a suitable vessel.

Figure 38



Unscrew securing nuts and disconnect the lower ends of anchoring strips (1) and (2).
Shift the tank, paying attention not to damage the pipings.

Figure 39



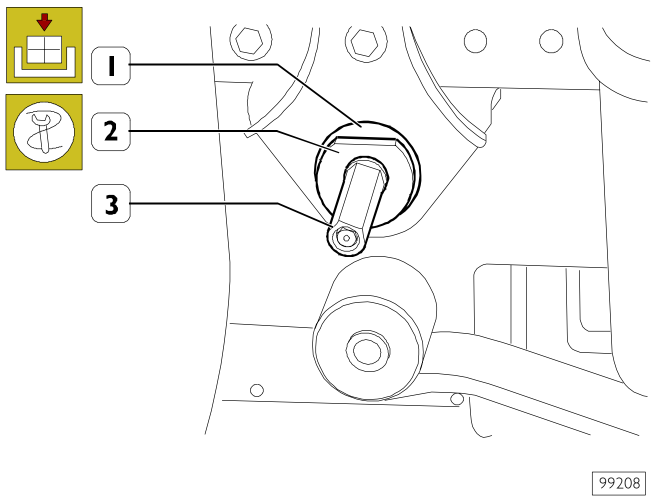
Unscrew bolts (1) and (2), unthread the screws, paying attention not to damage the thread, and recover shackles (3).
Perform same procedure on opposite side spring bushings.

Reconnecting front bushings

NOTE At reconnection, only new type spring bushings must be mounted.

Apply either soaped water or vaseline grease both on spring bushing surfaces and into leaf–spring housing hole.

Figure 40



Position new spring bushings (1) complete with spacer and apply tool 9934605 (2).
Mount spring bushings operating on nut (3).
Repeat described procedure on vehicle opposite side.

5004 Front and rear pneumatic suspensions

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PNEUMATIC SUSPENSIONS IN GENERAL

Pneumatic suspensions have high flexibility, high vibration–dampening capability, and above all, independently from vehicle load, due to system self–adjustment, the ”chassis–roadbed” distance remains constant. Pneumatic suspensions allow changing, through a suitable push–button, the ”chassis–roadbed” distance and therefore the vehicle working plane height.

The ECAS system, in addition to the known advantages offered by the pneumatic suspension, allows:

- a high air consumption reduction;
- prompt response in different adjustment processes;
- system easiness;
- wide safety concepts;
- chance of a complete system diagnosis.

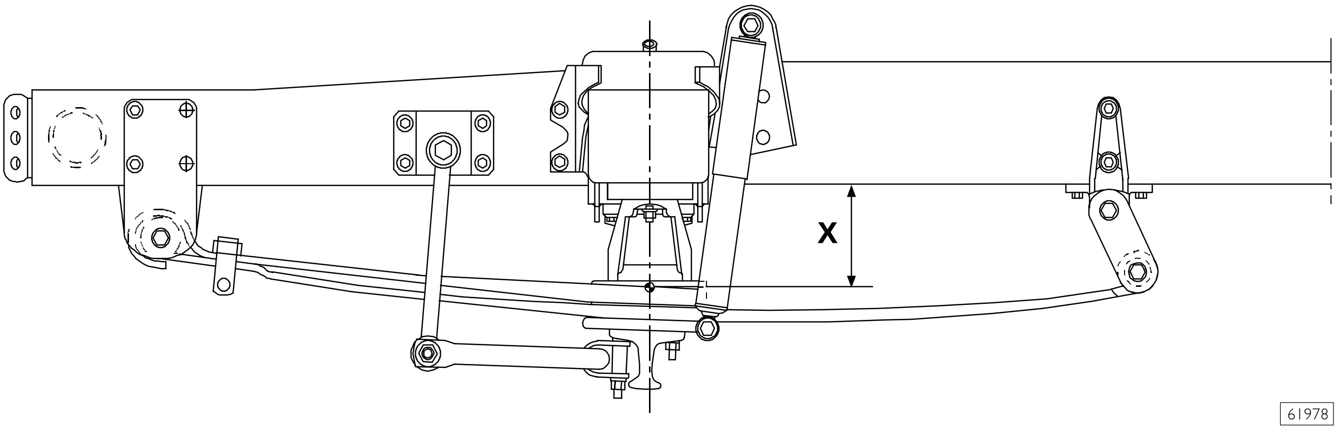
The **ECAS (Electronically Controlled Air Suspension)** system automatically checks the nominal vehicle pneumatic suspensions level, with the chance, for vehicles having it as equipment, of lifting the additional rear axle, when vehicle operating conditions so require and of obtaining the load transfer on drive axle during pickup, when the vehicle adherence conditions are unstable (help during pickup).

All above operations are anyway constrained by certain operating conditions and by the related safeties of the systems connected thereto.
The ECAS electronic unit automatically checks the chassis level (distance from the roadbed), through real values supplied by sensors, comparing them with nominal values recorded in memory.
In case of attitude deviations or variations, the electronic unit drives the electro–pneumatic assemblies, through which the real level is corrected with respect to the nominal one, previously set or stored by the driver.
The system has a remote control available for lifting/lowering and chassis leveling operations and it is possible to operate both with stopped vehicle and with moving vehicle.
The remote control, in addition to lifting, lowering and self–leveling operations, allows storing other chassis attitude levels and when operating needs so require, to recall them.

PNEUMATIC SUSPENSIONS ASSEMBLIES

NOTE The models equipped with mixed suspensions (mechanical front ones and pneumatic rear ones) keep the front suspension of the models corresponding with the mechanical suspension.

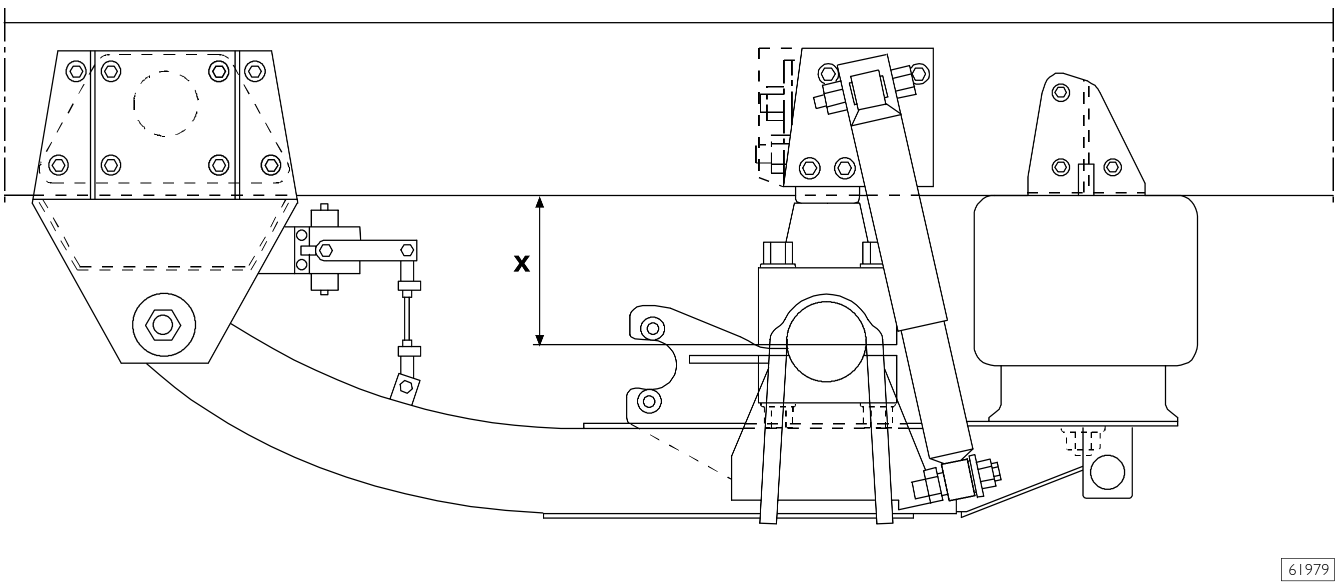
Figure 1



FRONT PNEUMATIC SUSPENSION ASSEMBLY

X = 179 mm

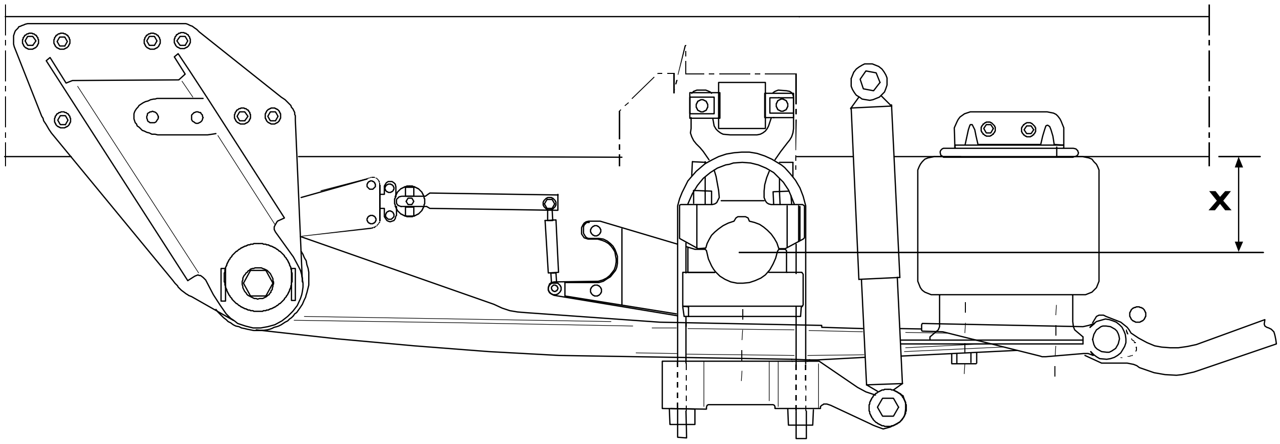
Figure 2



NEWAY TYPE REAR PNEUMATIC SUSPENSION ASSEMBLY

X = 185 mm for rear axle 4517
X = 175 mm for rear axle 4521

Figure 3



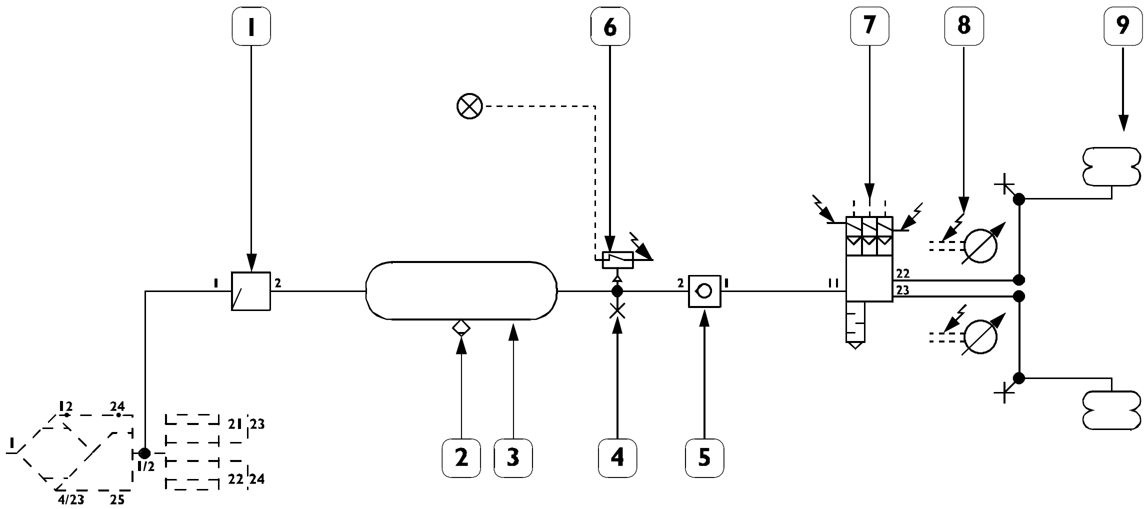
HENDRICKSON TYPE PNEUMATIC SUSPENSION ASSEMBLY

X = 185 mm

99002

Principle layout for rear pneumatic suspensions

Figure 4

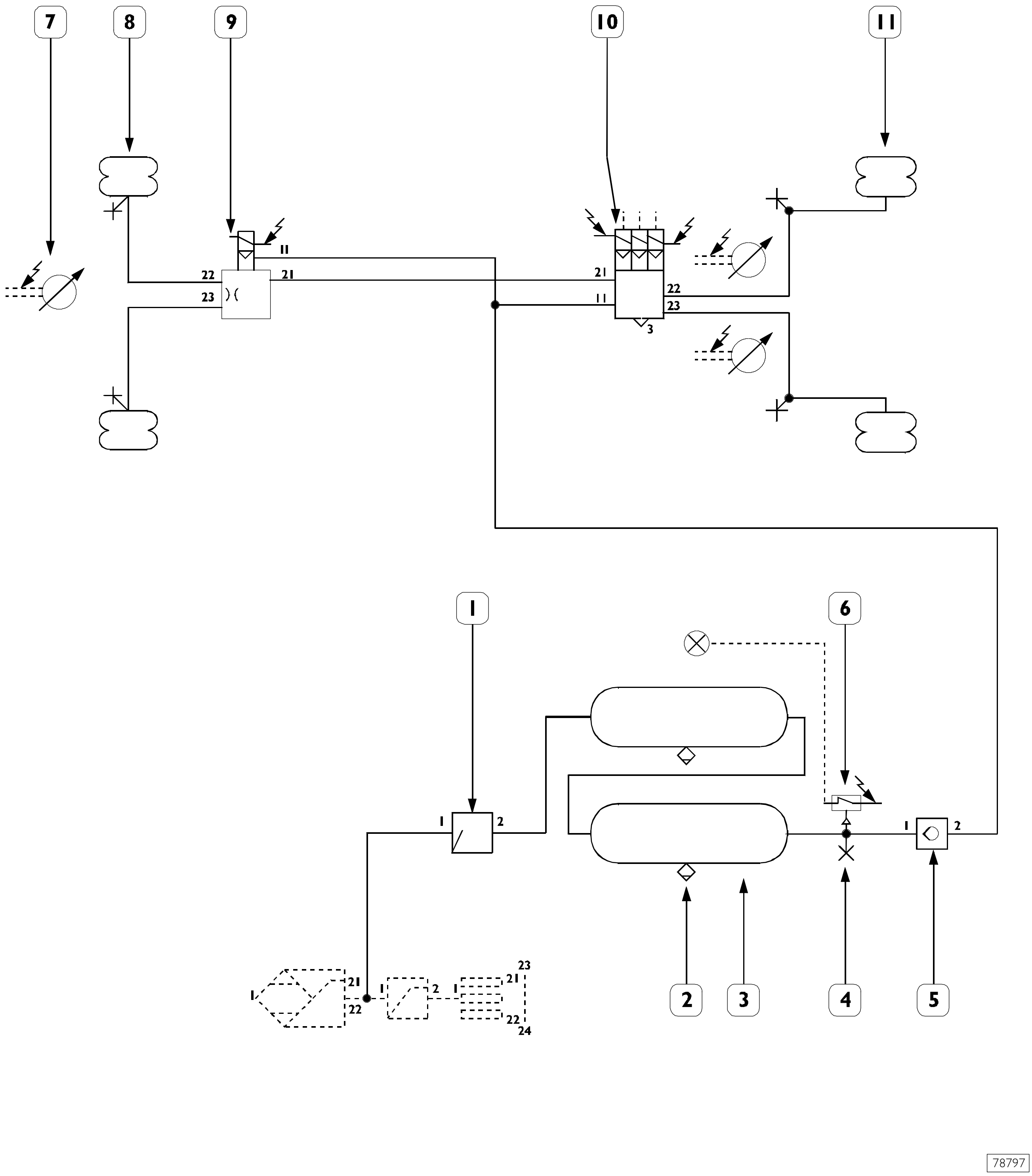


62390

1. Air intake valve with limited return – 2. Manual condensate drain valve – 3. Air tank – 4. Pressure control intake – 5. Check valve – 6. Low pressure indicator – 7. Electro–pneumatic distributor – 8. Electronic leveling valve – 9. Rear axle air spring

Principle layout for FULL pneumatic suspensions

Figure 5



1. Air intake valve with limited return – 2. Manual condensate drain valve – 3. Air tank – 4. Pressure control intake – 5. Check valve – 6. Low pressure indicator – 7. Electronic leveling valve – 8. Front axle air spring – 9. Front axle electro–pneumatic distributor – 10. Rear axle electro–pneumatic distributor –11. Rear axle air spring

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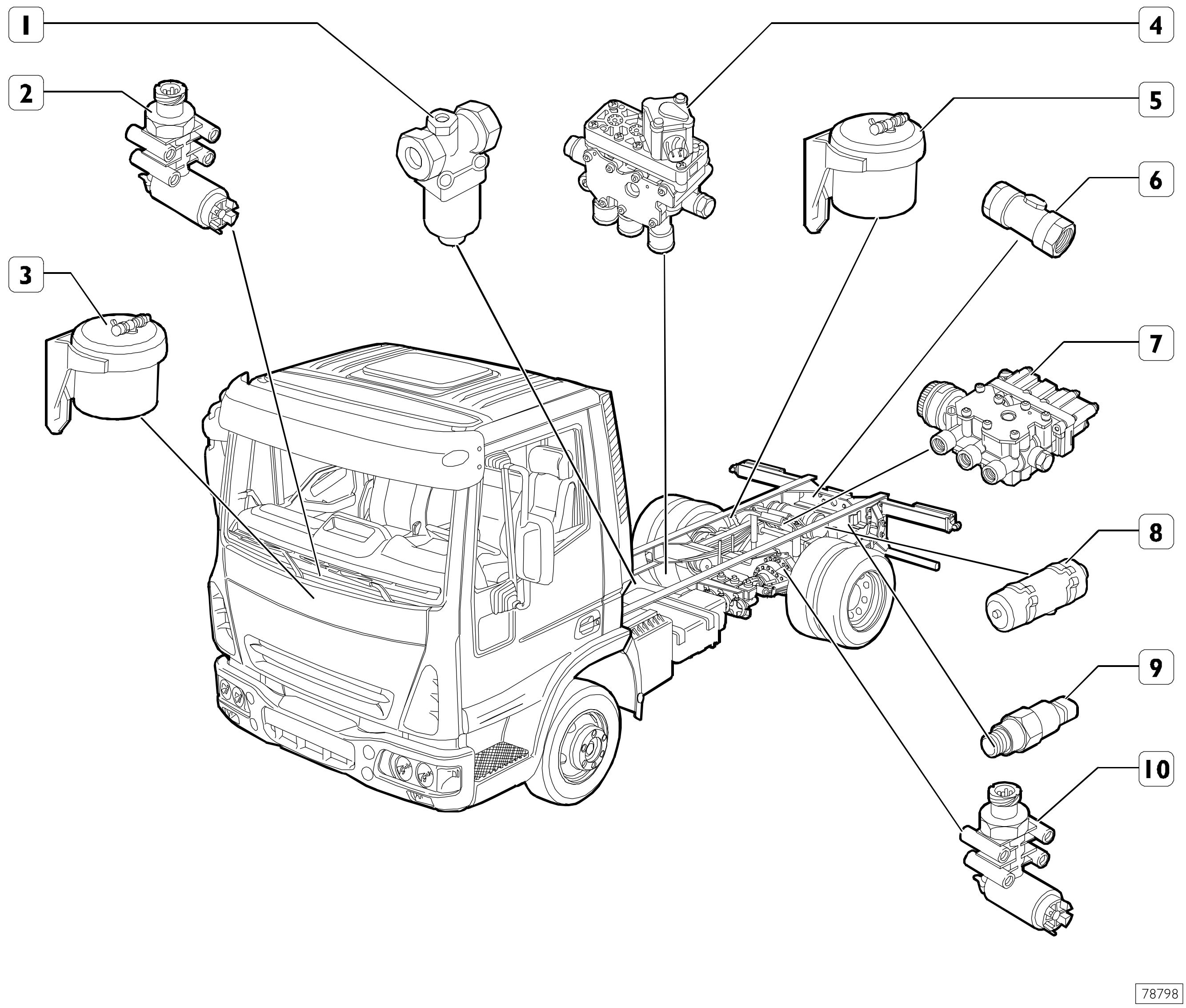
MAIN COMPONENTS ARRANGEMENT ON VEHICLE

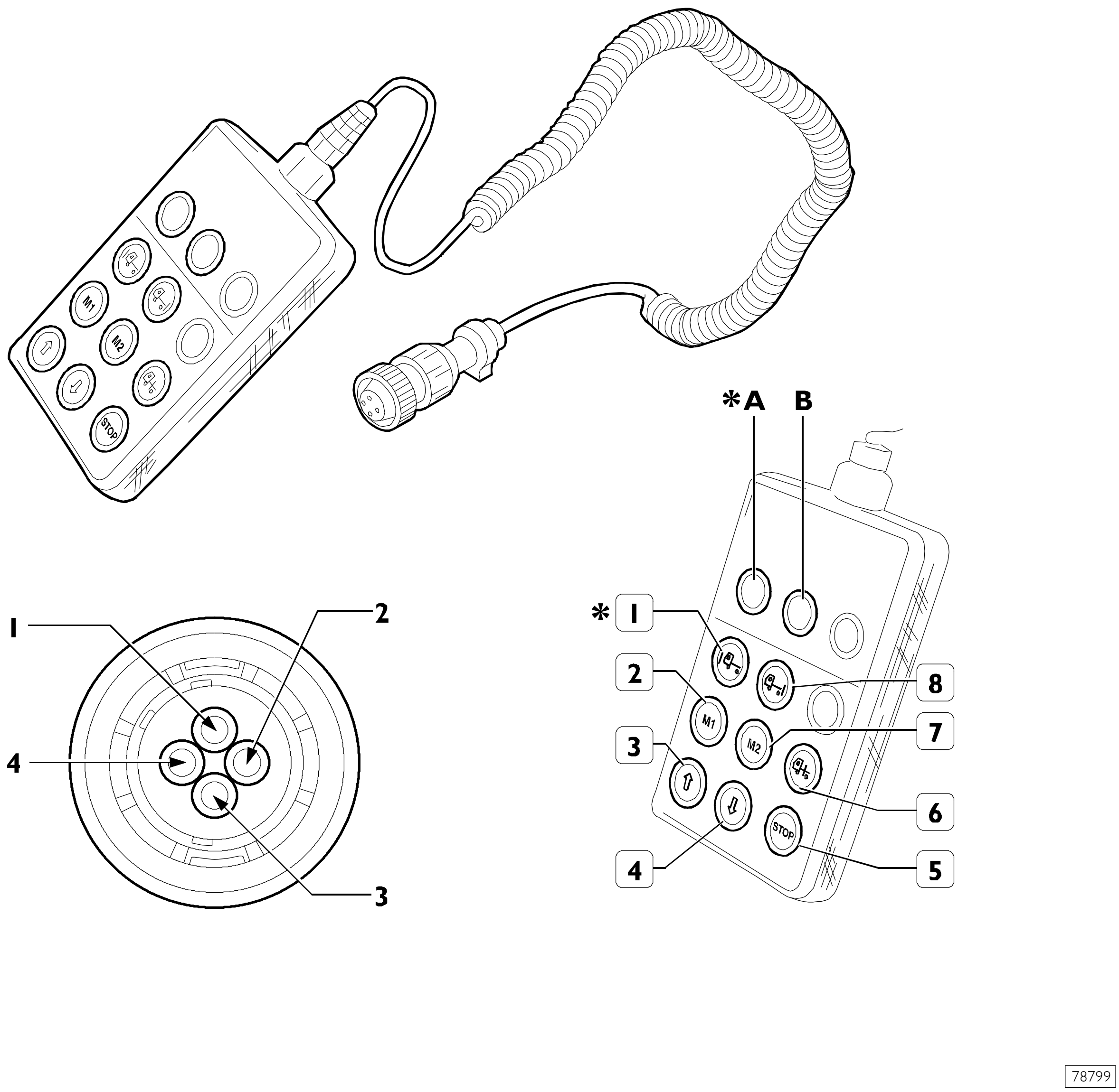
Figure 6



1. Controlled–pressure valve – 2. Front axle level sensor – 3. Front air spring – 4. Front axle electro–pneumatic distributor – 5. Rear air spring – 6. Check valve – 7. Rear electro–pneumatic distributor – 8. Tank – 9. Pressure control intake – 10. Rear axle level sensor

CHASSIS LIFTING, LOWERING AND SELF–LEVELING
Remote control

Figure 7



The traditional controls beside the driving place have been replaced by a remote control placed on the left side of the driving place.
This device allows managing the different chassis attitude functions.
Being of the removable type, it allows performing all selections both from the driving place and from ground.
It is composed of a set of selection push–buttons and of two signalling warning lights in the following order:
A) Green–coloured warning light for front axle selection *
B) Green–coloured warning light for rear axle selection

1) Front axle selection *
2) Memory level "1"
3) Chassis lifting
4) Chassis lowering
5) STOP
6) Chassis leveling
7) Memory level "2"
8) Rear axle selection

The remote control is connected to the system through a 4–pole connector:

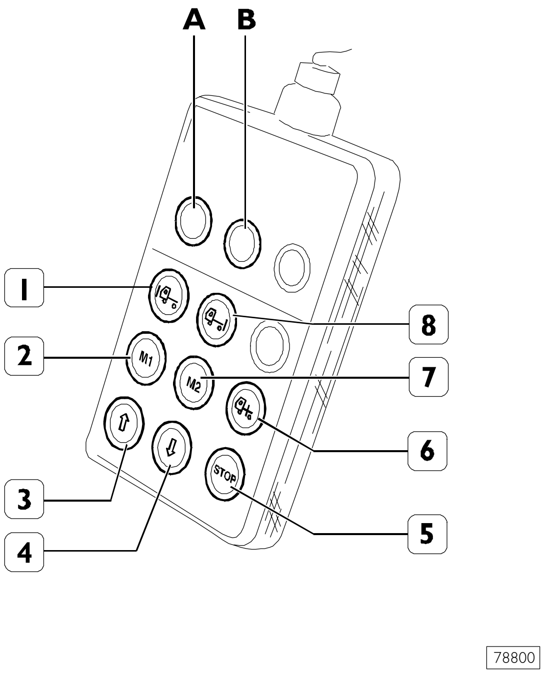
Pin 1 Supply positive
Pin 2 Negative
Pin 3 Communication line with unit
Pin 4 Communication line with unit

For the use of remote control, see chapter "Description and Functioning".
*Only for vehicles "Full pneumatic".

REMOTE CONTROL DESCRIPTION AND OPERATION

Chassis lifting/lowering

Figure 8



This operation can be activated ONLY below 20 km/h.

When such speed is exceeded, the set attitude will be kept constant.

In order to lift/lower the chassis, operate as follows:

- ❑ Press push–button (1) and/or (8) to select the desired axle; simultaneously, the related warning light ”A” and/or ”B” will turn on
- ❑ Press push–button (3) or (4) till the desired level is reached.

When push–button (3) or (4) is released, all solenoid valves will be de–energised and taken back to rest/maintenance conditions.

During this operation, the turned–on yellow–coloured warning light placed on the dashboard will signal the out–of–attitude condition to the driver.

This condition and the related signal will be kept also when disconnecting and connecting the key switch.

The maximum lifting limit is adjusted by level sensors as function of calibration set by the unit.

NOTE The push–button description is referred to FP vehicles remote control.

Chassis self–leveling

This operation can be activated at any speed.

In order to level the chassis, operate as follows:

- ❑ Press push–button (1 or 8, Figure 8) to select an axle; simultaneously, the related warning light ”A” and/or ”B” will turn on
- ❑ Press push–button (6, Figure 8).

By recalling this operation, the turned–on yellow–coloured warning light placed on the dashboard will signal the performed leveling to the driver.

This condition and the related signal will be kept also when disconnecting and connecting the key switch.

Above 20 km/h, if the self–leveling key has not been pressed, the unit will automatically take care of re–establishing the chassis level.

”M 1” – ”M 2” level

The system provides the chance of storing two further attitude levels ”M1” and ”M2” depending on its own needs.

These two positions can be recalled ONLY at a speed lower than 20 km/h.

In order to activate them, proceed as follows:

- ❑ Press push–button (1 or 8, Figure 8) to select an axle; simultaneously, the related warning light ”A” and/or ”B” will turn on
- ❑ Press push–button (3 or 4, Figure 8).

By recalling this operation, the turned–on yellow–coloured warning light placed on the dashboard will signal the out–of–attitude condition to the driver.

In order to store ”M1” and ”M2” levels, proceed as follows:

- ❑ Press push–button (1, Figure 8) to select the front axle; simultaneously, the related warning light ”A” will turn on
- ❑ Press push–button (3 or 4, Figure 8) till the desired level is reached
- ❑ REPEAT THE SAME OPERATIONS FOR REAR AXLE
- ❑ Press push–button (5, Figure 8) and keep it pressed
- ❑ Press push–button (2 or 7, Figure 8)
- ❑ Release push–button (2 or 7, Figure 8) and afterwards push–button (5, Figure 8).

NOTE In case of emergency, press push–button (5, Figure 8) to stop level operations.

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DIAGNOSTICS

Main pneumatic suspensions operating anomalies:

1 – Scarce or irregular pneumatic system recharge;
2 – Irregular vehicle attitude;
3 – Turned–on chassis misalignment warning light at a speed greater than 20 km/h.

1 SCARCE OR IRREGULAR PNEUMATIC SYSTEM RECHARGE

Leakages or breakages in pneumatic system pipings – YES → Close or replace loosened or damaged fittings. Replace broken or damaged pipings.

NO ↓

Inefficient air compressor operation. – YES → Revise or replace the air compressor.

NO ↓

Inefficient operation of pressure regulator embedded into A.P.U. – YES → Replace the A.P.U.

NO ↓

Inefficient controlled–pressure valve operation. – YES → Replace the controlled–pressure valve.

2 IRREGULAR VEHICLE ATTITUDE

Leakages or breakages in pneumatic system pipings – YES → Close or replace loosened or damaged fittings. Replace broken or damaged pipings.

NO ↓

Wrong pneumatic and/or electric connections. – YES → Locate the wrong connections and restore them.

(continued)

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Inefficient level sensor operation. — YES → Adjust the tie–rods and if necessary replace the level sensor.

NO ↓

Inefficient electro–pneumatic distributor operation. — YES → Replace the electro–pneumatic distributor.

NO ↓

Inefficient electronic unit operation. — YES → Replace the electronic unit.

3	**TURNED–ON CHASSIS MISALIGNMENT WARNING LIGHT AT A SPEED GREATER THAN 20 KM/H**

Leakages or breakages in pneumatic system pipings — YES → Close or replace loosened or damaged fittings. Replace broken or damaged pipings.

NO ↓

Damaged electric connections. — YES → Restore electric wirings.

NO ↓

Inefficient remote control operation. — YES → Replace the remote control.

NO ↓

Inefficient sensor operation. — YES → Adjust the tie–rods and if necessary replace the level sensor.

NO ↓

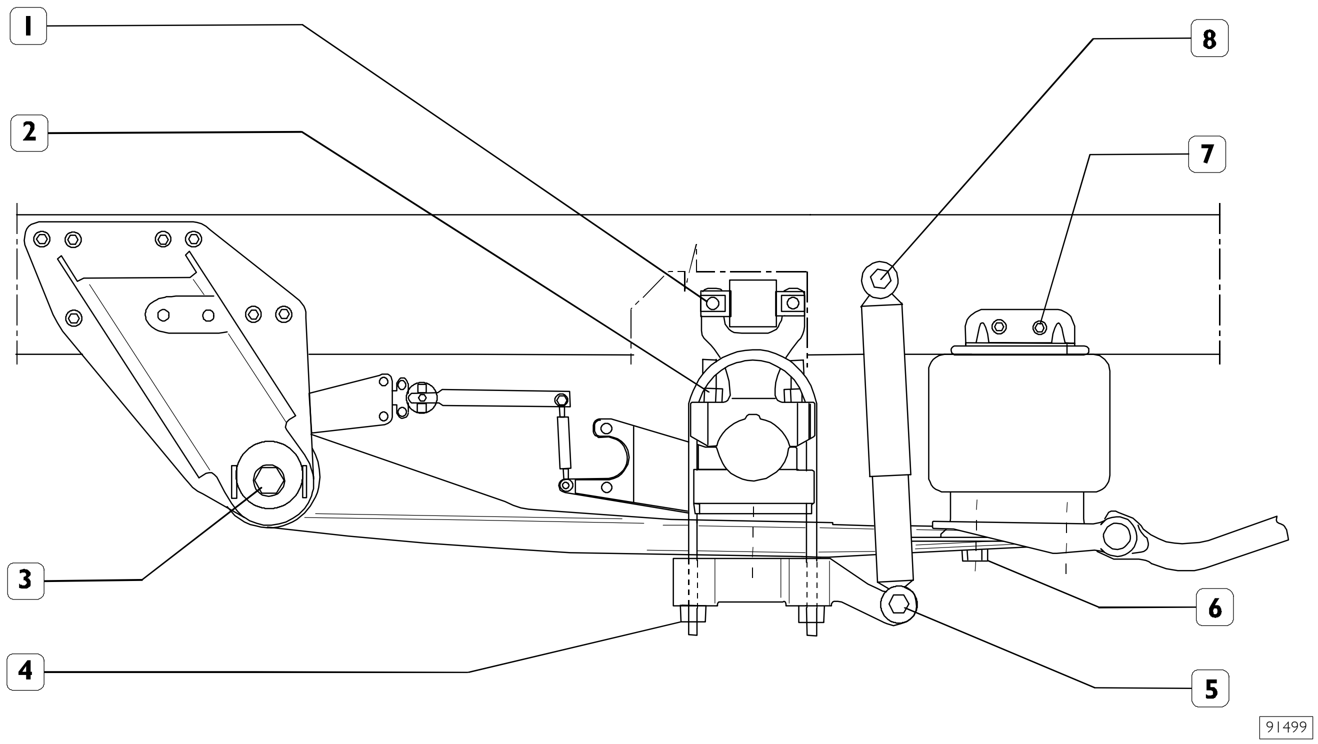
Inefficient electronic unit operation. — YES → Replace the electronic unit.

TIGHTENING TORQUES

PART	TORQUE	
	Nm	kgm
Front pneumatic suspension		
Nut for securing spring bracket	116.5 ± 16.5	(11.8 ± 1.6)
Screw for securing leaf spring to shackle	220 ± 20	(22.4 ± 2)
Nut for elastic small block securing screw	18 ± 2	(1.8 ± 0.2)
Neway type Rear pneumatic suspension		
Nut for securing air spring to chassis	92 ± 2	(9.3 ± 0.9)
Screw for securing connection cross–member to oscillating arms support	121 ± 12	(12.3 ± 1.2)

HENDRICKSON type rear pneumatic suspension

Figure 9



	PART		TORQUE	
			Nm	kgm
1	Fastener to secure the connection to upper fork	Nut Screw	206.5 ± 20.5 226.5 ± 22.5	20.6 ± 2 22.6 ± 2.2
2	Fastener to secure the connection to lower fork	Nut Screw	311 ± 31 382 ± 38	31 ± 3 38 ± 3.8
3	Fastener to secure support arm to suspension support		772.5 ± 77.5	77 ± 7.7
4	Bracket fastener		445 ± 45	44.5 ± 4.5
5	Shock absorber lower fastener	Nut Screw	157 ± 16 193.5 ± 19.5	15.7 ± 1.6 19 ± 1.9
6	Lower air spring fastener		50 ± 5	5 ± 0.5
7	Upper air spring fastener	Nut Screw	92 ± 11 112.5 ± 11.5	9 ± 1 11 ± 1.1
8	Shock absorber upper fastener	Nut Screw	157 ± 16 193.5 ± 19.5	15.7 ± 1.6 19 ± 1.9

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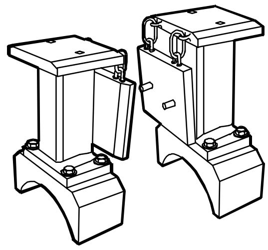
TOOLS

TOOLS No.		DENOMINATION
99346249		Reference pads for ECAS suspensions calibration

SPECIFICATIONS AND DATA

Pneumatic system

DENOMINATION	
Controlled–pressure valve	
❑ Type: MARELLI WABCO 434 100 232 0 – KNORR DR 4248	
Opening pressure	8.5 bar
Air tanks	
Front suspension	15 liters
Rear suspension	15 liters
Level sensors	
❑ Type: WABCO 441 050 012 0	
supply voltage	8 to 16V pulse
current absorption	max 90 mA
operating temperature	–40 °C to + 80 °C
Electro–pneumatic distributor	
❑ Type: WABCO 472 880 001 0 (for rear axle on versions P and FP) WABCO 472 880 020 0 (for front axle on versions FP)	
operating temperature	–40 °C to + 80 °C
operating (supply) pressure	5 to 13 bars
max dynamic pressure (outlet control)	20 bars
supply voltage	24 V
Check valve	
❑ Type: WABCO WESTINGHOUSE 434 014 000 0 – FERNA F100718	
operating pressure	max 20 bar
operating temperature	–40 °C to + 80 °C
Pressure control intake	
❑ Type: RAUFOSS 623.7776 – SIRT VFM 1615 – WABCO 463.703.114.0	
operating temperature	–40 °C to + 80 °C
Electronic unit	
❑ Type: WABCO	
supply voltage	18 to 32 V
operating temperature	–40 to 70 °C
Low pressure manometric switch	
❑ Type: TDS F13016	
Working voltage	0,001 to 1A
Electric load allowed	
Maximum working pressure	

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FRONT LEAF SPRING
(MODELS ML 80E18FP/21FP – ML90E18FP/21FP – ML 100E18FP/21FP)

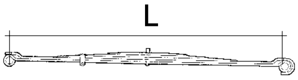
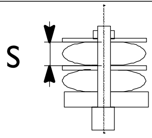
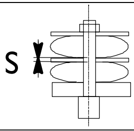
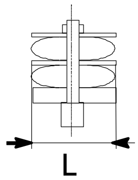
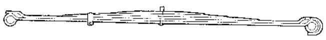
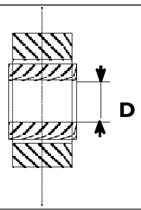
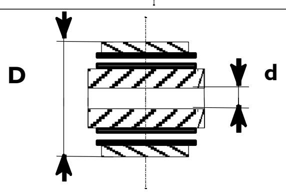
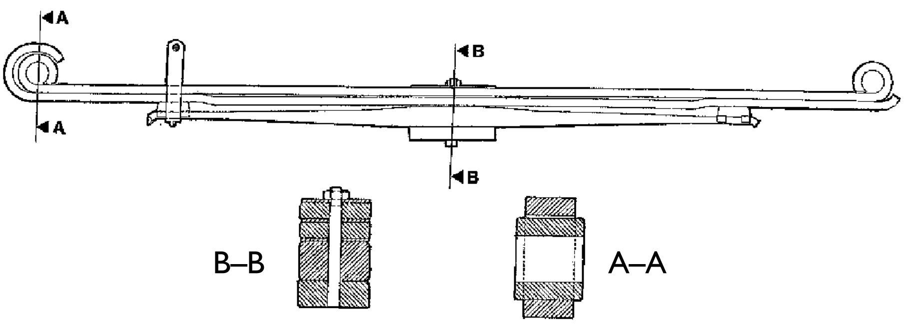
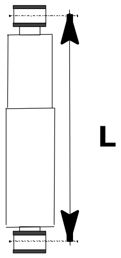
		mm
	Parabolic	N° 2
	Mother leaf and 2nd leaf length (measured at eyelet center)	1714 ± 3
	Main leaf thickness (measured in center) 1st leaf thickness 2nd leaf thickness	 29 21
	Thickness between leafs	3
	Leaf width	70
	CONTROL DATA WITH NEW SPRING: Static load set Static load flexibility	 55 13.84 mm/kN
	Internal master leaf eyelet diameter (bush seat)	$45.5\ ^{+0.1}_{-0}$
	D = external bush diameter d = internal bush diameter	$45.5\ ^{+0.27}_{-0}$ $16.5\ ^{+0.2}_{-0}$

Figure 10

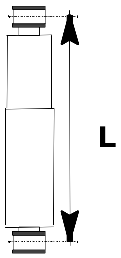
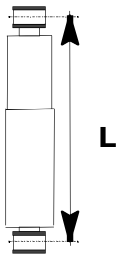


33722

Front shock absorbers

SHOCK ABSORBERS		FICHTEL & SACHS
 	Length between eyelet centers Open (mm) Closed (mm) Stroke (mm)	 650 ± 3 430 ± 3 220

Rear shock absorbers

SHOCK ABSORBERS		FICHTEL & SACHS
 ❑ for NEWAY type suspensions	Length between eyelet centers Open (mm) Closed (mm) Stroke (mm)	 617.2 ± 3 386.8 ± 3 230.4
 ❑ for HENDRICKSON type suspensions	Length between eyelet centers Open (mm) Closed (mm) Stroke (mm)	HENDRICKSON 666 ± 3 410.5 ± 3 255.5

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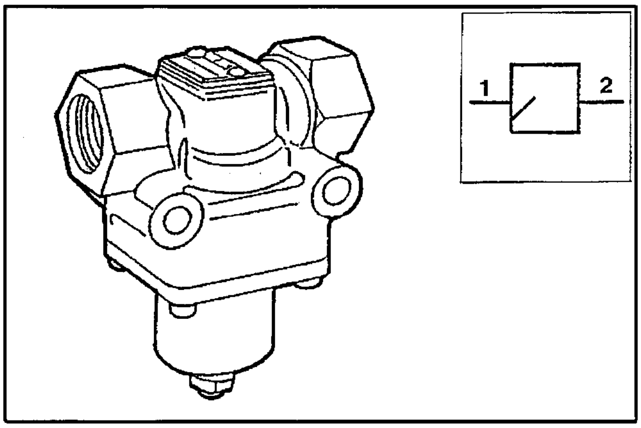
MAIN PNEUMATIC SYSTEM COMPONENTS

Controlled–pressure valve

Figure 11



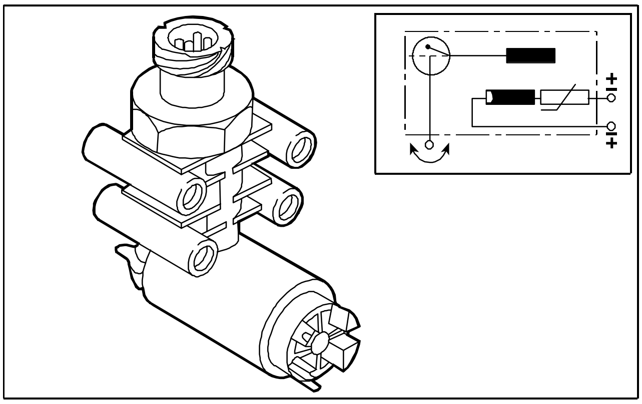
20437

The valve is of the type with limited return and performs two functions:

- It stops the tank supplying compressed air flow when in the tanks the pressure drops below a certain value (calibration) following a failure or excessive withdrawals.
- It supplies these tanks as soon as the braking system reaches a value that ensures a perfect efficiency in brake application.

Level sensor

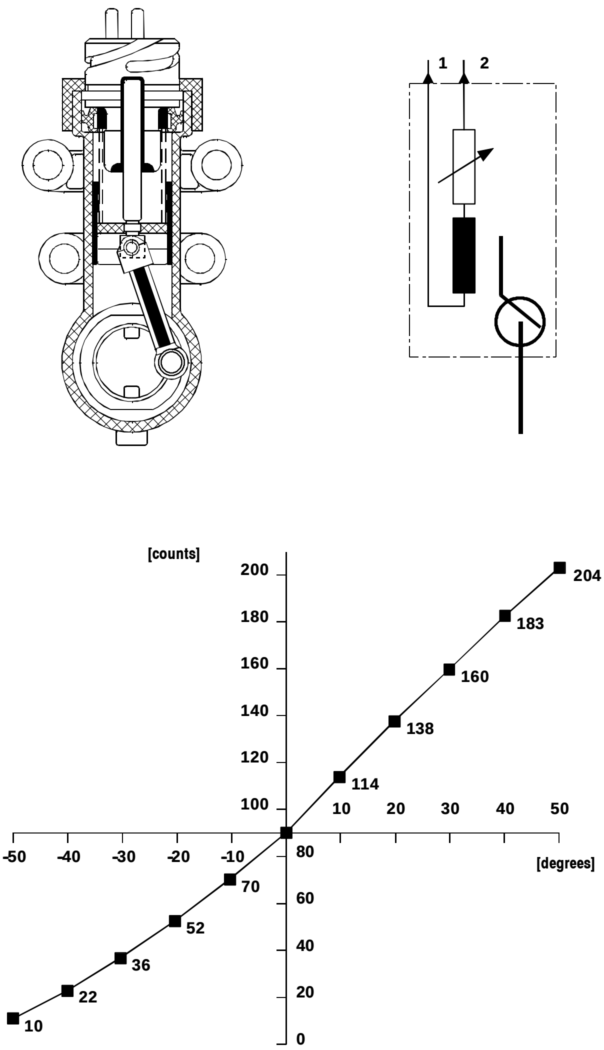
Figure 12



62421

The level sensor is composed of a coil fixed to the chassis and of a small piston.
Through an eccentric and a lever connected to the axle, upon every height variation, the small piston is moved inside the coil modifying the inductance.
These variations will be used by the electronic unit to be able to intervene in the different working stages of the system.
The sensor connection lever **has a fixed measure that cannot be adjusted.**

Figure 13

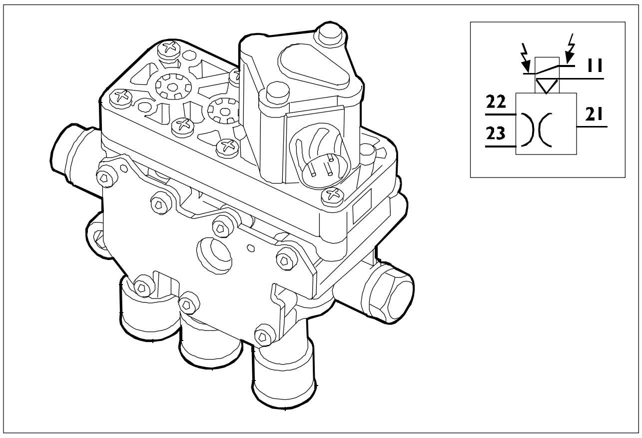


Rated characteristic curve of the sensor as function of angular lever displacement.

62422

Front axle electro–pneumatic distributor for 4 x 2 FP vehicles

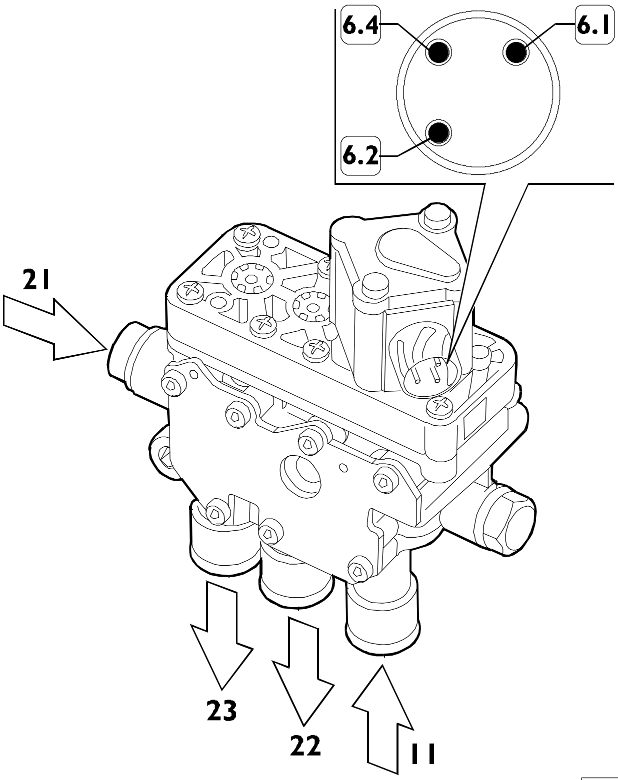
Figure 14



78802

This component is composed of a control solenoid valve and of two pneumatic distributors for managing both front axle sides.
In order to avoid pressure transfers between air springs and consequently to stabilize the front axle, a calibrated hole is present on internal connection between the two outputs.
The electro–pneumatic distributor is connected to the system through a 3–pole connector.

Figure 15



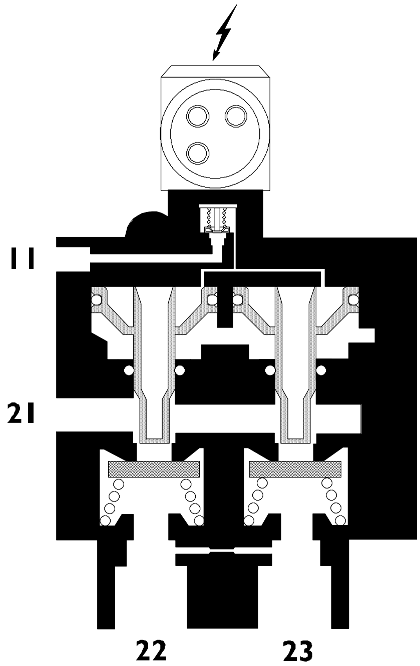
78803

Pneumatic connections
11 – from air tank
21 – from rear axle electro–pneumatic distributor
22 – to air spring on right side
23 – to air spring on left side

Electric connections
6.1 – Solenoid valve supply positive
6.2 – Negative
6.4 – —

Operation

Figure 16



78804

Front axle lifting

The unit energises the solenoid valve to supply the distributors, through the air duct (11) from the tank and energises solenoid valve "A" (Figure 19) of the rear axle electro–pneumatic distributor to supply the first distributor, that closes the exhaust to the atmosphere (3, Figure 19) and opens the air inlet (11, Figure 19) from the tank.

In this way, air coming from the duct (21, Figure 19) to duct (21) supplies the front axle air springs through ducts (22 and 23).

Front axle lowering

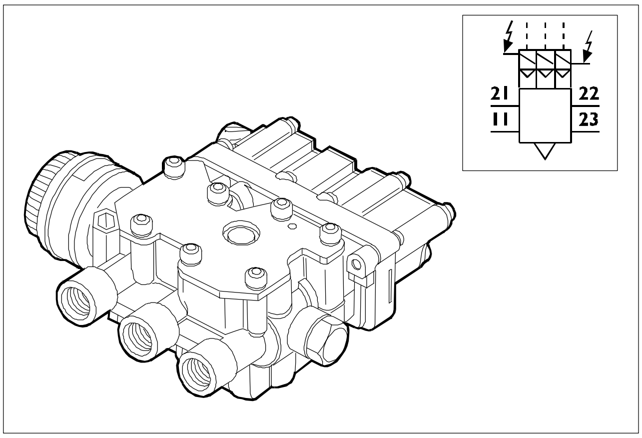
In this case the unit, by energising the solenoid valve supplying the distributor, allows the air exhaust from air springs to the atmosphere from duct (21) to duct (21, Figure 19) and opens the air inlet (3, Figure 19) that is open since solenoid valve "A" (Figure 19) of the rear axle electro–pneumatic distributor is de–energised.

Self–leveling

The unit, depending on level sensors position, will suitably control the front axle electro–pneumatic distributor solenoid valve and the rear axle electro–pneumatic distributor solenoid valves to perform lifting or lowering steps till vehicle leveling or "M1" or "M2" stored positions are reached.

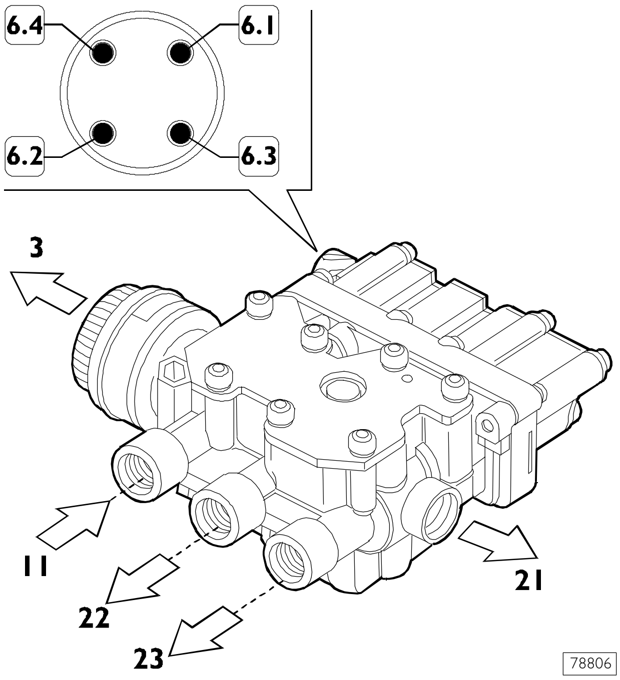
Rear axle electropneumatic distributor for 4 x 2 P/FP vehicles

Figure 17



This component is composed of 3 control solenoid valves "A", "B", "C" and of as many pneumatic distributors.
Task of solenoid valve "A" is managing supply/discharge distributor.
Task of solenoid valve "B" is managing chassis attitude distributor on right side.
Task of solenoid valve "C" is managing chassis attitude distributor on left side.
The distributor is connected to the system through a 4–pole connector.

Figure 18



Pneumatic connections

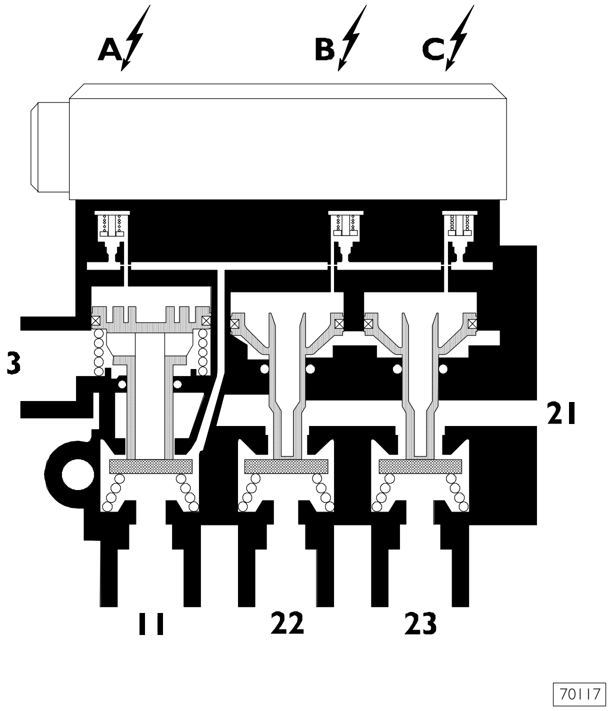
11 – from air tank
21 – to front axle electro–pneumatic distributor
22 – to air spring on right side
23 – to air spring on left side

Electric connections

Pin 1 – Solenoid valve "A" supply positive
Pin 2 – Solenoid valve "B" supply positive
Pin 3 – Solenoid valve "C" supply positive
Pin 4 – Common negative

Operation

Figure 19



Rear axle lifting

The unit energises solenoid valve "A" to supply the first distributor, that closes the exhaust to the atmosphere (3) and opens the air inlet (11) from the tank.
Afterwards, the unit energises solenoid valves "B" and "C" to supply the second and the third distributor and to thereby allow supplying rear axle air springs through ducts (22 and 23).

NOTE **4x2 P vehicles**

Duct (21) is plugged.

4x2 FP vehicles

Duct (21) is in connection with duct (21, Figure 16) of front axle electropneumatic distributor for airsprings supply.

Rear axle lowering

In this case the unit energises solenoid valves "B" and "C" to supply the second and the third distributor, allowing the air exhaust from air springs to the atmosphere from exhaust (3) that is open since solenoid valve "A" is de–energised.

Self–leveling

The unit, depending on level sensors position, will suitably control solenoid valves "A", "B" and/or "C" to perform lifting or lowering steps till vehicle leveling or "M1" or "M2" stored positions are reached.

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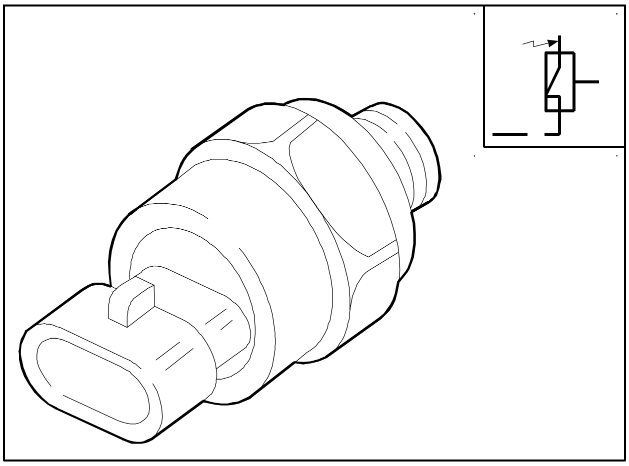
MANOMETRIC LOW AIR PRESSURE SWITCH

Figure 20

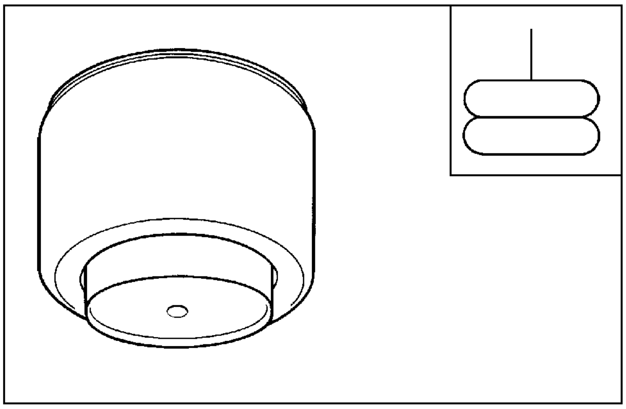


52723

The manometric switch is placed next to service air tank, on delivery piping for pneumatic suspensions.

5007 AIR SPRINGS

Figure 21



30106

It is an elastic member aimed to contain pressurised air and capable of modifying its extension independently from the applied load value.

Electronic unit.

The electronic control unit allows managing the different chassis positions as function of driver requests performed with the help of the remote control switch.

By inserting the key switch, the electronic unit carries out a system test supplying for a time of about 2 seconds the yellow–coloured and red–coloured warning lights placed on the dashboard.

If an anomaly is detected, depending on its severity, the red–coloured warning light can remain fixed on or blinking, while the yellow–coloured warning light can remain on only if the vehicle is not at normal level or if a feasibility error is detected.

The unit, having to keep constant the running levels requested by the driver and at the same time reduce air consumption, cyclically checks level sensors signals intervening for a possible correction ONLY with their offset > 5 counts.

The correction will be carried out with a delay of:

D about 1 sec. with stopped vehicle

D about 60 sec. with moving vehicle.

If the level is not restored within a maximum time of 30 sec. from the beginning of the correction, the unit stores a feasibility error.

NOTE All this is valid ONLY if the vehicle is moving from at least 5 min., since the system delays every check to allow the possible pneumatic system re–charge.

When braking, the electronic unit, receiving the stop lights switch signal, stops every automatic attitude adjustment. The electronic unit, though offering the chance of a "blink code" displayed through the red–coloured failure signalling warning light for a preliminary diagnosis, is equipped with a very advanced self–diagnostic system and is able to recognise and store, depending on environmental conditions, the possible anomalies, even of the intermittent type, occurred to the system during its operation, ensuring more correct and reliable repair interventions. All interventions dealing with diagnosis, programming, failure memory deletion, etc. can be carried out using the computerized "MODUS" diagnostic station. All system components, apart from the steering system, depend from the electronic unit, through a comb connector. Pin numbering, and therefore unit type, change according to the version.

500710 FRONT PNEUMATIC SUSPENSIONS DISENGAGEMENT – RE–ENGAGEMENT

Before carrying out disengagement/re–engagement operations, disconnect battery cables.

Disengagement

Arrange the vehicle on a plane ground, lock rear wheel with wedges and proceed as follows:

- Loosen front wheels securing nuts, lift the vehicle and place it on supporting stands.
- Place hydraulic trolley 99321024 under the wheels, remove securing nuts and detach the wheels.
- Unscrew nuts (11 and 7) and detach shock absorber (8).
- On the lower vehicle side, unscrew nuts (8) and remove stands (4) recovering plate (6).
- Unscrew the nut and withdraw rear pin (9) for anchoring leaf spring (3) to support (10).
- Unscrew the nut and withdraw rear pin (2) for anchoring leaf spring (3) to chassis support (1), lower the front axle and extract the complete leaf spring.

Re–engagement

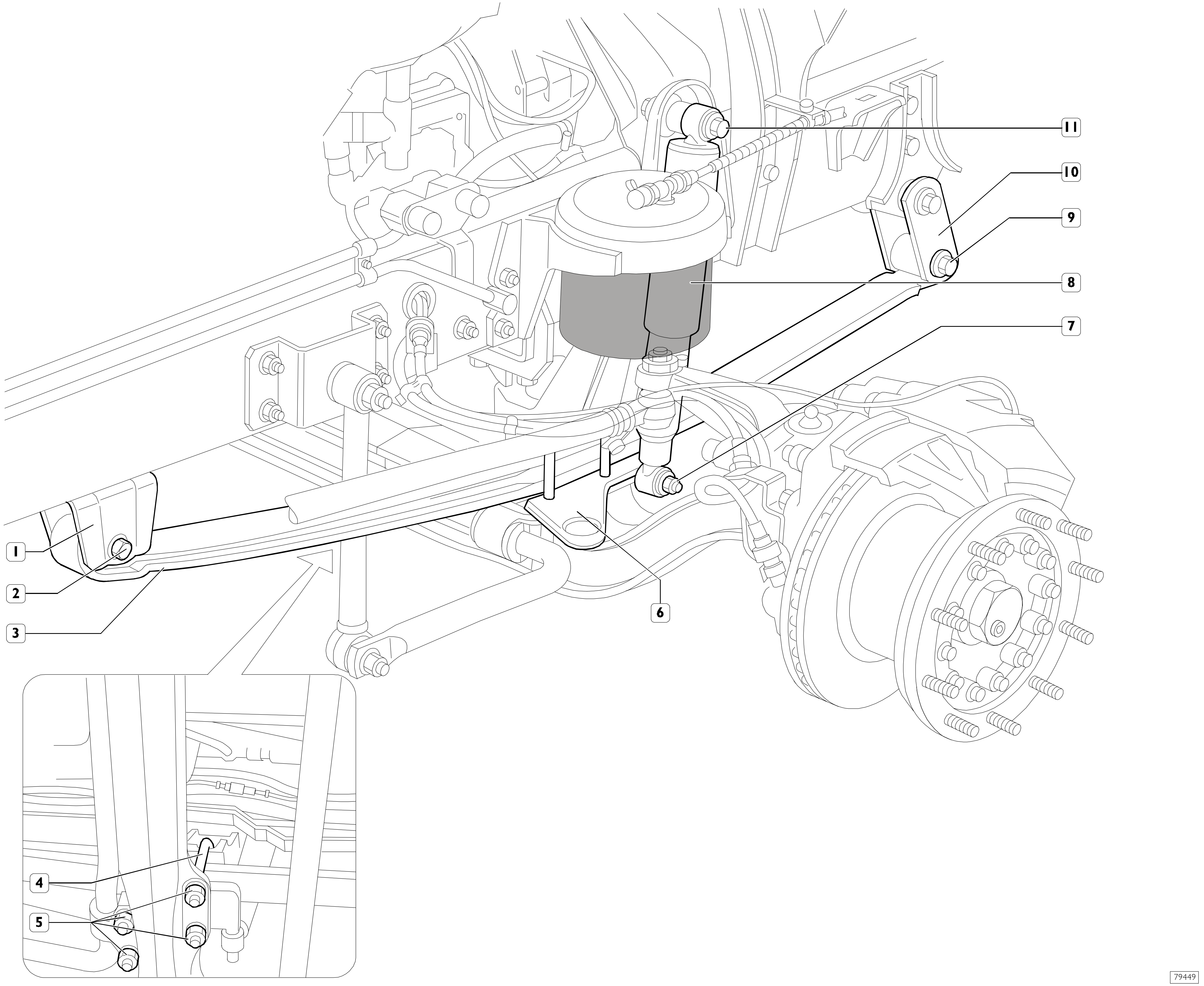
Suitably reverse the operations carried out for the disengagement and tighten at the required torque securing screws and nuts.

Self–locking nuts must always be replaced and tightened at the required torque.

Verify that:

- Check stand threading; when detecting anomalies, adjust the threading or replace them.

Figure 22



500730 NEWAY TYPE REAR PNEUMATIC SUSPENSIONS DISENGAGEMENT – RE–ENGAGEMENT

Before carrying out disengagement/re–engagement operations, disconnect battery cables.

Disengagement

Arrange the vehicle on a plane ground, lock front wheels and proceed as follows:

- ❑ Loosen rear wheels securing nuts, lift the vehicle from behind and place it on supporting stands in the marked point (⇒).
- ❑ Place hydraulic trolley 99321024 under rear wheels, remove securing nuts and detach the wheels.
- ❑ Unscrew nut (8 and 10) and disassemble shock absorber (7).
- ❑ Unscrew nut (12) for checking the air spring.
- ❑ Remove securing bolt (11) for stabilising bar.
- ❑ Unscrew nuts (5) and disconnect levelling valve tie–rod (4).
- ❑ Unscrew securing nuts (9) recovering plates (15), remove stands (14) and unscrew securing bolts for spacers (13).
- ❑ Unscrew nut (2), remove the pin and disengage suspension arm (6) from support (1).

Re–engagement

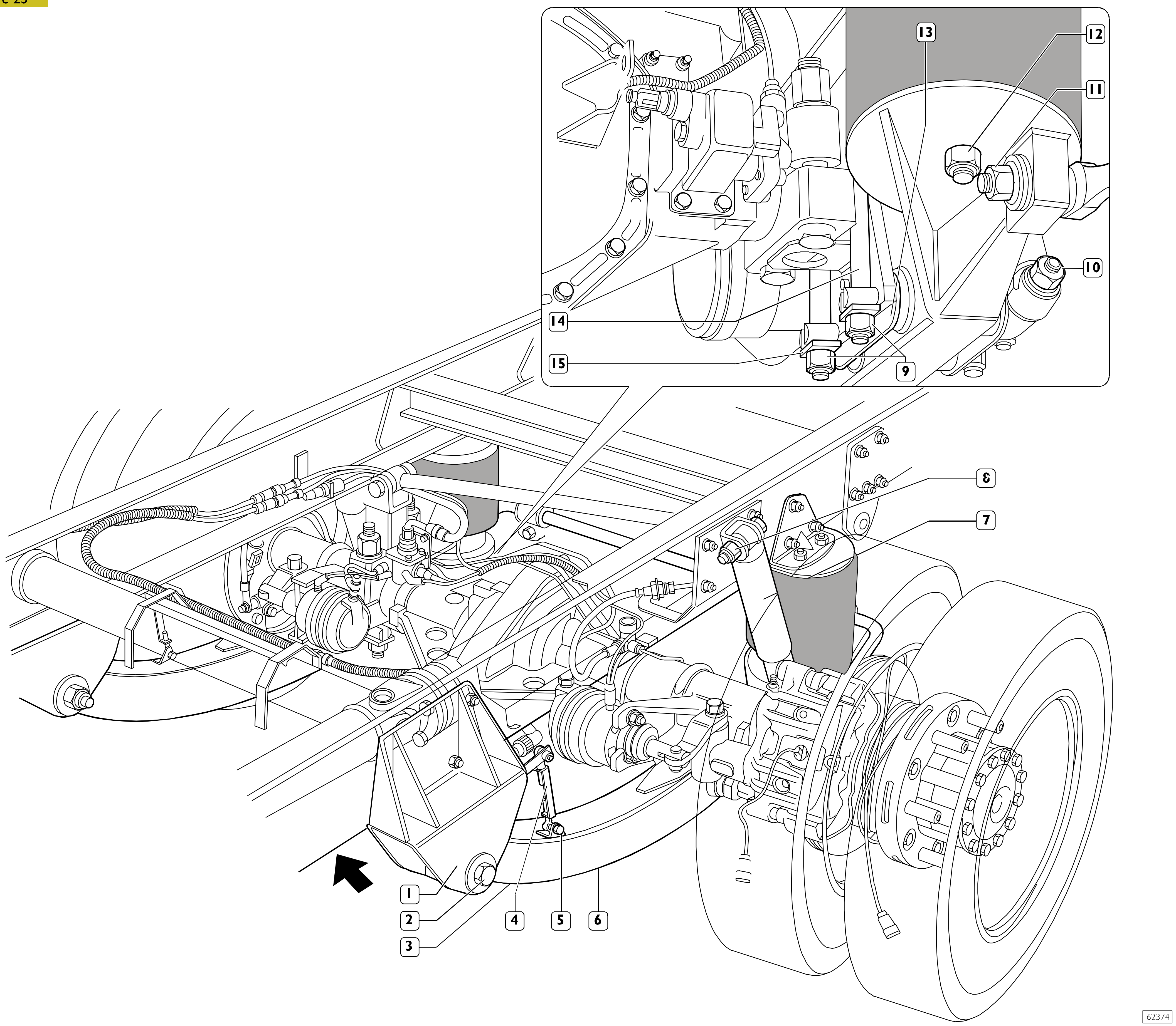
Suitably reverse the operations carried out for the disengagement and tighten at the required torque securing screws and nuts.

Self–locking nuts must always be replaced and tightened at the required torque.

Verify that:

- ❑ Check threading of stands (10); when detecting anomalies, adjust the threading or replace them.

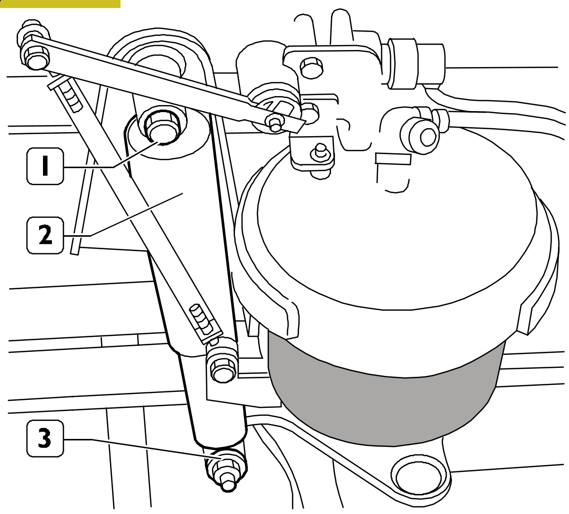
Figure 23



500910 FRONT SHOCK ABSORBERS

Disengagement

Figure 24



62379

Unscrew nuts (1 and 3) and disengage shock absorber (2).

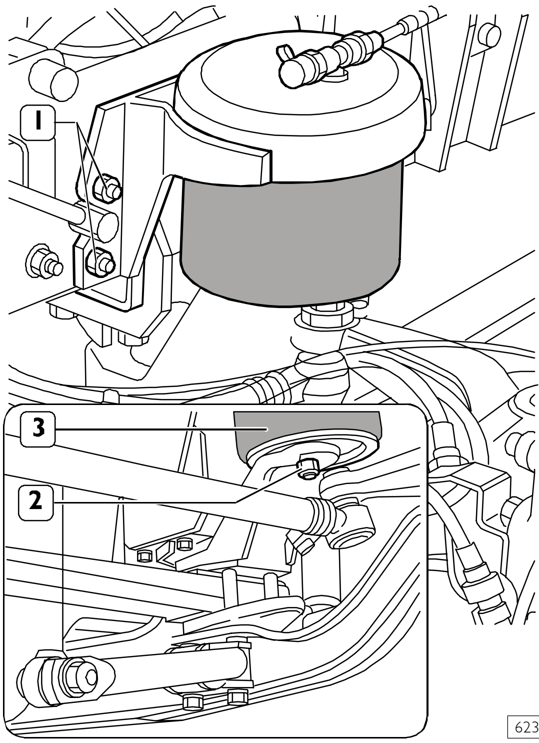
Re–engagement

For the re–engagement, reverse the operations carried out for the disengagement and comply with the required tightening torques.

500711 FRONT AIR SPRINGS

Disengagement

Figure 25



62380

Disconnect air supply piping and unscrew side nuts (1).
Unscrew nut (2) and remove air spring (3).

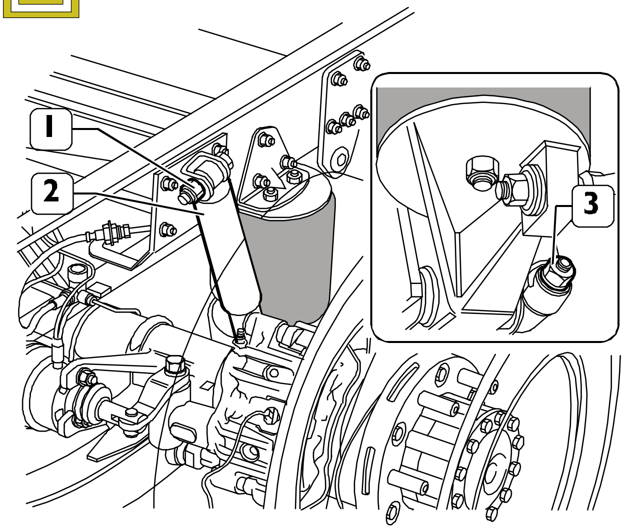
Re–engagement

For the re–engagement, reverse the operations carried out for the disengagement and comply with the required tightening torques.

500940 REAR SHOCK ABSORBERS

Disengagement

Figure 26



62375

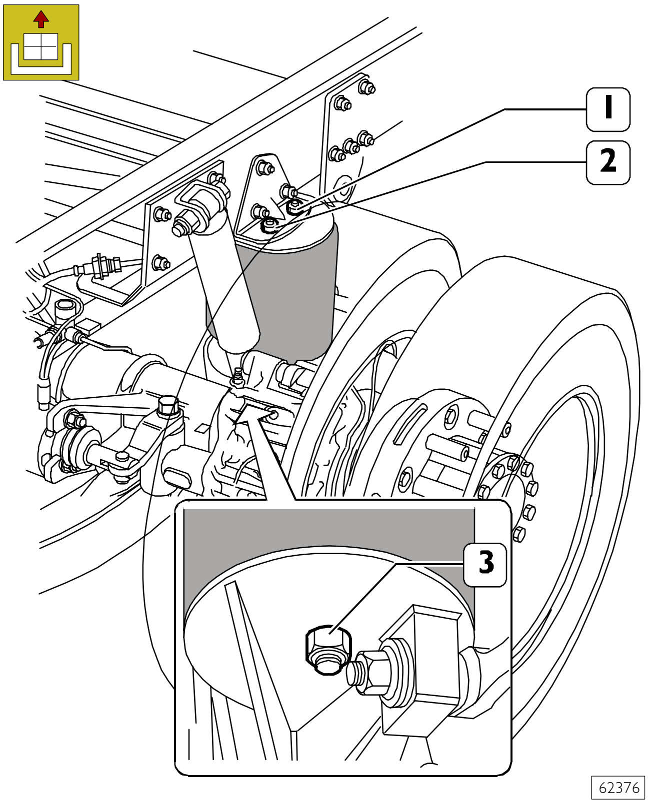
Unscrew nuts (1 and 3), remove screws and remove shock absorber (2).

Re–engagement

For the re–engagement, reverse the operations carried out for the disengagement and comply with the required tightening torques.

500731 REAR AIR SPRINGS
Disengagement

Figure 27



Disconnect air supply pipings.
Unscrew securing nuts (1 and 2).
Unscrew securing nut (3) and remove the air spring.

Re–engagement

For the re–engagement, reverse the operations carried out for the disengagement and comply with the required tightening torques.

528930 FRONT STABILISING BAR

For front stabilising bar disengagement and re–engagement, comply with the procedure described for mechanical suspensions.

528960 REAR STABILISING BAR

For rear stabilising bar disengagement and re–engagement, comply with the procedure described for mechanical suspensions.

SECTION 9

5025 Wheels and tyres

Page

DESCRIPTION

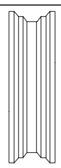
The wheel rim is the rigid wheel structure and is identified by the following dimensions:

- ❑ rim diameter, measured at the circumferential groove base (that is on the surface on which the air chamber rests);
- ❑ wheel rim circumferential groove width (that is the distance between the surfaces on which the cover rests).

The tire has the following tasks:

- ❑ absorbing the majority of bumps generated by road projections by exploiting air resiliency;
- ❑ developing on the ground the motive power supplied by the engine and necessary for the vehicle to move;
- ❑ ensuring the maximum adherence established by tire – road contact with a satisfactory life;
- ❑ supporting efforts generated by sudden brakings, by quick accelerations and by the centrifugal force thrust in a curve;
- ❑ guaranteeing vehicle stability also at high speeds; ensuring the vehicle directional power.

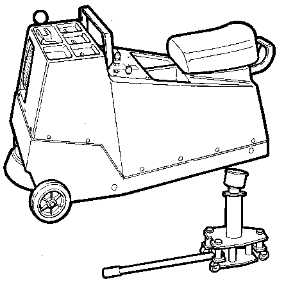
SPECIFICATIONS AND DATA

	WHEELS	TYRES
	With disk with drop center rim 17.5" x 6.00	9.5 R 17.5" 205/75 R 17.5" 215/75 R 17.5" 225/75 R 17.5"

Tire pressure values

NOTE For tire pressure checking, comply with the values stated in the specific "Use and Maintenance" booklet.

TOOLS

TOOL No.		DENOMINATION
99305037		Electronic apparatus for balancing vehicle front wheels

DIAGNOSTICS

Main tire anomalies:
1 – Excessive consumption.
2 – Irregular consumption.
3 – The vehicle tends to one side.

1	**EXCESSIVE CONSUMPTION**

Excessive speed on particularly severe grounds.	YES →	Reduce the speed.
NO ↓		
Sudden running speed variations for sudden starts or due to braking abuses.	YES →	Avoid every superfluous acceleration or braking.
NO ↓		
Excessive speed with tires with insufficient pressure.	YES →	Check pressures with cold tires.
NO ↓		
Tires at a higher pressure than the required one.	YES →	Decrease the pressures.
NO ↓		
Overloaded truck.	YES →	Refer to data related to allowed loads.

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2 IRREGULAR CONSUMPTION

Tire pressure differences between one pair of wheels and the other.

YES → Check the pressures.

NO

Insufficient tire pressure: wear is centered on the two tread sides more than in the central area.

YES → Inflate the tires.

NO

Tires inflated at a higher pressure than the required one with excessive central tread surface wear.

YES → Decrease the pressure.

NO

Insufficient front wheels toe–in: high internal tread surfaces wear.

YES → Proceed with the toe–in check and adjustment.

NO

Wrong front wheels attitude.

YES → Restore the normal wheel attitude.

NO

Wheel rim distortion with following unbalance.

YES → If possible, repair the rims or replace them; then, carry out wheel rebalancing.

NO

Wrong tire assembly on rims.

YES → Exactly assemble the tire and balance the wheel.

(continued)

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Condition		Remedy
Rear axle parallelism variation due to central pin breakage for leaf spring, or springs with different lengths or warped springs.	YES →	Revise the suspension.
NO ↓		
Excessive front wheel toe–in: excessive external tread surfaces wear	YES →	Check and adjust the toe–in.

3	THE VEHICLE TENDS TO ONE SIDE

Condition		Remedy
Unbalanced front wheels.	YES →	Proceed with the balancing.
NO ↓		
Different inflation pressure between front tires.	YES →	Check the pressures making them in compliance with the exact required value.
NO ↓		
Excessive wear difference between a pair of tires.	YES →	Replace the excessively worn tire.

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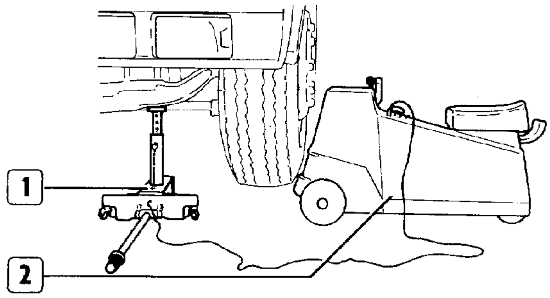
502511 STATIC WHEEL BALANCING

Figure 1

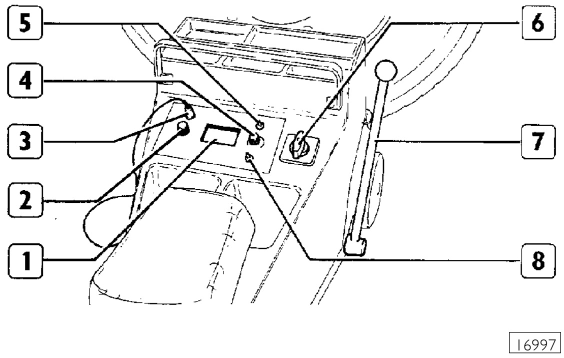


The front wheels balancing can be carried out with wheels assembled on the vehicle by using the suitable electronic balancing machine 99305037: in this way, there will be the high advantage of balancing the wheel together with the other rotating masses.

The operation must be carried out in the following way:

- ❑ Lift the front vehicle part and make sure that the wheels are freely rotating.
- ❑ Arrange the unbalance detector (1) under the front axle beside the examined wheel, placing it at such a height that the starter roller for apparatus 99305037 (2) gets in contact with the tire; under the opposite front axle side, place a support stand and lower the hydraulic jack.

Figure 2



- ❑ Connect unbalance detector cable (3) to apparatus 99305037.
- ❑ Make a reference sign onto the tire, such sign being composed of a radial track obtained with a chalk or a band of adhesive paper.
- ❑ Put switch (2) in static balancing position and sensitivity switch (4) next to notch 5 in the graduated scale.
- ❑ Insert switch (5) for instrument light (1) and switch (8) for stroboscopic lamp.
- ❑ Insert starting switch (6) for apparatus 99305037 in the first speed position in order to make the wheel rotate.

Take starting switch (6) to the second speed and push the balancing machine against the tire.
While the wheel is dragged rotating, it is detected that the stroboscopic effect on the wheel will make the reference mark appear stopped; the instrument (1) pointer, starting from the zero value, reaches a maximum value on the scale and then goes back towards zero.
When the pointer has begun moving away, move away the balancing machine, completely disconnect the starting switch (6) and brake the engine through the brake lever (7).
The wheel goes on rotating by inertia and the reference mark obtained on the tire moves; therefore, mark the point where the reference has moved.
Read on instrument (1) the value pointed to by the pointer, multiply it by 10, thereby obtaining the counterweight value to be applied to the rim.

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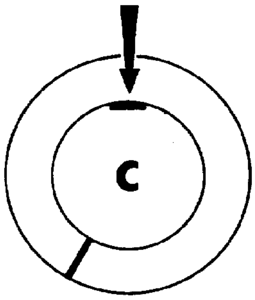
Figure 3



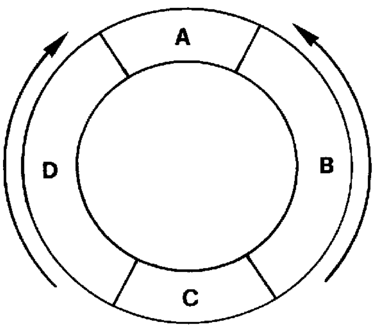
16998

Apply the thereby–computed counterweight as shown in the figure.
If, during the test, the instrument pointer (1, Figure 2) remains on the box green field, the wheel is balanced.

NOTE If the required weight for balancing the wheel is greater than 600 to 800 grams, divide by half the weight and position the two thereby–composed parts one half inside, and the other half outside the rim, paying attention that they are in the same position.

CORRECTION OF RESIDUAL STATIC UNBALANCE

Figure 4



23885

In order to correct the residual unbalance, repeat the already previously–performed operations; according to the new indication detected on the instrument (1, Figure 2), refer to the diagram in Figure 4 and operate in the following way for the adjustment:

- ❑ If the weight is in the area marked with letter A, it means that it is too light and then some weight must be added according to what is pointed to by the instrument (1, Figure 2).
- ❑ If the weight is in the lower area marked with letter C, it means that it is too heavy and then it must be decreased by what is signalled by the metering instrument.
- ❑ If the weight is in the areas marked with letters B and D, do not remove or add any weight, but rather move it by 5 cm upwards along the arrows direction, see Figure 4.

502510 TIRE PRESSURE

The tire pressure values must be checked with cold tires.
Scrupolously take care of pressure correctness, since, if it is greater than the required one, it generates running stiffness and excessive wear of the central tread surface, while if it is lower, the load is not distributed on the whole tread but is concentrated on the side parts, consuming them anticipately, and also damaging the internal tire structures.
A pressure unbalance between tires impairs vehicle driving stability and impairs running safety.
The anomalous tire wear can occur in different areas of tire tread.

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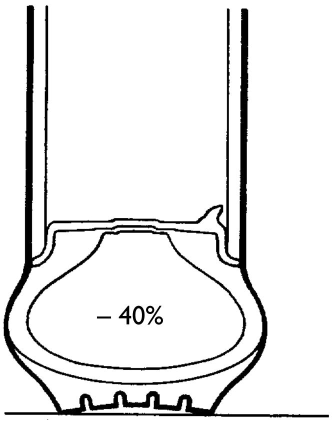
TIRE BEHAVIOUR DEPENDING ON PRESSURE

Demonstration layouts about tire behaviour and efficiency depending on pressure.

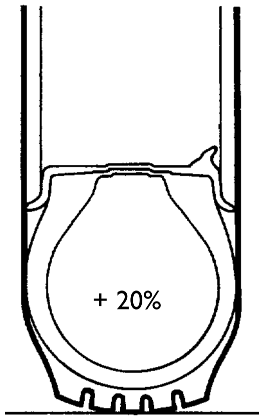
NOTE (The value placed inside every figure shows the tire pressure amount, while the efficiency is referred to the life of the tire itself.)

Figure 5



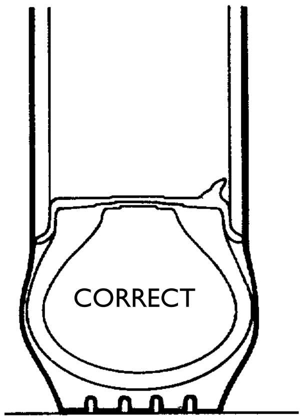
40% EFFICIENCY

Figure 6



90% EFFICIENCY

Figure 7



100% EFFICIENCY

Figure 8

It is adequate to replace the pair of tires assembled on an axle when, on the tread, following small blocks consumption, there clearly appear continuous extended bands for the whole tire width (displayed in the figures with dots).

The tires further show wear indicators A and B placed next to TWI indicator for PIRELLI tires (B) and next to MICHELIN symbol (A) for those of this second manufacturer: the replacement is mandatory in case these indicators are reached.

SECTION 10

5014 Steering system

Page

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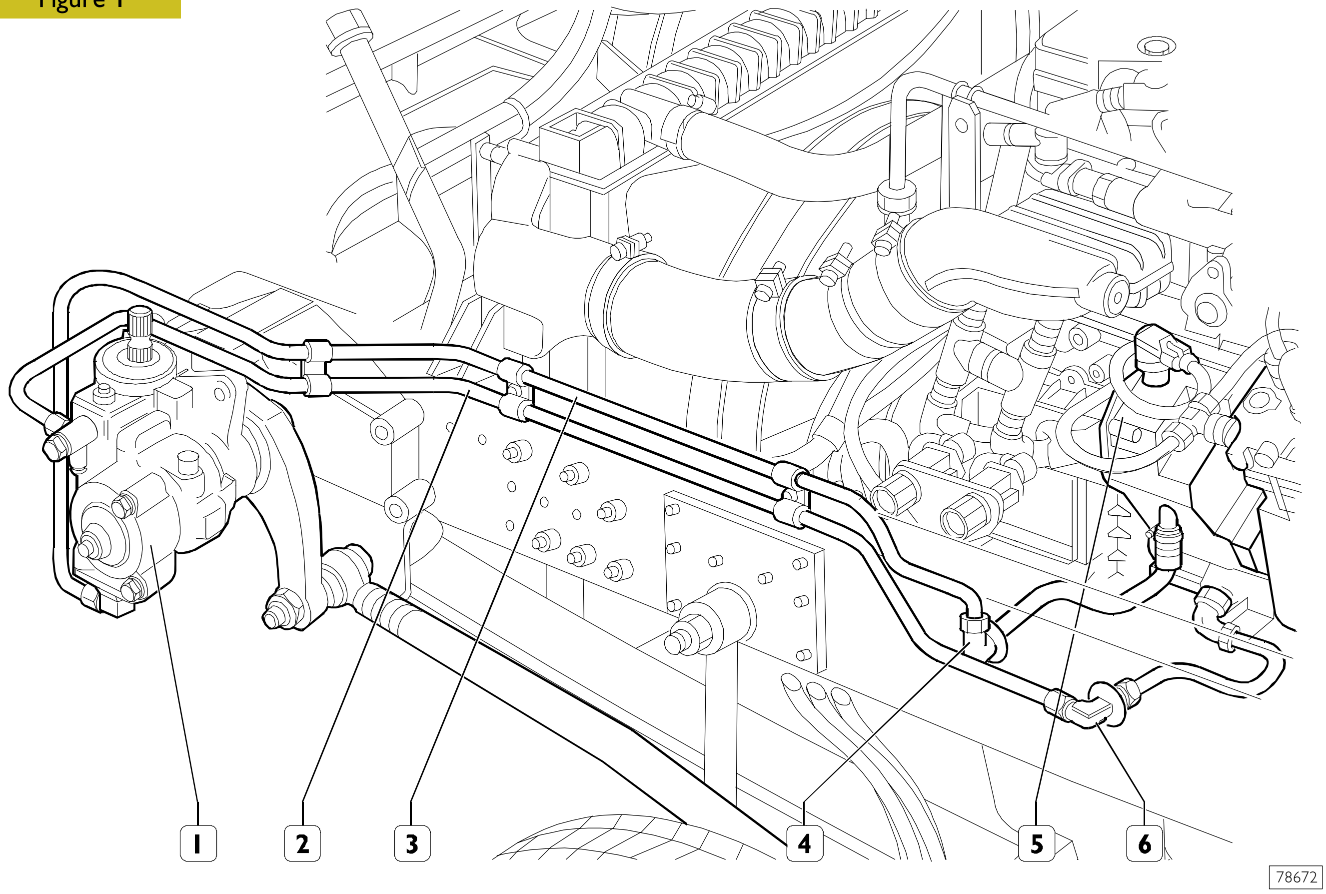
DESCRIPTION

Steering wheel control system on EuroCargo vehicles is made up of a ball circulation type hydraulic guide driven by a gear pump mounted in tandem with the air compressor.
This pump is characterised in that it has its oil tank integrated into its body.

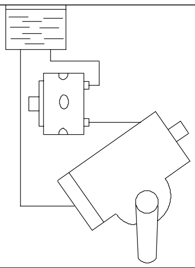
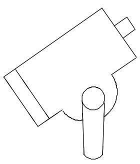
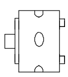
Hydraulic guide system installation view

Figure 1



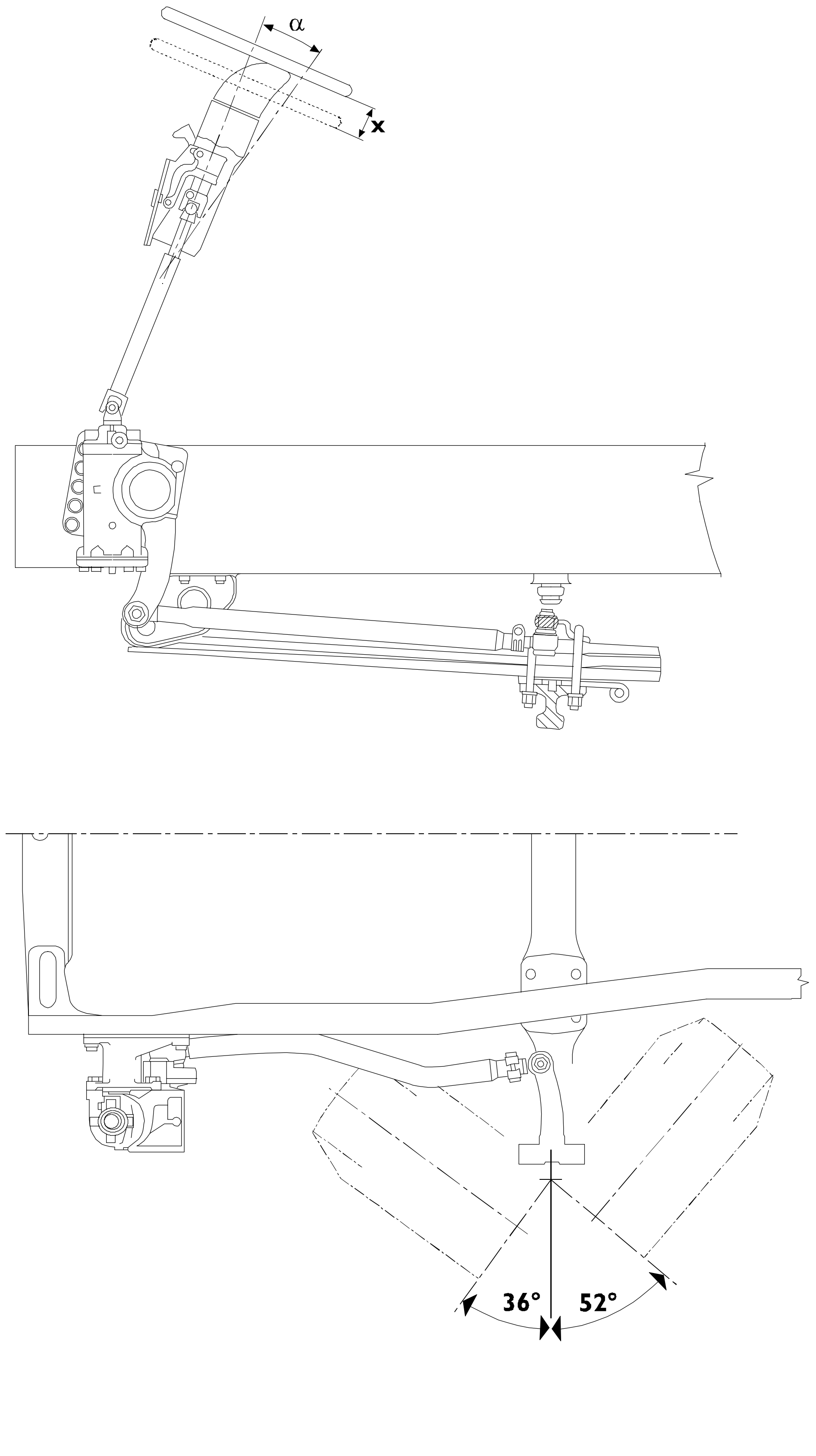
1. Hydraulic guide – 2. Delivery piping – 3. Return piping – 4. Channel fitting on return piping – 5. Power steering pump with integrated tank – 6. Channel fitting on delivery piping

SPECIFICATION AND DATA

	**Steering system**	**Hydraulic power steering**	
	Hydraulic power steering (continuous ball–type with built–in pressure relief valve)	ZF 8090	TRW TAS 30
	Variable operating pressure bar	130 + 13	140 + 10
	Reduction ratio	16.6 : 1	16.5 : 1
	Rpm/steering wheel	4	4.6
	Power steering pump with built–in tank and filter safety valve	ZF FN4 Integral	
	Minimum rpm rpm Maximum rpm rpm	600 2700	
	Operating pressure bar Capacity dm^3/min	165 (180) 16	
	Max. operating temperature	100 ° C	

STEERING WHEEL CONTROL SCHEME

Figure 2



α = angular adjusting range: 10°
x = axial adjusting range: 40 mm

DIAGNOSTIC

Main hydraulic power steering failures:

1 – Steering stiff when turning right and left;
2 – Steering stiff only when turning left or right;
3 – Steering stiff when the steering wheel is turned quickly;
4 – Hard jolts are felt at the steering wheel when steering;
5 – Steering wheel torsional vibrations;
6 – Steering wheel excessive play;
7 – Loss of fluid;
8 – Insufficient pressure in the circuit.

1	**STEERING STIFF WHEN TURNING RIGHT AND LEFT**

Cause		Remedy
Insufficient oil in the circuit	YES →	Check oil level with engine running; top up to dipstick upper notch and bleed the circuit.
NO ↓		
Air in the hydraulic circuit	YES →	Check the seal of the intake pipe and the pump shaft gasket and top up the oil. Bleed the circuit.
NO ↓		
Pressure relief valve locked or clogged	YES →	Remove the valve, wash and check that the throttle hole is not clogged.
NO ↓		
Oil pump flow rate insufficient	YES →	Replace the pump.
NO ↓		
Spider not sliding smoothly	YES →	Move the joint in both directions so that it slopes under its own weight.

2	**STEERING STIFF ONLY WHEN TURNING LEFT OR RIGHT**

Check		Action
Inefficient internal gaskets	YES →	Send the power steering to a ZF or TRW service centre.
NO ↓		
Hydraulic centre position is not correct (when the steering wheel is released it returns to an end position).	YES →	Have the power steering adjusted by a ZF or TRW service centre.

3	**STEERING STIFF WHEN THE STEERING WHEEL IS TURNED QUICKLY**

Check		Action
Pressure relief valve clogged	YES →	Remove the valve, wash and clean.
NO ↓		
Hydraulic pump flow rate insufficient	YES →	Overhaul or replace the hydraulic pump.
NO ↓		
Air in the steering system	YES →	Check the seal of the intake pipe and the pump shaft gasket and top up the oil. Bleed the circuit.

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4 HARD JOLTS ARE FELT AT THE STEERING WHEEL WHEN STEERING

Universal joint is slack	YES →	Replace the universal joint.
NO ↓		
Hydraulic power steering internal failure	YES →	Send the power steering to a ZF or TRW service centre.
NO ↓		
Oil level too low	YES →	Top up the oil and bleed the circuit.
NO ↓		
Wrong wheel alignment	YES →	Perform checks and adjustments as described in section "AXLE".
NO ↓		
Unbalanced wheels	YES →	Perform balancing following the instructions contained in section "Wheels and tyres".
NO ↓		
Drag link kingpins loose	YES →	Replace any worn part.
NO ↓		
Hydraulic pump not operating properly	YES →	Replace the pump.
NO ↓		
Oil seepage from hydraulic power steering circuit fittings	YES →	Check the efficiency of the gaskets on the fittings and replace any worn part.

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5 STEERING WHEEL TORSIONAL VIBRATIONS

Unbalanced wheels	YES →	Perform balancing following the instructions contained in section "Wheels and tyres".
NO ↓		
Incorrect wheel alignment	YES →	Perform checks and adjustments as described in section "AXLE".
NO ↓		
Air in the hydraulic system	YES →	Check the seal of the intake pipe and the pump shaft gasket and top up the oil. Bleed the circuit.

6 STEERING WHEEL EXCESSIVE PLAY

Backlash in ball joints and/or flexible mountings are slack	YES →	Secure mountings. Replace ball joints.
NO ↓		
Universal joint is slack	YES →	Replace the universal joint.
NO ↓		
Hydraulic power steering internal failure	YES →	Send the power steering to a ZF or TRW service centre.

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7 LOSS OF FLUID

Cause		Remedy
Tank cover not secured.	YES →	Secure the cover
NO ↓		
Gaskets and seals worn.	YES →	Replace, top up oil and bleed.

In any case, it is necessary to establish where and why the fluid is being lost, eliminate the cause and with engine running, top up fluid to the upper mark on the dipstick.

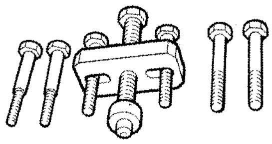
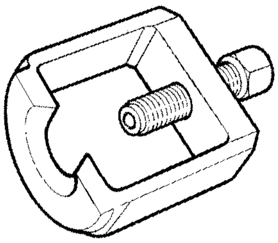
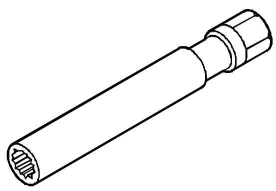
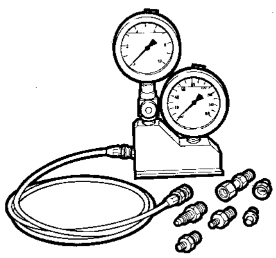
8 INSUFFICIENT PRESSURE IN THE CIRCUIT

Cause		Remedy
Pump not operating properly	YES →	Overhaul or replace the pump.
NO ↓		
Oil leaking from circuit fittings	YES →	Check the efficiency of the gaskets on the fittings and replace any worn part.
NO ↓		
Low fluid level in the tank	YES →	Top up level and bleed the circuit
NO ↓		
Oil leaking from circuit fittings	YES →	Check the efficiency of the gaskets on the fittings and replace any worn part.
NO ↓		
Low fluid level in the tank	YES →	Top up level and bleed the circuit

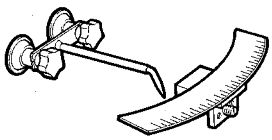
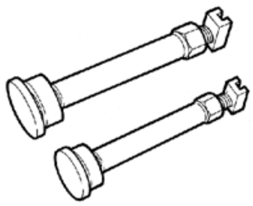
TIGHTENING TORQUE

COMPONENT		ZF 8090 TORQUE Nm	ZF 8090 TORQUE Nm	TRW TAS 30 TORQUE Nm	TRW TAS 30 TORQUE (kgm)
Screw or fastening the hydraulic power steering to the support		400 ± 10	(40 ± 1)	500 ± 25	(50 ± 2.5)
Nut for fastening the lever on the shaft		350 ± 10	(35 ± 1)	345 ± 34	(35.6 ± 3.5)
Screw for fastening the support to the chassis		325	(32,5)	325	(32,5)
Nut for fastening delivery pipe fitting		45	(4.5)	45	(4.5)
Nut for fastening return pipe fitting		55	(5.5)	55	(5.5)
Nuts to lock limiter adjusting screws	Dry tightening	12 + 3	(1.2 + 0.3)	75 ± 7.5	(7.5 ± 0.75)
Hydraulic steering on hydraulic guide	Oily tightening			55 ± 5.5	(5.5 ± 0.55)
Steering wheel fastening nut		72	(7.2)	72	(7.2)

TOOLS

TOOL No.		DESCRIPTION
99347042		Steering wheel puller
99347068		Puller for drag link pivots
99355019		Wrench (10 mm) for hydraulic power steering pump retaining screw
99374393		Tool with gauges to check ZF power steering hydraulic pressure

TOOLS

TOOL NO.		DESCRIPTION
99374398		Scaled sector and index to check steering wheel play (To be used with 99374393).
99374399		Pair of expenders for locking wheels (to be used with 99374393 – 99374398)

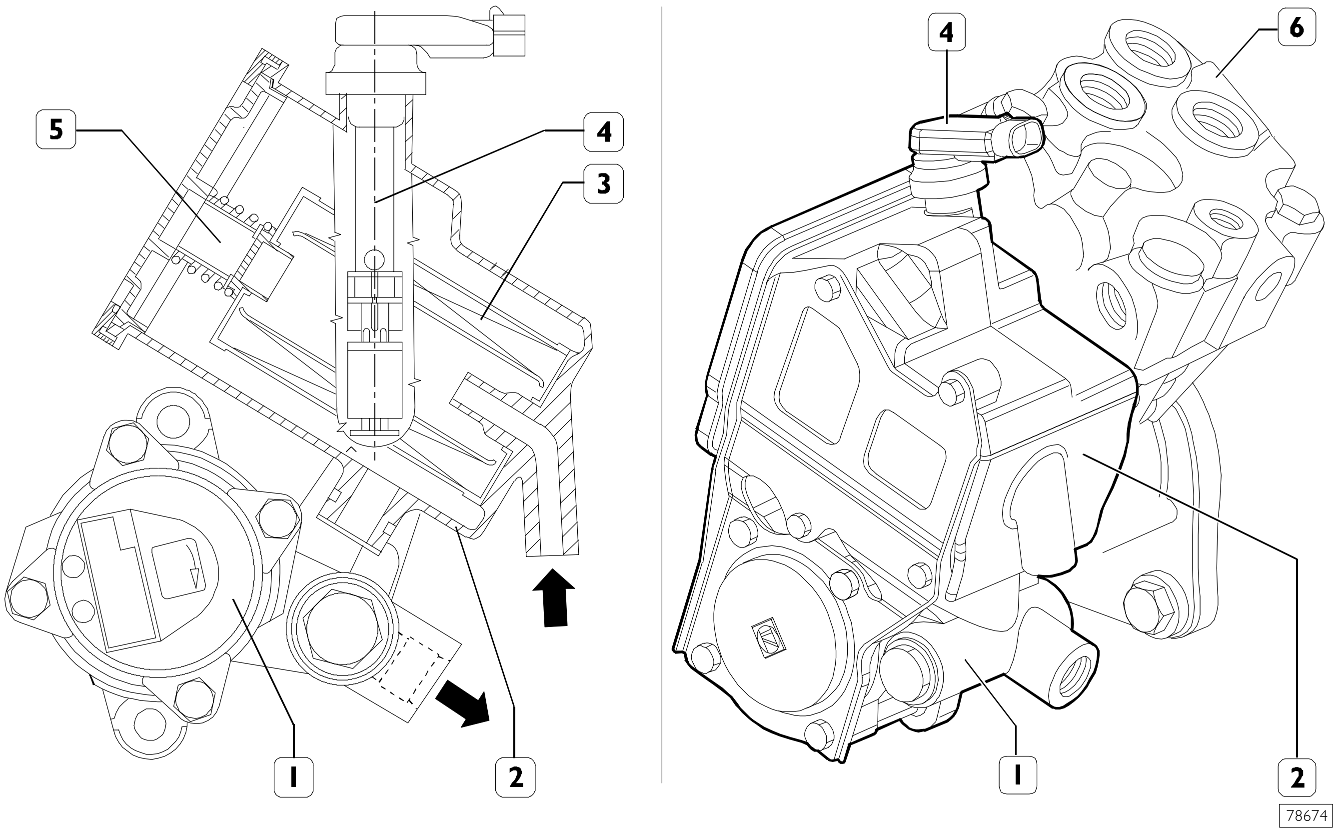
POWER STEERING PUMP ZF FN4 Integral Description

Power steering pump ZF FN4 Integral is mounted in tandem with the air compressor and has its oil tank integrated with an oil filter and a filter safety valve inside.

The filter is made in steel. Its rated duration is 10 years. Anyhow, should it become clogged, the safety valve acts to inhibit its filtering operation and still assure the use of servo–assistance.

The oil introduction plug also integrates the electric level sensor for visually signalling low oil level in the cab.

Figure 3



1. Power steering pump – 2. Oil tank – 3. Oil filter – 4. Oil introduction plug / level sensor – 5. Filter safety valve – 6. Air compressor

ZF 8090 HYDRAULIC POWER STEERING

Description

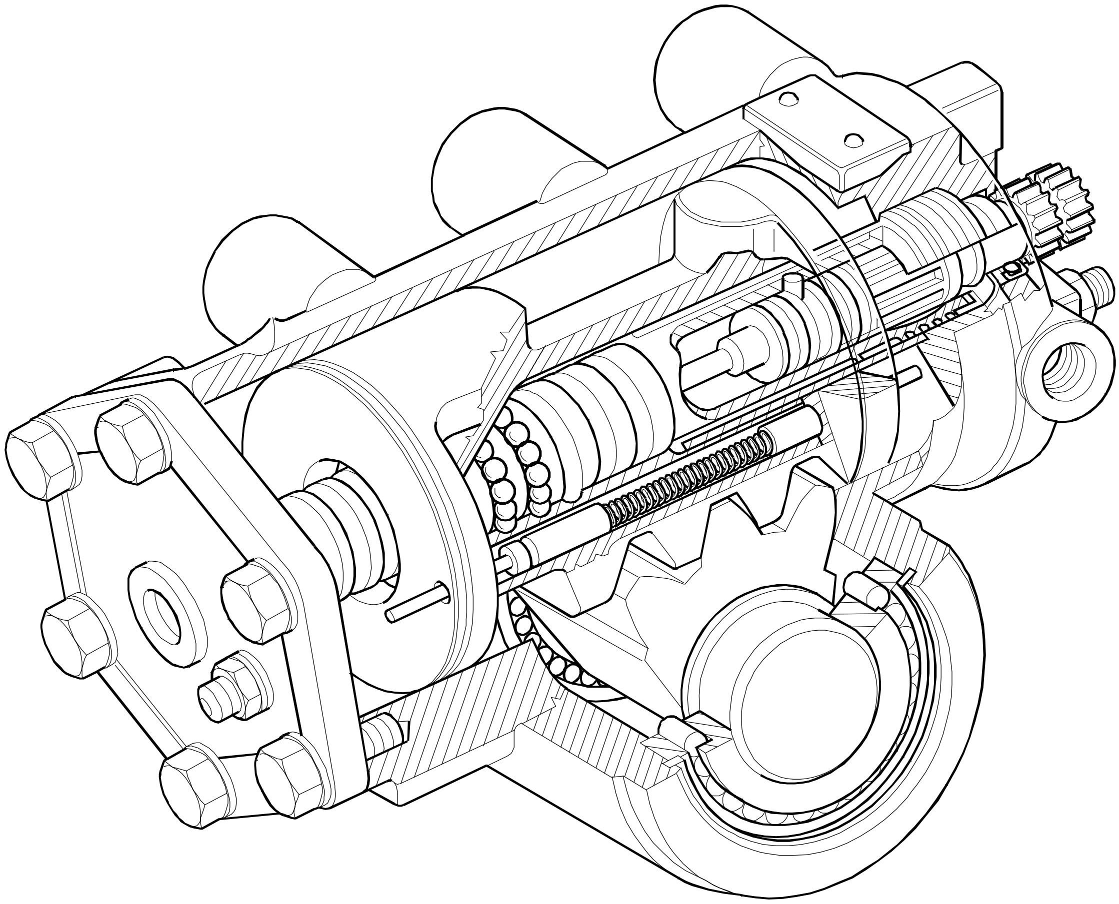
ZF 8090 hydraulic power steering of the continuous ball–type control and compact shape is mainly composed of box, integral mechanical part, control valve and operating cylinder. The rotary motion of the steering wheel, as can be seen in figures 3 and 4, is sent without friction from the steering shaft to the piston through a continuous ball sequence and then converted into an axial movement of the piston. The piston toothing driven in the box engages the sector gear shaft toothing and impart it the rotary motion. The steering arm secured to the shaft transmits the torque to wheel steering rods.

This exclusively mechanical steering is assisted by pressure oil supplied by a ZF pump which is operated by the engine.

The control valve consists of the rotary distributor, supported by rollers in the worm screw and fitted with six control splines on the perimeter, and of the worm screw end supported in the steering box and also fitted with six control splines.

The rotary distributor acts also as lower connecting element with the steering gear shaft and it turns together with the worm screw when the steering wheel is turned.

Figure 4



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ZF 8090 HYDRAULIC POWER STEERING

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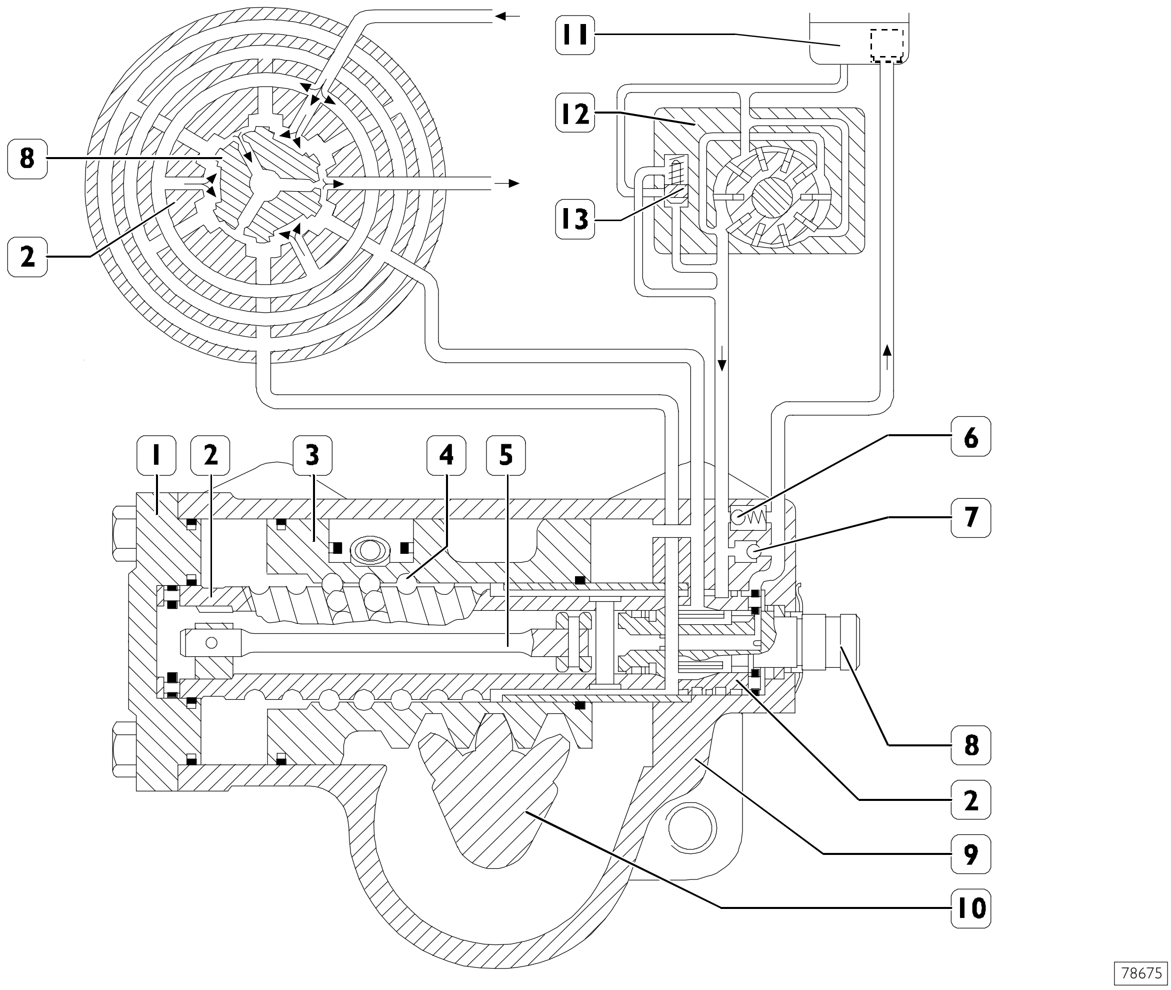
Figure 5



1. Cover – 2. Worm screw / control box – 3. Rack plunger – 4. Balls – 5. Torsion bar – 6. Pressure limiting valve – 7. Re–aspiration valve – 8. Inlet shaft / rotary distribution valve – 9. Hydraulic guide box – 10. Outlet shaft – 11. Oil tank – 12. Vane pump – 13. Flow rate limiting valve

Synchronous rotary motion is obtained since the worm screw and the rotary distributor (8) are connected through a torsion bar (5, Figure 5) that keeps the control valve in neutral position (straight running) until the steering wheel is turned.

When torque is transmitted by steering wheel or wheels to worm screw, the torsion bar elastic area is distorted and so, a relative motion takes place between the rotary distributor (8) and the worm screw end which acts as control box (2). This causes a shifting of distributor control splines with respect to worm screw end splines, and the control valve passes from the neutral position to the operating position. Pressure oil near the control valve (6) is now enabled to go through the open control splines and enter one of the two operating cylinder chambers, thus assisting the steering operation through the pressure exerted one of the piston surfaces.

Should power steering effect be lacking, steering can be performed all the same but with greater effort on the steering wheel.

To prevent steering lock (right and left) and damages to the steering rods due to all the hydraulic pressure, the ZF–Servocom is fitted with hydraulic steering limiting device (Figure 7).

The steering box houses a re–intake valve (7, Figure 5), for return circuit oil suction when steering without power steering is required.

According to the type of steering system, a valve limiting the pump delivery pressure according to a max. preset value is also present.

See Figures 5 and 6 for control valve and oil flow layout. The valve is represented in cross section to show its operation and the connection with the cylinder chambers.

Pressure oil coming from the pump flows into central ring groove of the control box and passing through three radial holes arrives to the rotary distributor arched control splines.

With the valve in neutral position, the reciprocal position of these splines and worm screw end splines enables pressure oil to pass through inlet ports to arrive to the control box arched splines. These are connected with both operating cylinder chambers through radial holes.

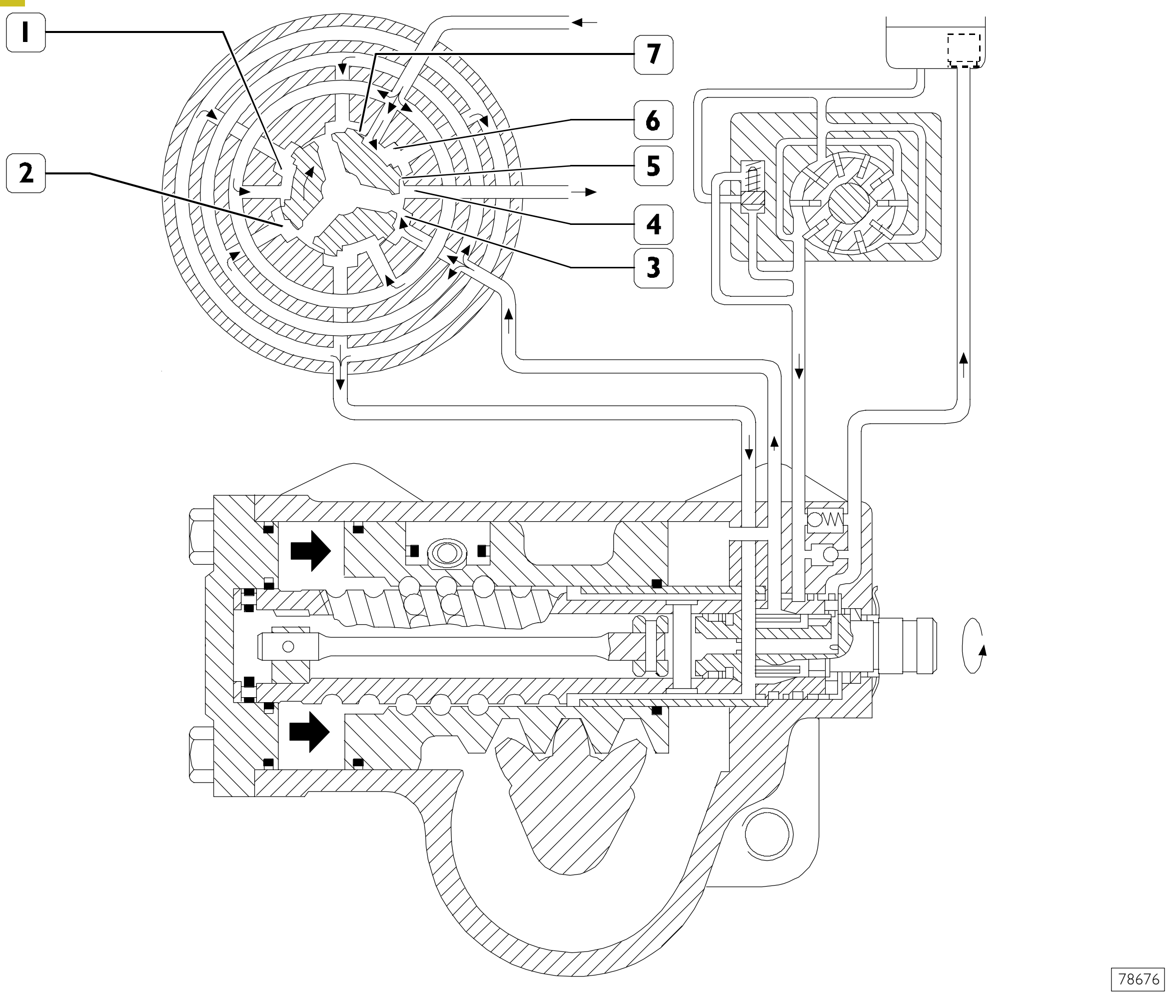
Therefore, with the control valve in neutral position, the pressure oil can enter both operating cylinder chambers and also the three splines of the rotary distributor return circuit and then flow back to the oil tank.

When the steering wheel is turned to the right, the right–hand screw threaded piston moves to the right (Figure 6). Since this piston movement shall be assisted, the pressure oil shall enter the left cylinder chamber. The three splines of the rotary distributor are moved clockwise, the inlet ports (6) open further to let the pressure oil flow in. Inlet ports (7) close and pressure oil flow is stopped towards the axial splines (2) of the control box. The pressure oil flows through the inlet ports (6) into the axial splines (1) of the control box and after passing through worm screw ball thread it arrives to left cylinder chamber. Hydraulic power steering takes place, whereas inlet ports (7) closing stops oil return to tank. Oil present into right cylinder chamber comes out and flows through open return ports (3) to the rotary distributor return splines (4), passing through its central hole and then it returns to the oil tank.

When the steering wheel is turned to the left (not shown), the operating cylinder piston moves to the left. The rotary distributor are moved counterclockwise. Pressure oil passes through the inlet ports (7) and goes to the axial splines (2) and then to the right cylinder chamber.

The oil in the left cylinder chamber flows back to the tank passing through ball thread, return ports (5), return splines (4) and rotary distributor central hole.

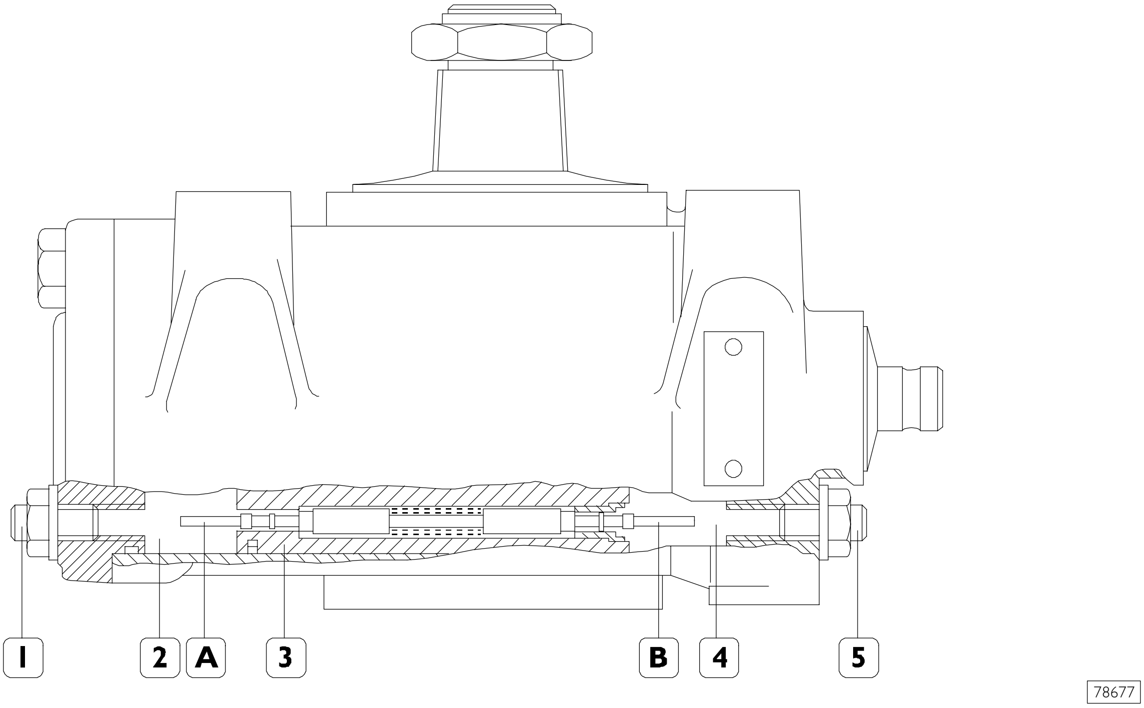
Figure 6



CONTROL VALVE IN OPERATING POSITION – STEERING WHEEL TURNED TO THE RIGHT.

1. Axial spline – 2. Axial spline – 3. Return port – 4. Return spline – 5. Return port – 6 Inlet port – 7. Inlet port

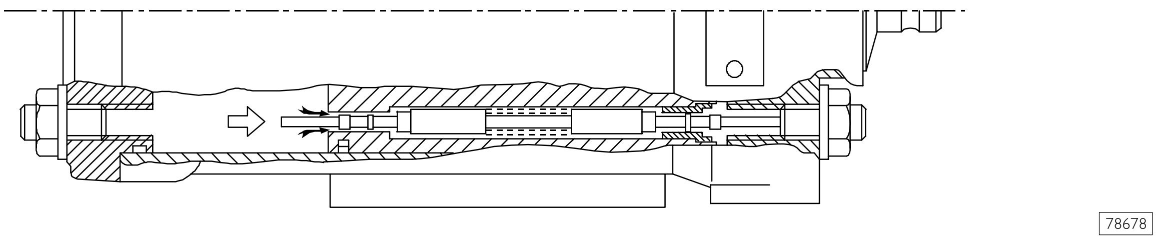
Figure 7



STRAIGHT RIDE, BOTH STEERING RANGE LIMITING VALVES ARE CLOSED

1. "Right–hand side steering" adjusting screw – 2. Left–hand chamber – 3. Rack plunger – 4. Right–hand chamber – 5. "Left–hand side steering" adjusting screw – A. " Right–hand side steering" limiting valve – B. "Left–hand side steering" limiting valve

Figure 8



PISTON MOVEMENT TOWARDS THE RIGHT, STEERING CONTROL VALVES OPEN, OIL PRESSURE REDUCED SIGNIFICANTLY

Hydraulic steering limiting device

In piston (3, Figure 7), two valves (A and B) for steering control are set axially. These valves are fitted with spring–loaded pistons having stems projecting from piston right and left front surfaces.

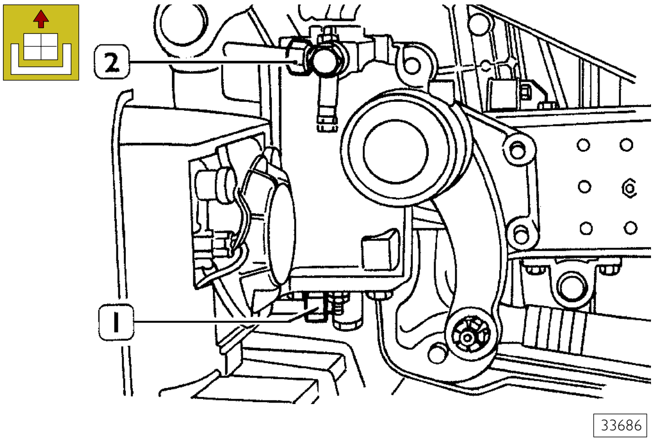
If piston is moved rightwards or leftwards to stop limit, stems can reach the adjusting screws (1 and 5) in the box and in the cover and then move. Both control valves stay closed until one of the two stem touches the adjusting screw. If by way of example the piston moves to right (Figure 8), the steering control valve (B) is opened by the screw (5) before the piston reaches the stop limit.

In this way the pressure oil in the left operating cylinder chamber can enter the right chamber, flow around the piston moved by valve (A) and through the open valve (B) and then reach the return circuit. If the piston is moved to the left, the valve (A) is opened after a preset stroke and the pressure oil in the right cylinder chamber can flow in the return circuit thus reducing the pressure inside the circuit chamber.

When the steering control valve is open, the power steering effect is reduced significantly and the steering wheel can be turned to full lock or wheel stop with greater effort.

541430 REMOVING AND REFITTING THE HYDRAULIC POWER STEERING (ZF 8090)

Figure 9

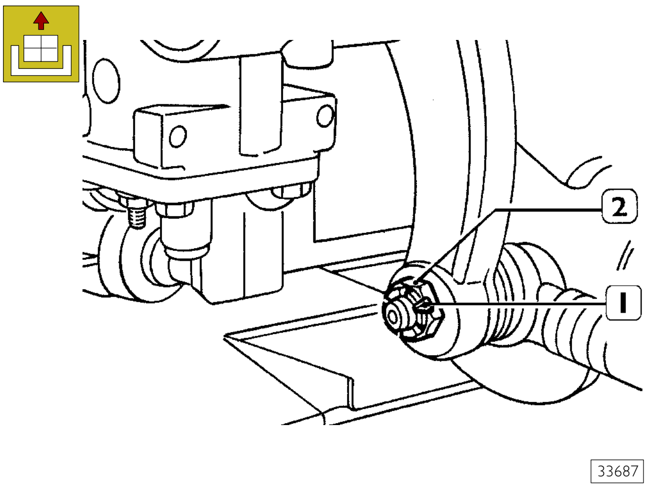


Removal

Set a proper container under the hydraulic power steering and remove the tank cover.

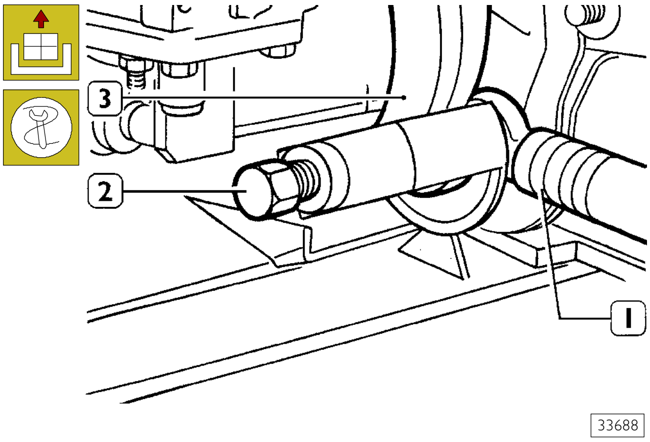
Loosen connections (1 and 2) and remove the oil delivery and return pipes from the hydraulic power steering.

Figure 10



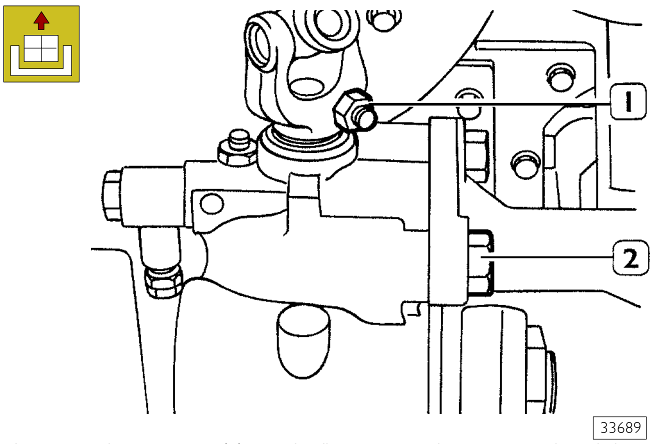
Remove the split pin (1) and loosen the nut (2).

Figure 11



Use puller 99347068 (2) to remove the drag link (1) from the lever (3).

Figure 12



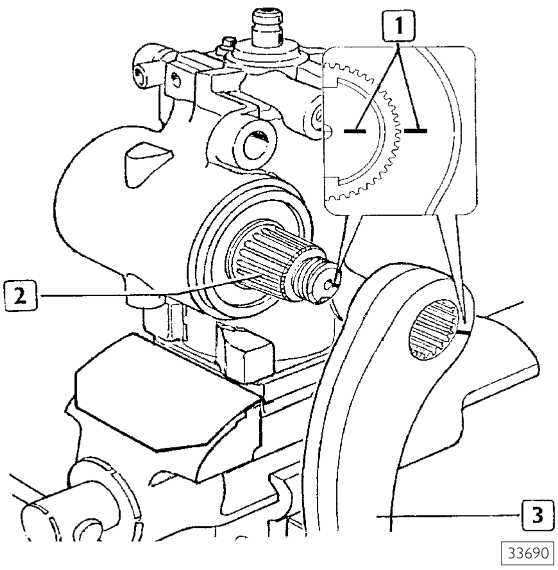
Loosen the screw (1) and disconnect the connecting joint. Loosen the screws (2) fastening the hydraulic power steering to the support.

Refitting

For refitting, reverse the removal operations and tighten the screws to the specified torque.

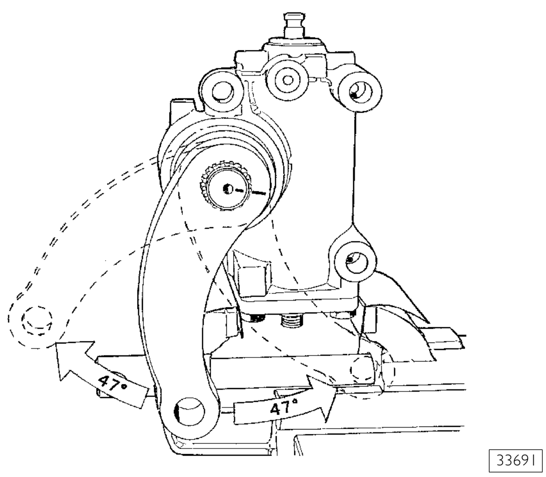
If the hydraulic power steering shall be replaced with a new one, before fitting the new one on the support, proceed as follows:

Figure 13



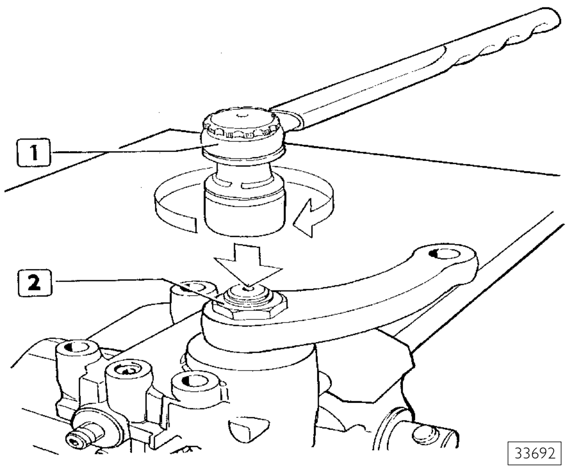
- Clamp the hydraulic power steering in a vice;
- fir the steering lever (3) so that the marks (1) on gear shaft (2) and lever (3) coincide;

Figure 14



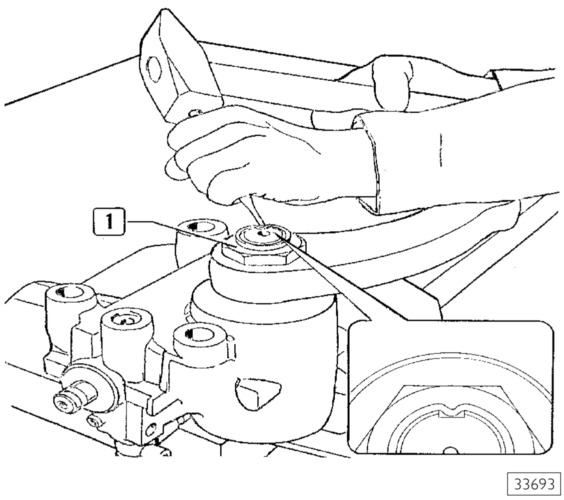
- Check whether lever angle stroke in both directions is 47°;

Figure 15



- Use the dynamometric wrench (1) to tighten the lever fastening nut (2) to 350 ± 35 Nm torque;

Figure 16

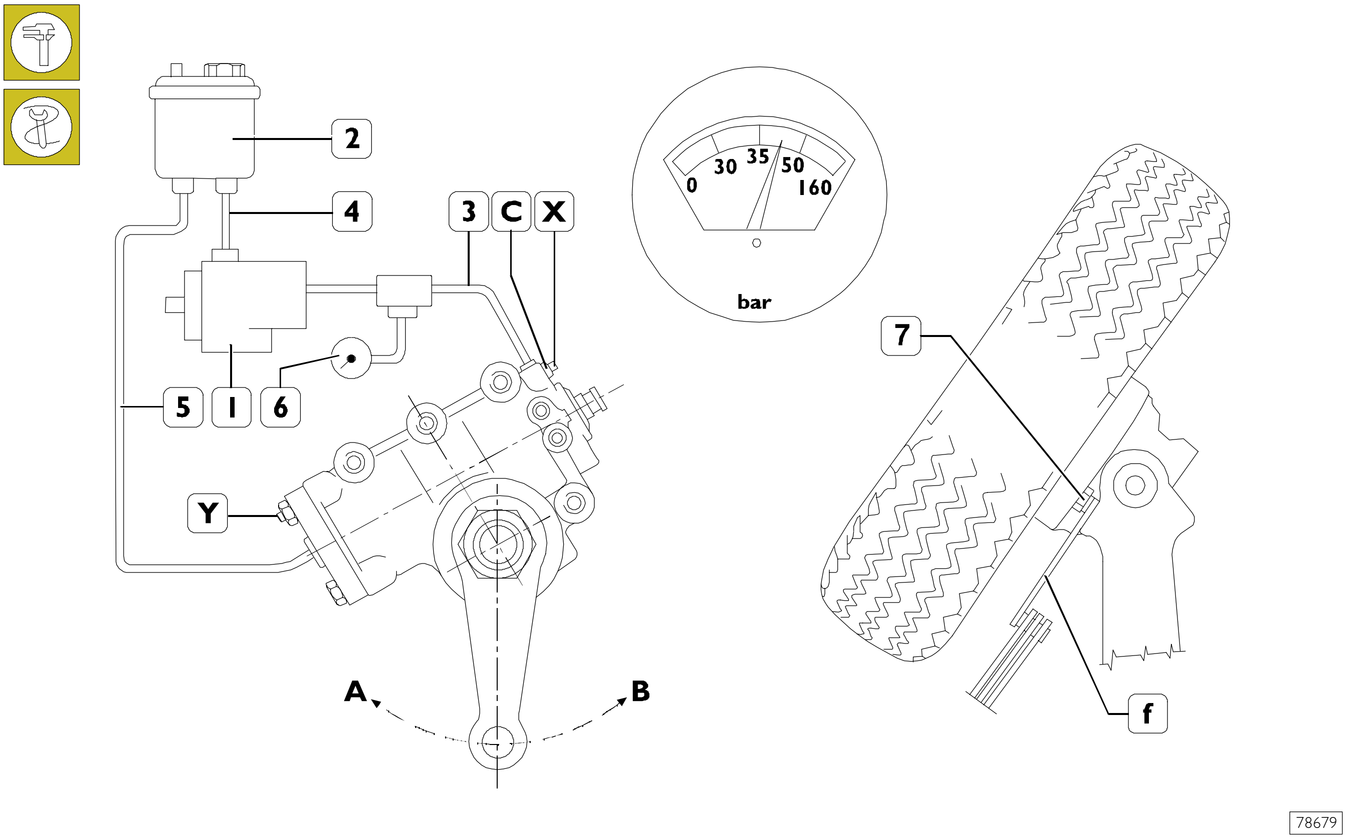


- Use the proper punch to press the nut collar (1).

Lubricate with oil the screws fastening the hydraulic power steering to the support.

501430 ADJUSTING THE HYDRAULIC STEERING LIMITING DEVICE

Figure 17



1. Hydraulic guide pump – 2. Tank – 3. Delivery piping – 4. Aspiration piping – 5. Flow back piping – 6. Hydraulic pressure gauges– 7. Axial adjustment screw – C. Lock nut – D. Lock nut – X. Hydraulic limiting adjustment screw (rotation in direction "A") – Y. Hydraulic limiting adjustment screw (rotation in direction "B") – f. Spacer thickness

f. Dimension (see table) for spacer to be inserted between the stoppers – 7. Stop

Connect the pair of gauges 99374339 to the power steering delivery pipe fitting and then rest the front wheels on rotary plates.

Fit a proper thickness spacer (f), see next table, between wheel stop components (7).

f SPACER THICKNESS, WITHOUT CODE

	Left wheel	Right wheel
Mechanical front suspension		
Unladen vehicle	3 mm	6 mm
Vehicle at full load	3 mm	3 mm
Pneumatic front suspension		
Unladen vehicle or Vehicle at full load	3 mm	3 mm

With front wheel on rotary plates, start engine and keep it at ≤ 1550 rpm. Steer until the wheel stop is against the spacer; then continue to turn the steering wheel for few seconds to overcome the counteracting force of the steering valve to reach the fixed stop.

In this position, the gauge is to indicate an oil pressure of 35 to 50 bar.

To adjust incorrect values, loosen the lock nut and loosen or tighten the screw of the relevant valve (X or Y).

During this stage, the steering wheel is to be left free to prevent undesired pressure increases.

Tighten the lock nut to 30 ± 5 Nm (3 ± 0.5 kgm); proceed in the same way to adjust the second stop.

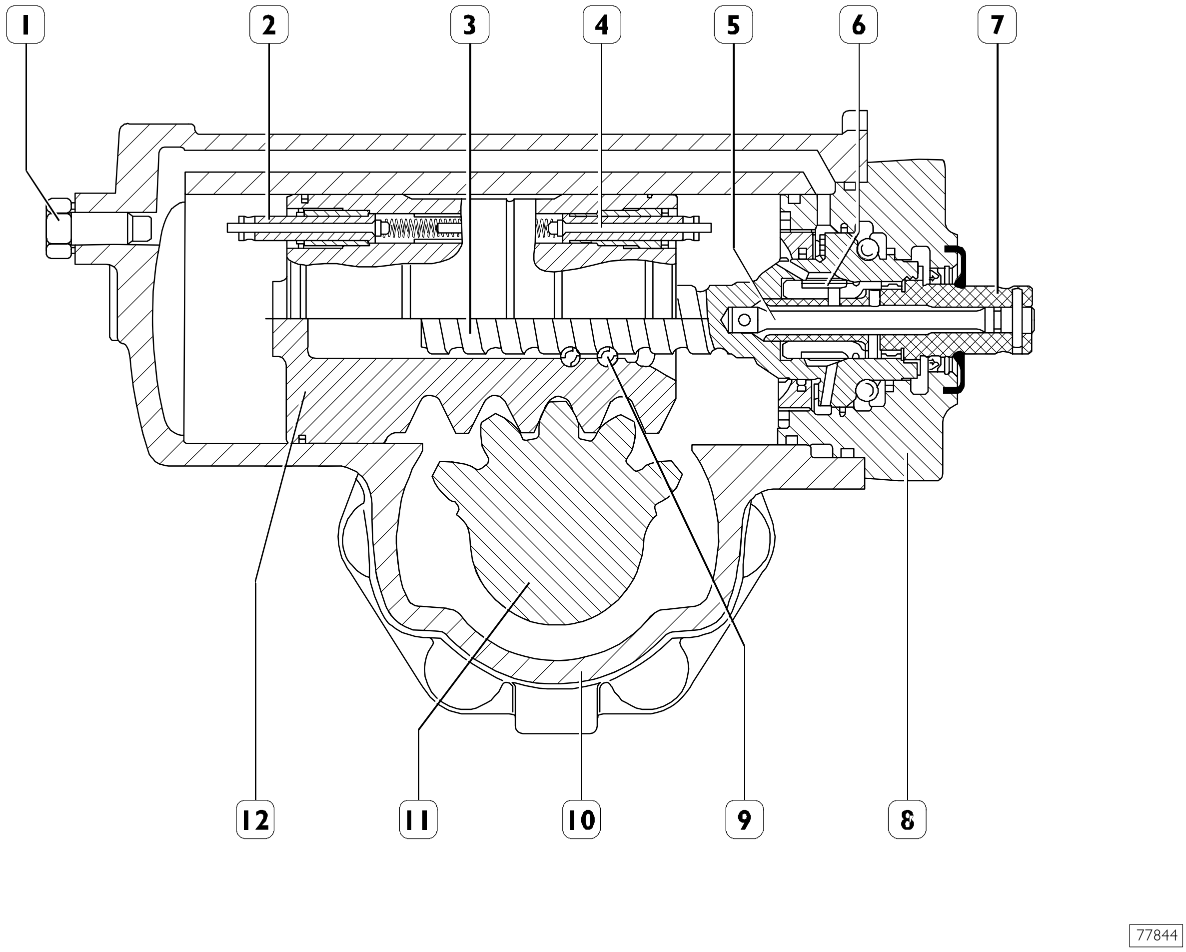
When the power steering arm moves in A, adjust valve (X), when it moves in B, adjust valve (Y).

When the pressure indicated is exceeding 50 bar, tighten (turn clockwise) the relevant steering control valve.

When the pressure indicated is less than 35 bar, loosen (turn counterclockwise) the relevant steering control valve. After adjustment, check the pressure drop again in both steering directions.

TRW TAS 30 HYDRAULIC POWER STEERING

Figure 18



1. Hydraulic steering limiter screw – 2. Right hydraulic steering control valve – 3. Worm screw – 4. Left hydraulic steering control valve – 5. Torsion bar – 6. Rotary distributing valve – 7. Input shaft – 8. Cover – 9. Balls – 10. Power steering box – 11. Output shaft – 12. Rack piston

Description

The continuous ball–type hydraulic power steering is mainly consisting of the box that houses: hand steering mechanism, hydraulic cylinder controlled by rotary distributing valve, hydraulic steering control valves and safety valves.

The rotary motion imparted to the steering wheel is transmitted from the input shaft (7) to the worm screw (3) through the torsion bar (5).

The worm screw (3) is then connected by a set of balls (9) to the rack piston (12) and converts the rotary motion of the piston into an axial movement.

Piston rack tooth (12) engages the sector gear shaft tooth and imparts it a rotary motion. The steering arm secured to the shaft transmits motion to wheel steering rods.

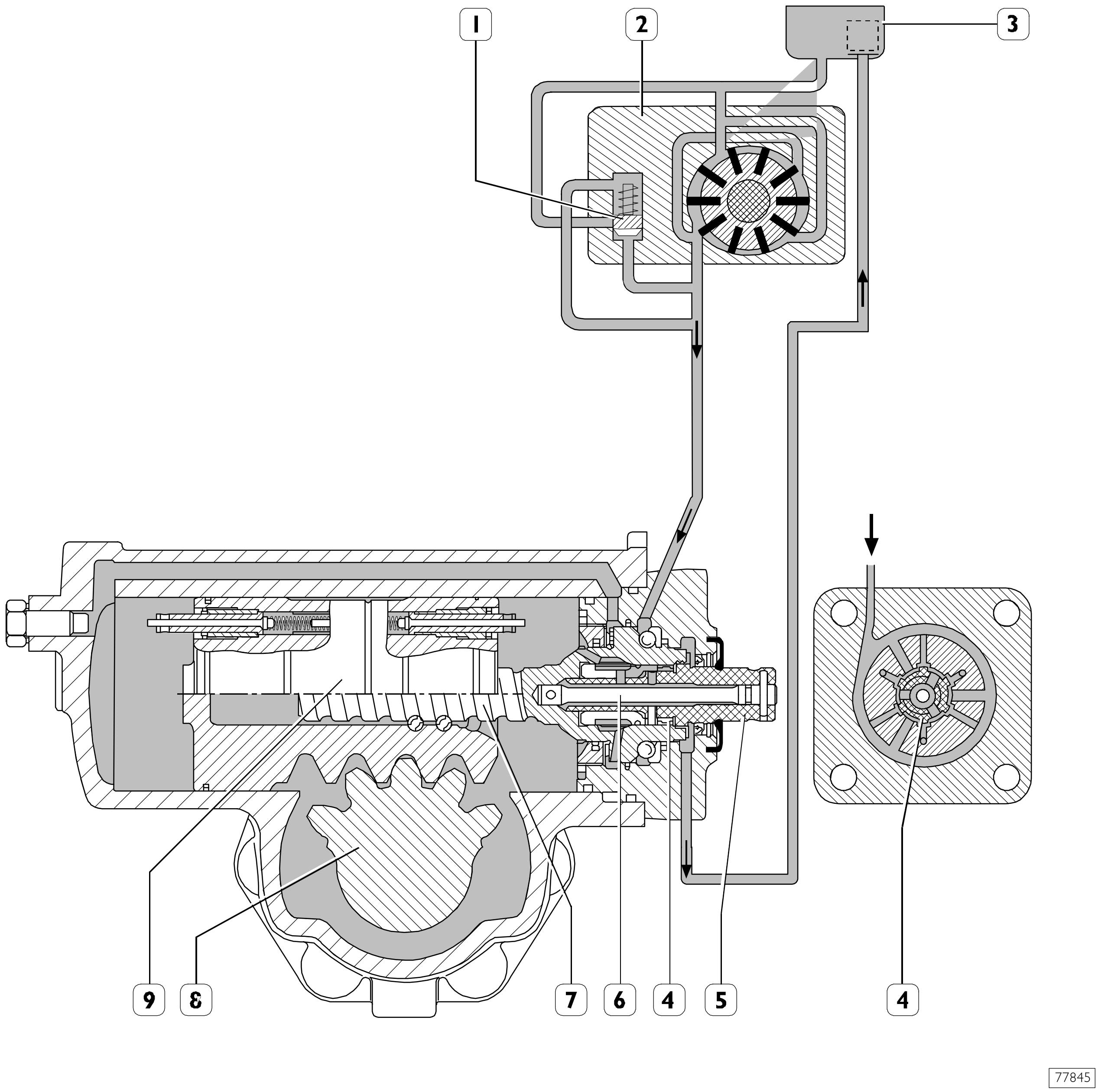
This exclusively mechanical steering is assisted by pressure oil provided by a vane pump operated by the engine.

If during steering, the wheels are submitted to hard impacts, the resulting force is transmitted through the output shaft (11) to the rack piston (12) and then to the worm screw (3). The internal power steering system enables the rotary distributing valve (6) to send high pressure oil to the cylinder chamber where this pressure can absorb the impact force. In this way kicks back on the steering wheel can be avoided.

Hydraulic power steering is fitted with an automatic air bleeder.

Neutral position – straight running

Figure 19

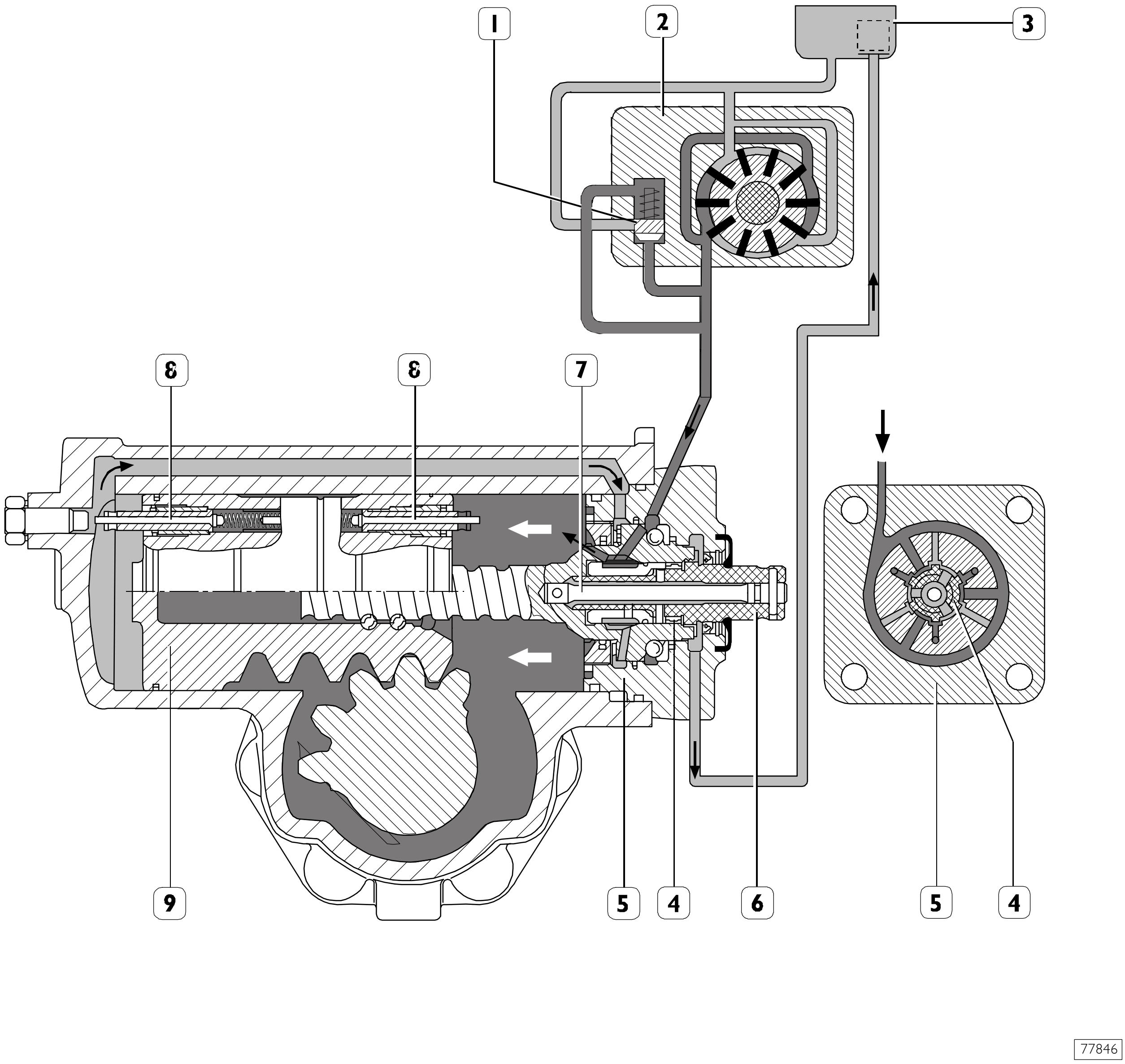


1. Capacity limiting valve – 2. Oil vane pump – 3. Oil tank – 4. Rotary distributing valve – 5. Input shaft – 6. Torsion bar – 7. Worm screw – 8. Output shaft – 9. Rack piston.

On the torsion bar (6) connecting the input shaft (5) to the worm screw (7) is fitted the rotary distributing valve (4); in straight running conditions the valve (4) keeps open the communication between the oil duct coming from the vane pump (2) and the drain one to the oil tank (3).

Steering to the right

Figure 20



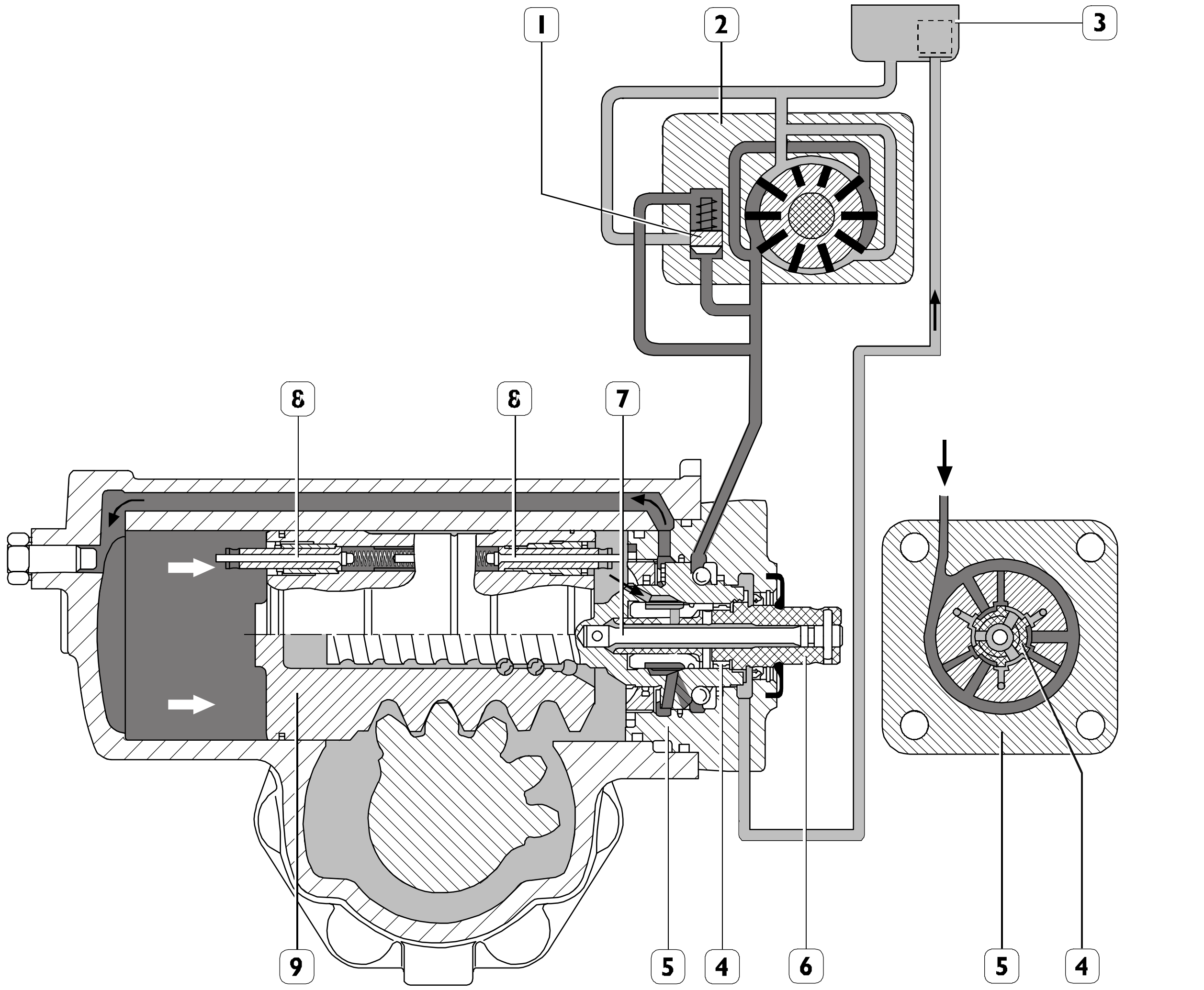
1. Capacity limiting valve – 2. Oil vane pump – 3. Oil tank – 4. Rotary distributing valve – 5. Valve body – 6. Input shaft – 7. Torsion bar – 8. Flow control valve – 9. Rack piston.

If when turning the steering wheel, the torque value transmitted is lower than the steering wheels stall torque, the elastic area of the torsion bar (7) is distorted and its integral rotary distributor (4) rotates with respect to the valve body (5), passing from the neutral condition to the operating condition. Being the drain pipe closed and the control pipe open, pressure oil enters the cylinder chamber involved in steering and moves the rack piston (9) axially.

Hydraulic power steering is kept until the steering control valve (8) intervenes or the action on the steering wheel that has produced torsion bar (7) distortion is stopped.
In this case the rotary distributor (4) is reset in neutral condition.
Should power steering effect be lacking, steering can be performed all the same but with greater effort on the steering wheel.

Steering to the left

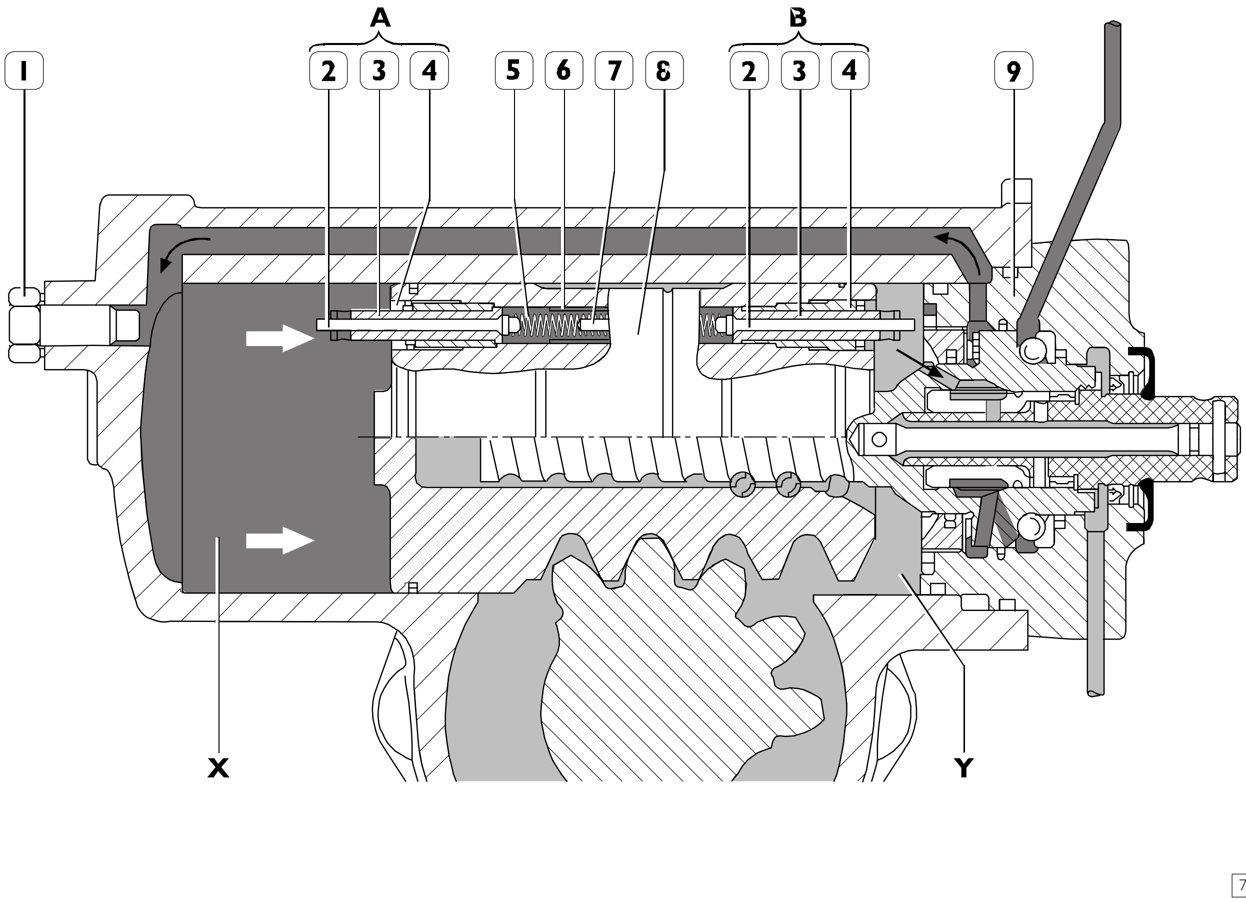
Figure 21



1. Capacity limiting valve – 2. Oil vane pump – 3. Oil tank – 4. Rotary distributing valve – 5. Valve body – 6. Input shaft – 7. Torsion bar – 8. Flow control valve – 9. Rack piston

HYDRAULIC STEERING LIMITING DEVICE

Figure 22



1. Steering hydraulic limiting screw – A and B steering control valve – 2. Piston – 3. Bush – 4. Valve body – 5. Spring – 6. Thrust sleeve – 7. Spacer pin – 8. Rack piston – 9. Cover – X. Left cylinder chamber – Y. Right cylinder chamber

Rack piston end (9) houses the two steering control valves **A** and **B**.

These valves consist of a body (5) which houses by forced coupling, the valve operation control bush (4) which acts as piston (3) seat. Pistons (3) are kept in closed position on bushes (4) by the counter spring (6).

Valves **A** and **B** stay closed until piston stems (3), due to rack piston movement, go in touch with the following:

- ❑ adjusting screw (2) if movement is to left;
- ❑ cover (10) if movement is to the right.

As a result the pressure oil in one chamber will pass through valve **A** and **B** opening to the opposite chamber and then is drained into the tank.

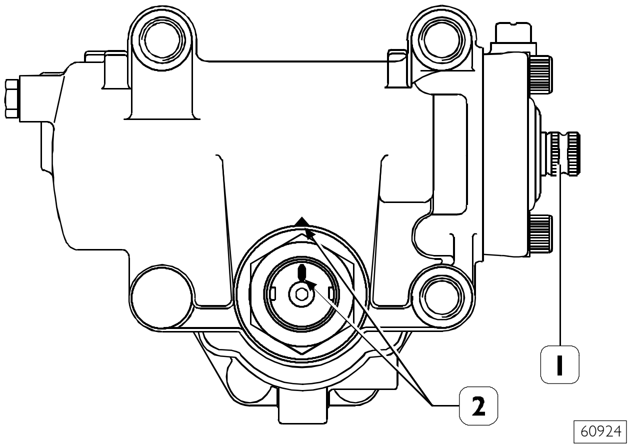
This figure shows the left steering.

When the flow control valve is open, the power steering effect is reduced significantly and the steering wheel can be turned to full lock with greater effort.

NOTE For removing and refitting the TRW TAS 30 power steering, follow the procedures described for ZF 8090.

Setting the TRW TAS 30 power steering limiting device automatic adjustment

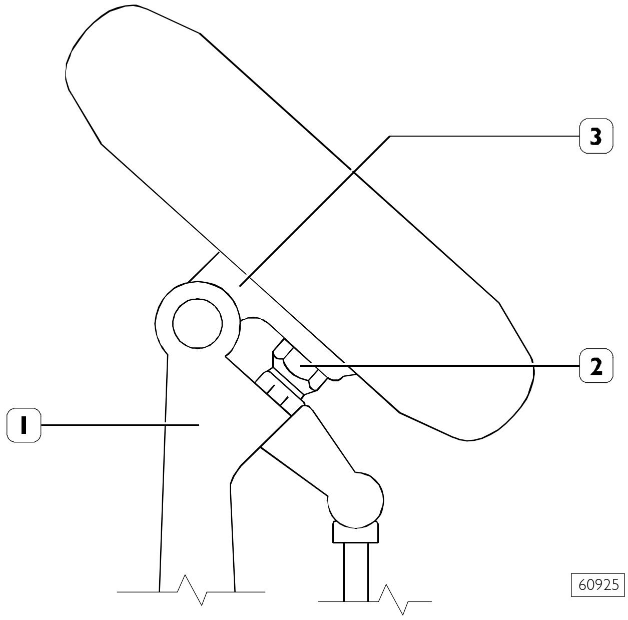
Figure 23



NOTE With power steering removed from vehicle, output shaft rotation shall not exceed 29° (equal to input shaft (1) 1.3 rpm) with respect to the central point indicated by marks (2).

Adjustment shall be performed after refitting the power steering on vehicle, with unladen vehicle and front wheel lifted.
Adjustment shall be performed in both steering directions.

Figure 24



Gearbox to neutral.
Start the engine and keep it at ≤ 1500 rpm.
Turn the steering wheel to one direction with 34 Nm torque until the setscrew (2) set on the stub axle (3) touches the axle (1).
In this way the bush (4, Figure 17) is set backwards with respect to the steering control valve body (5, Figure 17). The bush position (4, Figure 17) will determine the hydraulic pressure release inside the involved chamber before the screw (2, Figure 17) touches the axle (1) and protecting hydraulic system components.
Repeat the same operations in the other steering direction.

Checking the automatic adjustment

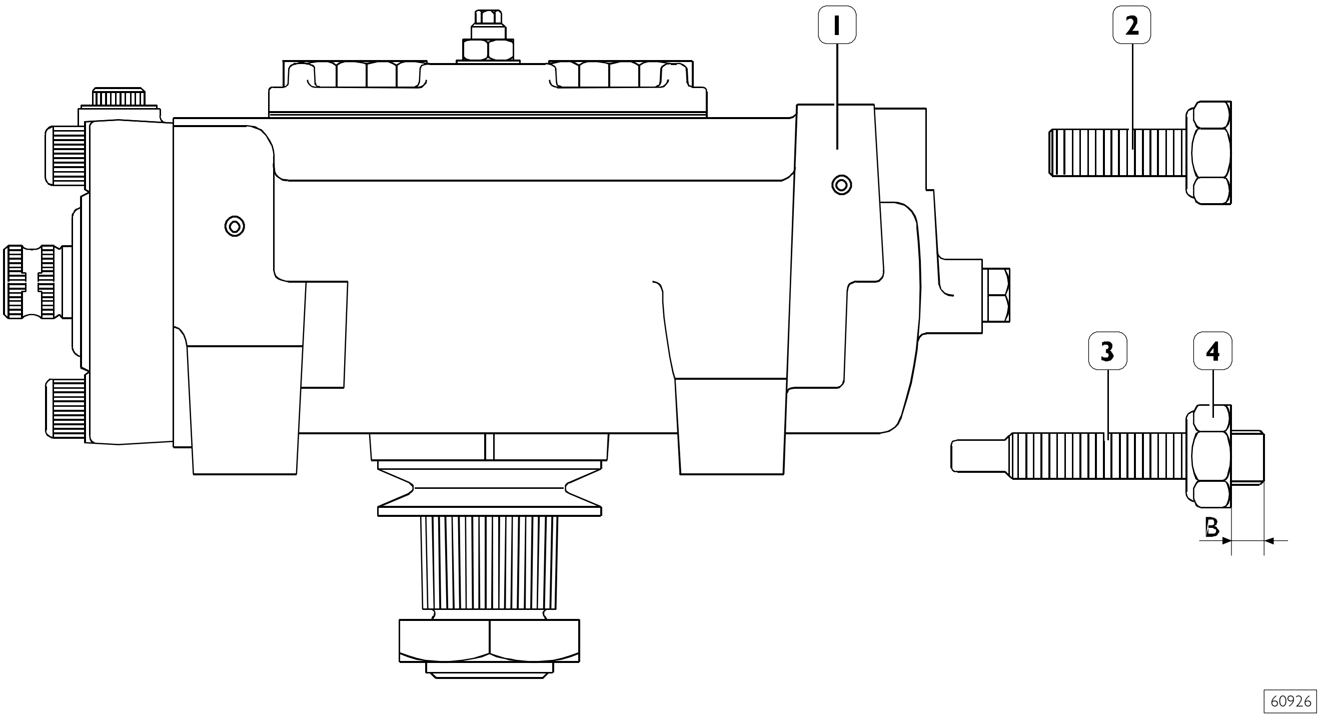
This check shall be performed with vehicle in full load condition, running at low speed, in both steering directions.
Turn the steering wheel until the hydraulic servocontrol is no longer operating.
In this position check whether the steering wheel rotation required to reach the steering stop (screw (2) touching the axle (3)) is falling between 60° and 120°.
Repeat the same operations in the opposite direction.
If different values are found, operate as described in the following paragraph "Fluid leaking manual adjustment".

Fluid leaking manual adjustment

Lift the front part of the vehicle, set the steering wheels in straight running condition and check whether the marks (2, Figure 22) showing the steering centre are coinciding.

NOTE Vehicle shall be unladen.

Figure 25



Set under the power steering (1) in correspondence with screw (2) a proper container to collect oil, loosen screw (2) and tighten the spare screw (3) including the nut (4).

NOTE Screw (3) shall be tightened until the gap B is 0 mm.

For left–hand drive vehicles: steer the wheels to the left (vice versa for right–hand drive vehicles) applying ≤ 54 Nm torque to the steering wheel, until the setscrew (2, Figure 23) is in touch with the axle (1, Figure 23).
Reset the wheels in straight running conditions and check whether the marks (2, Figure 22) showing the steering centre are coinciding.
Loosen the nut (3) so that the gap B is 20–22 mm and lock the nut (4) to 45–50 Nm torque.
Top up the tank until reaching the required oil level.

Gearbox to neutral.
Start the engine and keep it at ≤ 1500 rpm.
Turn the steering wheel to the left (for left–hand drive vehicles and vice versa for right–hand drive vehicles) applying ≤ 34 Nm torque until reaching the steering stop and keep it in this position.
Stop the engine.
Loosen the nut (4) and using the dynamometric wrench tighten the screw (3) to increase the torque of 1.1–2 Nm.

NOTE Keep the nut (4) stopped when tightening the screw (3).

In this condition, loosen the screw (3) by 2.5 turn and lock the nut (4) to 40–50 Nm torque.
Check automatic adjustment as described in the relevant section.

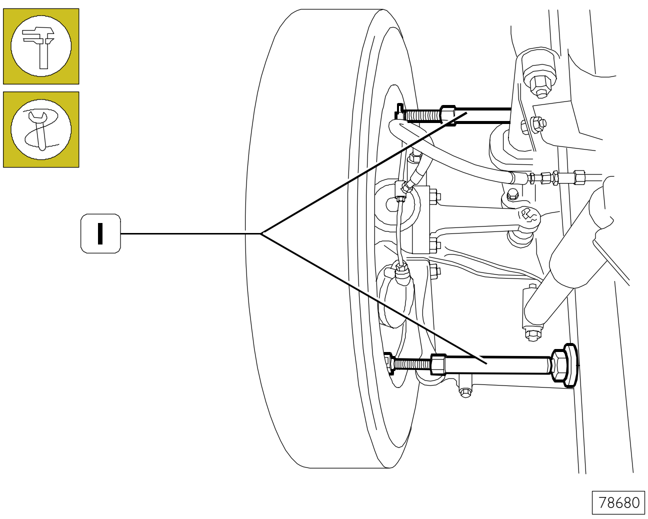
501430 BLEEDING THE AIR FROM THE HYDRAULIC POWER STEERING CIRCUIT

To bleed air from the power steering circuit, proceed as follows:

- ❑ Fill the circuit tank with the prescribed oil (TUTELA GI/A);
- ❑ Run the engine through the starter and continue to top up with oil so that the pump does not take in air.
- ❑ Top up the oil until the level no longer descends below the upper dipstick notch.
- ❑ Start the engine and keep it idling, check that the oil level does nor descend below the upper dipstick notch.
- ❑ Turn the steering wheel several times from stop to stop so that the air comes out from the power steering cylinder. Continue until no more air bubbles arrive in the tank.
- ❑ Accelerate the engine to maximum, stop it and check that the oil level in the tank does not rise by more than 1–3 cm.

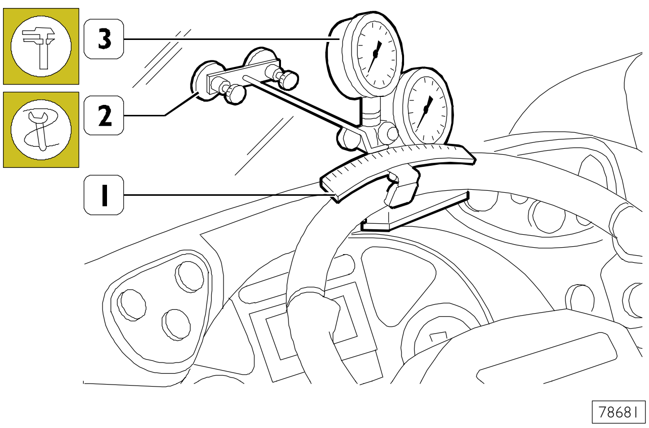
501430 MEASURING CLEARANCE IN STEERING BOX AT STEERING WHEEL

Figure 26



Use a suction cup to fasten a fix index (2) on the windscreen and the millimeter sector (1) on the steering wheel.
Lock drive side wheel in straight ride position by expanders 99374399 (1) and lift front axle.

Figure 27



Apply tool 99374398 fixing fixed index (2) on windscreen through vacuum cups and sector (1), divided into millimetres, on the steering wheel.

Set the pair of gauges 99374393 (3) from 0 to 10 and from 0 to 160 bar, connected to each other by a short circuit valve.

Connect the gauges pipe on the power steering oil delivery pipe fitting.

Top up the oil level if required.

Start the engine idling and read the pressure value on the 0–10 bar gauge.

Turn the steering wheel slowly to the left to increase the pressure by 1 bar; hold the steering wheel in this position and on the millimeter scale mark the value in mm that has been reached.

Turn the steering wheel right until a pressure increase by 1 bar is achieved, read what is shown on the scale divided into millimetres, add up right–hand and left–hand side steering values; addition must not exceed 40 mm.

CHECKING MAXIMUM PRESSURE OF POWER STEERING SYSTEM

With the pair of pressure gauges 99374393 previously connected and drive side wheel locked with expanders 99374399, start engine idling, steer in one direction applying 10 to 20 kg force on the steering wheel and detect pressure on 0 to 160 bar gauge.

NOTE The maximum pressure value is to be found on the ZF or TRW plate on the steering box.

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SECTION 11

Pneumatic System – Brakes

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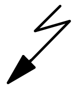
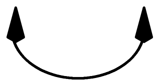
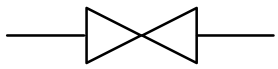
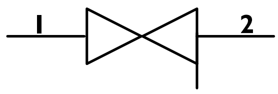
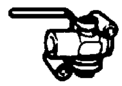
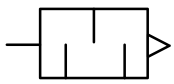
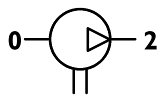
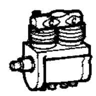
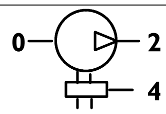
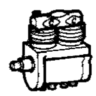
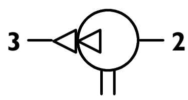
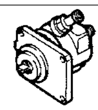
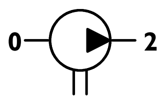
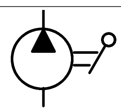
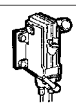
SYMBOLS FOR AIR/HYDRAULIC SYSTEM CIRCUIT DIAGRAMS (MISCELLANEOUS AND GENERATORS)

DESCRIPTION	SYMBOL	
HYDRAULIC FLOW		
AIR FLOW		
ELECTRIC LINE		
ABLE TO ROTATE		
CROSS OF CONNECTED LINES		
PRESSURE CONTROL SOCKET		
QUICK CONNECTION COUPLING		
COCK		
COCK WITH OUTLET		
SILENCER		
COMPRESSOR		
ENERGY SAVING COMPRESSOR		
VACUUM PUMP		
HYDRAULIC PUMP		
HYDRAULIC HAND PUMP		

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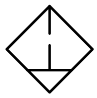
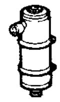
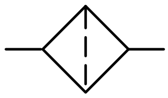
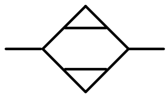
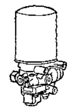
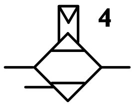
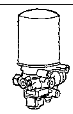
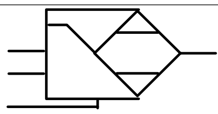
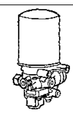
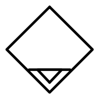
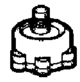
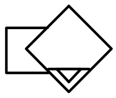
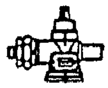
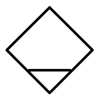
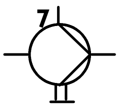
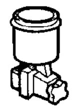
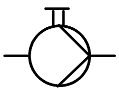
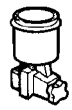
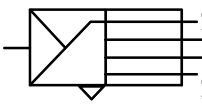
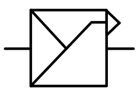
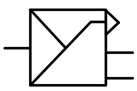
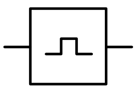
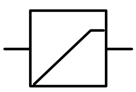
SYMBOLS FOR AIR/HYDRAULIC SYSTEM CIRCUIT DIAGRAMS (VALVES)

DESCRIPTION	SYMBOL	
CONDENSATE SEPARATOR		
FILTER		
DRIER		
DRIER		
DRIER WITH BUILT–IN REGULATOR		
AUTOMATIC CONDENSATE DRAIN VALVE		
CONTROLLED CONDENSATE DRAIN VALVE		
HAND CONDENSATE DRAIN VALVE		
CONTROLLED ANTI–ICING UNIT		
AUTOMATIC ANTI–ICING UNIT		
PRESSURE REGULATOR WITH INDEPENDENT CIRCUIT		
PRESSURE REGULATOR		
PRESSURE REGULATOR		
PRESSURE REGULATOR (GOVERNOR)		
PRESSURE RELIEF VALVE		

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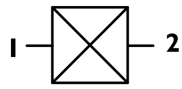
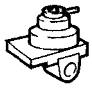
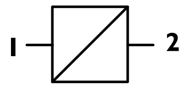
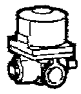
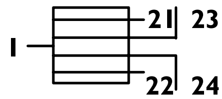
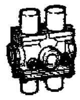
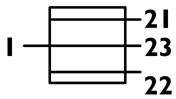
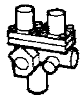
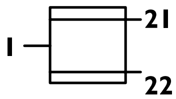
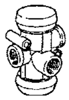
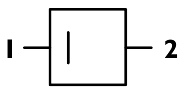
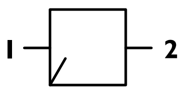
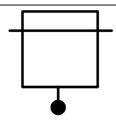
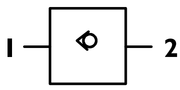
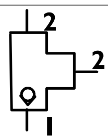
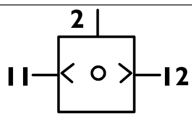
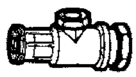
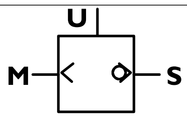
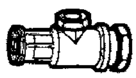
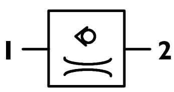
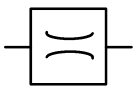
SYMBOLS FOR AIR/HYDRAULIC SYSTEM CIRCUIT DIAGRAMS (VALVES)

DESCRIPTION	SYMBOL	
PROPORTIONAL REDUCING VALVE		
ADAPTER VALVE		
4–CIRCUIT PROTECTION VALVE		
3–CIRCUIT PROTECTION VALVE		
2–CIRCUIT PROTECTION VALVE		
NON–RETURN AIR INLET VALVE		
LIMITED RETURN AIR INLET VALVE		
SAFETY VALVE		
CHECK VALVE		
CHECK VALVE		
DOUBLE SHUT–OFF VALVE		
DIFFERENTIAL DOUBLE SHUT–OFF VALVE		
THROTTLE VALVE WITH QUICK RETURN		
THROTTLE VALVE		

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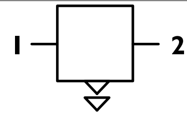
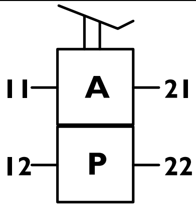
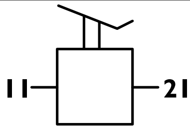
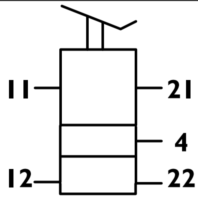
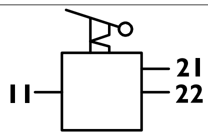
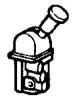
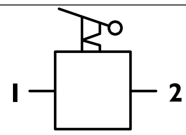
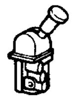
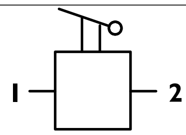
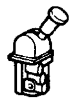
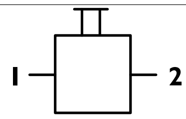
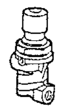
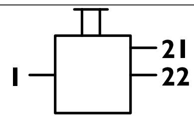
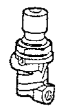
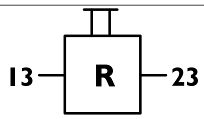
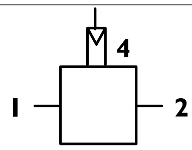
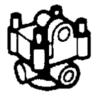
SYMBOLS FOR AIR/HYDRAULIC SYSTEM CIRCUIT DIAGRAMS (VALVES)

DESCRIPTION	SYMBOL	
QUICK DISCHARGE VALVE		
BRAKE CONTROL VALVE		
BRAKE CONTROL VALVE		
BRAKE CONTROL VALVE		
PARKING BRAKE CONTROL VALVE		
PARKING BRAKE CONTROL VALVE		
CONTROL VALVE		
BRAKE VALVE		
CONTROL VALVE		
RETARDER CONTROL VALVE		
SERVO CONTROL VALVE		

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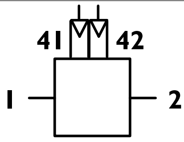
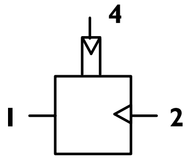
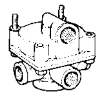
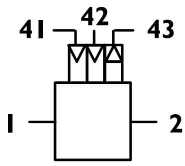
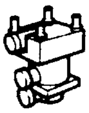
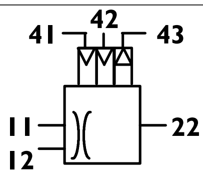
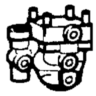
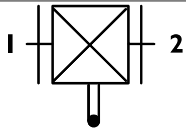
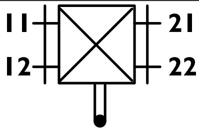
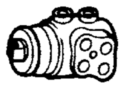
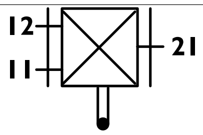
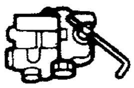
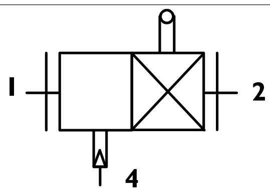
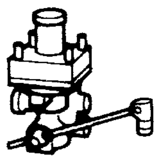
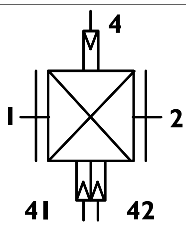
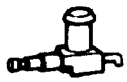
SYMBOLS FOR AIR/HYDRAULIC SYSTEM CIRCUIT DIAGRAMS (VALVES)

DESCRIPTION	SYMBOL	
SERVO CONTROL VALVE		
SERVO CONTROL VALVE FOR SINGLE LINE		
TRAILER BRAKING TRIPLE CONTROL VALVE		
TRAILER BRAKING TRIPLE CONTROL VALVE WITH BUILT–IN SERVO SWITCHING		
LOAD SENSING VALVE		
DOUBLE LOAD SENSING VALE		
LOAD SENSING VALVE WITH BY–PASS		
LOAD SENSING VALVE WITH BUILT–IN RELAY		
LOAD SENSING VALVE WITH BUILT–IN RELAY WITH AIR CONTROL		

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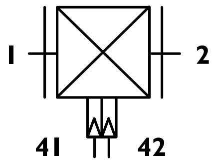
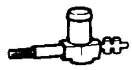
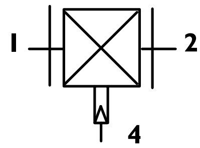
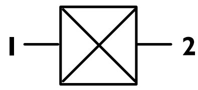
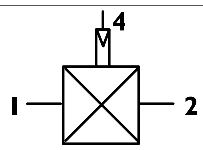
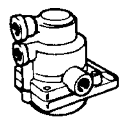
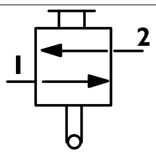
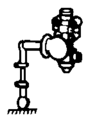
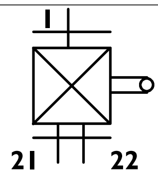
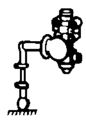
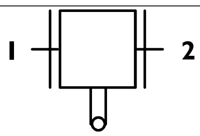
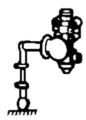
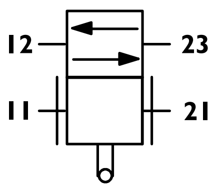
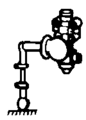
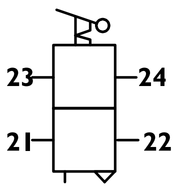
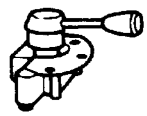
SYMBOLS FOR AIR/HYDRAULIC SYSTEM CIRCUIT DIAGRAMS (VALVES)

DESCRIPTION	SYMBOL	
LOAD SENSING VALVE WITH AIR CONTROL		
LOAD SENSING VALVE WITH AIR CONTROL		
PROPORTIONAL REDUCING VALVE		
SLAVE PROPORTIONAL REDUCING VALVE		
STROKE LIMITING VALVE		
LEVELLING VALVE		
LEVELLING VALVE		
LEVELLING VALVE WITH BUILT–IN STROKE LIMITER		
HAND–OPERATED SUSPENSION RAISING CONTROL VALVE		

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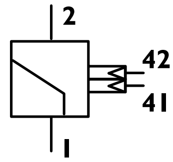
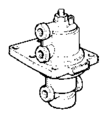
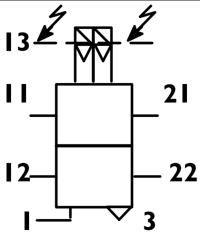
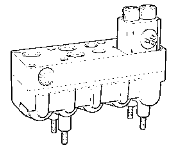
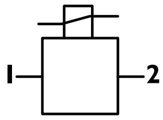
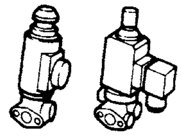
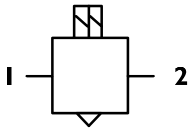
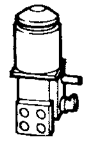
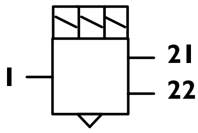
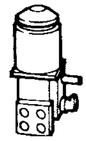
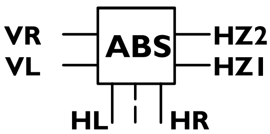
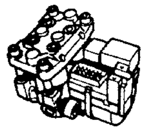
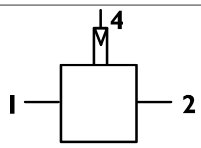
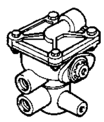
SYMBOLS FOR AIR/HYDRAULIC SYSTEM CIRCUIT DIAGRAMS (VALVES)

DESCRIPTION	SYMBOL	
GRADUAL CONTROL VALVE		
HAND–OPERATED SUSPENSION CONTROL VALVE WITH ELECTRICAL MONITORING		
ELECTROPNEUMATIC VALVE		
ELECTROPNEUMATIC VALVE		
ELECTROPNEUMATIC VALVE		
HYDRAULIC MODULATOR FOR ABS		
AUGMENTER VALVE		

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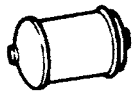
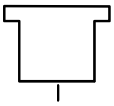
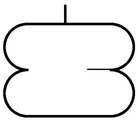
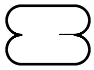
SYMBOLS FOR AIR/HYDRAULIC SYSTEM CIRCUIT DIAGRAMS (TANKS AND ACCUMULATORS)

DESCRIPTION	SYMBOL	
COMPRESSED AIR TANK		
BRAKE FLUID TANK		
AIR SPRING		

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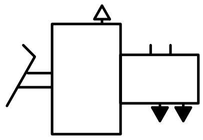
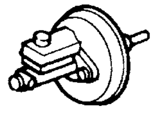
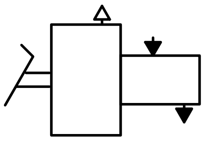
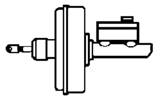
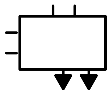
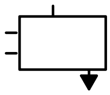
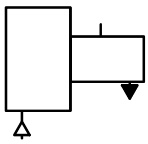
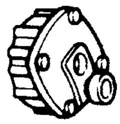
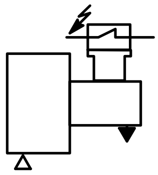
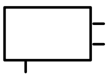
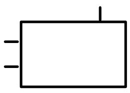
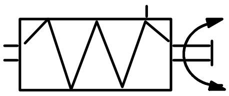
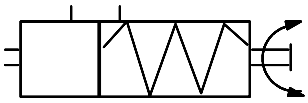
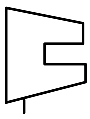
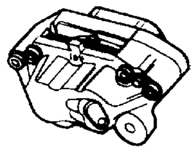
SYMBOLS FOR AIR/HYDRAULIC SYSTEM CIRCUIT DIAGRAMS (CONVERTERS, CYLINDERS AND CALLIPERS)

DESCRIPTION	SYMBOL	
VACUUM BRAKE		
VACUUM BRAKE		
DOUBLE CIRCUIT MASTER CYLINDER		
SINGLE CIRCUIT MASTER CYLINDER		
AIR/HYDRAULIC CONVERTER		
AIR/HYDRAULIC CONVERTER		
HYDRAULIC BRAKE CYLINDER		
OPERATING CYLINDER		
BRAKE CYLINDER		
SPRING CYLINDER		
COMBINED BRAKE CYLINDER		
FIXED DISC BRAKE CALLIPER		

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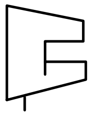
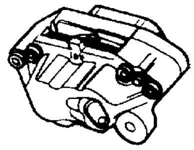
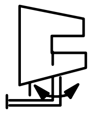
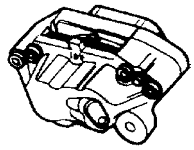
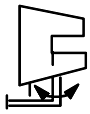
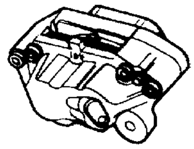
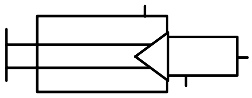
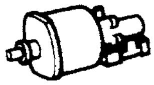
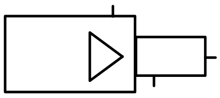
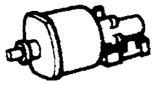
SYMBOLS FOR AIR/HYDRAULIC SYSTEM CIRCUIT DIAGRAMS (CYLINDERS AND CALLIPERS)

DESCRIPTION	SYMBOL	
FLOATING DISK BRAKE CALLIPER		
FLOATING DISK BRAKE CALLIPER WITH PARKING BRAKE		
MECHANICAL FLOATING DISK BRAKE CALLIPER		
SERVO CLUTCH		
SERVO CLUTCH		

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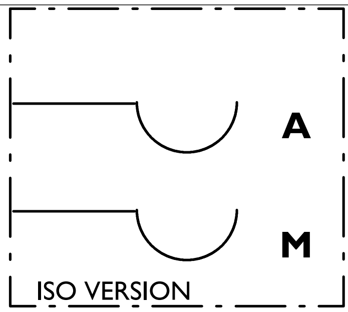
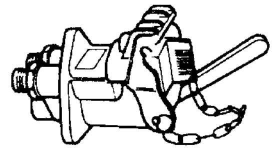
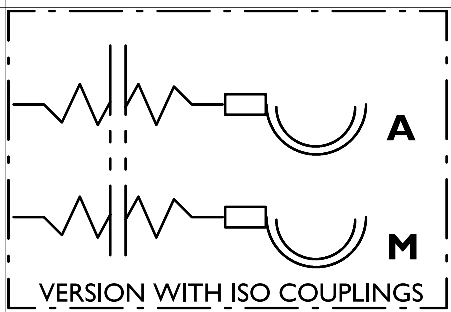
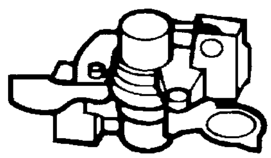
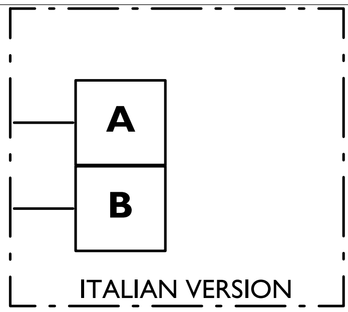
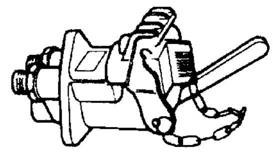
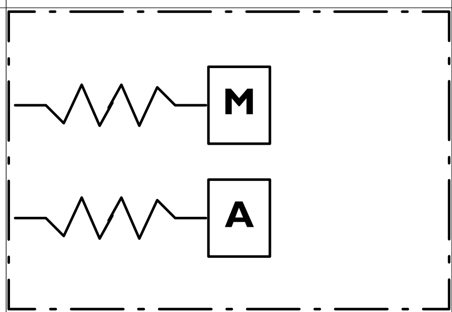
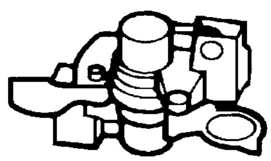
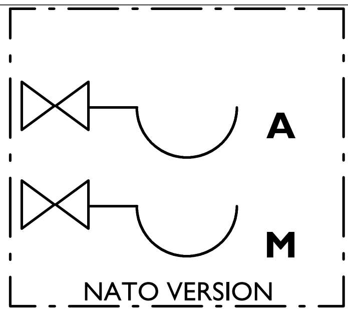
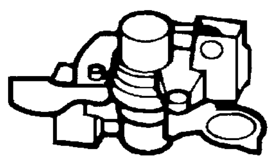
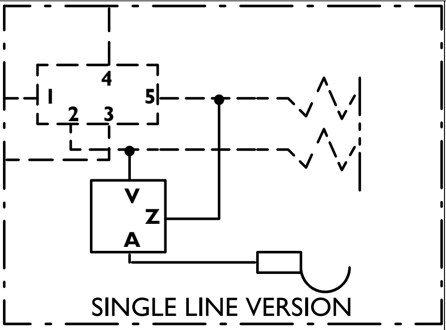
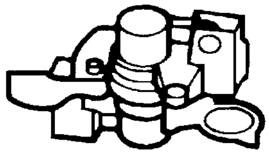
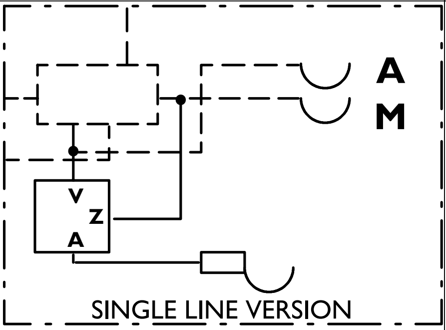
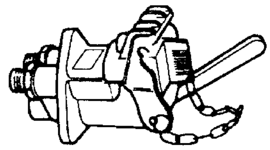
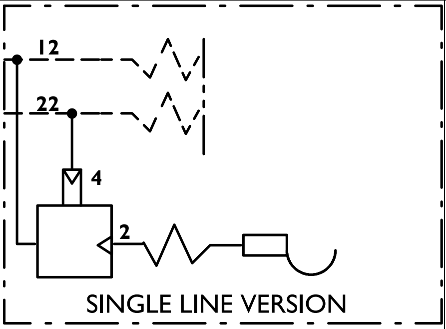
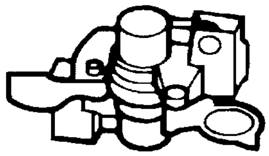
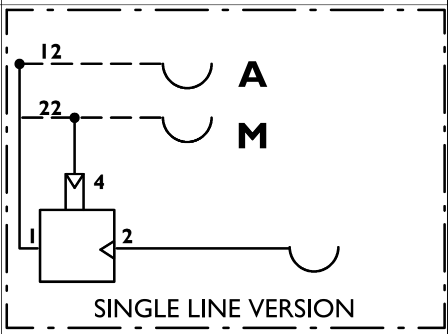
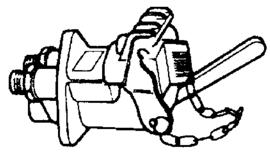
SYMBOLS FOR AIR/HYDRAULIC SYSTEM CIRCUIT DIAGRAMS (HALF–JOINTS AND COUPLING HEADS)

DESCRIPTION	SYMBOL	
“ISO” HALF–COUPLING		
“ISO” HALF–COUPLING		
“CUNA” HALF–COUPLING		
“CUNA” HALF–COUPLING		
“NATO” HALF–COUPLING		

32792 32793

SYMBOLS FOR AIR/HYDRAULIC SYSTEM CIRCUIT DIAGRAMS (HALF–JOINTS AND COUPLING HEADS)

DESCRIPTION	SYMBOL	
		
HALF–COUPLING		
HALF–COUPLING		
HALF–COUPLING		

32793

SYMBOLS FOR AIR/HYDRAULIC SYSTEM CIRCUIT DIAGRAMS (INDICATORS AND SWITCHES)

DESCRIPTION	SYMBOL	
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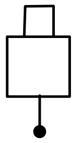
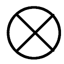
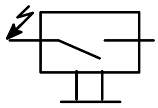
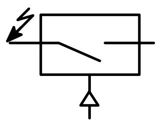
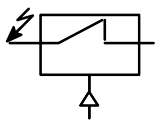
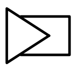
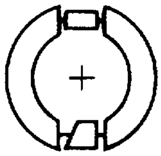
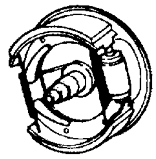
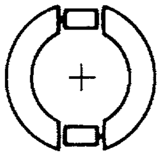
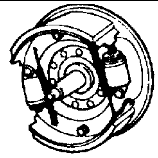
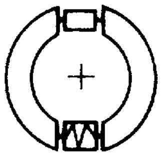
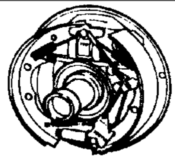
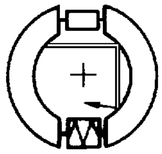
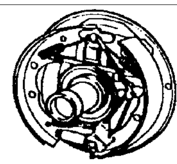
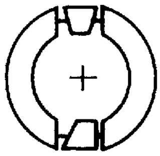
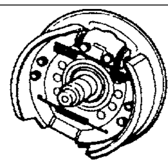
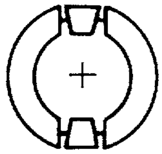
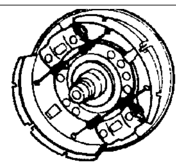
PRESSURE GAUGE		
PRESSURE TRANSMITTER		
LAMP		
MECHANICALLY CONTROLLED SWITCH		
PRESSURE SWITCH		
LOW PRESSURE SWITCH		
HORN/BUZZER		
SENSOR		

32794

SYMBOLS FOR AIR/HYDRAULIC SYSTEM CIRCUIT DIAGRAMS (BRAKES)

DESCRIPTION	SYMBOL	
SIMPLEX HYDRAULIC BRAKE		
DUPLEX HYDRAULIC BRAKE		
DUAL SERVO HYDRAULIC BRAKE		
DUAL SERVO HYDRAULIC BRAKE WITH PARKING BRAKE		
SIMPLEX CAM OPERATED BRAKE		
TWIN–DUPLEX CAM OPERATED BRAKE		

32795

799512 PIPES AND COUPLINGS

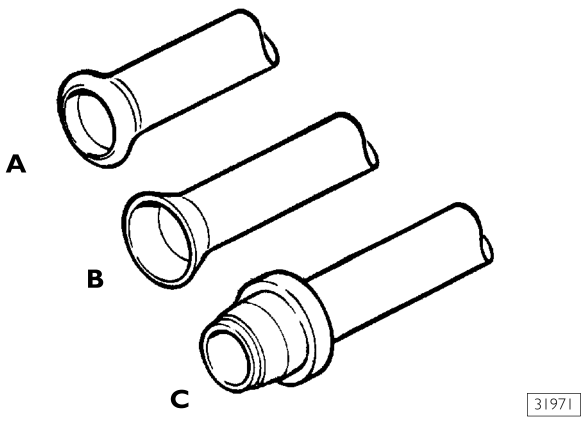
Overview

The pipes in the braking system of commercial vehicles are currently of two types:

- Flexible polyamide hoses with single or two–ply structure and in the following diameters (6–8–10–12–16 mm) supplied as spares by the metre.
- Rigid metal pipes of the following diameters (4.75–6.35–8–10–12 mm). Pipes between 4.75 and 10 mm diameter are supplied as spares in straight lengths of 4–5–6 m, whereas those exceeding 10 mm diameter are supplied as spares ready cut, bent and flared.

End forming on rigid pipes

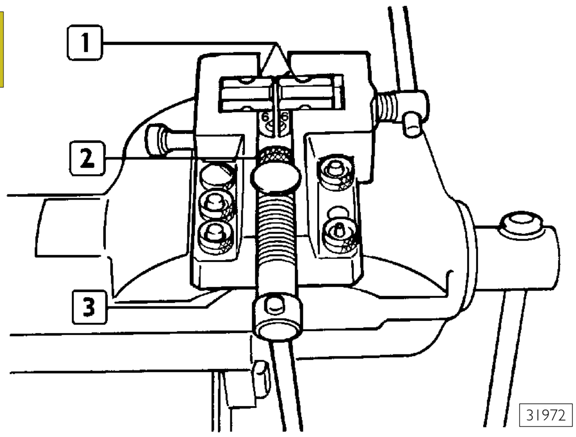
Figure 1



TYPES OF END FORMING ON RIGID PIPES

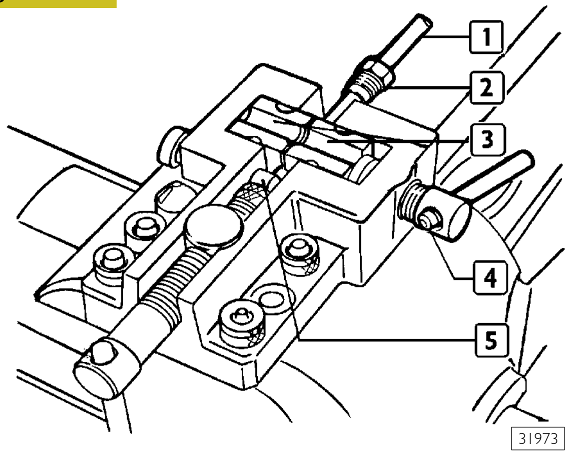
A type end forming

Figure 2



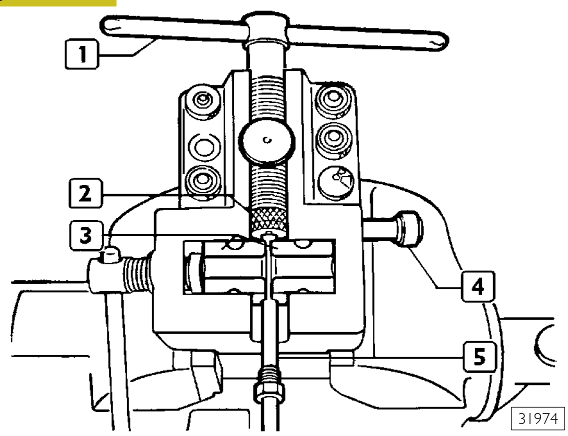
Position on press 99386523 (3) the blocks (1) so that the marked numbers indicating the diameter of the pipes to be machined are facing the die (2). The choice of the die (2) depends on the diameter of the pipe to be machined, the diameter for which it may be used is marked on every die (2).

Figure 3



Deburr the pipe (1), insert the union fitting (2) onto it and position it between blocks (3) bearing against the pin (5). Lock the pipe (1) with the screw (4).

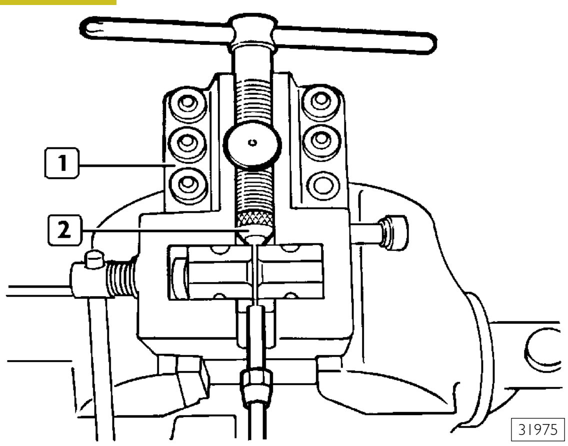
Figure 4



Move pin (4) to neutral position. Tighten the screw (1) until the die (2) comes up against the blocks (3), thus forming the end of the pipe (5).

B type end forming

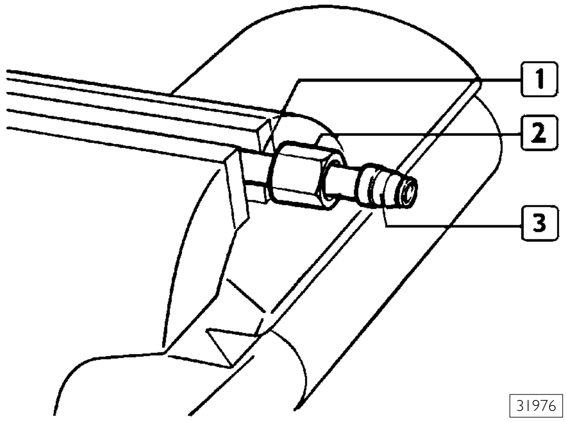
Figure 5



Fit die (2) on press 99386523 (1).
For end forming process, follow the procedure described above for A type end forming.

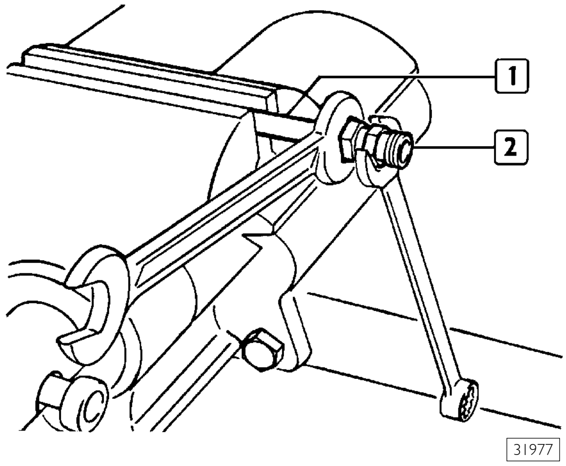
C type end forming

Figure 6



Fit nut (2) and ring (3) onto pipe (1).

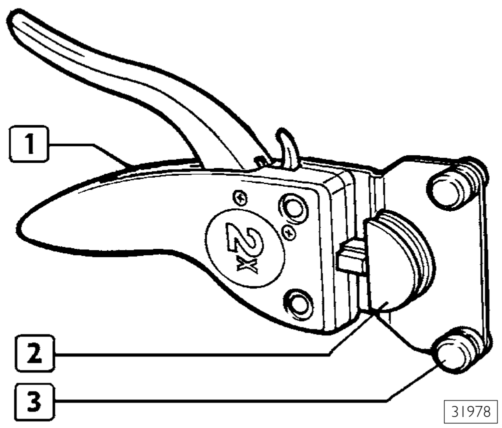
Figure 7



Fit union (2) and tighten so that the ring (3, fig.6) is locked onto the pipe (1).

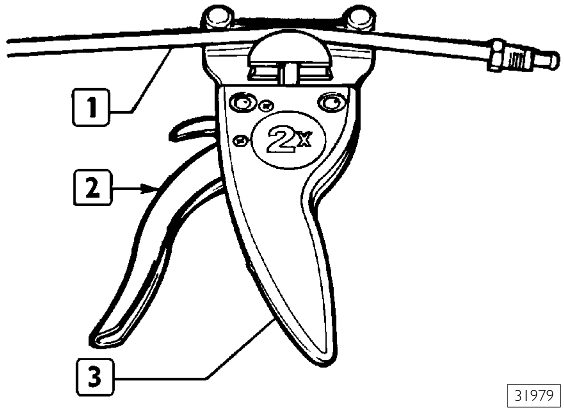
Bending rigid pipes

Figure 8



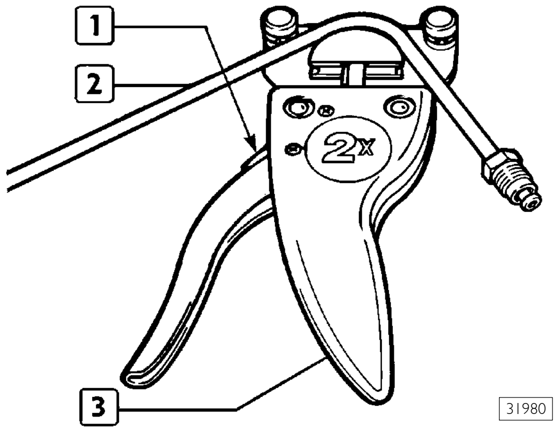
Assemble tool (1) 99386523, choosing parts (2) and (3) according to the diameter of the pipe to bend.

Figure 9



Position pipe (1) in tool (3) and bend the pipe by pressing the lever (2).

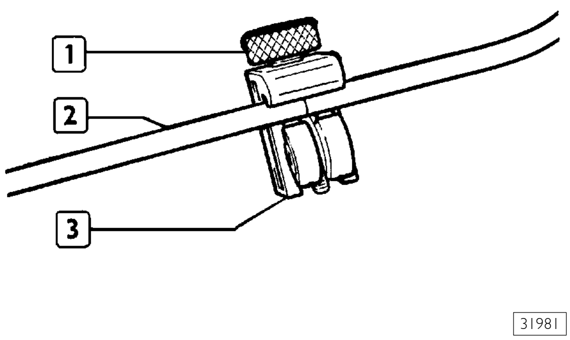
Figure 10



To release the pipe (2) from the tool (3), press the catch (1).

Cutting rigid pipes

Figure 11



Position pipe (2) in tool (3) 99386523 and tighten screw (1). Hold the pipe (2) and rotate the tool (3) until the pipe is completely cut.

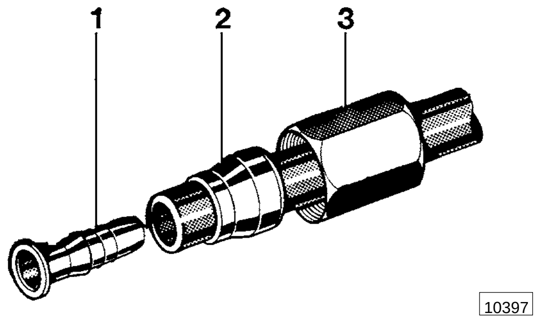
After cutting the pipe, deburr and proceed to form the end as described previously.

NOTE When tool (3) is rotated around pipe (2), screw (1) loosens. To cut the pipe completely, it is therefore necessary to tighten the screw (1) as and it become loose.

Replacing flexible hoses with threaded couplings

Carefully follow the instructions below:

Figure 12

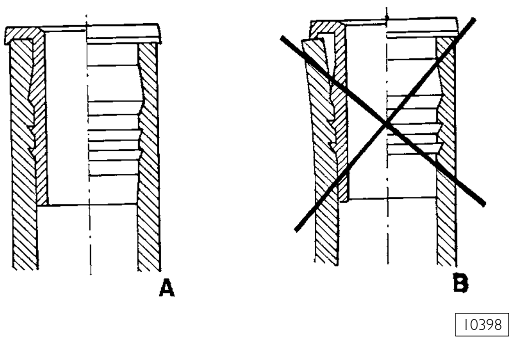


- ❑ Use only approved hoses;
- ❑ Check the condition of the new hose; there must be no cracks, cuts or incisions on it;
- ❑ Cut the hose to the required length, cutting at 90° to the centreline using proper pipe cutting pliers 99387050.

Fit onto the pipe, in the sequence given:

- ❑ nut (3), pressure ring (2) (larger thickness towards the nut (3)) and reinforcing bush (1);
- ❑ bush must be in perfect conditions (it must not show any distortion or signs of hammering);

Figure 13



FITTING REINFORCING BUSH
A = CORRECT FITTING METHOD
B = INCORRECT FITTING METHOD

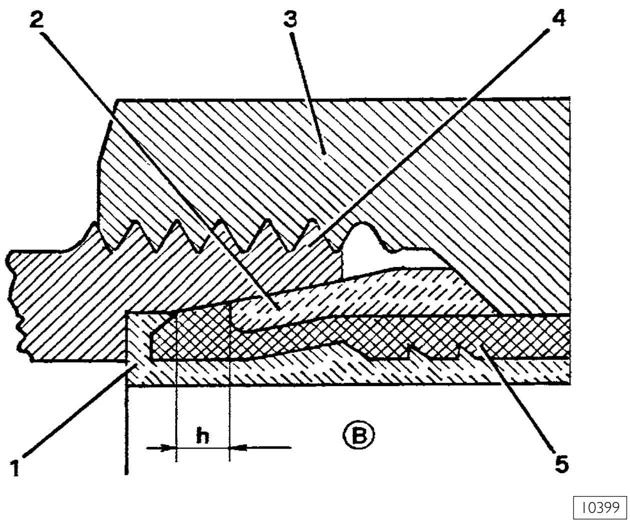
- ❑ Fit reinforcing bush using tool 99372219, ensuring that there is contact between its flange and the end of the hose;
- ❑ make sure that the end of the hose fits into the raked groove in the flange;
- ❑ end–form the seating bush, on fitting to the vehicle or on the bench, to a union.
- ❑ The pressure exerted and the final distance of the front edge of the pressure ring from that of the reinforcing bush must be the value listed in the table below.

NOTE If fittings are badly assembled, do not reuse the hose after extracting the bush and the seating ring.

	Pipe mm	Distance between bush and ring edge mm (*)	Assembling pressure N/mm^2
Double layer	6 x 1	from 1 to 1.5	0.040
	8 x 1	from 2 to 2.5	0.050
Single layer	10 x 1.5	from 2 to 2.5	0.050
	12 x 1.6	from 2 to 2.5	0.060
	16 x 2.34	from 3 to 3.5	0.060

(*) See reference h, Figure 14.

Figure 14



1. Reinforcing bush – 2. Pressure ring – 3. Nut – 4. Union – 5. Hose – h. Distance between bush edge and ring edge (see table)

Insert the end of the hose prepared in this way into the union body until the reinforcing bush flange bears against the seating:

- ❑ To tighten nut onto union, first of all screw in by hand and then complete tightening using a box wrench fitted on the dynamometric wrench, to be set according to the specified tightening torque.

When fitting the hose to the vehicle, some important points requiring care should be taken into account:

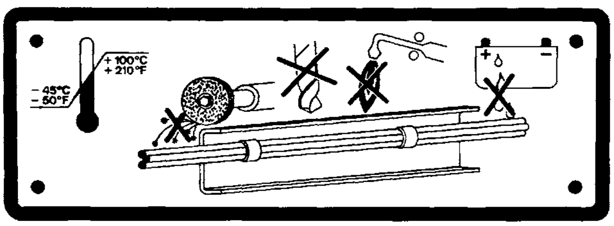
- Bends must comply with minimum radiuses, so as to avoid constrictions:

Pipe diameter mm	Minimum radius of curvature mm
6 x 1	≈ 40
8 x 1	≈ 50
10 x 1.5	≈ 60
12 x 1.6	≈ 75
16 x 2.34	≈ 100

Make sure that the hoses are not in contact with sharp edges or with sharp metal parts or sources of heat, but are at a minimum safety distance of 15 mm from these.

- When hoses run through chassis members or metal parts, make sure that the holes through which they pass are fitted with rubber grommets and that these are in good condition;
- Avoid sliding the hose along sharp edges which might cause cuts;
- When the hose has to be attached to existing piping, take into account of the additional heat to which it may be subjected (power steering piping); in this case, the hose must be protected with shields;
- When the hose has been connected, check that it is not under tension between the attachments points; leave it instead slightly slack to take up the more substantial variations in temperature, especially for short lengths;
- Before fitting, thoroughly clean the hoses by blowing compressed air through them to safeguard operation of the system;

Figure 15



13132

- Protect the hoses if grinding or welding operations are carried out on the vehicle; a label is fitted in the cab indicating the precautions to be observed carefully to avoid damages.

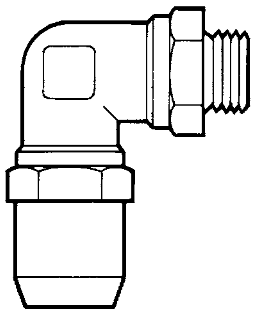
NOTE For greater safety and convenience in working, it is recommended to remove the hoses during these operations.

When fitting is finished, check that all seals (unions, couplings, etc.) are in perfect conditions.

Replacing flexible hoses with quick connection couplings

Swivel couplings:

Figure 16

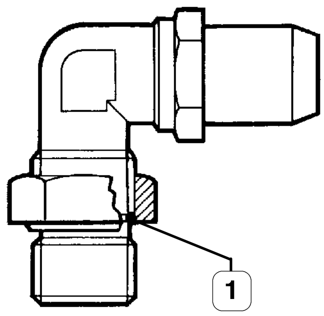


39306

Screw the coupling into the threaded seating provided on the air valve and tighten it to the tightening torque indicated in the table.

Banjo couplings:

Figure 17



39307

- Check that the sealing ring (1) is in its seat;
- Tighten the coupling until the sealing gasket touches the valve;
- Direct the valve correctly and keeping the movable part still, lock the hexagonal nut to the torque indicated in the table.

Swivel and banjo couplings:

COUPLING THREAD	TIGHTENIG TORQUE (Nm ± 10%)
M 10 x 1.0 mm	22
M 12 x 1.5 mm	24
M 14 x 1.5 mm	28
M 16 x 1.5 mm	35
M 22 x 1.5 mm	40

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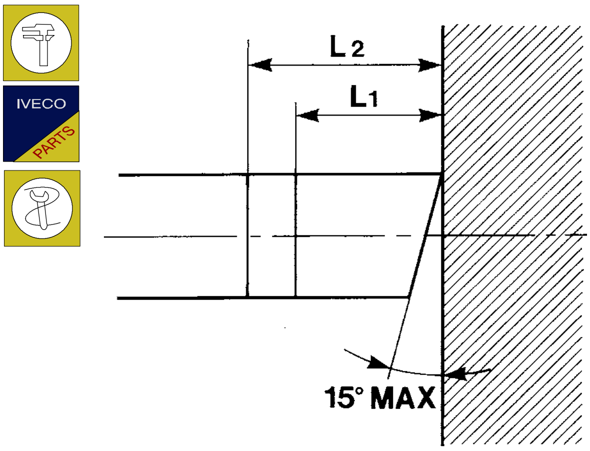
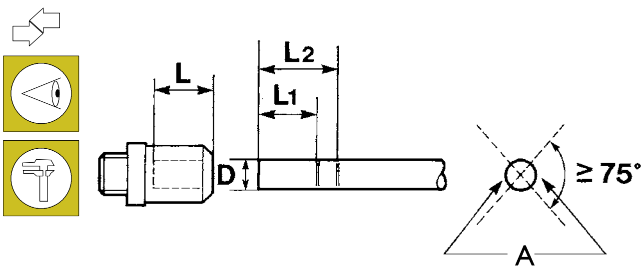
Figure 18



33977

- ❑ Use only approved hoses;
- ❑ Check the condition of the new hose; there must be no cracks, cuts or incisions on it;
- ❑ Cut the hose to 90°, maximum error 15° with reference to the axis. Use proper pipe cutting pliers 99387050 to cut to the required length.

Figure 19



33976

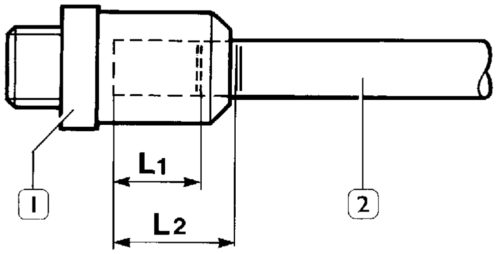
A = Mark to identify pipe end of stroke

- ❑ Use indelible ink to mark clearly two reference marks on both diametrically opposite faces of the hose at an angle of ≥ 75°, set at distances L_1 and L_2, to ensure correct fitting in place.

NOTE L_1 and L_2 vary according to the diameter of the hose and are to be measured at the longer part of the hose (see Figure 18).

D (mm)	L $^{0}_{+0,5}$ (mm)	L_1 $^{-0,5}_{+1}$ (mm)	L_2 $^{-0,5}_{+1}$ (mm)
6	19.8	17	22
8	20.5	18	23
12	25	22	28
16	27.1	24	30

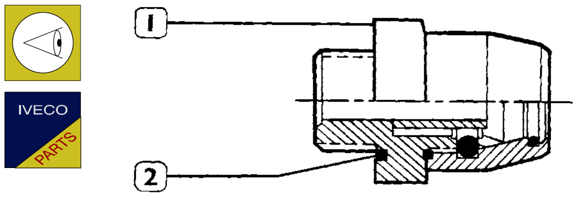
Figure 20



39308

- ❑ Insert the hose (2) by hand into the coupling (1) with a force between 30 and 120 N according to the hose diameter, so the reference mark L_1 is inside the hose whereas L_2 remains visible.

Figure 21



33978

When removing couplings (1) from pneumatic components, check the condition of the sealing ring (2), replace if required.

COUPLING THREAD	SEALING RING DIMENSIONS
M 10 x 1.0	10.1 x 1.6
M 12 x 1.5	11.0 x 2.0
M 14 x 1.5	–
M 16 x 1.5	15.0 x 2.0
M 22 x 1.5	–

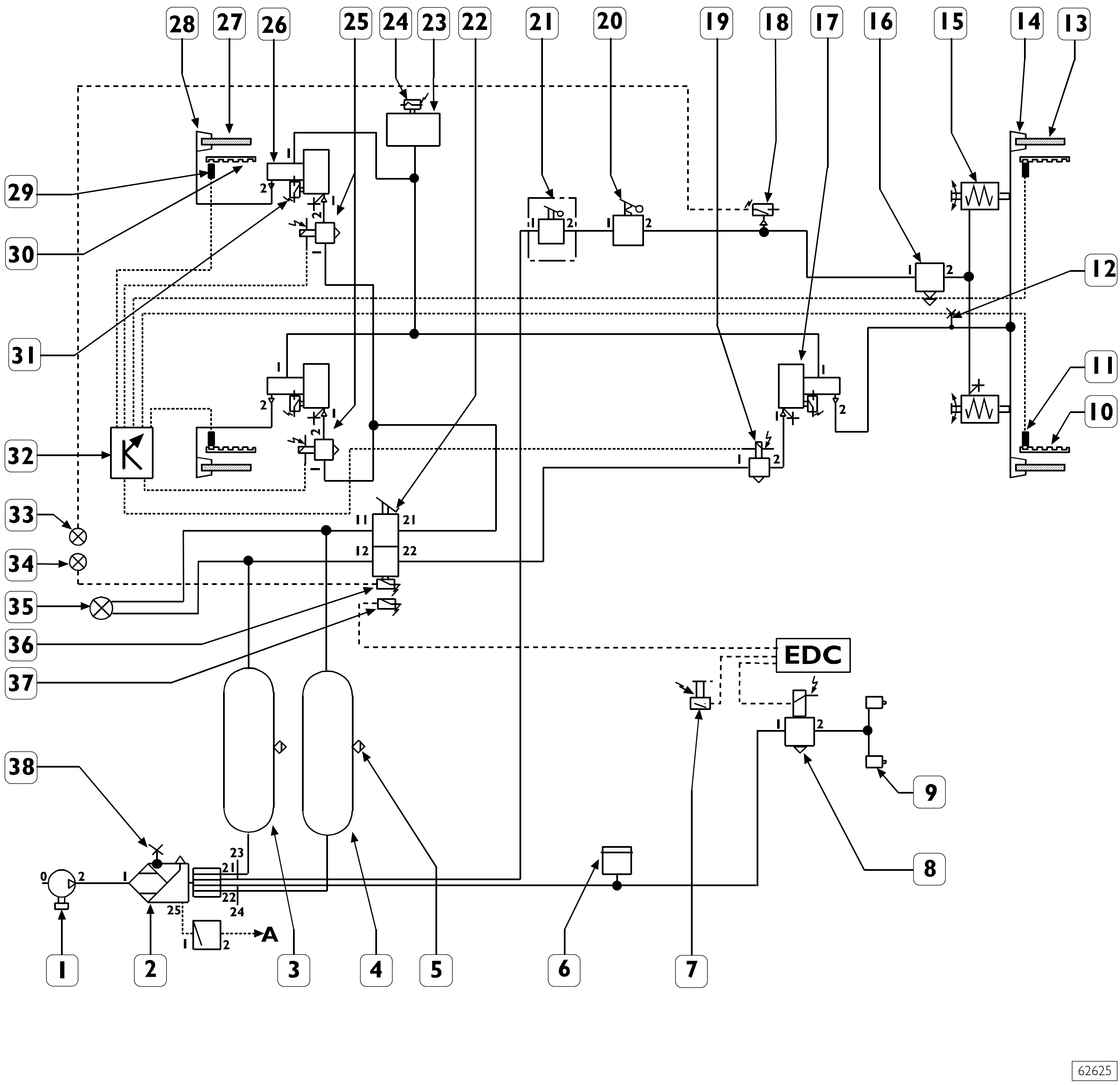
NOTE Whenever a hose is removed from a quick connection coupling, the coupling shall be replaced. Spare quick connection couplings are supplied complete.

NOTE Quick connection and threaded couplings are not interchangeable. This also applies to flexible hoses used with quick connection couplings and flexible hoses used with threaded couplings.

BRAKING SYSTEM

General layout for stand–alone vehicles

Figure 22



1. Compressor – 2. Air Processing Unit, 11 bar setting – 3. 15 l rear axle air tank – 4. 15 l axle air tank – 5. Manual condensate bleeder valve – 6. Safety valve (optional) – 7. Exhaust brake push button – 8. Exhaust brake solenoid valve – 9. Exhaust brake valve control cylinder – 10. Phonic wheel – 11. Rear axle rpm sensor – 12. Hydraulic control socket – 13. Brake disc – 14. Brake calliper – 15. Spring cylinder for parking brake – 16. Dump valve for parking brake – 17. Rear axle air/hydraulic converter – 18. Low pressure switch indication for handbrake on – 19. ABS solenoid valve – 20. Autorestrictive hand distributor for parking brake control – 21. Safety hand distributor (optional) – 22. Autorestrictive coaxial duplex distributor – 23. Oil tank – 24. Low oil level warning light – 25. ABS solenoid valves – 26. Air/hydraulic converter – 27. Brake disc – 28. Brake calliper – 29. Speed sensor – 30. Phonic wheel – 31. Converter extra travel warning light – 32. ABS ECU – 33. Parking brake led – 34. STOP light led – 35. Axle/rear axle pressure gauge – 36. Stop light relay control switch – 37. Switch indicating brake on for EDC – 38. Air control socket – A. To service circuit

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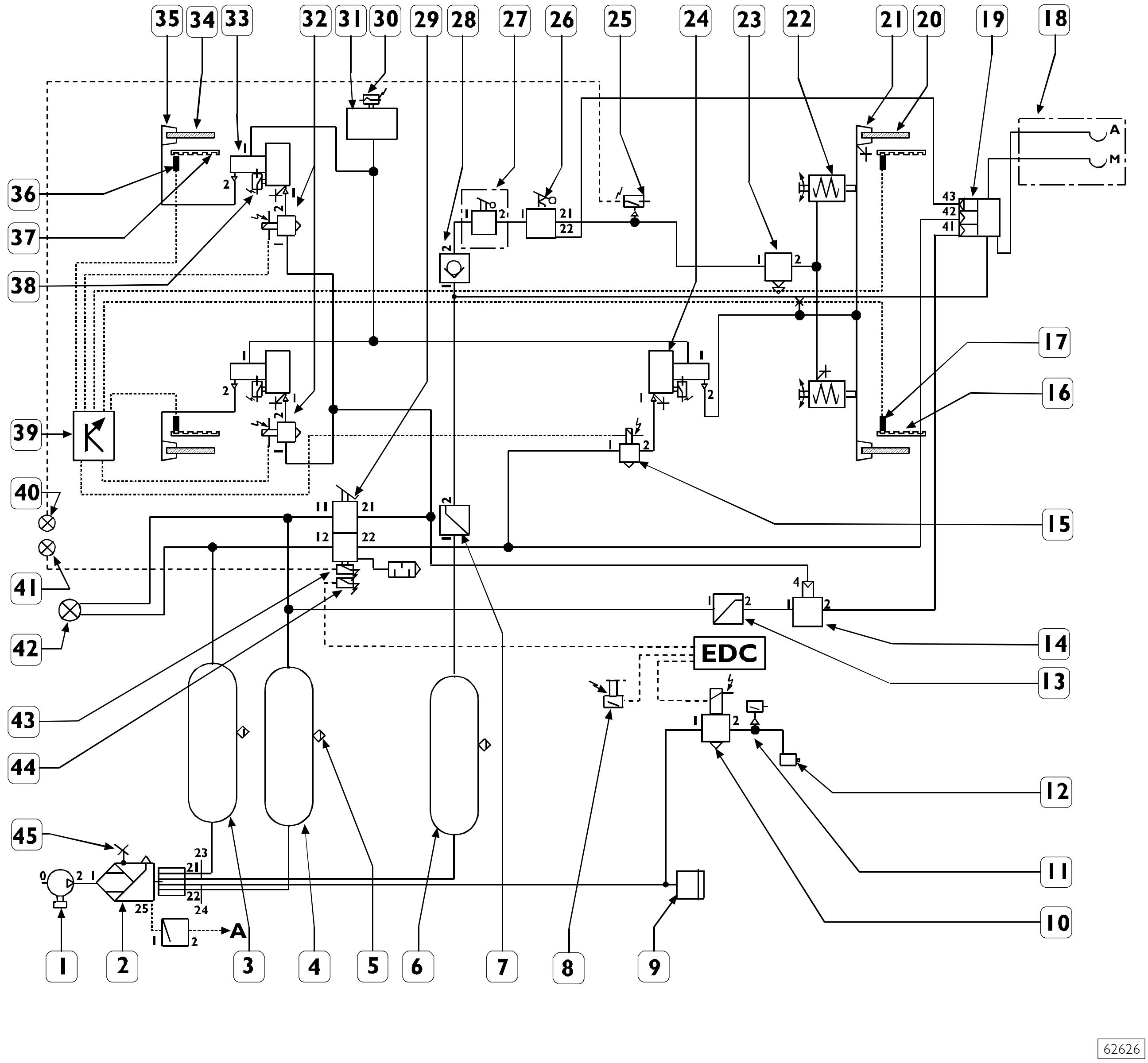
BRAKING SYSTEM

General layout for towing vehicles

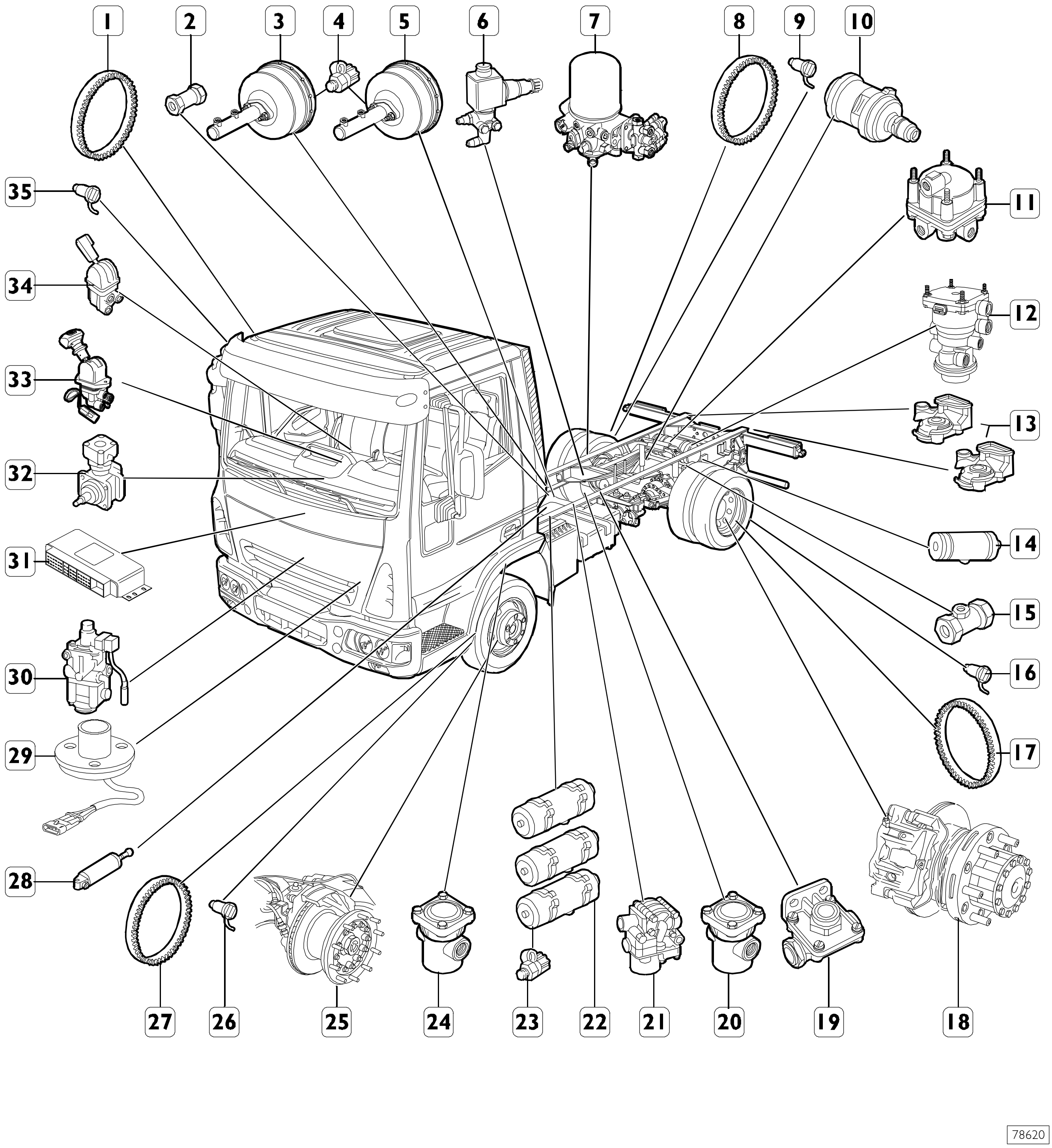
Figure 23



1. Compressor – 2. Air Processing Unit, 11 bar setting – 3. 15 l rear axle air tank – 4. 15 l axle air tank – 5. Manual condensate bleeder valve – 6. 15 l air tank for parking brake and trailer recharge – 7. Pressure reducer for parking circuit and trailer recharge – 8. Exhaust brake push button – 9. Safety valve (optional) – 10. Exhaust brake solenoid valve – 11. Trailer braking control pressure switch – 12. Exhaust brake valve control cylinder – 13. Trailer control pressure reducer – 14. Trailer braking control augmenter valve – 15. ABS solenoid valve – 16. Phonic wheel – 17. Speed sensor – 18. Trailer coupling half–joints – 19. Triple control servo distributor for trailer – 20. Brake disc – 21. Brake calliper – 22. Spring cylinder for parking brake – 23. Dump valve for parking brake – 24. Air/hydraulic converter – 25. Low pressure switch indication for handbrake on – 26. Hand distributor for parking brake control – 27. Safety hand distributor (optional) – 28. Parking circuit single–acting valve – 29. Autorestrictive coaxial duplex distributor – 30. Low oil level warning light – 31. Oil tank – 32. ABS solenoid valves – 33. Air/hydraulic converter – 34. Brake disc – 35. Brake calliper – 36. Speed sensor – 37. Phonic wheel – 38. Converter extra travel warning light – 39. ABS ECU – 40. Parking brake led – 41. STOP light led – 42. Axle/rear axle pressure gauge – 43. Stop light relay control switch – 44. Switch indicating brake on for EDC – 45. Air control socket – A.To service circuit

BRAKING SYSTEM MAIN COMPONENTS LAYOUT ON VEHICLE

Figure 24



1. Phonic wheel – 2. Check valve – 3. Air/hydraulic converter – 4. Pressure control socket – 5. Air/hydraulic converter – 6. Exhaust brake solenoid valve – 7. A.P.U. – 8. Phonic wheel – 9. Wheel speed sensor – 10. Spring cylinder – 11. Augmenter valve – 12. Triple control servo distributor – 13. Coupling head – 14. Parking brake + trailer tank – 15. Hydraulic pressure control socket – 16. Wheel speed sensor – 17. Phonic wheel – 18. Rear disc brake assembly – 19. Dump valve – 20. Pressure reducer – 21. Electropneumatic valve – 22. Air tanks – 23. Pressure control socket – 24. Pressure reducer – 25. Front disc brake assembly – 26. Wheel speed sensor – 27. Phonic wheel – 28. Exhaust brake operating cylinder – 29. Engine brake drive pushbutton – 30. Duplex distributor – 31. ABS ECU – 32. Single–cylinder compressor – 33. Parking brake distributor – 34. Trailer slow–down control distributor (optional) – 35. Wheel revolution sensor

Description

Service braking
Air/hydraulic pedal type with three independent circuits: one to activate front axle braking components, the other to activate rear axle components and, the third one for braking the trailer.

Exhaust brake
Since the exhaust brake system is of the electric type it is controlled by the EDC control unit. Three types of exhaust brake control are provided that can be selected through the proper switch set on the instrument panel, according to the different road types/conditions.

With selector to position (o), the push button set on the left side of the cab floor is always operating.

With selector to position 1, the exhaust brake is combined with the accelerator pedal and operates at accelerator pedal release.

With selector to position 2, exhaust brake and service brake are combined and operation takes place from the first pedal stroke section and holding in position.

Whenever the exhaust brake is on the corresponding led on the instrument panel is on.

Exhaust brake operation combined with accelerator pedal disables every control operation connected to the Cruise Control.

Operation
Irrespectively of the set type of selection, the exhaust brake solenoid valve is controlled by the EDC electronic control unit through connector B pin 11.

Exhaust brake solenoid valve switching from N.C. to N.O. enables engine oil flowing to operating cylinder which, by operating on engine exhaust throttle valve enables its braking.

Parking brake
It consists of hand distributor pneumatic control and spring cylinder which operates on rear wheel brakes to lock them.

In case of failure this system brakes the vehicle automatically.

Brakes
Brake linings house an electrical cable connected to a warning light set on the dashboard which indicates brake lining wear.

ABS device phonic wheels are fitted on wheel hubs.

Rear callipers are equipped with parking brake device.

Front and rear brakes are of the disc type. Discs are fitted on wheel hubs and are equipped with cooling fins to reduce the high temperature produced during braking.

Front and rear brakes
Front brakes
Axle 5833/1

- Type: GIRLING 68 032 134/35 2 × 60
- Type: BREMBO 22.5760.13/23 2 × 60
- Type: BREMBO 22.5760.11/21 2 × 60

Axle 5833

- Type: GIRLING 68 032 056/7 2 × 68
- Type: BREMBO 22.5660.12/22 2 × 68
- Type: BREMBO X906311/10 2 × 68

Rear brakes
Rear axle 4517

- Type: GIRLING 68 032 211/0 2 × 60
- Type: BREMBO 22.5770.13/23 2 × 60
- Type: BREMBO 22.5770.11/21 2 × 60

Rear axle 4521

- Type: GIRLING 68 032 208/9 2 × 68
- Type: BREMBO 22.5670.12/22 2 × 68
- Type: BREMBO 22.5670.10/20 2 × 68

DIAGNOSTIC

Main operating failures in the brake system:

1 – Recharging of the system poor or irregular;
2 – Rear axle service braking poor or irregular;
3 – Front axle service braking poor or irregular;
4 – Trailer service braking poor or irregular;
5 – Parking brake poor or inoperative;
6 – Parking brake on trailer poor or inoperative;
7 – Parking brake slow to release;
8 – Trailer parking brake slow to release;
9 – Vehicle skids when braking;
10 – Insufficient retarder braking on trailer;
11 – Early brake lining wear
12 – Brake system warning light comes on;
13 – Parking brake warning light on with hand lever in drive position
14 – Noisy brakes

! The complete diagnosis of electric and electronic components must be made using Modus, E.A.SY. and IT2000.

1 RECHARGING OF THE SYSTEM POOR OR IRREGULAR

Pneumatic system pipes leaking or broken	YES →	Tighten or replace loose or damaged fittings. Replace broken or damaged pipes.
NO ↓		
Air compressor faulty	YES →	Overhaul or replace the air compressor.
NO ↓		
A.P.U. is faulty	YES →	Overhaul or replace the A.P.U.

2 REAR AXLE SERVICE BRAKING POOR OR IRREGULAR

Pneumatic system pipes leaking or broken	YES →	Tighten or replace loose or damaged fittings. Replace broken or damaged pipes.

(continued)

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Worn and/or vitrified brake linings – YES → Overhaul or replace the brake linings

NO ↓

Rear brakes are faulty – YES → Overhaul the rear brakes

NO ↓

Duplex distributor is faulty – YES → Overhaul or replace the duplex distributor

NO ↓

Brake cylinders are faulty – YES → Overhaul or replace the brake cylinders

NO ↓

ABS solenoid valve is faulty – YES →
- ❑ Check electric wiring
- ❑ Replace the ABS valve

NO ↓

Automatic device to take up backlash is faulty – YES → Replace the complete brake calliper

3	**FRONT AXLE SERVICE BRAKING POOR OR IRREGULAR**

Pneumatic system pipes leaking or broken	YES →	Tighten or replace loose or damaged fittings. Replace broken or damaged pipes.
↓ NO		
Duplex distributor is faulty	YES →	Overhaul or replace the duplex distributor
↓ NO		
Worn and/or vitrified brake linings	YES →	Overhaul or replace the brake linings
↓ NO		
Front brakes are faulty	YES →	Overhaul the front brakes
↓ NO		
Relay valve is faulty	YES →	Overhaul or replace the relay valve
↓ NO		
Diaphragm brake cylinder are faulty	YES →	
↓ NO		
Automatic device to take up backlash is faulty	YES →	Replace the complete brake calliper

(continued)

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ABS solenoid valve is faulty	YES →	❑ Check electric wiring ❑ Replace the ABS valve

4	**TRAILER SERVICE BRAKING POOR OR IRREGULAR**

Pneumatic system pipes leaking or broken	YES →	Tighten or replace loose or damaged fittings. Replace broken or damaged pipes.
NO ↓		
Triple control servo distributor is faulty	YES →	Overhaul or replace the triple control servo distributor
NO ↓		
Duplex distributor is faulty	YES →	Overhaul or replace the duplex distributor
NO ↓		
A.P.U. is faulty	YES →	Overhaul or replace the A.P.U.
NO ↓		
Worn and/or vitrified brake linings	YES →	Overhaul or replace the brake linings
NO ↓		
Trailer brakes are faulty	YES →	Overhaul trailer brakes

5	**PARKING BRAKE POOR OR INOPERATIVE**

Fault		Remedy
Pneumatic system pipes leaking or broken	YES →	Tighten or replace loose or damaged fittings. Replace broken or damaged pipes.
NO ↓		
Combined brake cylinders are faulty	YES →	Overhaul or replace the combined brake cylinders
NO ↓		
Parking brake hand lever is faulty	YES →	Overhaul or replace the hand lever
NO ↓		
Worn and/or vitrified brake linings	YES →	Overhaul or replace the brake linings
NO ↓		
Relay valve is faulty	YES →	Overhaul or replace the relay valve
NO ↓		
Rear brakes are faulty	YES →	Overhaul the rear brakes

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6	**PARKING BRAKE ON TRAILER POOR OR INOPERATIVE**

Pneumatic system pipes leaking or broken	YES →	Tighten or replace loose or damaged fittings. Replace broken or damaged pipes.
↓ NO		
Triple control servo distributor is faulty	YES →	Overhaul or replace the triple control servo distributor
↓ NO		
Parking brake hand lever is faulty	YES →	Overhaul or replace the hand lever
↓ NO		
Worn and/or vitrified brake linings	YES →	Overhaul or replace the brake linings
↓ NO		
Trailer brakes are faulty	YES →	Overhaul trailer brakes
↓ NO		
Trailer control servo distributor is faulty	YES →	❑ Check electric wiring ❑ Replace the trailer control servo distributor

7	**PARKING BRAKE SLOW TO RELEASE**

Pneumatic system pipes leaking or broken	YES →	Tighten or replace loose or damaged fittings. Replace broken or damaged pipes.
NO ↓		
Relay valve is faulty	YES →	Overhaul or replace the relay valve
NO ↓		
Combined brake cylinders are faulty	YES →	Overhaul or replace the combined brake cylinders
NO ↓		
Parking brake hand lever is faulty	YES →	Overhaul or replace the hand lever
NO ↓		
Rear brakes are faulty	YES →	Overhaul the rear brakes

8	TRAILER PARKING BRAKE SLOW TO RELEASE

Cause		Remedy
Pneumatic system pipes leaking or broken	YES →	Tighten or replace loose or damaged fittings. Replace broken or damaged pipes.
NO ↓		
Triple control servo distributor is faulty	YES →	Overhaul or replace the triple control servo distributor
NO ↓		
Parking brake hand lever is faulty	YES →	Overhaul or replace the hand lever
NO ↓		
Trailer brakes are faulty	YES →	Overhaul trailer brakes

9	VEHICLE SKIDS WHEN BRAKING

Cause		Remedy
Pneumatic system pipes leaking or broken	YES →	Tighten or replace loose or damaged fittings. Replace broken or damaged pipes.
NO ↓		
Duplex distributor is faulty	YES →	Overhaul or replace the duplex distributor

(continued)

Front brakes are faulty	YES →	Overhaul the front brakes
NO ↓		
Rear brakes are faulty	YES →	Overhaul the rear brakes
NO ↓		
Triple control servo distributor is faulty	YES →	Overhaul or replace the triple control servo distributor

10 INSUFFICIENT RETARDER BRAKING ON TRAILER

Pneumatic system pipes leaking or broken	YES →	Tighten or replace loose or damaged fittings. Replace broken or damaged pipes.
NO ↓		
A.P.U. is faulty	YES →	Overhaul or replace the A.P.U.
NO ↓		
Triple control servo distributor is faulty	YES →	Overhaul or replace the triple control servo distributor
NO ↓		
Parking brake hand lever is faulty	YES →	Overhaul or replace the hand lever

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11 EARLY BRAKE LINING WEAR

Duplex distributor is faulty	YES →	Overhaul or replace the duplex distributor
NO ↓		
Brakes are faulty	YES →	Overhaul the brakes
NO ↓		
Triple control servo distributor is faulty	YES →	Overhaul or replace the triple control servo distributor
NO ↓		
Relay valve is faulty	YES →	Overhaul or replace the relay valve

12 BRAKE SYSTEM WARNING LIGHT COMES ON

Pneumatic system pipes leaking or broken	YES →	Tighten or replace loose or damaged fittings. Replace broken or damaged pipes.
NO ↓		
A.P.U. is faulty	YES →	Overhaul or replace the A.P.U.
NO ↓		
Improper wiring of warning light electric circuit	YES →	Find wrong connection and reset wiring

13 PARKING BRAKE WARNING LIGHT ON WITH HAND LEVER IN DRIVE POSITION

Improper wiring of warning light electric circuit	YES →	Find wrong connection and reset wiring
NO ↓		
Parking brake hand lever is faulty	YES →	Overhaul or replace the hand lever
NO ↓		
A.P.U. is faulty	YES →	Overhaul or replace the A.P.U.

14 NOISY BRAKES

Worn brake linings	YES →	Replace the brake linings
NO ↓		
Foreign matters between brake discs and linings	YES →	Remove the foreign matters between brake discs and linings
NO ↓		
Irregular brake discs	YES →	Grind or replace the brake discs.

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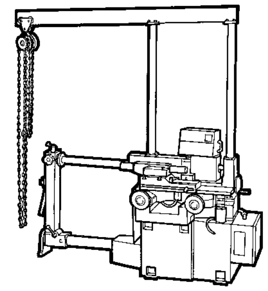
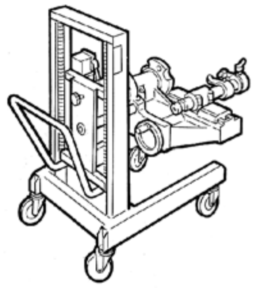
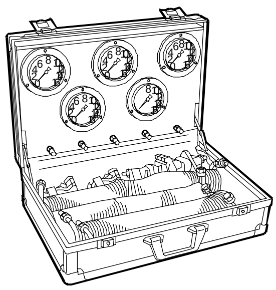
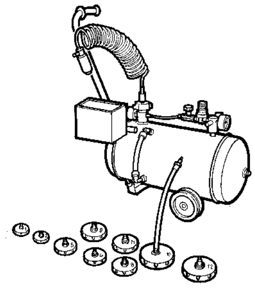
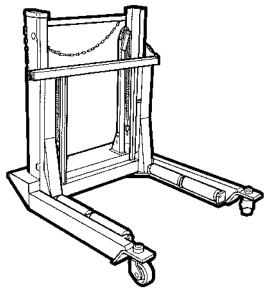
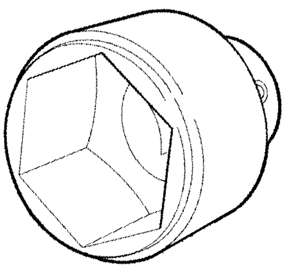
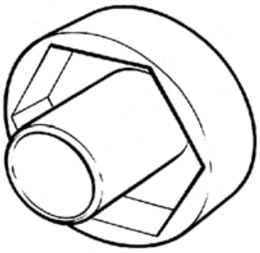
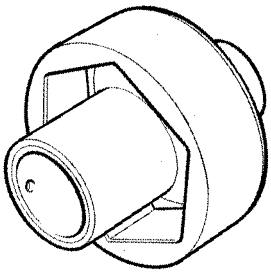
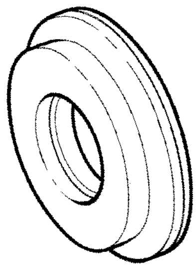
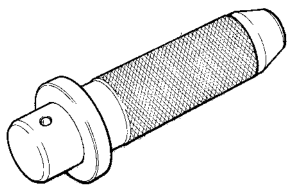
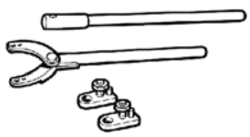
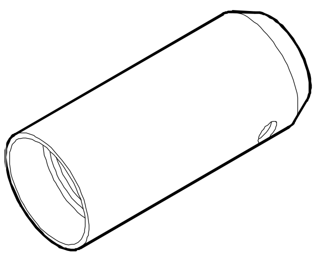
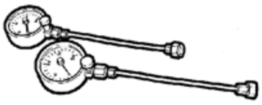
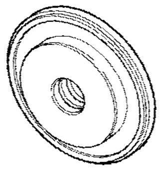
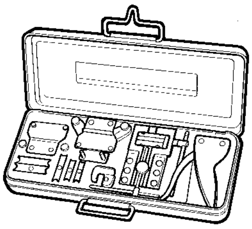
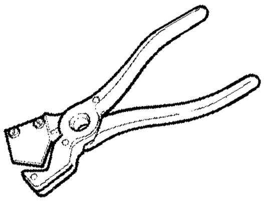
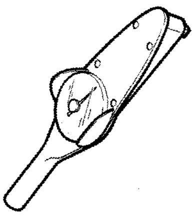
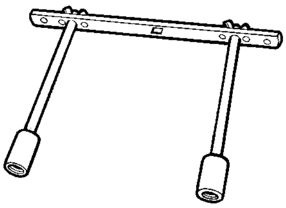
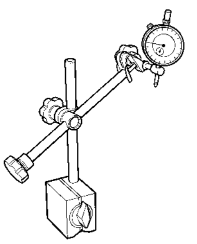
TIGHTENING TORQUE

COMPONENT	TORQUE	
	Nm	(kgm)
Compressor		
Head fastening screws	25 to 30	(2.5 to 3.0)
Connecting rod cap fastening screws	13+3	(1.3+0.3)
Air/hydraulic converters		
Screws fastening master cylinder to converter cover	40 ± 4	(4 ± 0.4)
Screws fastening converters to chassis	62 ± 5	(6.2 ± 0.5)
Nut for screw for fastening half bearing collar	10	(1)
Limit switch fastening to cover	20	(2)
Air inlet connection on base	17.5	(1.8)
Front brakes		
Wheel bearing fastening ring nut	279.5 ± 14.5	(2.8 ± 1.4)
Cheese–headed socket head screw for front wheel bearing adjusting clamp	27.5 ± 2.5	(2.75 ± 0.25)
Self–locking hexagonal–head screw for fastening brake callipers	169.5 ± 16.5	(17 ± 1.6)
Hexagonal–head screw for fastening brake disc to wheel hub	40 ± 4	(4 ± 0.4)
Front wheel hub cover	89 ± 9	(8.9 ± 0.9)
Tapered threaded plug for front wheel hub cover	57.5 ± 2.5	(5.9 ± 0.25)
Air bleeding screw on brake calliper	17.5	(1.8)
Hydraulic calliper guide pin screws	120	(12.2)
Rear brakes		
Air bleeding screw on brake calliper	17.5	(1.8)
Hydraulic calliper guide pin screws	120	(12.2)
Rear axle 4517		
Nut for fastening wheel bearings	490.5 ± 49.5	(49 ± 5)
Self–locking screw for fastening brake callipers	107.5 ± 10.5	(10.8 ± 1)
Wheel fastening nut	400^{+50}_{-20}	(42^{+5}_{-2})
Locking screw for ring nut to secure rear wheel bearings	9.1 ± 0.9	(0.9 ± 0.1)
Rear axle 4521		
Wheel bearing fastening nut	463.5 ± 46.5	(46 ± 5)
Screw for locking wheel fastening nut	9.1 ± 0.9	(0.9 ± 0.1)
Self–locking screw for fastening brake callipers	163.5 ± 13.5	(16 ± 1)
Wheel securing nut	500^{+50}_{-20}	(50^{+5}_{-2})

TOOLS

TOOL No.		DESCRIPTION
99301001		Brake drum and disc grinder and lathe
99301005		Brake discs grinding assembly
99305117		Air circuits testing equipment
99306010		Tool for bleeding air from brake and clutch circuits
99321024		Hydraulic trolley for removing and refitting wheels
99355038		Wrench (65 mm) for axle wheel hub cover

TOOL No.		DESCRIPTION
99357071		Wrench (85 mm) for wheel hub bearing adjusting nut (rear axle 4521)
99357080		Wrench (91.5 mm) for wheel hub bearing adjusting nut (rear axle 4521)
99374370		Tool for fitting wheel hub internal gaskets (to be used with 99370006)
99370006		Handgrip for interchangeable beaters
99370317		Reaction lever with flanges check extension
99370713		Guide for mounting axle wheel hub

TOOL No.		DESCRIPTION
99372269		Pair of pressure gauges to check pressure and adjust hydraulic braking control
99374132		Tool for fitting wheel hub internal gaskets (to be used with 99370006)
99386523		Flanging machine for brake pipes
99387050		Cutting nippers for polyamide pipes
99389819		0 to 10 Nm torque wrench with ¼" square connection
99395026		Tool for checking hub rolling torque (to be used with torque wrench)
99395684		Magnetic–base dial gauge

SPECIFICATIONS AND DATA – PNEUMATIC SYSTEM

DESCRIPTION

Compressor

❑ Type: KNORR	Single–cylinder
Displacement	225 cm^3
❑ Type: KNORR	Single–cylinder
Displacement	360 cm^3 (*)

(*) series–production on Full Pneumatic models – Optional on the other models

A.P.U. (drier/4 ways)

❑ Type: KNORR

Drier

Disconnection pressure	11.0 ± 0.2 bar
Connection/disconnection pressure difference	0.7 + 0.6 bar
Safety valve opening pressure	13.0 + 4.0 bar
Heat resistance	max + 100° C
Operating temperature	–40° C to +80° C
Supply voltage	24 V
Power	100W 24V

4–way protection valve

Opening pressure section 21–22	≥ 7.5 bar
Opening pressure section 23–24	≤ 8.0 bar
Closing pressure section 21–22	6.5 ± 0.25 bar
Closing pressure section 23–24	≥ 6.5 bar

Air tanks

Axle	15 lt
Rear axle	15 lt
Parking + trailer	15 lt

Duplex distributor

❑ Type: Knorr DX 65B – DX 65A

Feed pressure	11 ± 0,2 bar
Autolimiting pressure	7.6 ± 0,3 bar

Pressure limiting valve (for towable vehicles)

❑ Type: BENDIX AC 156B – WABCO 475 015 039 0

Feed pressure	11 bar
Outlet pressure	$8.5^{+0}_{-0.4}$ bar

DESCRIPTION

Augmenter valve (towing vehicles)

- Type: KNORR AC 575 A

Operating pressure	10 bar
Increment percentage	48%

- Type: KNORR AC 576 A

Operating pressure	10 bar
Increment percentage	29%

Triple control servo distributor (towing vehicles)

- Type: KNORR AC 597 C

Operating pressure	max 8.5 bar
Predominance	0.5 bar

- Type: KNORR AC 597 B

Operating pressure	max 8.5 bar
Predominance	0.5 bar

Variable and automatic coupling heads

- Type: KNORR, BOSCH, COBO

Operating pressure	7.5 bar

Air/hydraulic converters

- Type: 20/31.75 (Model 80E..) – 20/33,34 (Models 60E.. – 65E.. – 75E.. – 80EL..)

Air piston diameter	20”
Air piston stroke	max 50 mm
Extra–stroke indicator activation	39 – 41.5 mm
Hydraulic piston diameter	31.75 – 33.34 mm
Hydraulic piston stroke	max 50 mm

- Type: 24/31.75 (Models 75E.. – 80EL.. – 90E.. – 100E..)

Air piston diameter	24”
Air piston stroke	max 50 mm
Extra–stroke indicator activation	39 mm
Hydraulic piston diameter	31.75 mm
Hydraulic piston stroke	max 50 mm

Manual discharge valve

- Type: VOSS 520 899 750 0 – SIRIT VSM 2215

Maximum pressure	13 bar

- Type: TECKNOMATIK – TP 1609.00.00

Maximum pressure	13 bar

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DESCRIPTION

Parking brake distributor (single vehicles)

❑ **Type: KNORR DFR 0208 A**

Supply pressure	11 bar
Operating pressure	7.5 bar
Control lever excursion (discharging) with safety braking start (resistance point)	67°
Parking braking	73°

Parking brake distributor (vehicles adapted for towing)

❑ **Type: KNORR DPM 90 EY**

Supply and operating pressure	8.5 bar
Control lever excursion (discharging) with safety braking start (resistance point)	67°
Parking braking	73°
Control braking for supply check to trailer braking modulated servodistributor	86°

Dump valve

❑ **Type: BENDIX KY 2590/4**

Max. operating pressure	10 bar

Spring cylinder

❑ **Type: BENDIX 1186753 (Models 60E.. – 65E.. – 75E.. – 80EL..)**

Cylinder stroke		max 40 mm
Spring load	min	5500 N
	max	6300 N

❑ **Type: BENDIX 1186754 (Models 80E.. – 90E.. – 100E..)**

Cylinder stroke		max 40 mm
Spring load	min	6700 N
	max	7500 N

ABS electronic control unit

❑ **Type: KNORR–BREMSE**

Voltage	22 to 26 Volt

ABS solenoid valve

❑ **Type: KNORR IC 65 307 – IC 57664**

Max. service pressure	10 bar

❑ **Type: WABCO 472 195 0550**

Max. service pressure	13 bar

SPECIFICATIONS AND DATA – BRAKES

FRONT AND REAR BRAKE CALLIPERS AND DISCS	Front axle 5833/1 Rear axle 4517	Front axle 5833 Rear axle 4521
Brake calliper cylinders: – number – diameter ∅ mm	 2 60	 2 68
Brake lining thickness – standard S mm – min. admitted S mm	 15.75 1.6	 16.1 1.6
Brake disc diameter ∅ mm	304.0 to 304.3	322.0 to 322.3
Brake disc thickness: – standard S mm – min. admitted S mm	 30.00 to 30.15 27.75	
WHEEL HUBS		
Wheel hub bearings Front axles 5833 – 5833/1 Rear axles 4517 – 4521	 2 taper rollers 2 taper rollers and 1 needle	
Wheel hub bearing end float mm	max 0.16	
Bearing rolling torque: – Axle 5833 – 5833/1 Nm (kgm) – Rear axle 4517 Nm (kgm) – Rear axle 4521 Nm (kgm)	 0 to 2.3 (0 to 0.23) 0 to 4 (0 to 0.04) 0 to 4.5 (0 to 0.46)	
Wheel hub backlash adjustment Axles 5833 – 5833/1 Rear axles 4517 – 4521	 by ring nut by nut	
Wheel hub bearing oil Quantity per hub L (kg)	Tutela W 140/M DA 0.10 (0.09)	

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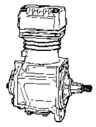
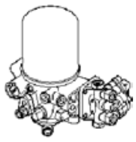
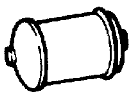
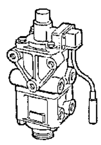
BRAKE SYSTEM MAIN COMPONENT CHECKS

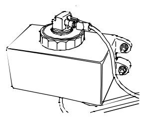
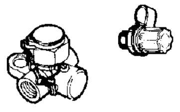
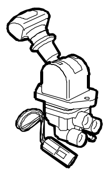
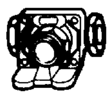
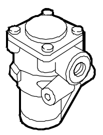
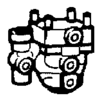
Since the vehicle system is approved according to the European road code standards, efficiency and components shall be checked periodically using tool 99305117.

These checks shall be performed with vehicle stopped, using the compressed air from the tanks, recharged, with engine running, from compressor.

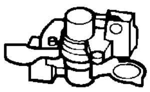
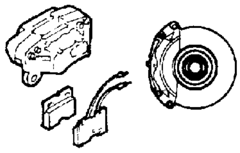
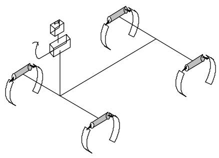
Always block the vehicle before starting any type of operation. Periodically check the gauges comparing them with a master gauge.

DEVICE	DESCRIPTION	CHECKS
	Compressor	Check tightness of fittings and compressor fastening; make sure that cooling fins are not dirty.
	A.P.U. (Air Processing Unit)	Operate on a bleeder valve or loosen a screw plug (with built–in bleeder hole) to check that the air drier is operating properly. The air should come out from the tank with no signs of condensate water.
	Air tanks for: Wet Front axle Rear axle Parking + trailer Regeneration (optional)	Check the seal and anti–rust protection. Discharge the condensate from the tanks through the bleeder valve.
	Duplex distributor	Press the pedal to the end of its stroke, releasing the pedal it should return immediately to its home position. Pressure restriction: 7.6 ± 0.3 bar Check that the pedal gasket is not worn, that the brake control rods are well secured and lubricated with no strain. Check that the lever housings are not worn or oxidised.
	Air/hydraulic converters – front and rear hydraulic pumps	1) Check converter and relevant hydraulic pump operation by depressing the brake pedal, with engine started or, in any case, with pneumatic system at 7.5 bar operating pressure. 2) Disconnect hydraulic pump delivery pipe and seal with caps to prevent coming out of brake fluid. Connect converter to a compressed air source and check that at ≤ 0.3 bar pressure the diaphragm covers the whole 50 mm stroke and control the hydraulic pump piston with smooth sliding. Otherwise proceed with overhauling. Reconnect the delivery pipe and bleed the hydraulic circuit.

(continued)

DEVICE	DESCRIPTION	CHECKS
	Brake fluid tanks:	Check brake fluid level, top up if required with Tutela DOT SPECIAL up to marking. Change the brake fluid every year.
	Air or hydraulic pressure control sockets	Check that protection plugs are fitted and tightened properly.
	Parking brake distributor	Operate the parking brake distributor until it triggers; the gauge on the control socket shall indicate pressure release to 0 bar in 1 second.
	Parking brake distributor (with check position)	The automatic coupling joint pipe and the gauge shall indicate at the same time a pressure of 7.5 bar.
	Dump valve	Check operation and seal. Operate the parking brake distributor and check compressed air quick bleeding from circuit.
	Spring cylinder	Check operation and seal. Operate the parking brake distributor until it triggers; check that mechanical components are properly adjusted to keep the vehicle braked also on a slope.
	Exhaust brake control operating cylinder	Check operation and seal.
	Pressure limiting valve	Check set pressure (see specifications and data table). Check operation.
	Triple control servo distributor for trailer braking, with built–in modulated servo switching	Fill the tank. Connect a gauge to the automatic coupling head and a to variable coupling head. At a pressure of 1 bar, coming from the duplex distributor, the variable coupling head should have a pressure between 0.8 and 1.5 bar. Make a full braking (vehicle at a standstill). Prescribed pressure must result at the coupling head, or a pressure that is 0.5 bar less. Activate the parking brake, at the variable coupling head the pressure should remain the same, or reduced by 0.5 bar.

(continued)

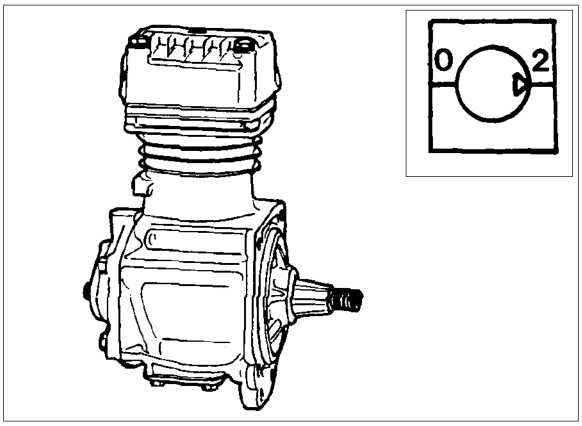
DEVICE	DESCRIPTION	CHECKS
	Coupling heads	Check there is no dirt or damage on the coupling guides. After coupling, operate the brake pedal and check the seal and stability between the coupling heads when delivering air at 7.5 bar. Check there are no air leaks from the coupling gaskets.
	Disc brake calliper Brake disc Brake linings	Check brake lining wear condition, brake disc scoring and wear, piston efficiency, and dust cover wear conditions.
	Pipes and fittings	Ensure that metal pipes are in perfect conditions, with no dents or cracks. Polyamide hoses must show no cracks, cuts or scores. Also make sure that they are not near sharp edges of the bodywork or chassis that could damage them. Check that all the brackets fastening the pipes are securely fixed – loose fastenings cause vibrations that could give rise to breakages. Check that polyamide hoses are not in contact with oil or mineral grease and rubber solvents. Depress the brake pedal and check that the pipes are not blown. Check there are no leaks from fittings, otherwise tighten them fully, taking care when tightening not to cause irregular pipe torsion. In all the above cases the parts are to replaced if there is a minimum doubt as to their efficiency. Apart from their condition, it is recommended to replace hoses after considerable mileage, or after a period of long vehicle use. This will prevent sudden breakages due to age and fatigue.
	Pneumatic system seal with engine off below the starting pressure	This check is made on threaded couplings. Deliver air at a pressure of not less than 5 bar and spread quite thick soapy water on the joints and couplings using a soft brush, then observe carefully for signs of leaks. An air leak is within tolerance if it corresponds to a soap bubble with a diameter of 25 mm in 5 seconds, or a pressure drop within 10 minutes amounting to 2% of the disengagement pressure (0.22 ± 0.02 bar).
	Pneumatic system seal in partial braking range with 3 bar	For 3 minutes the pressure must remain stabilised in the pneumatic system. The check is made with the parking brake deactivated.

BRAKING SYSTEM MAIN COMPONENTS

790510 COMPRESSOR

❏ KNORR

Figure 25



30411

It produces the compressed air required to feed the braking system and the auxiliary services.

Diagnostic

FAILURE	POSSIBLE CAUSE	REMEDY
Oil leakage from flange on outer side	Incorrect tightening torque.	Tighten the screws to the prescribed values.
	Flange body sealing surface not perfectly flat.	Check the sealing surfaces, replace faulty part or straighten them.
	Broken gasket	Replace the gasket
	Shaft gasket damaged.	Replace the gasket
Oil leakage from head	Damaged scraper ring (this can be seen because the whole seal seat is shiny)	Replace the entire piston.
	Scraper ring is badly fitted.	Fit in place with TOP inscription facing the compressor head.
	Scraper rings and piston rings are all on the same vertical line.	Fit in place at 120° with reference to each other.
	Scored or ovalized cylinder.	Grind the cylinder and fit a bigger piston.
No compression at all	Deteriorated compression or intake valve.	Replace the faulty parts.
	Piston rings are all on the same vertical line.	Fit the rings at 120° with reference to each other.
	Piston perforated or piston elements broken.	Replace the entire piston.
	Damaged gaskets.	Replace the gaskets.
Poor efficiency	Worn piston rings.	Replace the piston (and piston rings).
	Air leakage between cylinder and head.	Replace the gasket and tighten the screws to the prescribed torque.
	Excessive backlash between piston and cyl.	Grind the cylinder and fit a bigger piston.
	Particles of carbonized oil between the intake and compression valves.	Clean the valves.
Mechanical noises	Excessive backlash between small end and pin, between pin and piston hole, between shaft and big end, between shaft and bearing brass and between flanges and shaft.	Check the tolerance of the couplings involved
	Excessive backlash between piston and cyl.	Grind the cylinder and fit a bigger piston.
	Excessive deposits between piston and cylinder head caused by burnt oil.	Clean the incrustations and replace the valves.
Water seepage	Head gasket or contact surfaces scored and uneven.	Replace the faulty parts.

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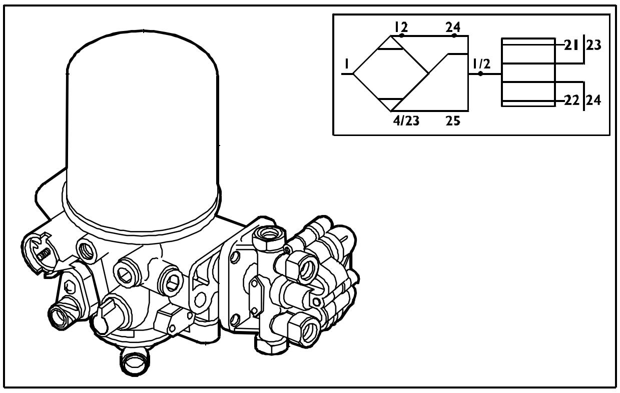
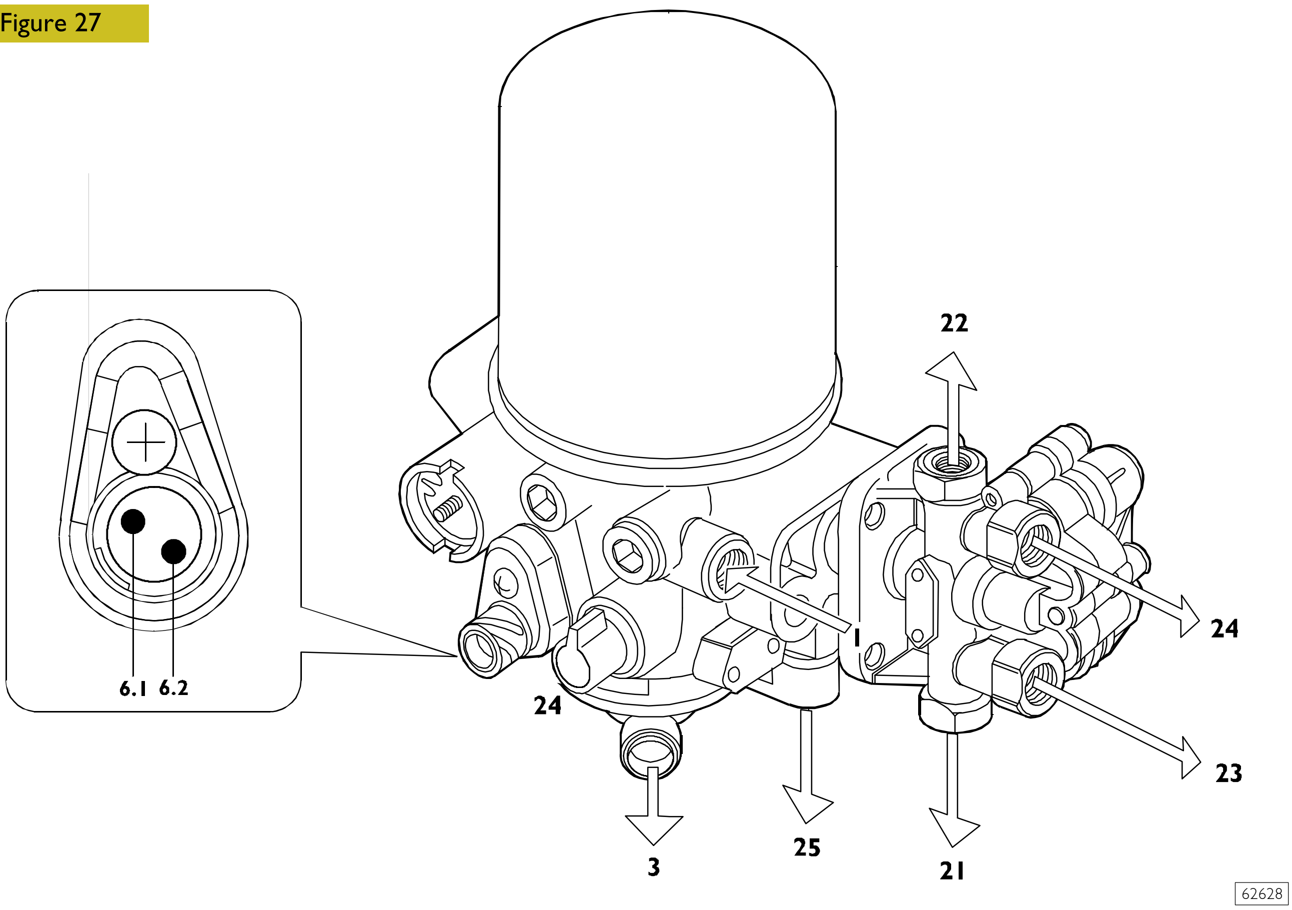
A.P.U. (Air Processing Unit)

Figure 26



Its task is keeping cleanness and correct humidity of air in the distribution system and keeping the necessary output pressure for operating the connected systems.
This component integrates the functions of four–way pressure regulator, pressure reducer for parking, services and trailer.

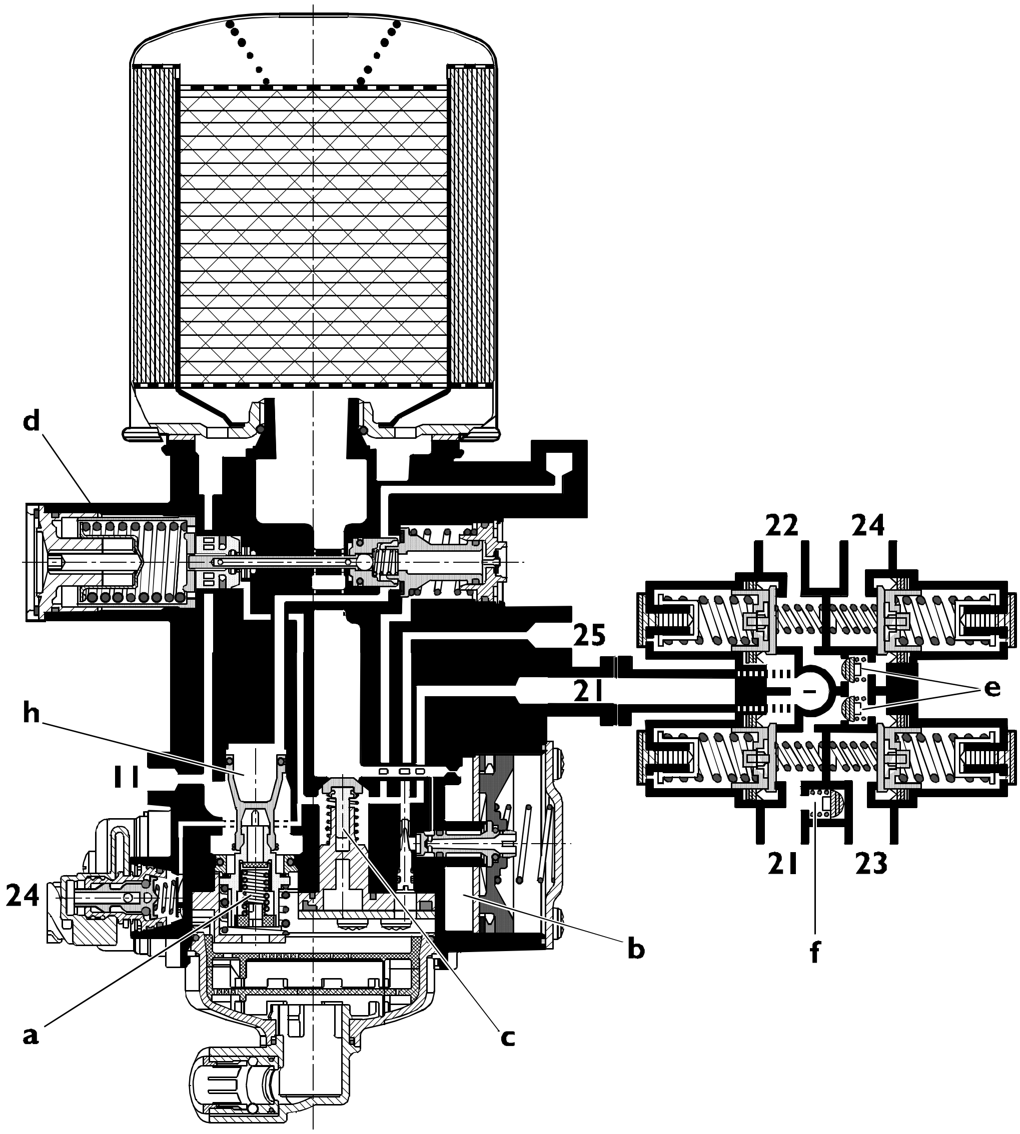
Figure 27



Pneumatic connections	Electric connections
Drier	6.1 – Negative for thermostatic resistance
1 – From compressor	
3 – Exhaust	
24 – To services	
25 – To pneumatic suspension	
4–way valve	
21 – To rear axle air tank	
22 – To front axle air tank	6.2 – Positive for thermostatic resistance
23 – To parking plus trailer air tank	
24 – To services	

Operation

Figure 28



62629

Recharge stage:

Compressed air coming from compressor through the feed pipe fitting "11" sets on the safety valve "a" (at 13^{+4} bar) and goes to the drier filter passing through the proper duct.

Compressed air flowing through the filter releases its humidity and feeds timer chamber "b" through the calibrated hole. At the same time, it opens hold single–acting valve "c" and, in this way, it feeds outlet pressure intake 24, pressure regulator "d", outlet 25 for pneumatic suspension circuit feed and for–way protection valve through outlet 21. This valve adjusts air below the controlled pressure valves of brake system outlets 21 and 22.

On reaching ≤ 7.5 bar pressure controlled pressure valves will open enabling to feed connected systems (rear axle braking system 21 and front axle braking system 22).

At the same time, through the two single–acting valves "e", air can reach the controlled pressure valve of the secondary sections.

Further pressure increase and the obtained > 8 bar pressure enable the opening of the controlled pressure valves of the secondary sections and therefore to feed outlets 23 and 24.

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When reaching the regulator calibration pressure of $10.3^{+0.2}$ bar, there occurs the opening thereof and the consequent opening of discharge valve "h" that generates a pressure drop inside the drier and the unidirectional keeping valve "c" closure and the activation of the drier filter regeneration step. The slow pressure drop of the timer supply chamber allows the pressure return from systems for a time of about 20 seconds. The compressed air returning from systems, when passing through the filter, will guarantee its regeneration and will discharge itself in the atmosphere through vent 3.

Failure phase of duct 21

In case there is a failure to main four–way protection valve circuit, the component will behave as follows:

The pressure drop that affects outlet 21 creates a general pressure drop in the whole component till the closure pressure is reached (6.5 bar) for the controlled–pressure valve in the faulty section.
This pressure decrease also goes to the regulator "d" that by moving itself goes back to its recharge condition.
The pressure drop in duct 21 creates the displacement and discharge opening of the safety valve "f" for the parking duct, that discharges the protection valve duct 23. With moving vehicle, the parking cylinders supply will be guaranteed either by the manual self–limited distributor (single vehicles) or by closing the unidirectional valve (vehicles adapted for towing) avoiding the vehicle self–braking.

Under this failure condition, the possible connected trailer will instead be automatically braked.

The system recharge, ensured by the regulator intervention, will take back the pressure at the opening levels of the controlled–pressure valve of the faulty section (about 7.5 bar), guaranteeing this pressure in all other component outlets.

The possible failure of all other sections will guarantee that the faulty valve opening pressure is kept for the healthy sections.

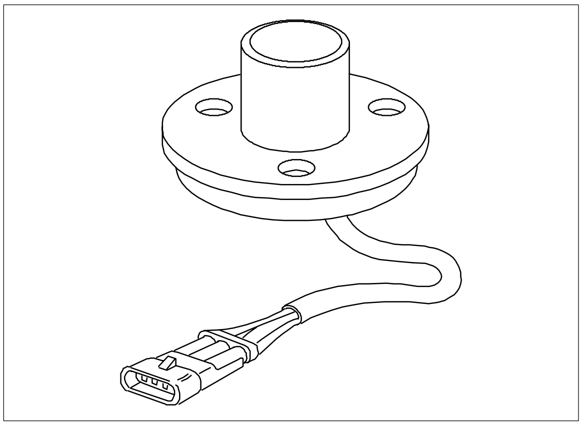
With any protection valve failure, the system supply is ensured at pressure levels that guarantee brake functionality but filter regeneration will not be ensured any more since this function is only activated when reaching the regulator triggering pressure.

Diagnostics

INCONVENIENCE	POSSIBLE REASON	REMEDY
Excessive amount of condensate in the circuit	Clogged filtering cartridge.	Replace the cartridge
The calibration pressure is not reached in the tank	Air leakage from safety valve.	Revise the device replacing the worn parts
	Worn sealing gaskets.	Revise the device replacing the worn parts
Exhaust air leakage	Insufficient piston seal.	Revise the device replacing the worn parts
Air leakage next to plugs	Valve leakages in the four sections.	Revise the device replacing the worn parts.
Air leakage in case of section failure	Faulty non–return valve operation.	Revise the device replacing the worn parts, if necessary, or replace the device.

ENGINE BRAKE SWITCH

Figure 29

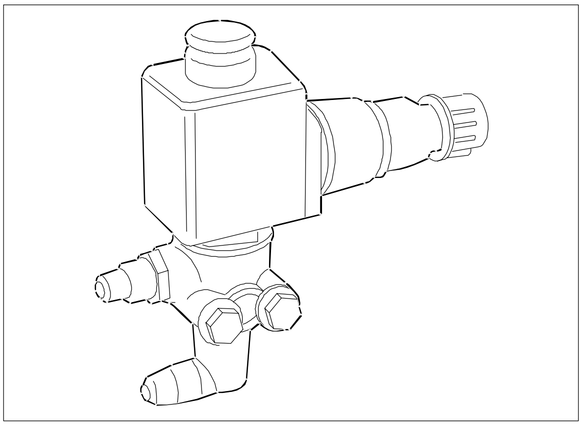


62372

It is a N.O. switch assembled on cabin floor. It provides a negative signal to the electronic unit for inserting the engine brake.

793336 ENGINE BRAKE SOLENOID VALVE

Figure 30

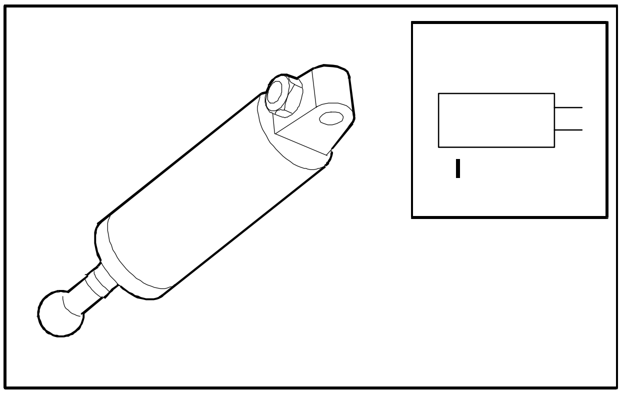


62382

It is an on/off solenoid valve of the N.C. type placed on the chassis.
This solenoid valve, driven by the unit, suitably supplies the engine brake control operating cylinder. A luminous signaller, placed on the dashboard, signals the engine brake insertion.

543730 ENGINE BRAKE CONTROL OPERATING CYLINDER

Figure 31

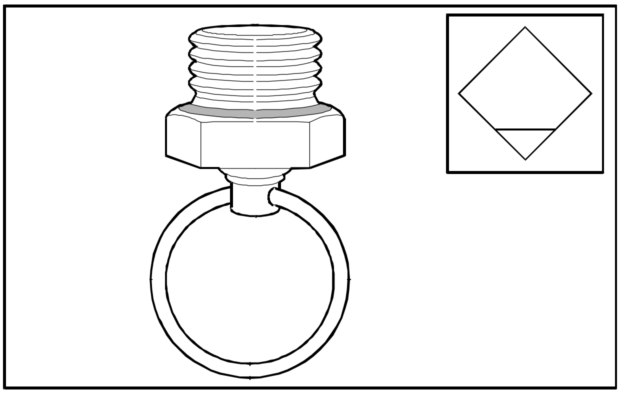


72658

The operating cylinder actuates the throttle valve clogging the engine exhaust gases duct.

MANUAL DISCHARGE VALVE

Figure 32



71957

This valve is assembled in tanks and its function is manually removing the possible condensate accumulated in the system tanks.

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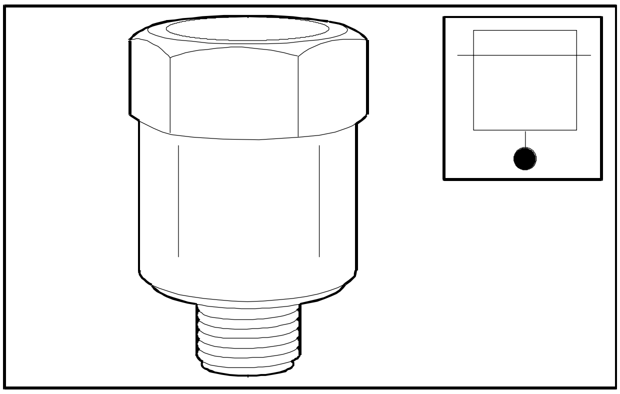
SAFETY VALVE (Optional)

Figure 33

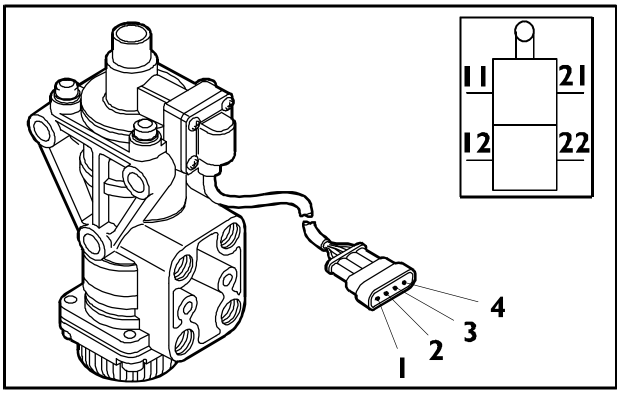


71959

It ensures the system limiting at a safety pressure in case of lack of pressure regulator operation.

793110 DUPLEX DISTRIBUTOR

Figure 34



62579

The device is divided into two independent sections whose adjustment members are controlled in parallel by a push rod that operates on an equalizer.

It takes air from tanks and delivers it to braking elements.

It is self–limited, that is, it limits air delivery at a maximum established pressure and therefore there occurs a higher energy availability and a constant maximum braking pressure independently from pressure oscillations in tanks.

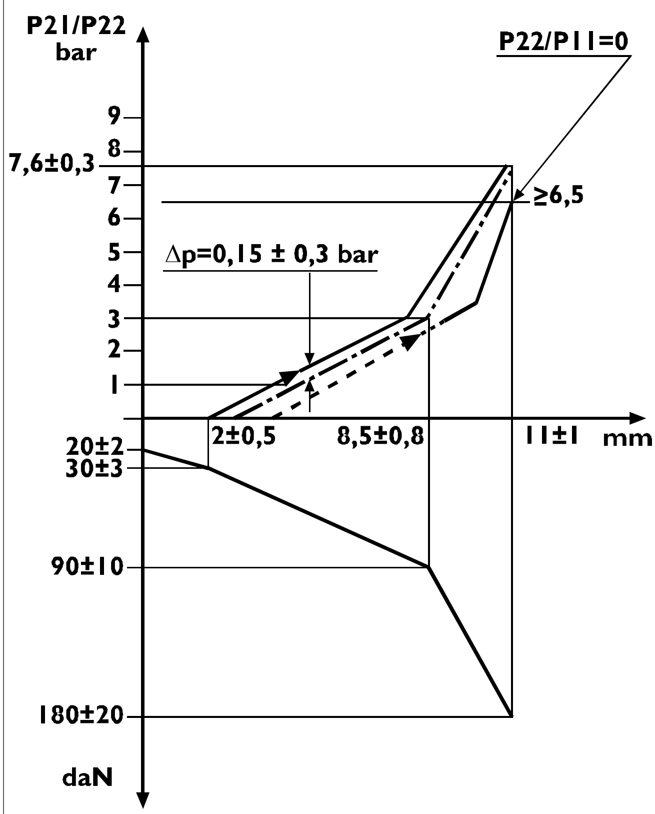
Pneumatic connections

11 – From front axle air tank
12 – From rear axle air tank
21 – To front axle
22 – To rear axle
3 – Discharge

Electric connections

1 – Not used
2 – Positive STOP lights/Body Controller
3 – Input positive
4 – EDC positive

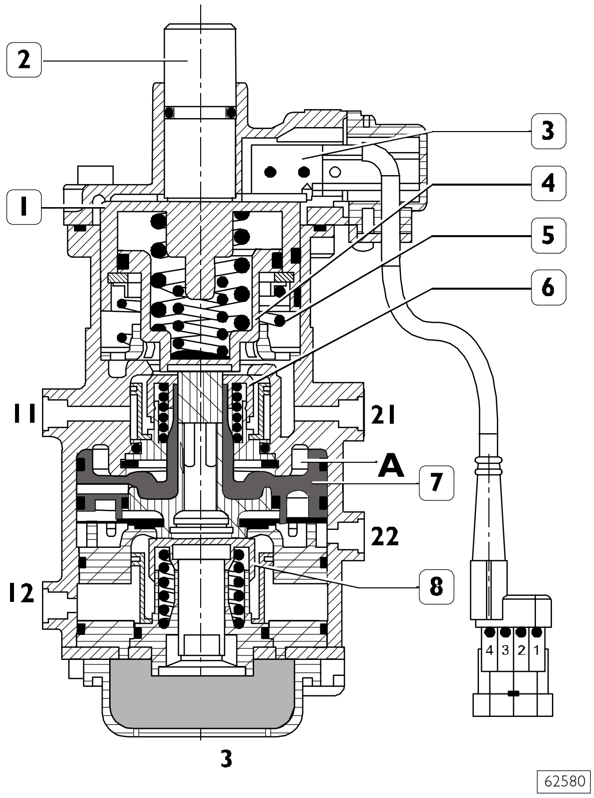
Figure 35



71951

The diagram shows the characteristic distributor curve and the self–limitation value at 7.6 ± 0.3 bar.

Figure 36



In rest condition the bleeder is open since spring (5) pushes upwards the piston unit (upper valve seat) (1 and 4).
Valves (6 and 8) are in their seats and cut off air flow between air inlet fitting **11** and **12** and outlets **21** and **22**.
Lower valve (7) seat piston is at rest (running) with bleeder **3** open.
Depressing the brake pedal the control push rod (2) and the piston unit (1 and 4) are pushed downwards.

Piston (4) push rod seat first closes the bleeder and then opens the upper valve (6). The compressed air coming from fitting **11** feeds the fitting **21** and chamber **A**.

When a pressure value of approx. 0.15 to 0.3 bar is reached inside section **21** and chamber **A**, the valve (8) opens due to the effect of piston thrust.

Piston (7) rests on valve (8), closes the exhaust outlet and opens the passage between fitting 12 and fitting 22.

In case of failure of the control section, the other one activates only for effect of upper pistons (1 and 4) mechanical thrust.

Pressing the control push rod (2) (max. stroke), sections **21** and **22** outlet pressure reaches 7.6 ± 0.3 bar, i.e. pressure autorestrictive value.

In case of 0 (zero) bar failure in feed fitting, when fully operating on control peg (8), air pressure in outlet fitting must be equal to or greater than 6.5 bar.

This is guaranteed by the mechanical thrust of the control push rod (2) which is resting on piston (1). Piston (4) goes then in contact to (7) and opens the valve (8).

At push rod (2) 0.5 to 1.5 mm stroke, stop light contacts close and exhaust brake contacts open in microswitches (3)

Brake release

When releasing the brake pedal, the control push rod (2) and the piston unit (1 and 4) return upwards together with piston (7).

Continuing to release the brake pedal the valves remain on the relevant inlet seats and then piston bleeding seats (4 and 7) disconnect from valves and air flows to atmosphere through bleeder **3**.

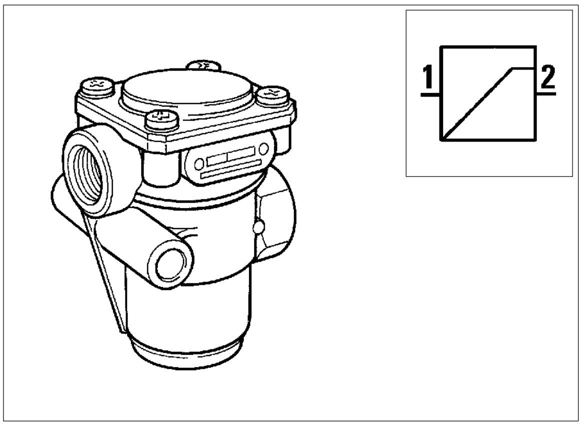
When brake release is ended, microswitches (3) return to running position.

Diagnostic

FAILURE	POSSIBLE CAUSE	REMEDY
Air escapes from the discharge hole	Leaks from outlet ducts due to sealing gasket wear	Overhaul the device and replace worn components
Irregular autorestrictive distributor	Auto-restriction higher or lower than required.	Adjust the device through the relevant screw
Vibrations when braking	Worn springs.	Overhaul the device and replace worn components
	Air leaks due to piston gasket seals in the two sections	Overhaul the device and replace worn components
Irregular operation of stop light control switch	The electric circuit does not close	Replace the switch
	The electric circuit does not open	Replace the switch

793321 PRESSURE LIMITING VALVE

Figure 37



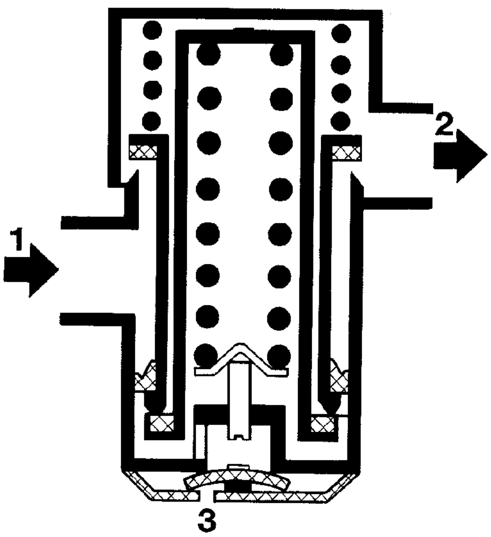
34953

Cuts off the compressed air flow to the user when the pressure in the latter reaches a determined value (set point).

Operation

❑ System feed

Figure 38

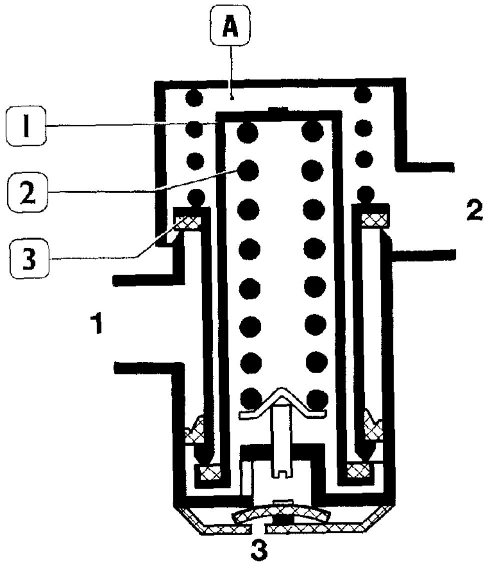


70118

Air from tanks freely flows through valve from fitting 1 to fitting 2 until it reaches calibration pressure.

Pressure limiting

Figure 39



20046

When the air contained in chamber (A) reaches the set value it overcomes the spring force (2) and pushes downwards pistons (1 and 3) thus stopping feeding.
Should set pressure on fitting **2** be accidentally exceeded, the piston shall continue its downstroke and the valve (2) shall open for the time required for releasing the excessive pressure through hole **3**.

Setting at the bench

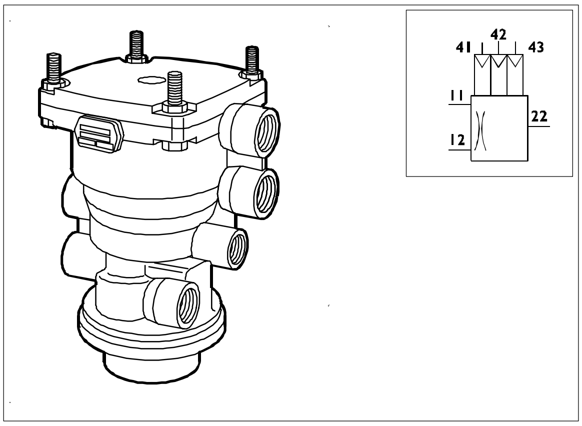
Set the device on the test bench and connect fittings **1** and **2** through the pipes to the gauges and air supply.
Correct to $7.5^{-0.3}_{-0}$ bar pressure through the adjusting screw and at the same time check the perfect seal of the unit.

Diagnostic

FAILURE	POSSIBLE CAUSE	REMEDY
Pressure at fitting 2 is different from set value	Valve misadjusted. Leaks from the sealing rings. Faulty piston and relevant seat	Adjust the device Overhaul the device and replace the damaged components. Replace the device.

793332 TRIPLE CONTROL SERVO DISTRIBUTOR

Figure 40



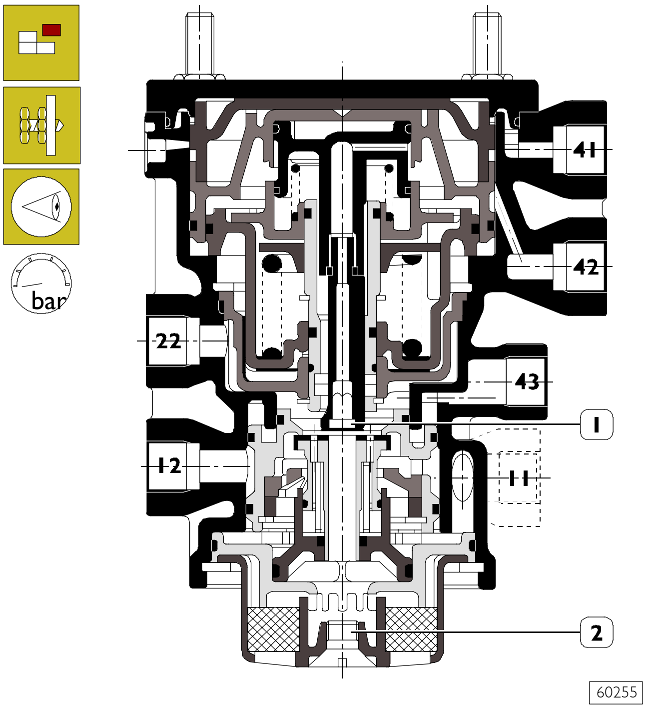
The unit, controlled by two separate circuits of the duplex distributor and the tractor spring brake circuit, controls the trailer braking. It is also equipped with a predominance regulating device fitted on the lower external part.

The unit houses a device to actuate the trailer brake should there be a fault in the control pipe.

Predominance regulation

Unit is equipped with a predominance regulating device.

Figure 41



To regulate servo distributor predominance, proceed as follows:

- ❑ Loosen the screw (2) from the silencer body.
- ❑ Fit a setscrew wrench into the hole through the silencer body and operate body (1) hexagonal hole.
- ❑ Turn CLOCKWISE to increase predominance.
- ❑ Turn COUNTERCLOCKWISE to decrease predominance.

Diagnostic

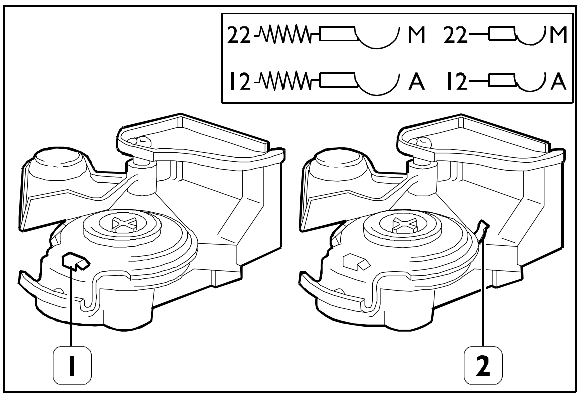
FAILURE	POSSIBLE CAUSE	REMEDY
Air leak from exhaust when in rest condition	Leaks from sealing gaskets. Faulty exhaust valve and relevant seat	Overhaul the unit and replace faulty components. Overhaul the unit and replace faulty components.
Outlet pressures different from established values	Air leak from sealing gaskets. Worn or faulty pistons and seats. Strained springs.	Overhaul the unit and replace faulty components. Overhaul the unit and replace faulty components. Overhaul the unit and replace faulty components.

798510 COUPLING HEADS

❑ Moderate

❑ Automatic

Figure 42

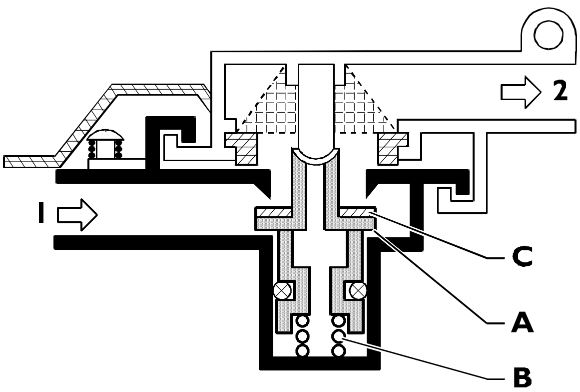


52871

The version for "Moderate" duct is equipped with a red cover and a safety projection (1), while the version for "Automatic" duct is equipped with a yellow cover and a lateral safety projection (2). The safety projections are used to avoid coupling errors.

Operation

Figure 43



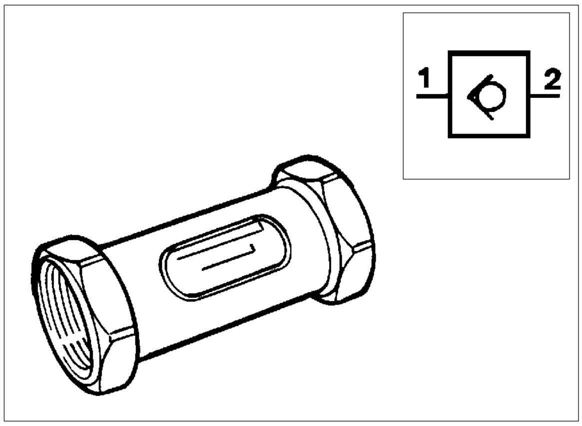
72657

The coupling operation consists in rotating a head with respect to the other (tractor trailer), guided by a rib that runs into a suitable guide till it locks. In this phase, the sealing gasket (C) pushes the closure valve (A) of the other head downwards, winning the spring resistance (B). A communication is thereby opened between the two heads guaranteeing their seal. By uncoupling the heads, the valves are automatically closed guaranteeing their seal.

793319 CHECK VALVE

❑ WABCO

Figure 44

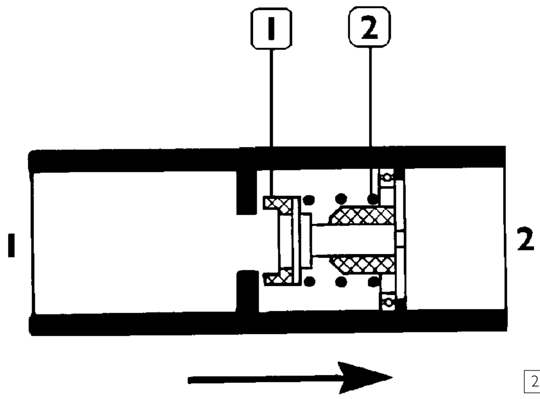


33987

Prevents compressed air flow back from trailer tank.

Operation

Figure 45



25958

1. Complete valve – 2. Spring

Enables the compressed air to flow in the direction of the arrow marked on the housing and prevents reflux

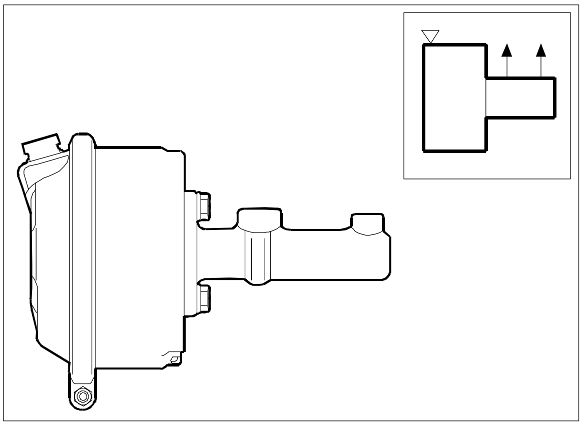
Valve connections:

1 – Feed

2 – Delivery

794101 AIR/HYDRAULIC CONVERTERS (diaphragm)

Figure 46



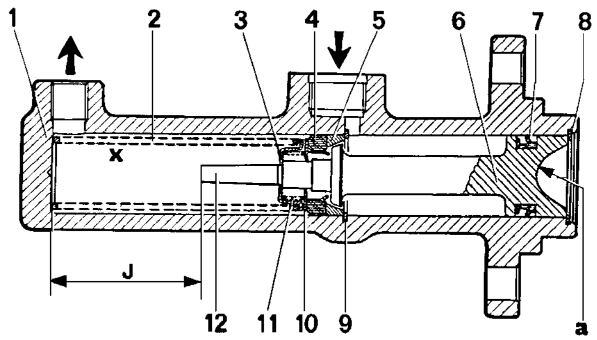
62369

This device transmits brake force and improves braking power. Initial pneumatic force, is transmitted hydraulically from diaphragm converter pump (master cylinder) to braking components.

Master cylinder

❑ BENDITALIA (Ø 31,75)

Figure 47



25966

MASTER CYLINDER LONGITUDINAL SECTION (BENDITALIA)

1. Cylinder body – 2. Spring – 3. Cup – 4. Sealing ring – 5. Spacer – 6. Piston – 7. Sealing ring – 8. Stop ring – 9. Shim split ring – 10. Spacer ring – 11. Spring – 12. Piston rod – j. Stroke

Brake fluid comes to inlet fitting from the tank set above and flows into cylinder body chamber (x). During braking it is compressed by piston (6) operated by converter push rod and is sent to brake calliper cylinders.

Checks

Connect converter to a compressed air source and check that at 0.3 bar the diaphragm is covering the whole 50 mm stroke. After 39 mm stroke brake lining wear indication switch contacts must close. Disassemble the converter if diaphragm damages are found. Mark collar position on half bearings; loosen collar fastening nut and separate the cover from the base, recover the return spring, remove the diaphragm from edges. If the stroke value indicated by the switch is not complying, or failure is found, remove from the servo brake cover. Check diaphragm return spring efficiency. Check sliding contact and push rod guide bush wear.

Check whether the total stroke of the master cylinder piston is corresponding with the values shown in the specifications and data table and that stroke is performed smoothly and regularly. Check also return spring efficiency and absence of leaks from the sealing ring.

NOTE Should master cylinder failures be found, replace the whole assembly since individual parts are not supplied as spare.

Refitting

Metal parts shall be perfectly clean and free from oil or derivative sign. Reverse removal operations. Grease the push rod in the guide bush sliding part. Take care to diaphragm connection between the two converter half bearings. Reposition the collar as marked before. Apply switch to cover with relevant washers and lock it to the specified torque. Repeat operation and stroke check by compressed air. Grease piston seat (a, Figure 47) with SP 349, fit the gasket and then the master cylinder to the converter, insert the fastening screws with spring washers and tighten to the specified torque.

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Diagnostic

PNEUMATIC CYLINDER

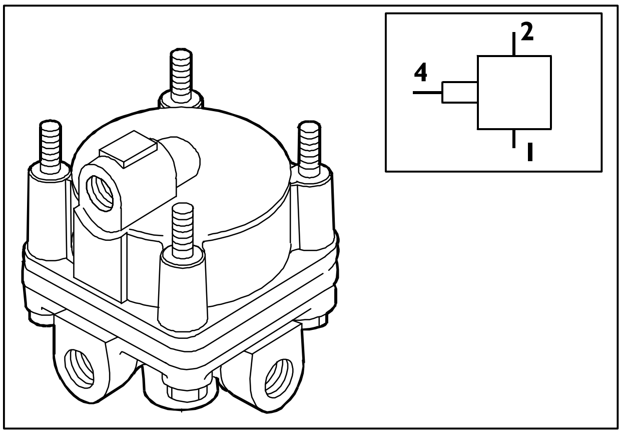
FAILURE	POSSIBLE CAUSE	REMEDY
Air leaks from vent during braking	Diaphragm with micro pores or perforated	Replace the diaphragm. Diaphragm anchoring between the two half bearings shall be perfectly airtight.
Insufficient brake shoes control master cylinder activation force	Diaphragm damaged or worn	Replace the diaphragm. Replace the spring.
Slow return to rest position	Strained return spring	Replace the entire converter if required.
	Hardened push rod when sliding into guide bush	Overhaul the unit and replace the faulty components.

MASTER CYLINDER

FAILURE	POSSIBLE CAUSE	REMEDY
Missing axle braking – discontinue axle braking	Locked master cylinder. Leaks due to sealing ring wear (4 and 7, Figure 47)	Remove master cylinder form converter cover, replace the assembly.
Slow piston return to rest position	Faulty piston–cylinder coupling; strained return spring	Remove master cylinder form converter cover, replace the assembly.

793325 AUGMENTER VALVE (towing vehicles)

Figure 48



78616

This device is fed by the pressure reducer and is controlled by the duplex distributor. It is used to improve control pressure to triple control servo distributor to provide the coupling half joint with the pressure values required by EC standards. Device connections:

1 – From (feed) pressure reduction unit

2 – To trailer braking triple control servo distributor

4 – From duplex distributor

Diagnostic

FAILURE	POSSIBLE CAUSE	REMEDY
Air leak from bleeder	Worn sealing gasket	Overhaul the unit and replace the worn components
Outlet pressure lower than preset pressure	Worn sealing gaskets	Overhaul the unit and replace the worn components
	Faulty piston and relevant seat	Replace the unit

ANTI–SKID SYSTEMS

Antilock braking system (ABS)

This system is able to prevent wheel locking which could occur when braking, under any vehicle load conditions and wheel–road surface friction coefficient, to ensure better braking performance and better vehicle stability.

The system is activated at ignition and automatically operates for speeds over 5 km/h if, after braking, one or more wheels tend to lock.

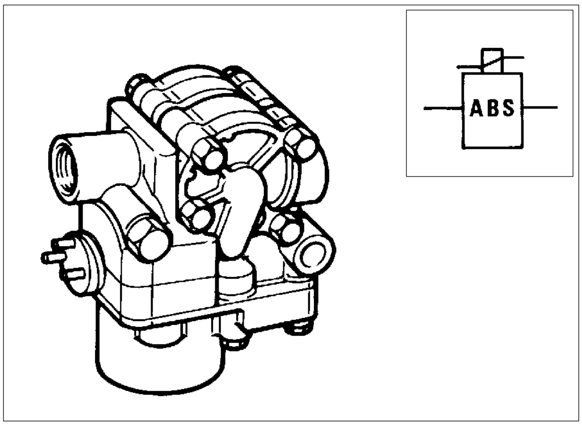
The ABS system can control the cutting out of the exhaust brake and the reduction gear locking (if any).

These are deactivated if it is detected that one or more driving wheels tend to lock.

The reactivation is automatic when the ABS system operation terminates.

526714 ELECTROPNEUMATIC VALVE

Figure 49



35379

This component modulates the air pressure in the front brake circuit.

Valve connections:

1 – From duplex distributor

2 – To front circuit air/hydraulic converter

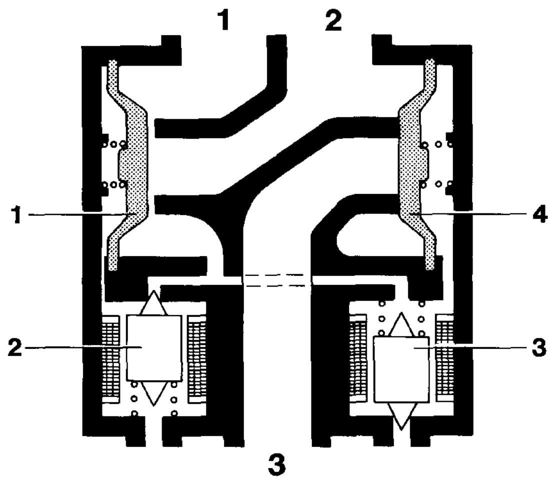
3 – Discharge

Operation

The electropneumatic valve modulates the air pressure at air/hydraulic converter inlet, according to signals received from ECU during three stages:

❑ Pressure increase

Figure 50

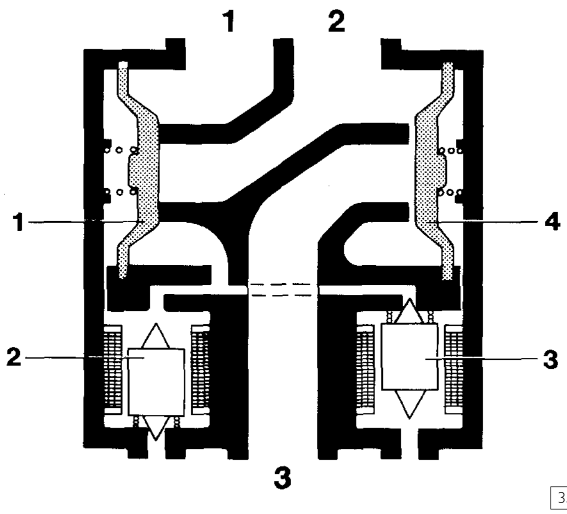


35380

Compressed air coming from duplex distributor to duct **1** pushes the diaphragm (1) outwards, thus enabling air to arrive on outlet **2** and therefore to air/hydraulic converter. At the same time, air is set behind the diaphragm (4) which closes the bleeder thus enabling to increase pressure in duct 2.

❑ Pressure decrease

Figure 51



35381

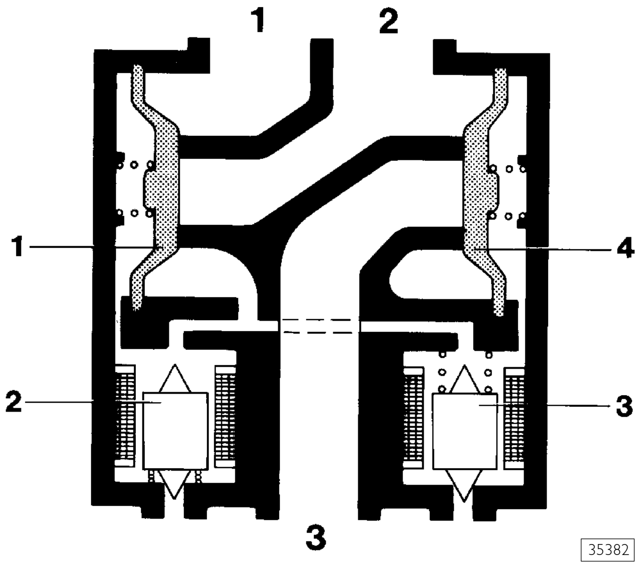
ECU detects if one wheel tends to lock and intervenes by sending a pulse to solenoid valves (2 and 3).

Solenoid valve (2) moves downwards whereas solenoid valve (3) moves upwards. The air contained and behind diaphragm (4) moves behind diaphragm (1) which stops supply.

Diaphragm (4) moves outwards and enables duct **2** air bleeding to atmosphere through duct **3** thus reducing pressure on solenoid valve outlet.

❑ Pressure keeping

Figure 52

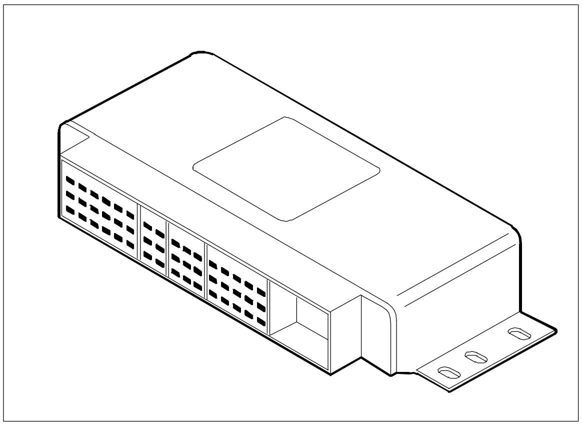


In this stage both solenoid valves are moved downwards, thus enabling air to set behind diaphragms (1 and 4) which, due to the higher available surface, stop both supply and discharge thus keeping constant the pressure value previously obtained in duct **2**, whatever the pressure exerted on the pedal brake is.

526711 ELECTRONIC CONTROL UNIT

❑ KNORR – BREMSE

Figure 53



62609

The ECU is the brain of the system. It controls the system solenoid valves according to the signals received from the wheel rpm sensors.

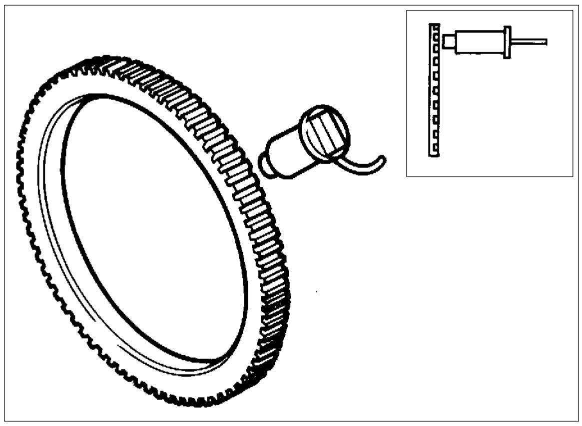
Operation

Each channel features four function circuits; the first is the input circuit that receives the analog signals from the sensor on the relevant wheel, signals are debugged and converted to digital data through the measurement of the cycle duration. There is also a main circuit which has a microprocessor to process the information received from the input circuit. The microprocessor contains a sophisticated programme that enables it to determine the wheel acceleration and deceleration values, and to make logic combinations of the various adjustment signals. When necessary it sends out two command signals that are sent to the relevant electropneumatic valve through the third control unit circuit, to suitably adjust the braking pressure.

The fourth and last circuit is the safety circuit that checks the efficiency of the various system components.
In case of failure, it not only informs the driver by switching on the relevant warning light on the dashboard, but it also automatically disconnects the entire ABS system, leaving the conventional braking system fully efficient.

526713 RPM SENSORS
526712 PHONIC WHEELS

Figure 54



35383

Rpm sensors and phonic wheels detect the revolutions of the respective wheels.

Operation

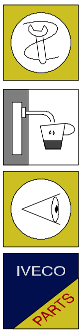
The phonic wheel is housed on the wheel hub and turns at the same speed as the wheel. It generates in the sensors, by induction, alternate voltages having a frequency that is proportional to the rotation speed of the wheel. These voltage signals are transmitted to the ECU for processing.

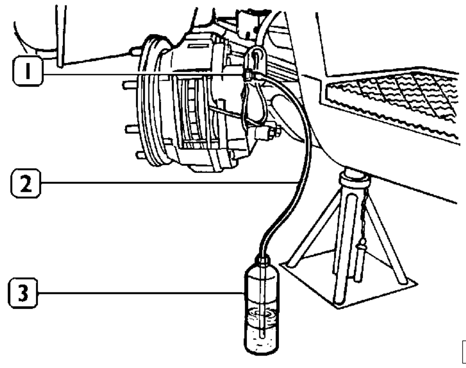
Each wheel has a sensor and a phonic wheel installed. This enables individual adjustment of the braking pressure for each wheel, thus optimising driving stability and braking distance.

AIR BLEEDING FROM HYDRAULIC CIRCUIT

Front brake circuit

Figure 55





33898

Apply to the bleeder screw (1) a transparent plastic hose (2) with one end immersed into a container (3) filled partially with brake fluid.

Depress the brake pedal repeatedly.

Press down the brake pedal and loosen 1 turn the bleeder screw at the same time.

Screw again the bleeder screw and depress the brake pedal repeatedly.

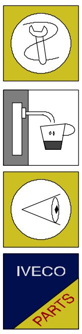
Repeat the above operation until the brake fluid flows homogeneous.

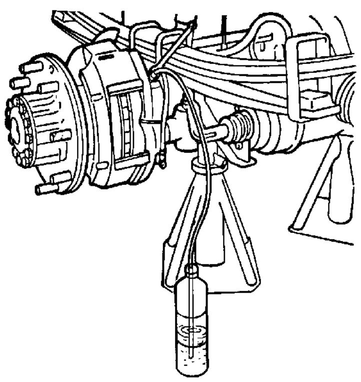
Bleed air from the opposite brake circuit. Check that brake fluid level in the tank is always sufficient.

These operations enable to bleed the air contained in the hydraulic circuit fluid pipes.

Rear brake circuit

Figure 56





33990

Disconnect load sensing valve control rod and lock it upwards to set the load sensing valve in max. opening position.

Bleed air from the hydraulic circuit.

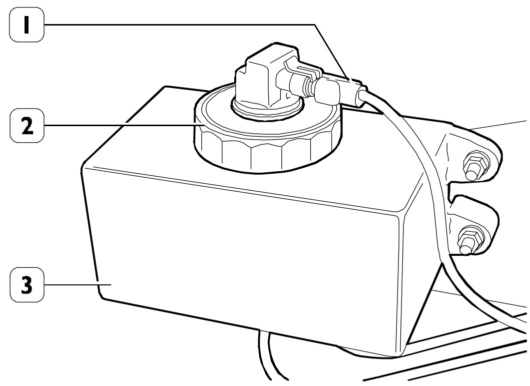
Operate as previously described for the front brake circuit.

Once bleeding is over, reconnect the load sensing valve control rod.

> ⚠ After completing the bleeding operations, top up the tank fully with **Tutela TRUCK DOT SPECIAL**.

Air bleeding from the hydraulic circuit using the deaerating device

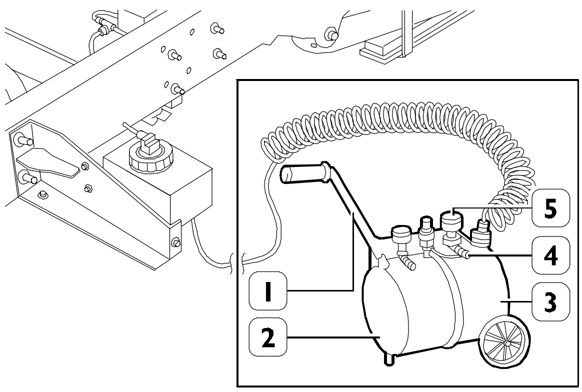
Figure 57



68383

Disconnect cable (1) from low brake fluid warning indicator cover connection.
Remove the cover (2) from front brake circuit tank (3).

Figure 58



62384

Connect the deaerating device (1) 99306010 to front brake circuit tank and bleed air from the brake circuit proceeding as follows:

- ❑ charge the air tank (2);
- ❑ fill the tank (3, Figure 57) with **Tutela TRUCK DOT SPECIAL**;
- ❑ remove protection caps from bleeder screws;
- ❑ fir the suitable box wrench on the bleeder screw;
- ❑ apply to the bleeder screw (1, Figure 55) a transparent plastic hose (2, Figure 55) with one end immersed into a container (3, Figure 55) filled partially with brake fluid.

- loosen the bleeder screw on the brake calliper by approx. one turn;
- open cock (4) until the gauge (5) indicates 1 to 1.2 bar pressure.

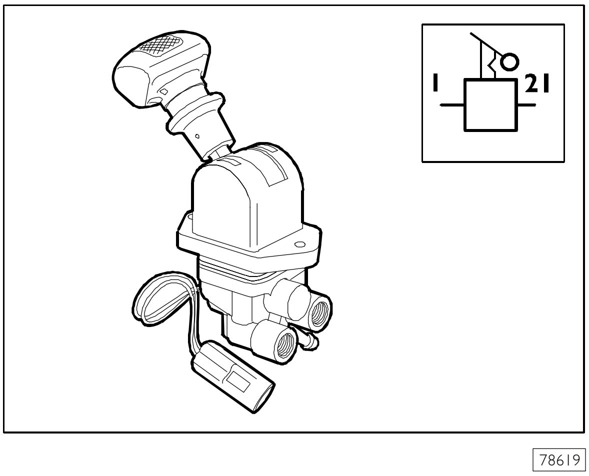
Close the bleeder screw when brake fluid comes out homogeneous from the plastic hose.

Bleed air from the opposite brake circuit.

After completing the bleeding operations, disconnect the de–aerating device, check brake fluid level in the tank and low brake fluid sensor electrical connections.

794310 PARKING BRAKE CONTROL HAND DISTRIBUTOR (stand–alone vehicles)

Figure 59



This device, inserted in the tractor parking brake circuit enables the actuation of the vehicle emergency and parking braking discharging the air contained in the spring cylinders.

Device connections:

1 – From four–way safety valve:

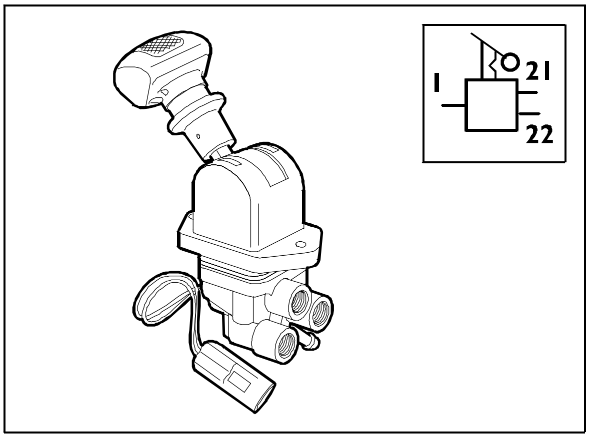
21 – To dump valve upstream spring cylinders.

Diagnostic

FAILURE	POSSIBLE CAUSE	REMEDY
Air leaks from bleeder with distributor lever in braking release position	Piston, exhaust valve, sealing rings worn or damaged	Clean carefully and check that all the rubber components and relevant seats are in perfect conditions. Overhaul the device and replace the faulty components.
Air leaks from bleeder with distributor lever in emergency or parking braking position	Piston and sealing ring worn or damaged	Clean carefully and check the components. Overhaul the device and replace the faulty components.
Air leaks from distributor control lever cover	Plate, gasket, sealing rings worn or damaged	Clean carefully components, check the seal and gasket surfaces. Check that all the rubber components and relevant seats are in perfect conditions. Overhaul the device and replace the faulty or worn components. Restore contact surfaces if required.
Distributor control lever is difficult to turn	Interference inside the distributor	Clean carefully and check all the components. Overhaul the device and replace the faulty components. When refitting grease slightly all sliding parts. If faults or wear are found that could impair operation, replace the entire device.

794310 PARKING BRAKE CONTROL-HAND DISTRIBUTOR (Towing vehicles)

Figure 60



78618

This device enables emergency and parking braking of the tractor and trailer.
Parking braking is mechanical for the tractor and pneumatic for the trailer.
This device also enables the checking of the tractor braking effect. This operation is required when the vehicle is parked on very steep roads.

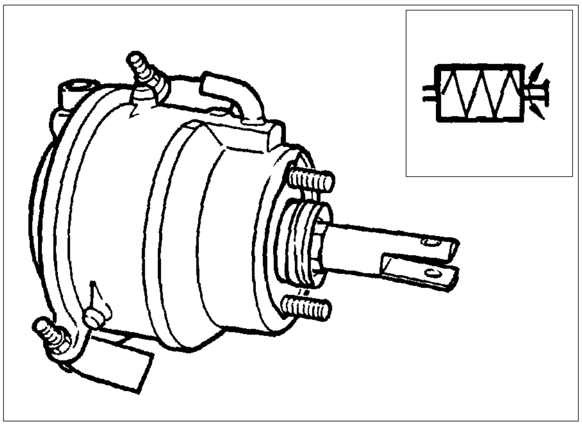
Device connections:
1 – From four–way safety valve
21 – To spring cylinders
22 – To trailer braking triple control servo distributor.

Diagnostic

FAILURE	POSSIBLE CAUSE	REMEDY
Air leaks from bleeder with control lever:		
In braking release position	Exhaust valve, relating seat or retaining ring defective.	Overhaul the device and replace the faulty components. Clean carefully its components.
In braking position	Drive valve, retaining rings and valve for component control defective.	Overhaul the device and replace the faulty components. Clean carefully its components.
Control lever is difficult to turn	Interference inside the distributor	Overhaul the device and moisten all the sliding parts.

794922 SPRING BRAKE CYLINDER

Figure 61



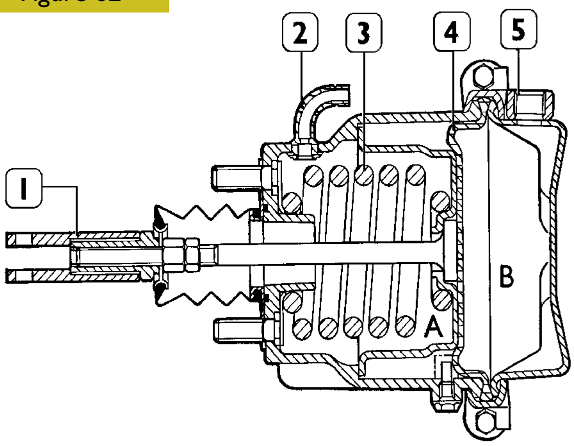
34007

This device brakes the vehicle during the parking braking and when the pneumatic system is discharged.

Operation

❑ Brake releasing position

Figure 62

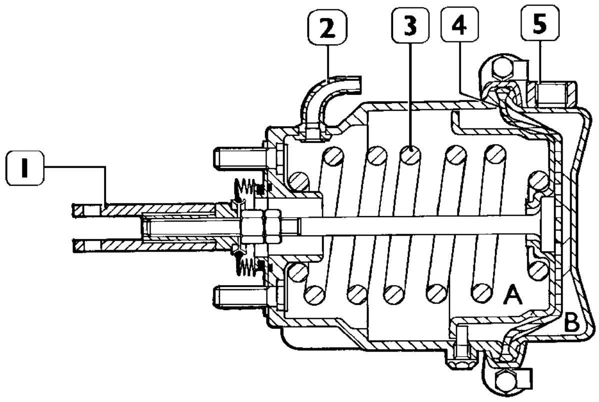


34008

With the lever in running position, air arrives to the dump valve and therefore to spring cylinder.
Air arrives to chamber B through fitting (5), operates the diaphragm (4) compressing the spring (3) and pushing outwards the sleeve (1) which is directly connected to the parking brake control lever. Pressure contained in chamber A is bled outside through fitting (2).

❑ Braking position

Figure 63



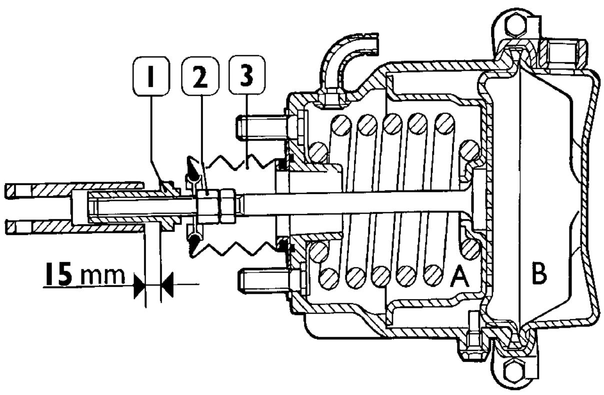
34009

With the lever in braking position, the air contained in chamber B, flows through fitting (5) and is bled by the dump valve. Spring (3) is released and drives the sleeve (1) and the diaphragm (4).
In chamber A, which is in communication with the outside, enters air at atmospheric pressure through fitting (2) due to the vacuum created by sleeve (1) and diaphragm (4) movement.

Spring cylinder emergency brake release device

❑ Vehicle braking release

Figure 64

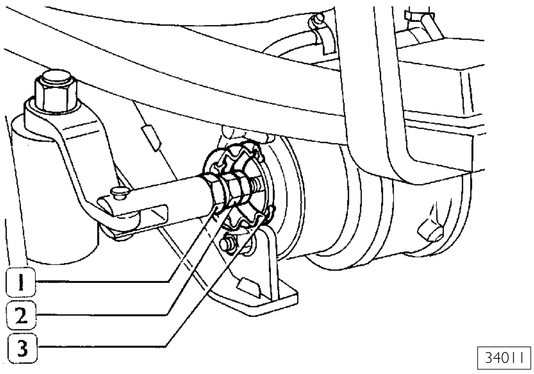


34010

Should it be impossible to feed air to chamber B, due to a failure upstream the spring cylinder, this device enables to release vehicle brakes by hand to enable towing. To perform this function proceed as follows:

❑ Set parking brake control lever to braking position.

Figure 65



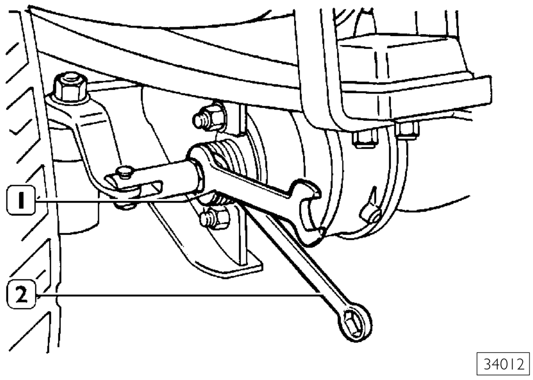
- ❑ Remove the protection boot (3).
- ❑ Stop the nut (2) using a 17 mm wrench.
- ❑ Use a 24 mm wrench to loosen the nut (1) for approx. 15 mm (see Figure 64).

NOTE Total spring release shall take place without loosening the thread completely.

After this operation on the emergency releasing device the vehicle can only be towed.

Resetting the rear brakes in running condition

Figure 66



After repairing the failure upstream the spring cylinder, reset the cylinder in normal operating conditions as follows:

- ❑ stop the nut (2, Figure 65) using the wrench (2); tighten nut (1, Figure 65) using the wrench (1);
- ❑ reset the boot to initial conditions; lift the rear part of the vehicle using hydraulic jack, set it on suitable stands, remove wheels, remove brake linings, and tighten the screw of the automatic backlash adjusting device to reset the proper backlash between brake linings and brake disc, during towing backlash may be varied.
- ❑ Perform these operations as described in chapter "replacing the brake linings".
- ❑ Fill tanks.

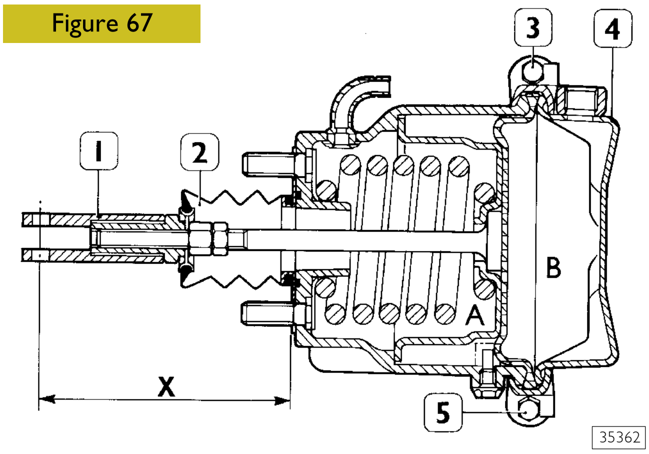
Refit brake linings, refit wheels, lower the vehicle and then depress the brake pedal several times.
Perform the above operations for both rear wheels.

NOTE To prevent improper backlash setting of the device contained in rear brake callipers, set the lever in running position only when the system has been repaired and spring cylinder position has been restored.

Repair operations

- ❑ Removal

Figure 67



Remove the boot (2), remove the sleeve (1), remove the nuts (3 and 5) with the relevant clamp and remove the cover (4). Overhaul the device and replace the worn components.

- ❑ Refitting

For refitting reverse the removal operations.

NOTE When refitting the sleeve, check that dimension X is 170 mm with lever in brake release position and full tanks.

Diagnostic

FAILURE	POSSIBLE CAUSE	REMEDY
Air leaks from fitting (2) with lever in brake release position	Damaged diaphragm.	Overhaul the device and replace the diaphragm.
Insufficient piston stroke for vehicle brake release	Improper sleeve adjustment	Adjust sleeve length.
	Damaged spring	Overhaul the device and replace the spring.

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5274 REPAIRING BRAKES

NOTE The following operations have been performed on model 80E18 and unless otherwise specified, stand valid also for the other models. Furthermore, a phonic wheel with the relevant wheel rpm sensor is fitted on front and rear wheel hubs.

Front brakes

Description

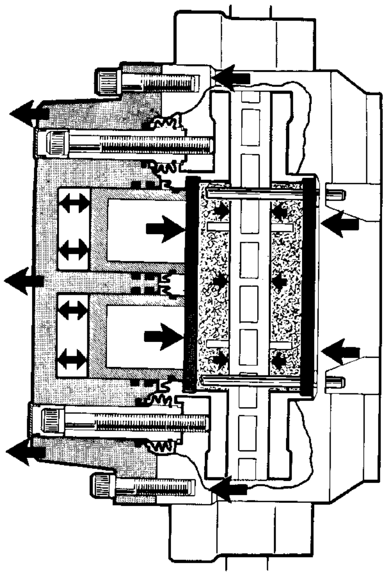
The supporting plate of the brake calliper assembly is secured to the stub axle by means of a support.

The hydraulic brake calliper body is connected to the plate by guide pins fitted with sliding sleeves which are lubricated and fitted with dust boots.

The hydraulic brake calliper body, performing floating operation on the plate, consists of two pistons.

Operation

Figure 68



27296

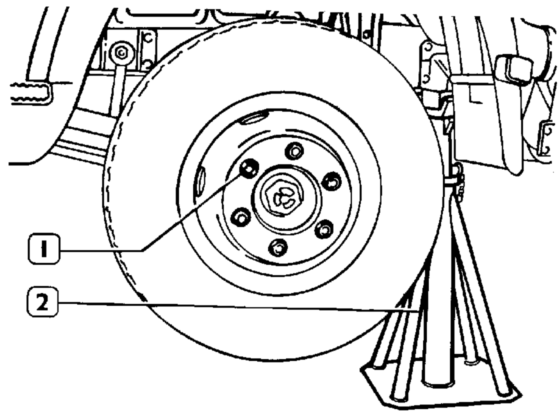
"GIRLING – BREMBO" 2 x 68 BRAKE CALLIPER HYDRAULIC OPERATION DIAGRAM

When hydraulic pressure is applied to the rear part of the pistons, they move and push the brake lining against the brake disc. For reaction, the hydraulic calliper body slides on guide pin sleeves to bring the opposed brake lining against the brake disc.
When operating the brake, the closing pressure of brake linings on brake disc is the same.

When hydraulic pressure is stopped, the piston sealing ring located in the cylinder part, moves back slightly the piston thus enabling the sliding components to reduce their movement to retract the brake linings, which however remain near the brake disc to be ready for next braking.

5274 REPLACING FRONT BRAKE LININGS

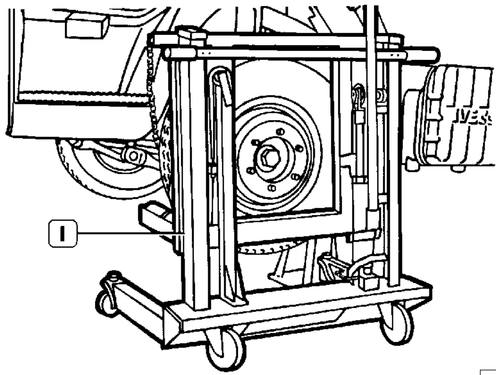
Figure 69



32963

Set the vehicle on flat ground and lock the front wheels. Loosen front wheel fastening nuts (1). Lift the front part of the vehicle using a hydraulic jack and rest it on two stands (2).

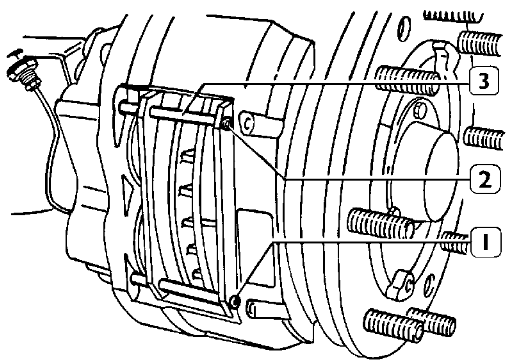
Figure 70



32964

Loosen the fastening nuts and remove the wheels using the hydraulic trolley 99321024 (1).

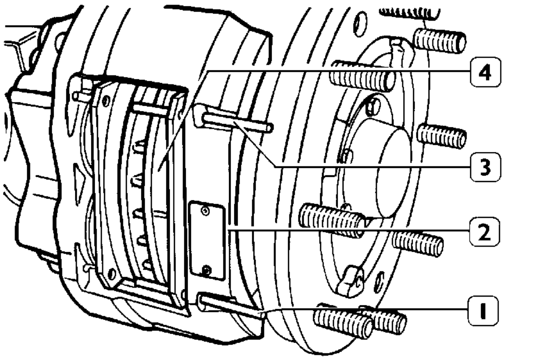
Figure 71



33856

Remove the safety clips (1 and 2) from the retaining pins (3).

Figure 72

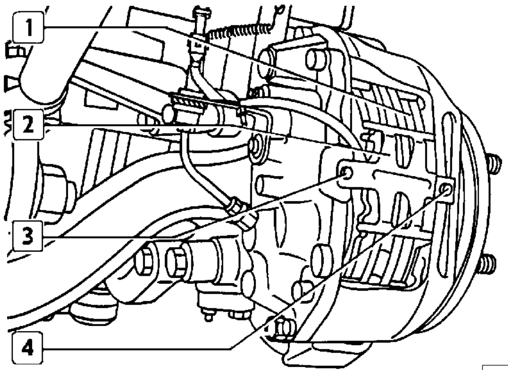


33857

Remove the retaining pins (1 and 3) from the brake calliper body (2) and then remove the brake lining (4).

For 5833/1 front axle

Figure 73

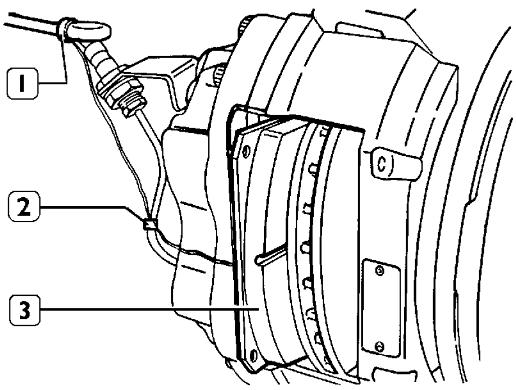


33859

Loosen screw (3) and nut (4), remove the spring (2) and then remove the brake lining (1).

For any model

Figure 74

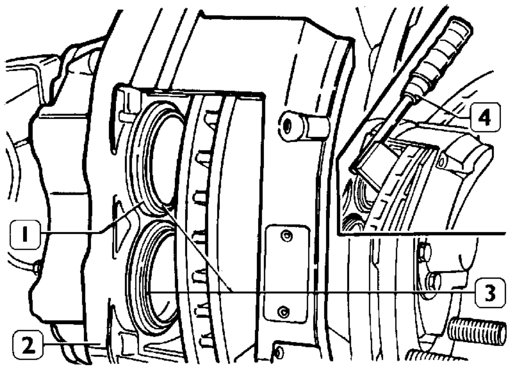


33860

Remove the clamps (1 and 2) fastening the brake lining wear indicator cables and disconnect the connection.

Remove the brake lining (3).

Figure 75



33861

NOTE Visually check dust–proof cowlings (1), to be replaced, if faulty. Since this operation requires to remove the pistons from the brake calliper body, it is recommended to remove the brake calliper body from the supporting plate for complete overhauling. Check also absence of brake fluid leaks from pistons (3).

Overhaul both hydraulic brake callipers although failures are found just one brake calliper.

Clean the brake calliper using a wire brush taking care not to damage the dust boots.

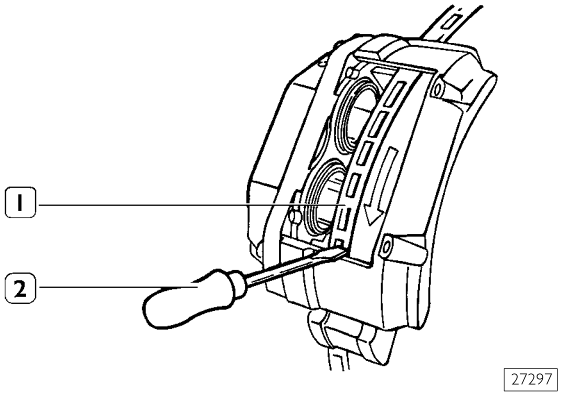
Use the proper tool (4) to move pistons (3) back.

Pistons can be moved back friendly by opening partially the bleeder screw and enabling brake fluid flow through drain pipe into a container.
Bleeding is not required, but top up the tank with **Tutela TRUCK DOT SPECIAL**.
Do not reuse the brake fluid drained out from the circuit.

Clean the sliding surfaces of the brake linings. Check brake disc conditions: corrosion, scoring or cracking shall not be present. Grind the brake disc, if required, as specified in the relevant chapter and replace if worn.

In case of replacement, replace both brake discs.

Figure 76



Clean dirty and rust on brake disc edge. Rest a scraper or an old screwdriver (2) on the calliper body and turn the disc (1) to remove dirt, rust and scales.

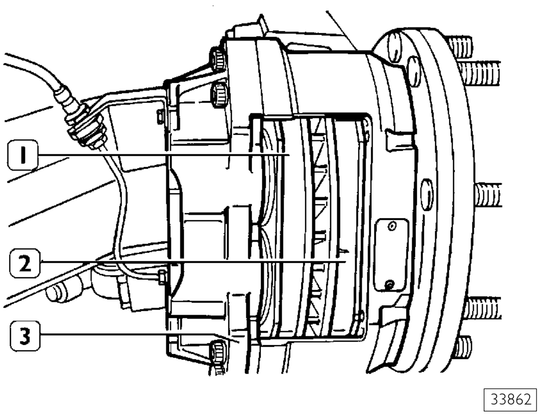
Finish with emery cloth. Remove residues with vacuum cleaner or with clothes and brush.

Do not use oil and derivatives that could damage the rubber parts and therefore the brake.

Use only methylated spirit or isopropyl alcohol.

Clean accurately brake disc braking surfaces.

Figure 77



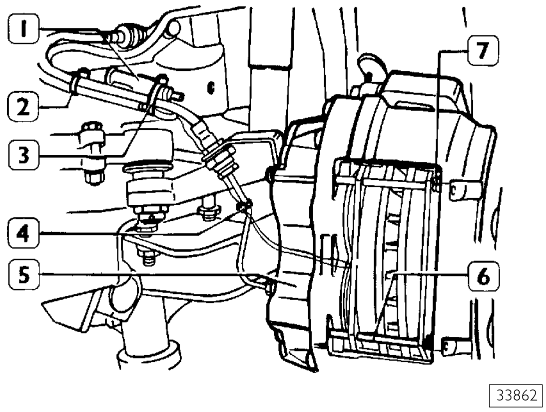
Fit new brake linings (1 and 2) in the brake calliper.

Check whether they are sliding smoothly into their seats. To fit the new brake linings it can be required to centre the hydraulic brake calliper assembly by sliding it.

Should a pair of brake linings be replaced, always replace a complete set for each axle.

For 5833 front axle

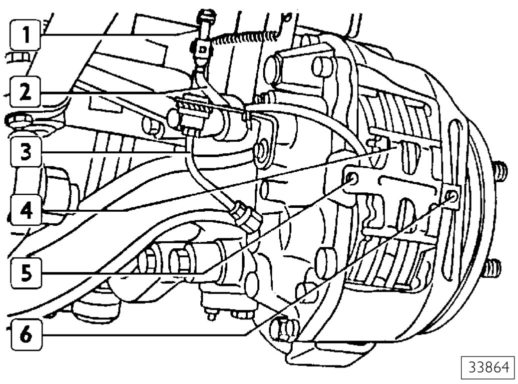
Figure 78



Connect wear indicator cable pin (1). Apply clamp (3) and then (2 and 4) and fasten the cables to the brake fluid pipe. Fit the retaining pins (6) into brake calliper (5) seats and refit the safety clips (7).
Proceed as described on the opposite side.

For 5833/1 front axle

Figure 79



Connect wear indicator cable pin (1). Secure the cable (2) to pipe (3). Apply the spring (4) to the brake calliper and lock it by screw (5) and nut (6).

Proceed as described on the opposite side.

Fit wheels using the hydraulic trolley 99321024.

Lower the vehicle.

Tighten wheel fastening nuts to the specified torque.

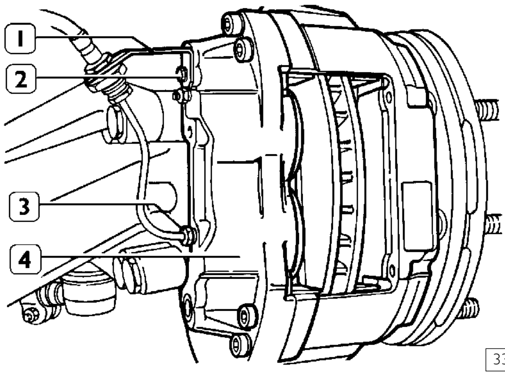
Fit the protection cap on the wheel hubs.

Once repair operations are completed, depress the brake pedal repeatedly with the vehicle running in both directions to set the brake linings.

527413 REMOVING FRONT BRAKE CALLIPERS

For any model

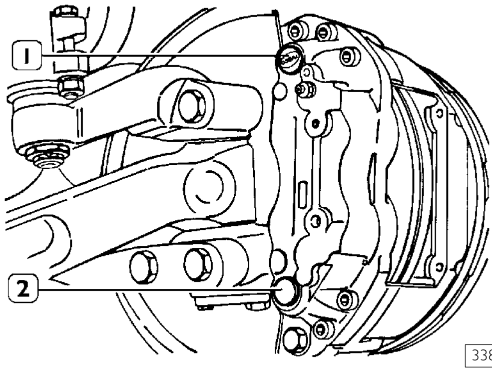
Figure 80



33865

To remove the brake linings comply with the previous paragraph: replacing the brake linings. Loosen the screw (2) fastening brake fluid hose supporting bracket (1). Release fitting (3) and then remove it from hydraulic calliper body (4), disconnect the pipe and drain out the contained brake fluid into a container.

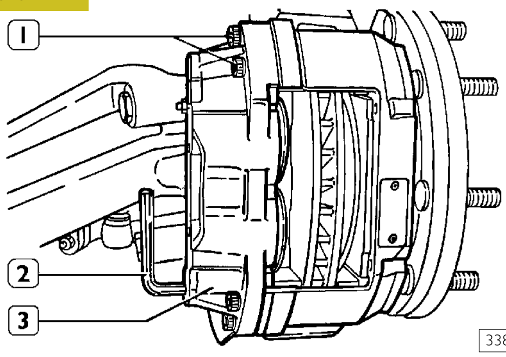
Figure 81



33866

Remove the protection caps (1 and 2) for guide pin screw holes.

Figure 82

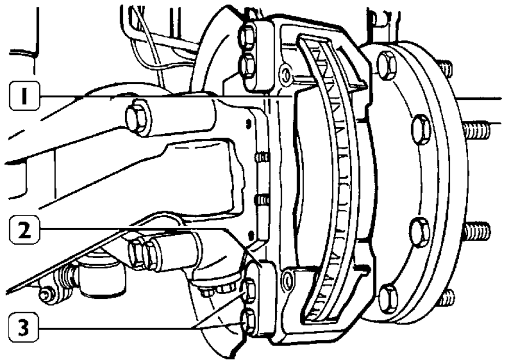


33867

Use the proper wrench (2) to release and loosen the two guide pin screws (8, SENZA CODICE) fastening the hydraulic calliper body (3) and remove it from the supporting plate.

Since the hydraulic brake calliper (3) must not be separated, never loosen or remove the fastening screws (1), also during overhaul at the bench.

Figure 83

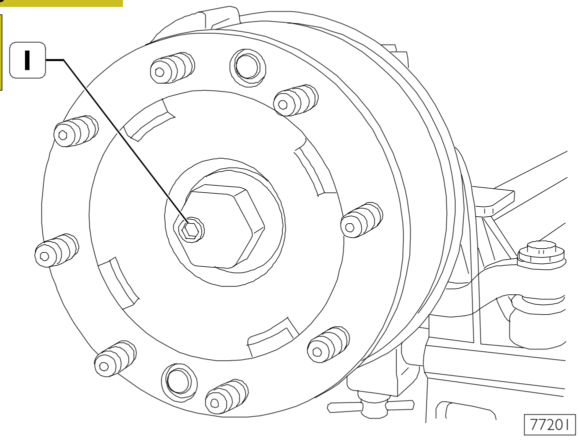


33868

Loosen the self–locking screws (3) fastening the supporting plate (1) to the brake calliper support (2) and remove it.

520620 REMOVING FRONT WHEEL HUBS

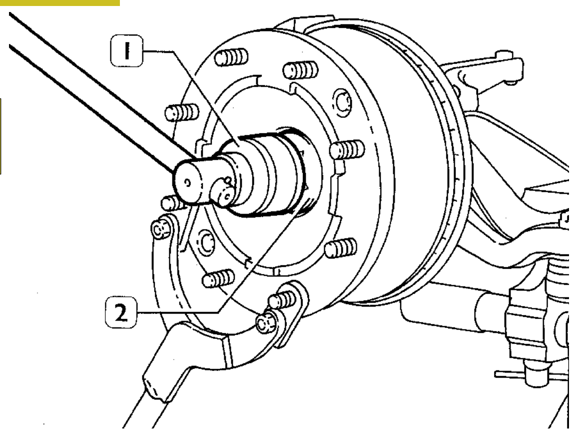
Figure 84



77201

Turn the wheel hub so that the screw plug (1) faces downwards; release the plug and drain oil into the appropriate container.

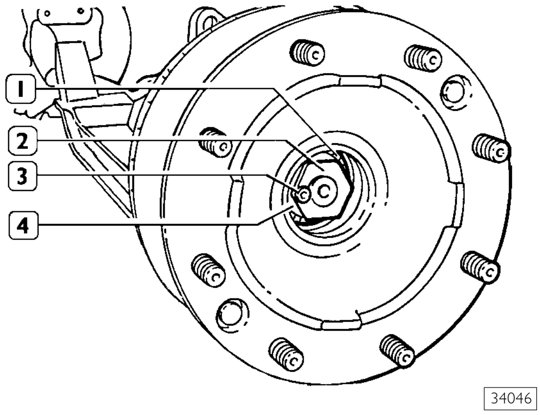
Figure 85



32995

Block the wheel hub rotation and use reaction lever 99370317 and wrench 99344038 (1) to unscrew the sump (2) while draining oil into the appropriate container.

Figure 86

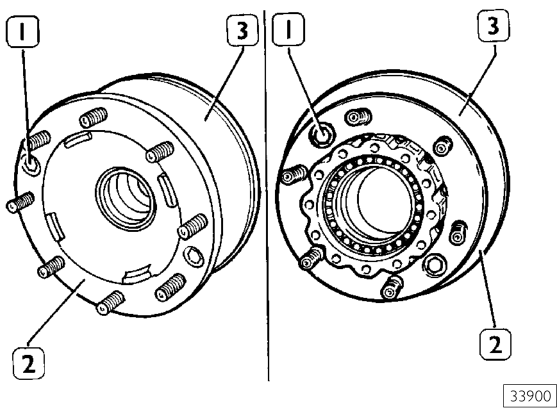


Loosen the screw (3), the adjusting ring nut (2), withdraw the washer (4), the outer bearing (1) and remove the brake disc with the wheel hub.

Remove the opposite brake assembly and keep separate the components.

OVERHAULING THE BRAKE DISCS

Figure 87



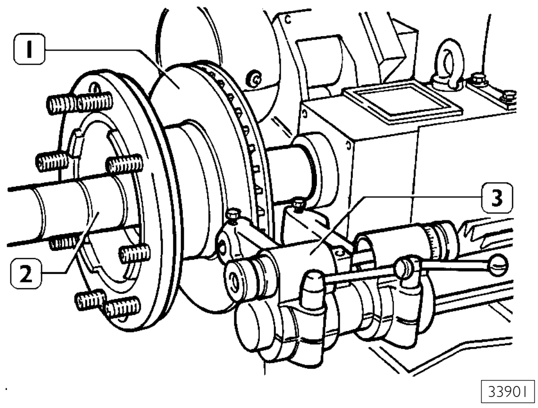
Check wear on brake disc surfaces.

Grind or turn the brake discs and replace them if required, if values different from those shown in specifications and data are found.

Remove screws (1), and remove the hub (2) from the disc (3). Replace the disc (3) and refit the new one following the above procedure in reverse sequence.

527411 TURNING AND GRINDING THE BRAKE DISCS

Figure 88

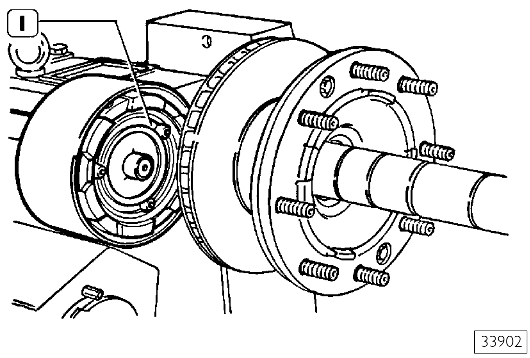


- ❑ fit the brake disc (1) including the hub on lathe shaft 99301002 (2);
- ❑ fit a set of spacers on the shaft to remove unit end play, tighten the lock nut and place the lathe support.

Align the tool holder (3) and the brake disc (1), adjust tool depth to remove the same amount of brake disc working surface.

Turn the brake disc (1) with one or more removal runs according to the scoring found.

Figure 89



Fit the proper grinding tool 99301010 (1) on lathe 99301001 and grind both brake disc surfaces.

NOTE Perform grinding with segmental wheel gradually in order to remove completely any turning swarf.

Rear brakes

Operation

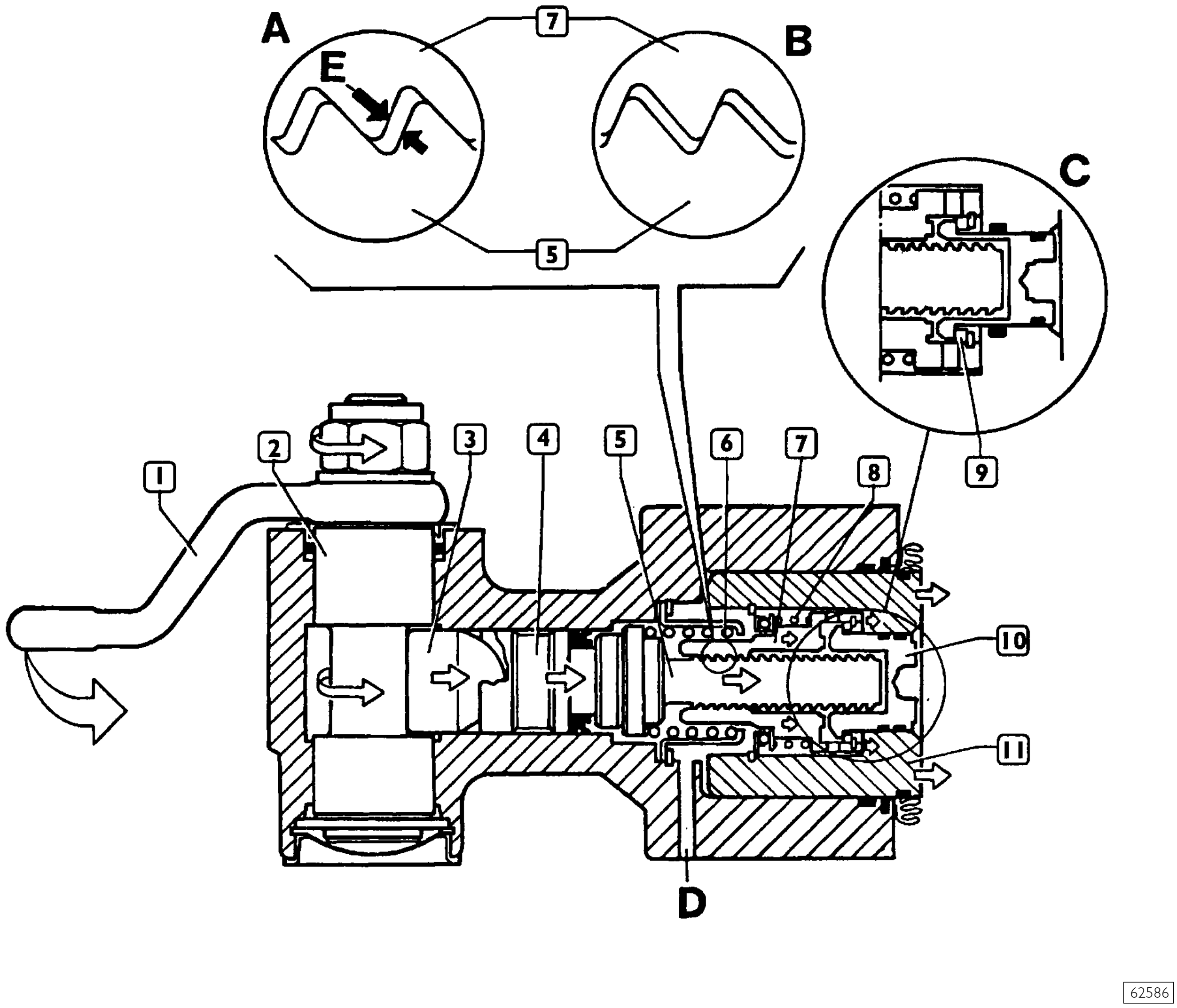
The operation of the rear brake calliper is similar to that of the front one.

The rear brake calliper is fitted with a parking brake device and with a device to take up automatically the backlash, created by lining wear, between brake linings and disc.

NOTE To take up the backlash it is necessary to depress the brake pedal.

REAR BRAKE CALLIPER HYDRAULIC OPERATION DIAGRAM (GIRLING)

Figure 90



Parking brake device operation

When the parking brake is engaged by the proper lever, the spring cylinders operate on the levers (1) of both callipers making the cam (2) rotate. Cam (2) rotations makes the rod (3) moving against the tappet (4) which operates the screw (4).

Screw (5) thread couples with ring nut thread (7, detail B).

Ring nut (7) engagement surface is forced against the secondary piston (10). Since neither the ring nut nor the screw can rotate, the primary piston (11) is forced towards the outside thus activating the parking brake.

Automatic backlash take up device operation

Brake fluid flows through passage D and operates the primary piston (11) which presses the brake linings against the brake disc.

As the piston (11) moves outwards, backlash (E) is taken up extending between screw (5) and ring nut (7). In this way the force acting on the engagement is decreased. Spring (8) is compressed and the backlash between screw (5) and ring nut (7) is taken up completely (see detail B). This makes the ring nut (7) rotate anticlockwise and loosen to take up the backlash due to brake linings wear.

Print 603.93.381

As fluid pressure increases, the secondary piston (10) is pressed outwards the primary piston (11) increasing the force of the engagement surface against piston 10 (see detail C) and piston (10) against the anti–friction washer (9). This action stops the ring nut (7) rotation to avoid excessive backlash take up. In this situation neither the ring nut (7) nor the screw (5) can rotate. Whatever outward movement of the piston (11) produces a pressure increase of the pads against the disc and the compression of the spring (6) which keeps the screw (5) into its seat thus impairing its rotation. When the brake is released, the springs (6 and 8) reset the initial condition and the primary piston (11) sealing ring guarantees the return of the piston.

NOTE Automatic backlash take up is performed only if piston (11) outwards movement exceeds the backlash existing between the screw (5) and the ring nut (7) (see details A and B).

The secondary piston (10) is fitted with a mechanical device to retighten the ring nut that has loosened when taking up the backlash.

TECHNICAL DATA

The parking device with automatic backlash take up (pad and disc) is fitted to keep constant the parking brake stroke.

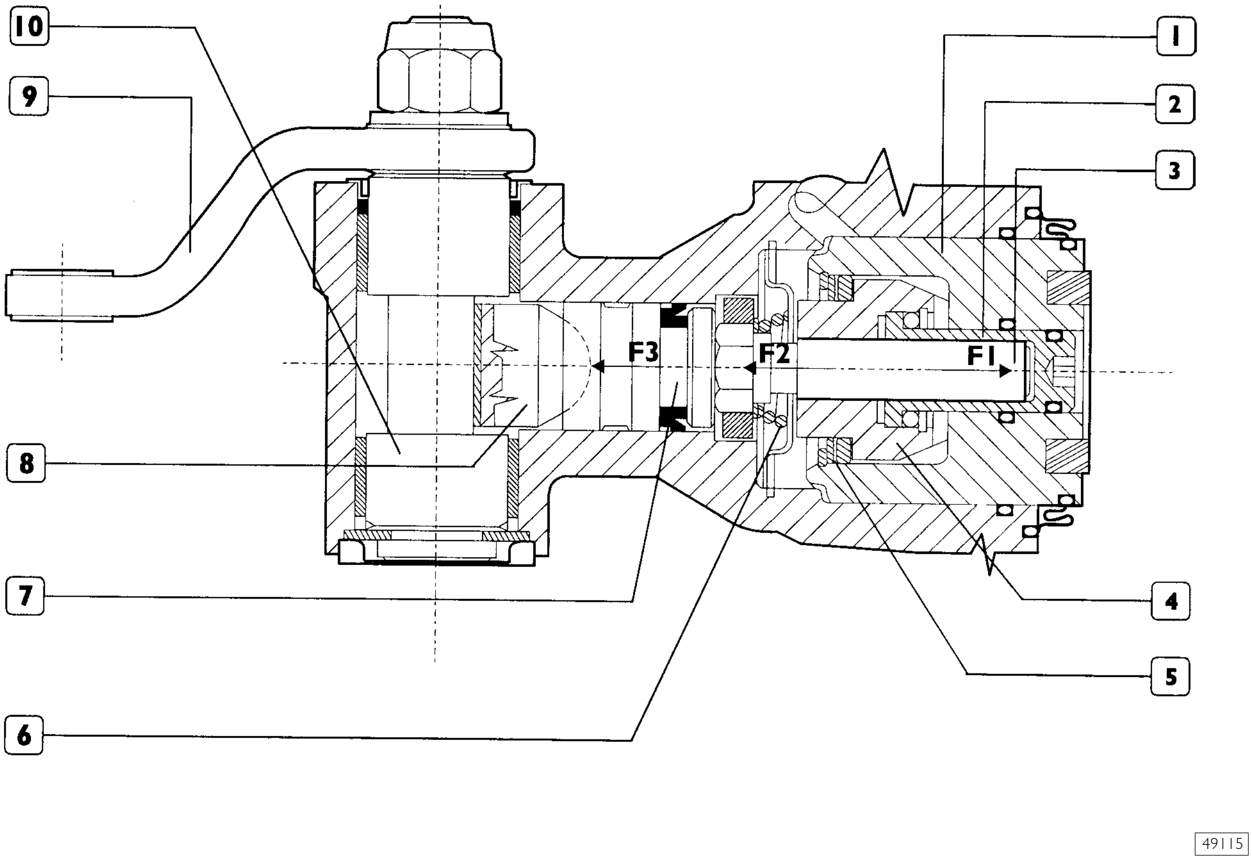
The take up device enables, by a certain pressure value, to cut out the influence of the temporary distortions due to pressure increase in order to avoid excessive backlash take up with subsequent residual torque or brake locking.

The take up device operates during the service braking.

It is built so as to take up automatically the calliper body backward movement due to external pad and disc wear, with control lever rotation to obtain a constant gap between the actuator cylinder and its application point on the control lever.

Operation of the system for taking up wear

Figure 91



BACKLASH TAKE UP DEVICE COMPONENTS (BREMBO)
1. Piston – 2. Bushing – 3. Threaded pin – 4. Threaded bush – 5. Spring – 6. Spring – 7. Piston – 8. Cap – 9. Control lever – 10. Cam

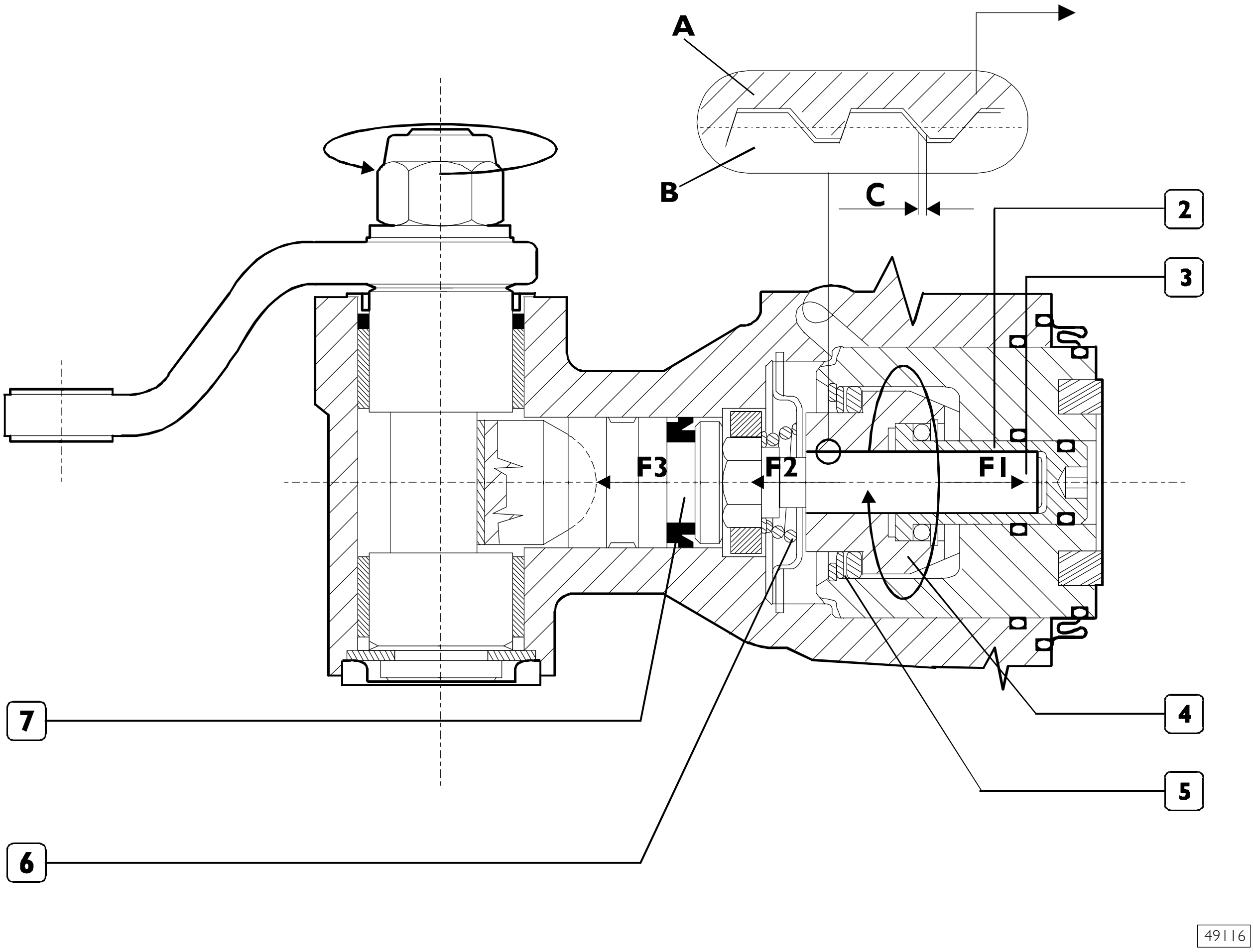
F1 = S1 x p
S1 = surface corresponding to d 1
p = hydraulic pressure
F1 = Force generated by the spring
F3 = Thrust on floating element due to pressure p

Functional backlash is corresponding to the backlash existing between threaded pin (3) and threaded bush (4) threads, which are pressed respectively against piston (7) and piston (1) by springs (5 and 6). During braking and under the hydraulic pressure action, the piston (1), the bush (4) and the bushing (2) move outwards, whereas the pin (3) is submitted to two opposite actions:

- thrust F2 of the spring (6) which keeps it against piston (7)
- thrust F1 (through bushes (2 and 4)), opposite to F2, due to hydraulic pressure action on surface S1.

First operation stage (F1 ≤ F2) – Low pressure

Figure 92



A = Bush – B = Pin – C = Functional backlash

F1 = S1 x p
S1 = surface corresponding to d 1
p = hydraulic pressure
F1 = Force generated by the spring
F3 = Thrust on floating element due to pressure p

Force F2 due to spring (6) is higher than or equal to the force generated by the hydraulic pressure on surface S1.

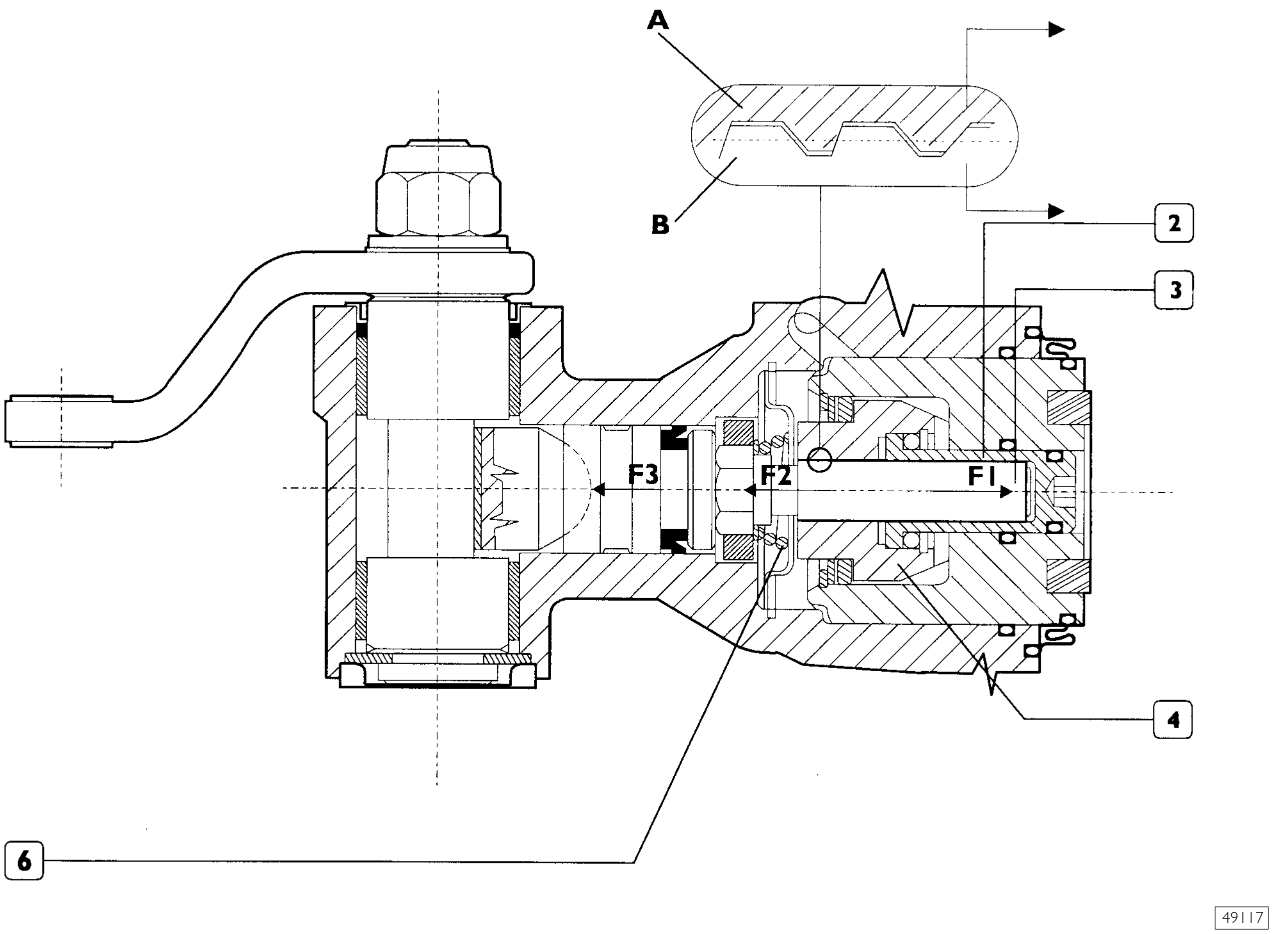
Under these conditions the pin (3) is kept pressed against piston (7) whereas piston (1), bush (4) and bushing (2) start to move outwards.

The bush (4) moves (driven by the piston through the seeger–spring (5)–bearing pack) until its internal thread comes in contact with the pin (3) thread (functional backlash take up)

If piston movement continues, the bush (4) looses its contact with the piston in the taper area and due to the seeger–spring (5)–bearing pack it starts to rotate on pin (3) thread, thus following piston outwards movement.

Second operation stage (F1 > F2) – High pressure

Figure 93



A = Bush
B = Pin
F1 = S1 x p
S1 = surface corresponding to d 1
p = hydraulic pressure
F1 = Force generated by the spring
F3 = Thrust on floating element due to pressure p

Force F2 due to spring (6) is < than the force generated by the hydraulic pressure on surface S1.
Under these conditions the piston continues to move forward (until encountering pads resistance against the disc). The bushing (2) drives the bush (4) with the seeger–bearing assembly applied to it, whereas the bush (4) drives the pin (3) with a force F = F1 – F2.

Setting between piston and bush (4) in the taper area is therefore obtained with subsequent forward movement of the piston–bush–bushing–pin block.

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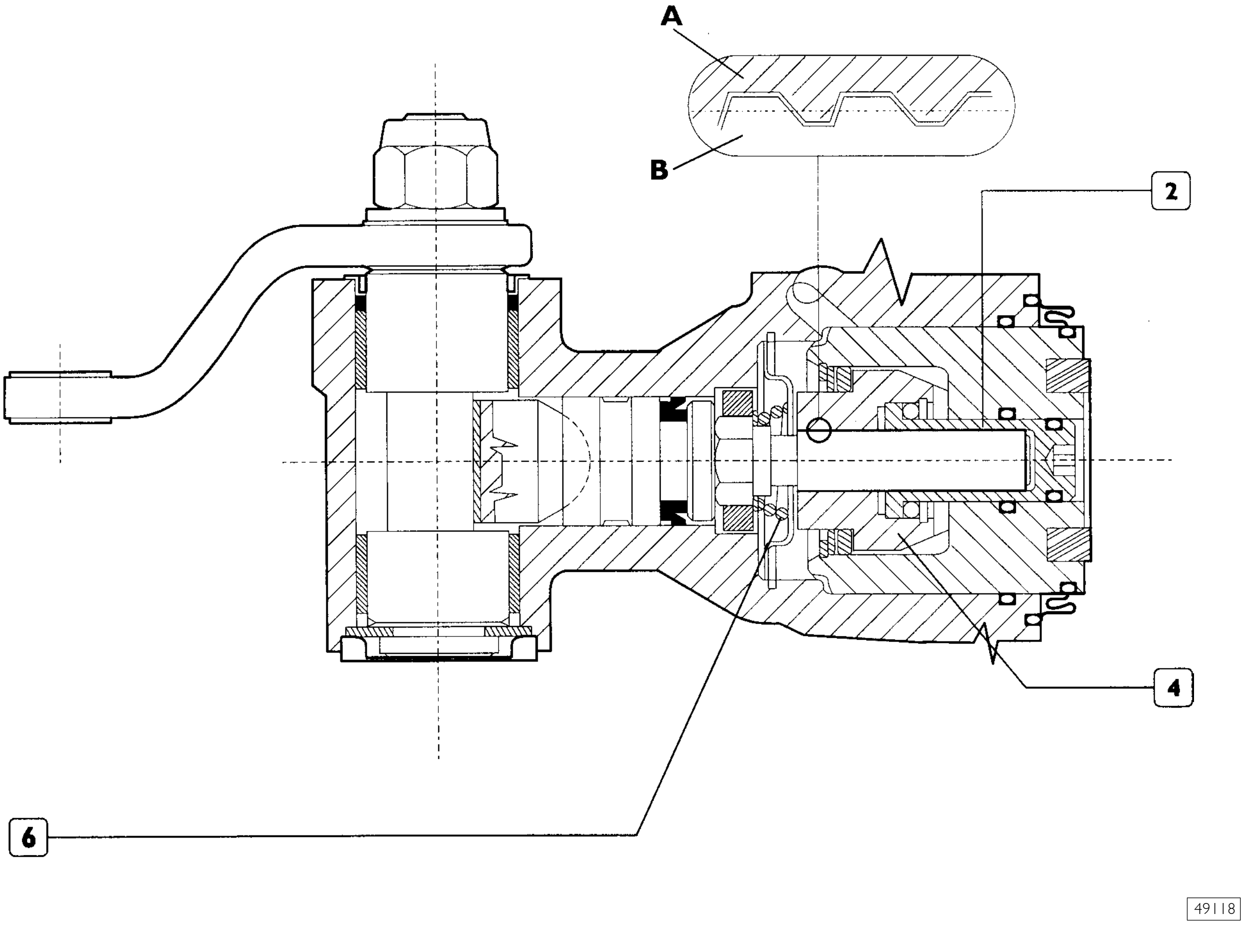
Third operation stage (Pressure resetting to zero) – Resting position

Figure 94

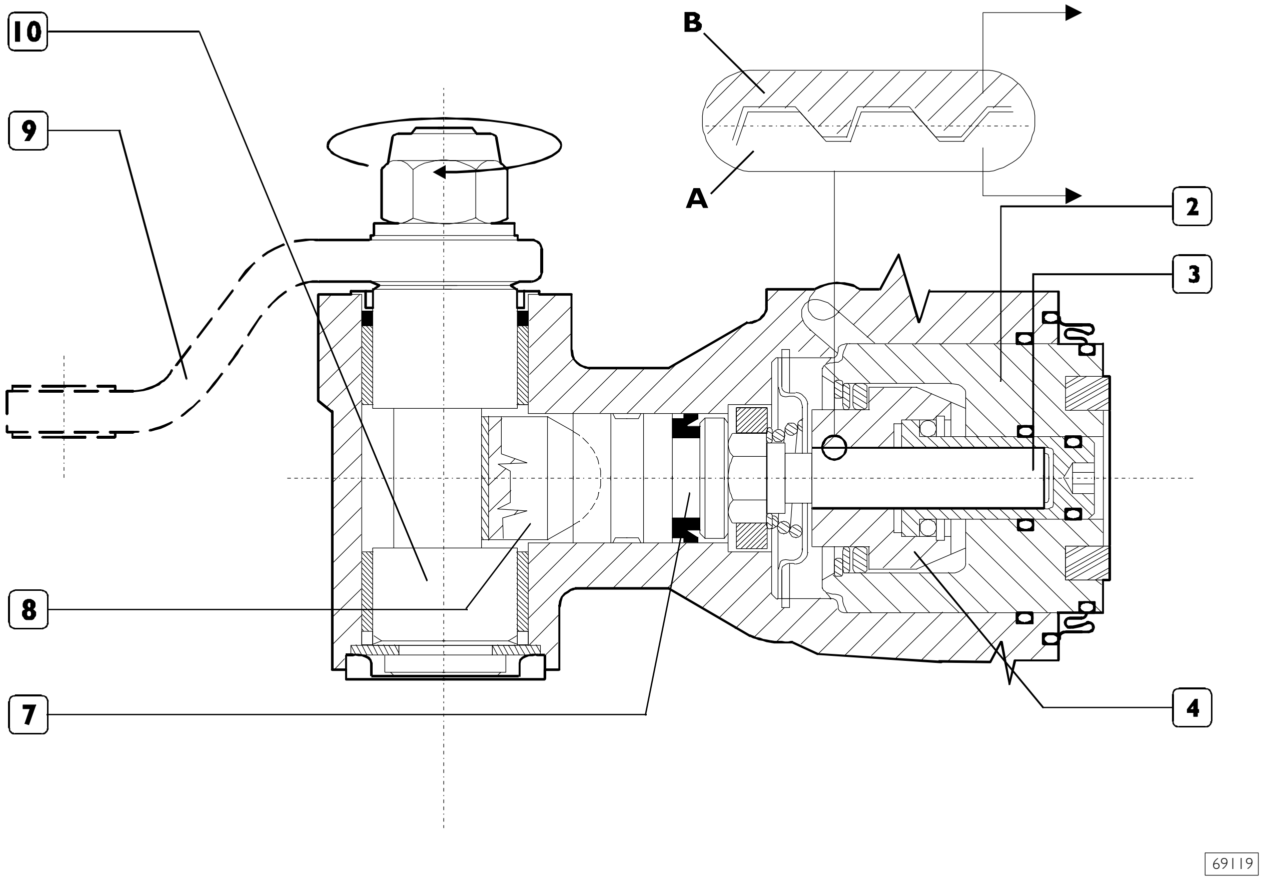


A = Bush
B = Pin
F1 = S1 x p
S1 = surface corresponding to d 1
p = hydraulic pressure
F1 = Force generated by the spring
F3 = Thrust on floating element due to pressure p

Hydraulic pressure resetting to zero.
The return movement of piston–threaded pin–threaded bush, up to a certain hydraulic pressure corresponding to threshold pressure (F1 = F2) is the same.
Spring (6) moves back the pin that takes up the backlash with the bush thread (4), that drives back the bush (4) and therefore, indirectly the bushing (2) and the piston (during these movements there is also bush (4) disconnection from piston in the taper area).
The pin returns in contact with the piston (6). Bushing (2) and piston move back due to seal roll–back.

Parking braking

Figure 95



A = Bush
B = Pin

Parking brake operation

The tightening force is transmitted through the following components: control lever (9), cam (10), cap (8), piston (7), threaded pin (3), threaded bush (4) and piston (1).

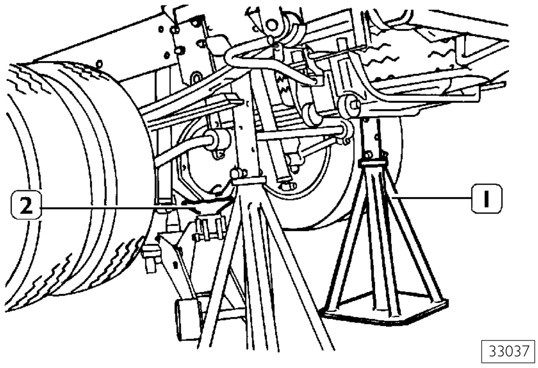
Lever (9) rotary motion is converted into linear motion along the piston axis by cam (10).

To obtain constant tightening force the gap between the actuator cylinder set on vehicle and its application point on the control lever shall be constant.

During brake operation this gap tends to decrease due to calliper body retraction for the effect of pad and disc wear; it is therefore required to adjust the control lever which is performed automatically during service braking (stages A–B). Hydraulic pressure exerts a force F3 on piston (7) that transmits it to cap (8) and then to cam (10); it is therefore created a moment that rotates the control lever (9) according to piston forward movement, thus recovering calliper retraction.

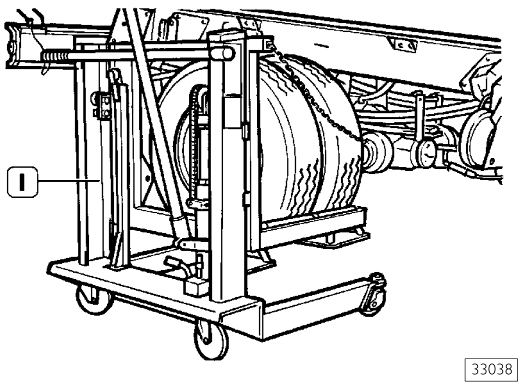
527417 REPLACING THE REAR BRAKE LININGS

Figure 96



Set the vehicle on flat ground. Set the parking brake lever to running position, loosen rear wheel fastening nuts. Use the hydraulic jack (2) to lift the rear part of the vehicle and rest it on two stands (1).

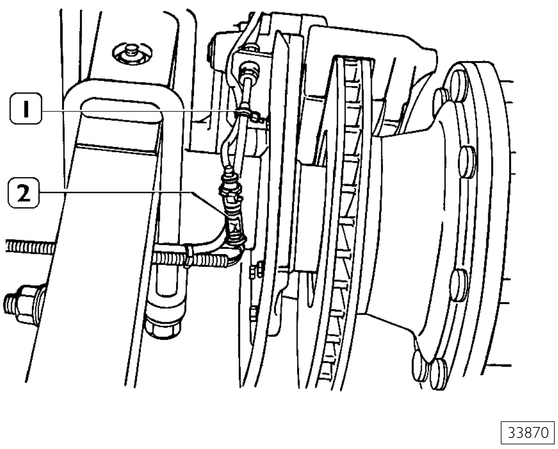
Figure 97



Loosen the fastening nuts and remove wheels using the hydraulic trolley 99321024 (1).

Removal

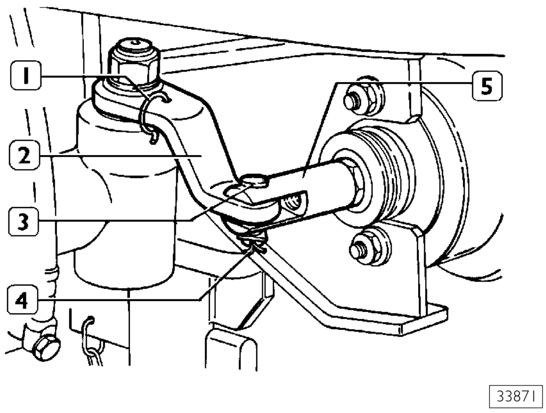
Figure 98



Remove clamps (1).

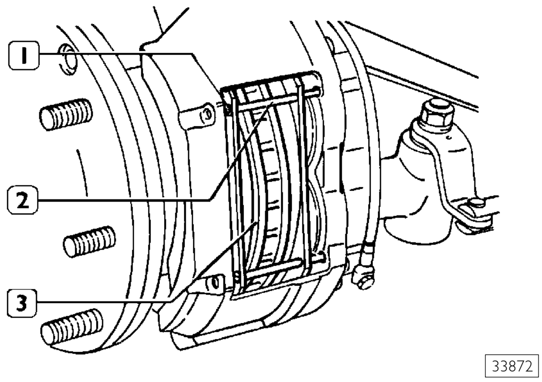
Disconnect brake lining wear indicator pin (2).

Figure 99



Remove the split pin (4), withdraw the pin (3), lock the parking brake device lever (2) by split pin (1) or proper pin. Set parking brake lever in braking position and disconnect the lever (2) from the sleeve (5).

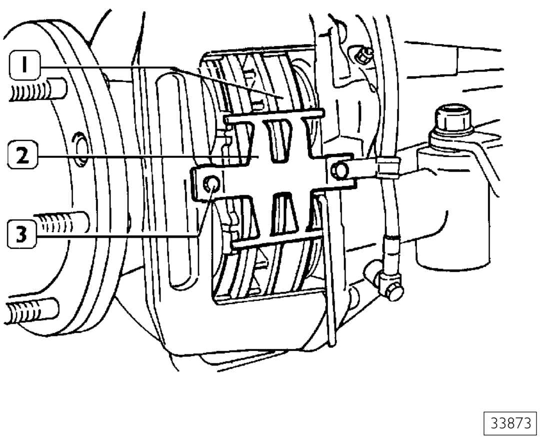
Figure 100



Remove the safety clips (1), remove the retaining pins (2) and remove the brake linings (3).

For rear axle 4517

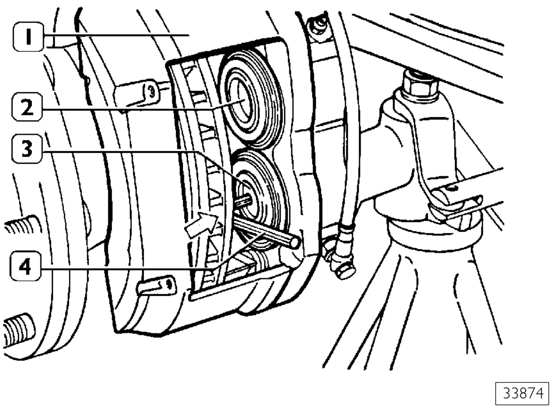
Figure 101



Remove screws (3), disconnect clip (2) and withdraw the brake linings (1).

For any model

Figure 102



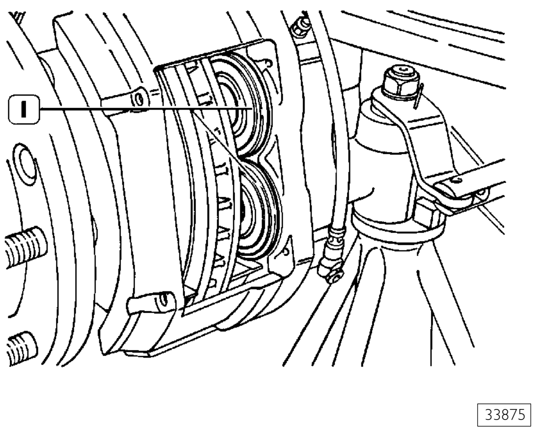
Move the brake calliper (1) towards the vehicle. Use a setscrew (4) to screw, in arrow direction the screw set inside piston (3) to reset it to initial conditions.

NOTE The screw inside lower piston shall be tightened to stop limit and then loosened by half a turn.

Move back piston (2).

Pistons can be moved back friendly by opening partially the bleeder screw and enabling brake fluid flow through drain pipe into a container.
Close the bleeder screw.
Bleeding is not required, but top up the tank with Tutela DOT SPECIAL.
Do not reuse the brake fluid drained out from the circuit.

Figure 103



Visually inspect the dust boots (1), replace if damaged. Since this operation requires to remove the pistons from the brake calliper body, it is recommended to remove the brake calliper body from the supporting plate for complete overhauling.

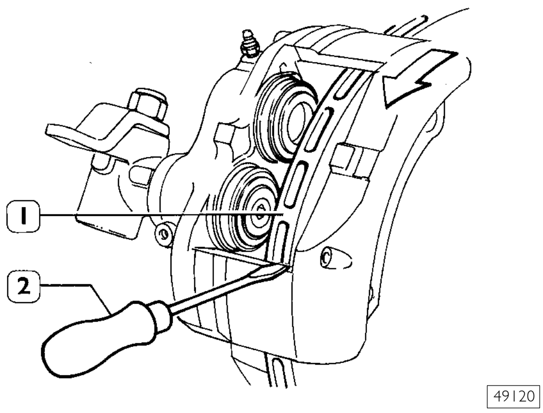
Check also absence of brake fluid leaks from pistons (3).

Overhaul both hydraulic brake callipers although failures are found just one brake calliper.

Clean the brake calliper using a wire brush taking care not to damage the dust boots.

Clean the sliding surfaces of the brake linings. Check brake disc conditions: corrosion, scoring or cracking shall not be present. Light surface marks are tolerated, grind the brake disc, if required, as specified in the relevant chapter and replace it if worn.
In case of replacement, replace both brake discs.

Figure 104



Clean dirty and rust on brake disc edge. Rest a scraper or an old screwdriver (2) on the calliper body and turn the disc (1) to remove dirt, rust and scales.

Finish with emery cloth. Remove residues with vacuum cleaner or with clothes and brush.

Do not use oil and derivatives that could damage the rubber parts and therefore the brake.

Use only methylated spirit or isopropyl alcohol.

Clean accurately brake disc braking surfaces.

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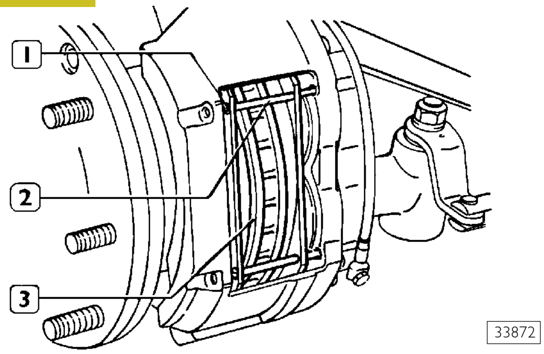
Refitting
For rear axle 4521

Figure 105

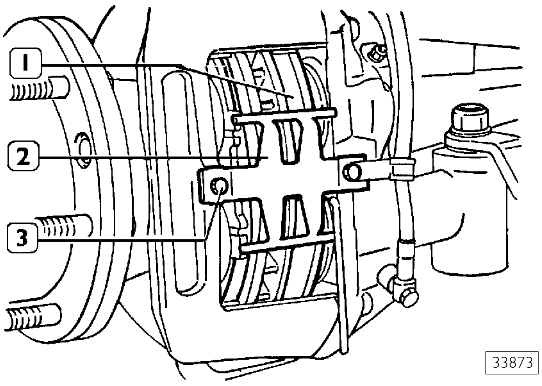


Fit new brake linings (3) in the brake calliper.
Check whether they are sliding smoothly into their seats.
Fit retaining pins (2) and assemble the clips (1).

Should a pair of brake linings be replaced, always replace a complete set for each axle.

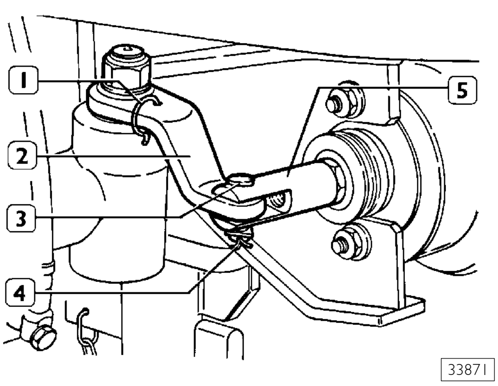
For rear axle 4517

Figure 106



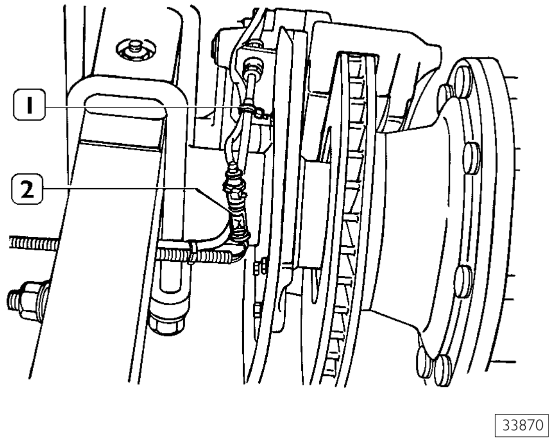
Put in new braking gaskets (1) as previously described for models with rear axle 4521. Reassemble safety spring (2) and lock it with screws (3).

Figure 107



Set parking brake lever in running position. Remove the split pin (1). Connect hand brake device lever (2) to spring cylinder sleeve (5) by pin (3) and split pin (4) avoiding too long strokes of the lever (2).

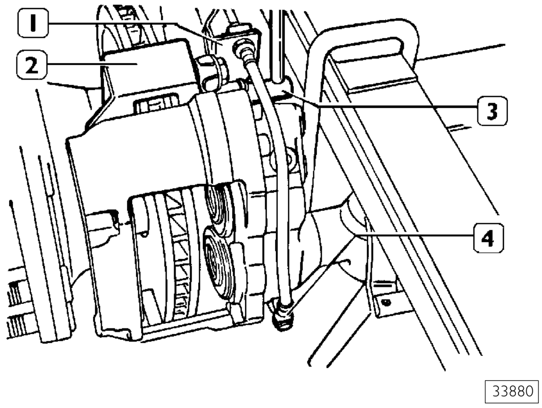
Figure 108



Connect brake lining wear indicator pin (2) and apply indicator cable fastening clamps (1) to brake fluid pipes.
Fit wheels using the hydraulic trolley 99321024.
Lower the vehicle.
Tighten wheel fastening nuts to the specified torque.
Once repair operations are completed, depress the brake pedal repeatedly with the vehicle running in both directions to set the brake linings.

527413 REMOVING THE REAR BRAKE CALLIPERS

Figure 109



To remove the rear brake linings, comply with the procedure previously described in the paragraph dealing with brake lining replacement.

Loosen the screws fastening the brake fluid hose supporting bracket (1), loosen fitting (4), disconnect the pipe and drain out brake fluid into a proper container.
Use the proper wrench (3) to loosen the supporting plate (2) fastening screws and remove the brake calliper assembly.

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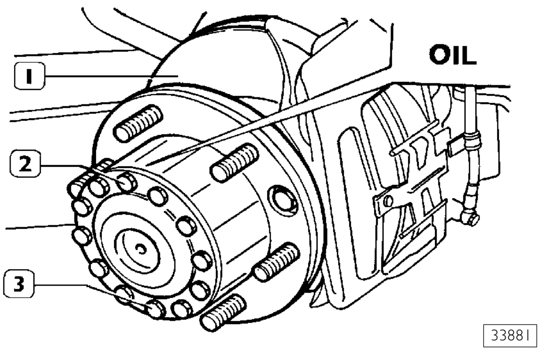
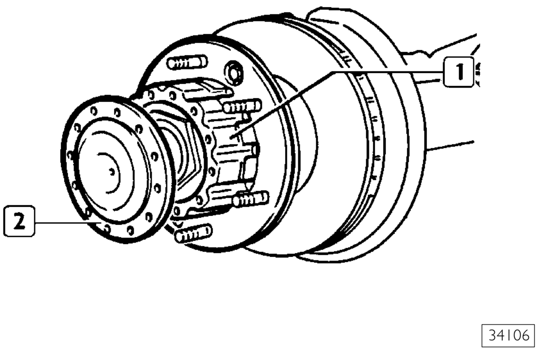
525030 REMOVING REAR WHEEL HUBS

Figure 110



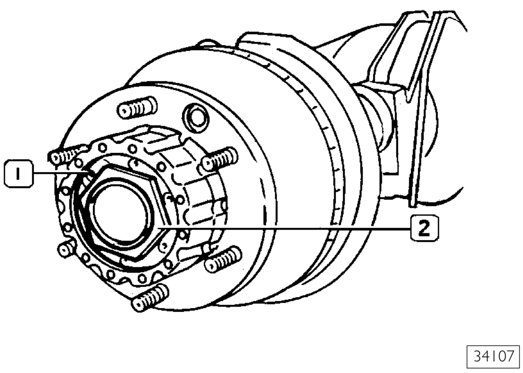
Turn brake disc (1) until one of the two OIL inscriptions is set upwards. Remove screws (2 and 3) and drain out oil. Then loosen in sequence all the other axle shaft fastening screws.

Figure 111



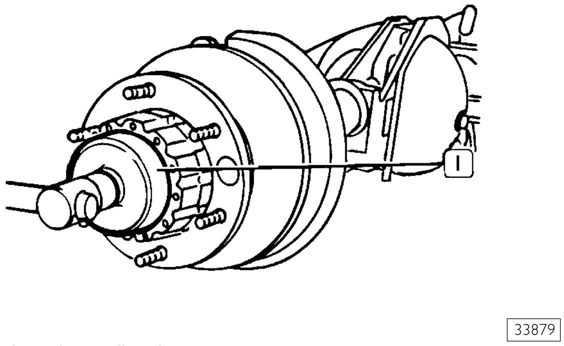
Remove the axle shaft (2) from the wheel hub (1).

Figure 112



Remove adjusting nut (2) safety screw (1).

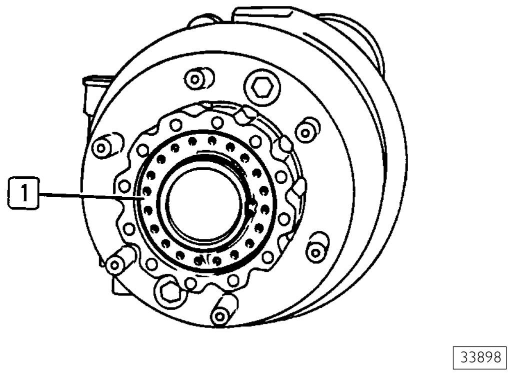
Figure 113



Loosen bearing adjusting nut.

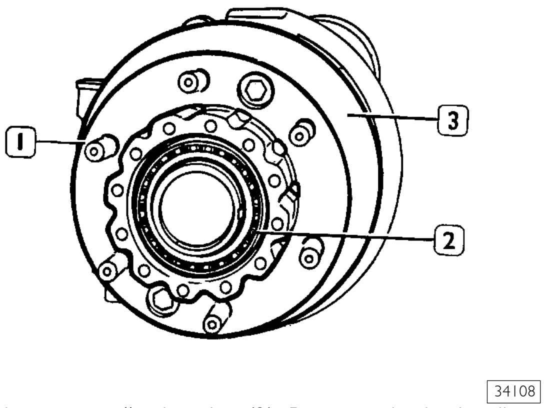
NOTE Use wrench 99377080 (1) for rear axle 4517 and wrench 99357071 (1) for rear axle 4521.

Figure 114



Remove the safety washer (1).

Figure 115



Remove the taper roller bearing (2). Remove the brake disc (3) including the wheel hub (1).

Remove the opposite brake assembly and keep components separated.

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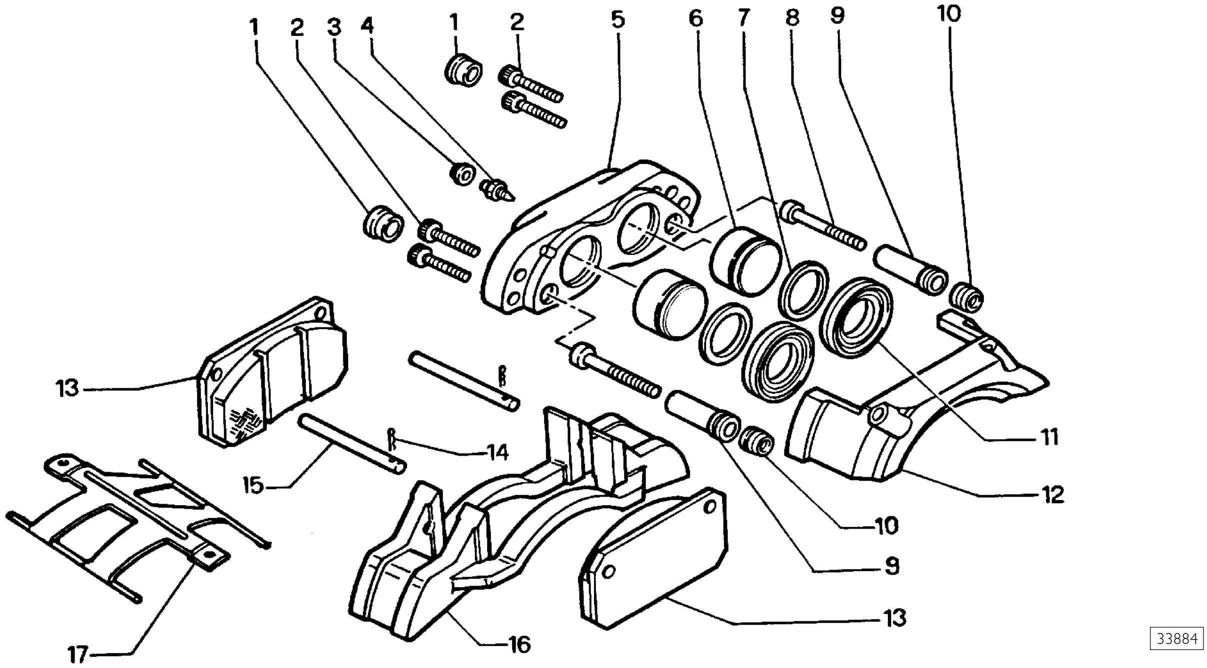
527413 OVERHAULING THE BRAKE CALLIPERS

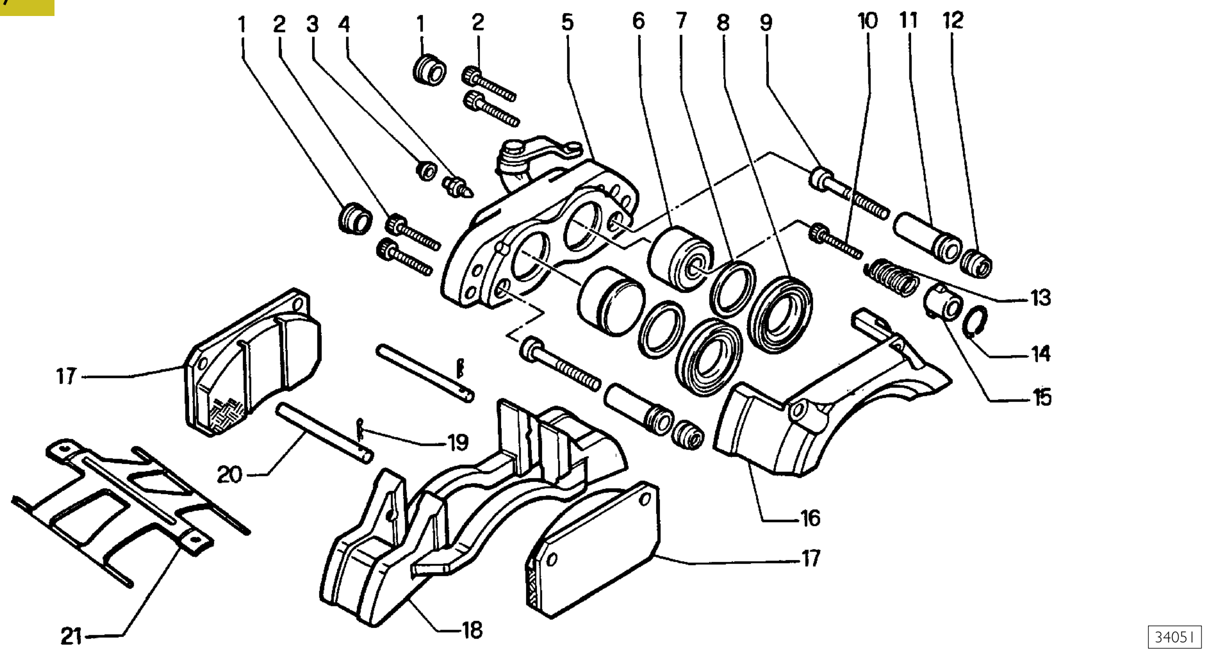
Figure 116



FRONT BRAKE CALLIPER COMPONENTS (GIRLING AND BREMBO)

1. Plug – 2. Screw – 3. Dust cap – 4. Bleeder screw – 5. Brake calliper body – 6. Piston – 7. Sealing ring – 8. Guide pin – 9. Guide pin sleeve – 10. Dust cover – 11. Dust boot – 12. Brake calliper half body – 13. Brake lining – 14. Safety clip (only models with front axle 5833) – 15. Retaining pin (only models with front axle 5833) – 16. Supporting plate – 17. Safety clip (only models with front axle 5833/1)

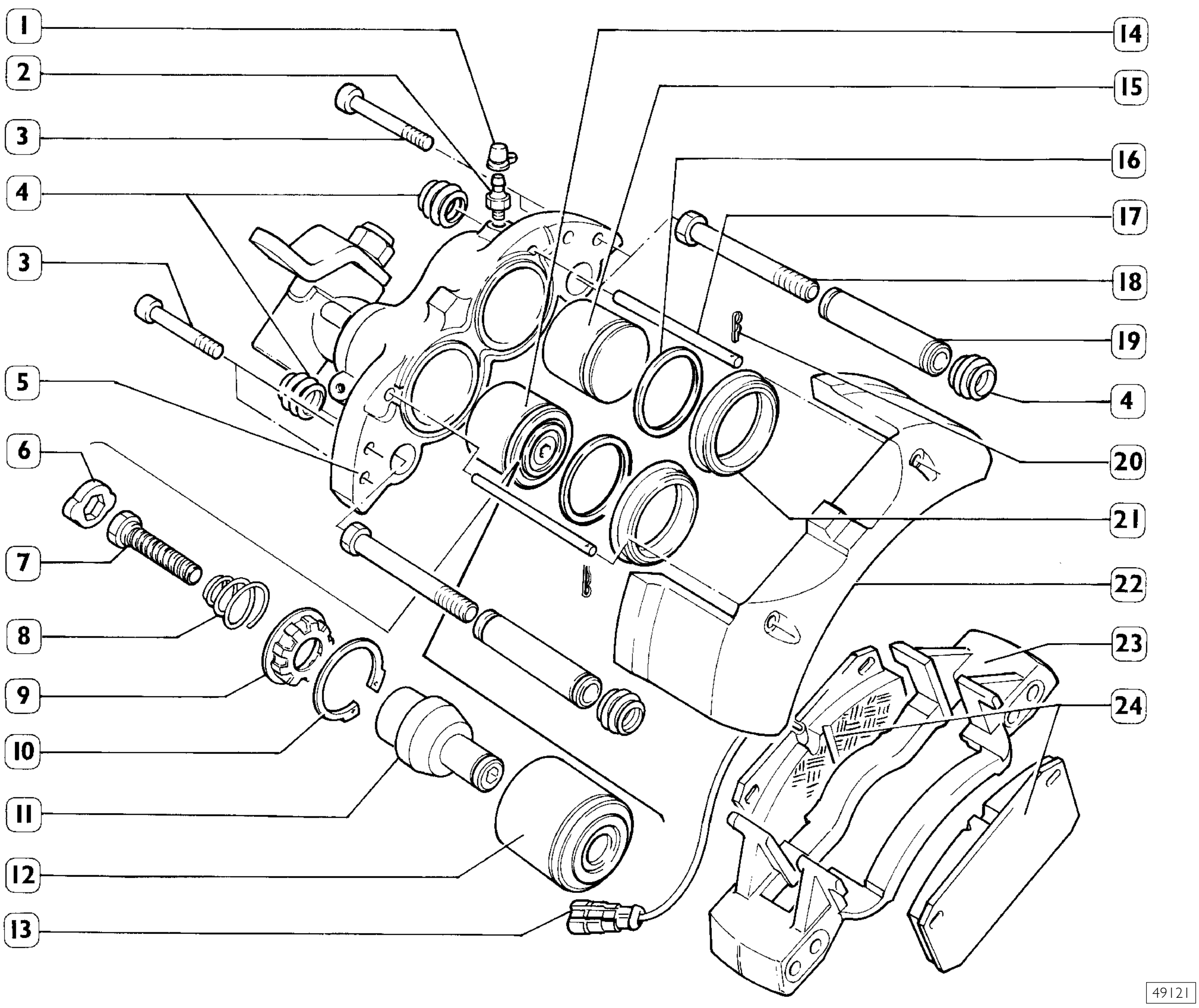
Figure 117



REAR BRAKE CALLIPER COMPONENTS (GIRLING)

1. Plug – 2. Screw – 3. Dust cap – 4. Bleeder screw – 5. Brake calliper body – 6. Piston – 7. Sealing ring – 8. Dust boot – 9. Guide pin – 10. Screw – 11. Guide pin sleeve – 12. Dust boot – 13. Spring – 14. 0 Ring – 15. Rubber spring retaining cover – 16. Brake calliper half body – 17. Brake lining – 18. Supporting plate – 19. Safety clip (only models with rear axle 4521) – 20. Retaining pin (only models with rear axle 4521) – 21. Safety clip (only models with rear axle 4517)

Figure 118



REAR BRAKE CALLIPER COMPONENTS (BREMBO)

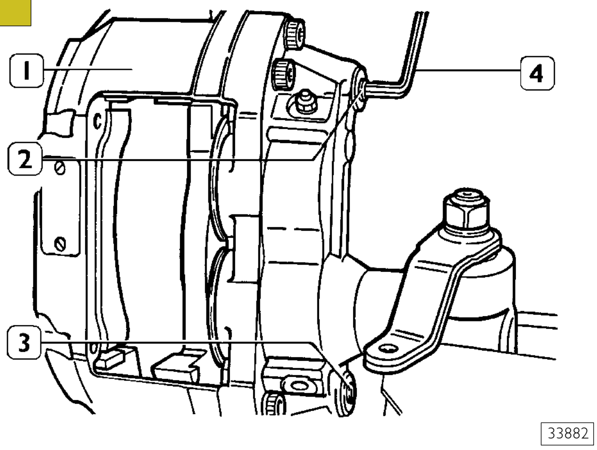
1. Dust cap – 2. Bleeder screw – 3. Screw – 4. Dust boot – 5. Brake calliper body – 6. Safety block – 7. Screw – 8. Spring – 9. Spring ring nut – 10. Seeger ring – 11. Secondary piston – 12. Primary piston – 13. Brake lining wear indicator connection – 14. Complete primary piston – 15. Piston – 16. Sealing ring – 17. Retaining pin – 18. Guide pin – 19. Guide pin sleeve – 20. Retaining clip – 21. Dust boot – 22. Brake calliper half body – 23. Supporting plate – 24. Brake linings

Brake callisper removal

NOTE The following operations have been performed on the front brake calliper and unless otherwise specified stand valid also for the rear brake calliper.

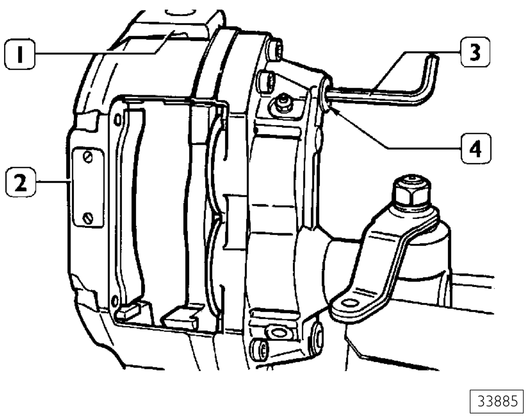
For rear calliper

Figure 119



Set the brake calliper (1) on the bench and clamp it in a vice. Remove plugs (2 and 3) using a setscrew wrench (4).

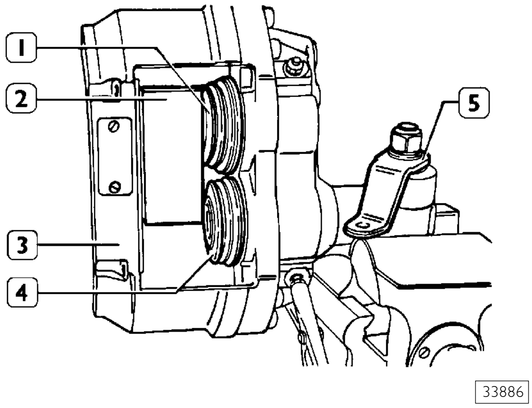
Figure 120



Remove the guide pins (4) fastening the hydraulic calliper body (2) using wrench (3).

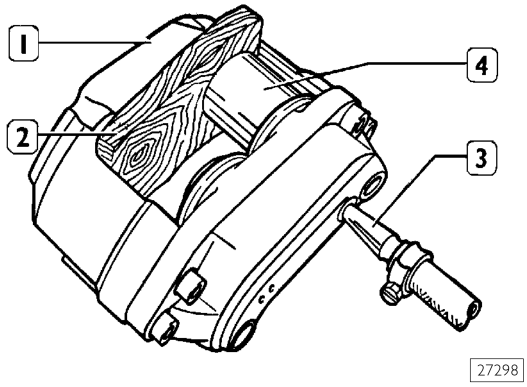
Remove the supporting plate (1).

Figure 121



Fit a wooden board (2) of proper thickness in contact with hydraulic brake calliper (3) to prevent damages when piston (1) is removed. Blow compressed air through the brake fluid inlet hole until piston (1) comes out. Remove the wooden board (2). Remove the piston (4) by moving the lever (5) in both directions several times.

Figure 122



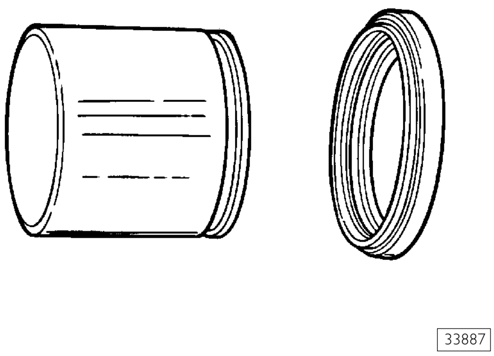
Fit a wooden board (2) of proper thickness in contact with hydraulic brake calliper (1) to prevent damages when pistons (4) are removed and to hold the first removed piston to avoid its complete removal from the relevant seat since this will enable pressure release and will impair second piston removal.
Use the proper hose (3) to blow compressed air into brake fluid inlet hole, moderate the flow if required, until both pistons in contact with the wooden board come out.

Remove the wooden board with a slight rotation and remove pistons from their seats.

For front and rear calliper

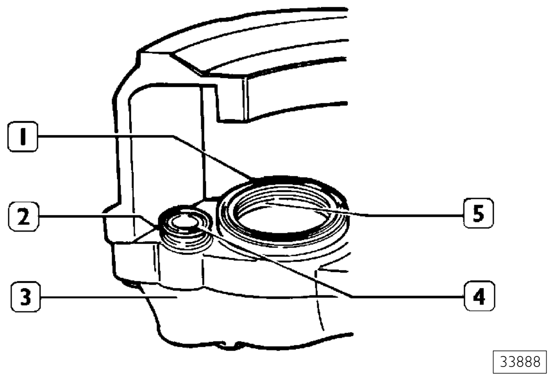
Keep hands away.
Mark piston position with relevant seats to refit them into proper initial positions.

Figure 123



Piston and dust boot view.

Figure 124

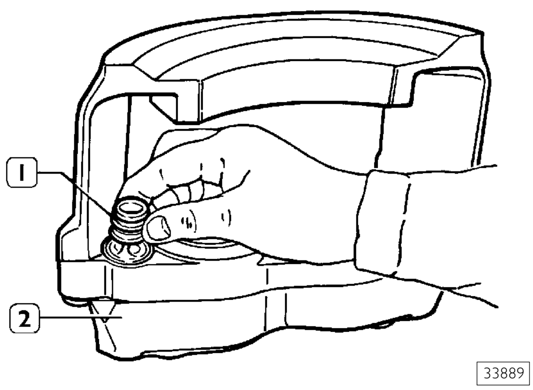


Remove the dust boots (1) from the seats on hydraulic calliper (3) cylinders.

Remove and then withdraw sealing rings (5) from seats.

Release guide pin sleeves (4) from dust covers (2), then remove them from the calliper body.

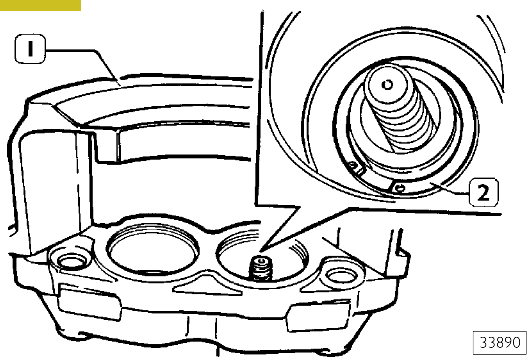
Figure 125



Remove dust covers (1) from the seats on the brake calliper (2) with a slight pressure.

For rear calliper

Figure 126

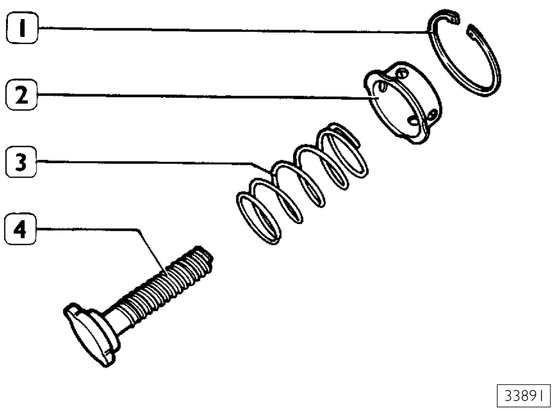


Clamp the calliper (1) in a vice and using the proper pliers remove the seeger ring (2).

When removing the seeger ring, cover partly the hole using the proper tool to prevent sudden removals of the components pushed by the spring.

For Girling rear calliper

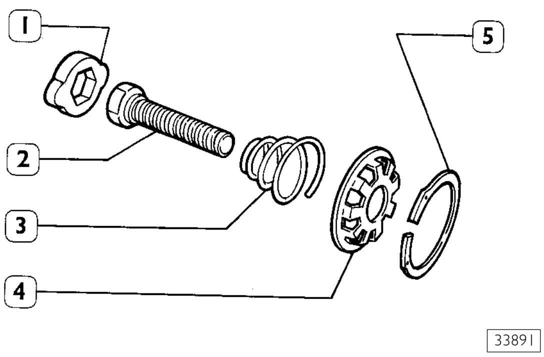
Figure 127



Remove from the brake calliper: the seeger ring (1), the spring retaining cover (2), the spring (4) and the screw (3).

For Brembo rear calliper

Figure 128



Remove from the brake calliper: the seeger ring (5), the spring ring nut (4), the spring (3), the screw (2) and the safety block (1).

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For front and rear calliper

Remove the opposite hydraulic bake calliper and keep separate the components of each calliper.

Component cleaning and checking

To wash metal parts use a solution composed of warm water and FIAT LCD detergent.

Immerse the hydraulic calliper body and the relevant supporting plate in a basin containing the detergent solution; use a wire brush to remove dirt from the calliper body, then using a common brush remove any residues and clean accurately the piston seats.

Use a synthetic brush of proper size to remove grease residues from guide pin sleeve seats.

Loosen the bleeder screw, blow compressed air on the calliper body and especially into brake fluid pipes.

Retighten the bleeder screw.

Use a cloth soaked with isopropyl alcohol or equivalent product to clean accurately the pistons, the cylinders and the guide pin sleeves.

Inspect cylinder and piston sliding surfaces; scoring or wear shall not be present.

Slight corrosion or oxidation traces in boot or sealing ring grooves can be removed by steel wool or extra–fine emery cloth.

If cylinder or piston surfaces are worn or damaged, replace the hydraulic brake calliper assembly, to be fitted on the original old supporting plate. Check wear condition on guide pin sleeves and relevant seats on brake calliper body; sliding surfaces must not show wear or damages. Fit sleeves into their seats and check regular sliding, otherwise replace them or reset the seat on the calliper body if required.

NOTE Regular braking is also dependant on hydraulic brake calliper sliding on guide pin sleeves.

Check wear conditions of brake lining retaining pins and relevant safety clips. Replace if worn or damaged. Replace also piston dust boots and guide pin sleeve dust covers although they do not show deformation or distortion at visual inspection.

As concerns the rear callipers, check wear on the device for taking up the backlash automatically and on parking brake, replace worn or damaged parts if required.

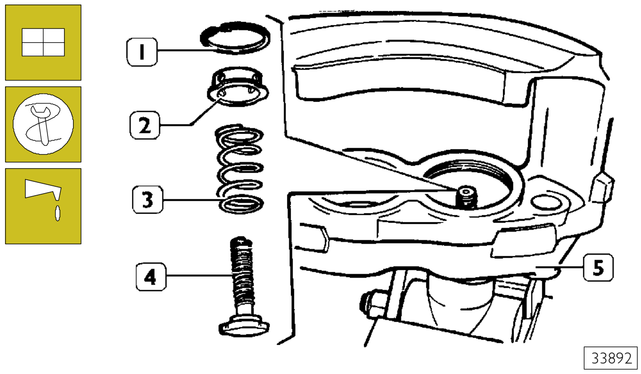
Brake calliper refitting

Hydraulic brake calliper components shall be lubricated only with **Tutela TRUCK DOT SPECIAL**.

Sealing shall always be replaced after repair operations.

For rear calliper (Girling)

Figure 129

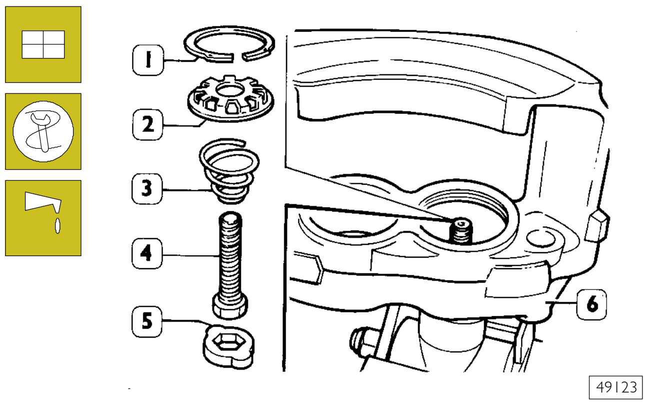


Refit in the brake calliper (5) the parts composing the device for taking up the backlash automatically and the parking brake after lubricating them with brake fluid in the following sequence.

Refit the screw (4), the spring (3), the spring retaining cover (2) and the seeger ring (1).

For rear calliper (Brembo)

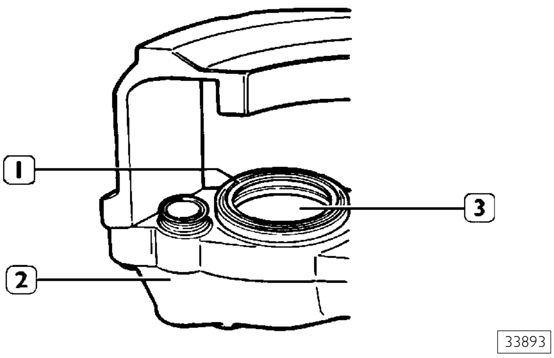
Figure 130



Refit in the brake calliper (6) the parts composing the device for taking up the backlash automatically and the parking brake after lubricating them with brake fluid in the following sequence: refit the safety block (5), the screw (4), the spring (3), the spring ring nut (2) and the seeger ring (1).

For front and rear calliper

Figure 131



Set the hydraulic brake calliper on a perfectly clean work bench.

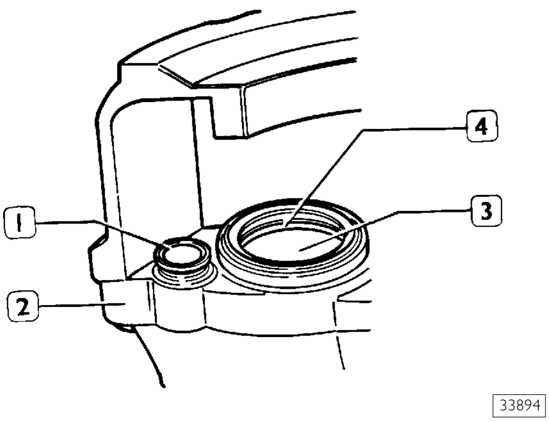
Fit dust covers (1) on the hydraulic brake calliper body (2) and push slightly to check their correct positioning.

Grease calliper body holes and smear guide pin sleeves with the suitable grease provided in tube in the Spare Kit.

Never use another type of grease.

Immerse the sealing rings in brake fluid. Fit sealing rings (4) into cylinder seats (3).

Figure 132

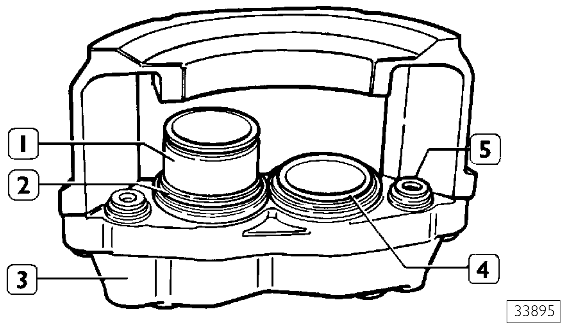


Apply dust boots (1) on brake calliper body seats (2) and push slightly to check their correct positioning, they shall not be removed from their seats.

Lubricate cylinder surfaces (3) with brake fluid without fouling the upper boot edge.

For front calliper

Figure 133



Set the hydraulic brake calliper body in a vice fitted with caps. Lubricate the pistons by immersing them partly into brake fluid.

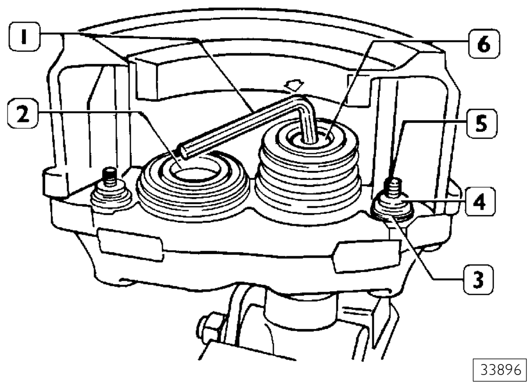
Insert the piston (1) in the upper edge of the dust boot (2), rotate slightly to enable fitting then, keeping it perfectly perpendicular to its seat, insert it into brake calliper body cylinder (3). Use a wooden board resting on the piston (1) and press to fit it partially. Insert dust boot edge (2) into piston grooved seat (1).

Fit pistons (1 and 4) into their seats.

Fit the sleeves (5) into brake calliper seats (3) and position properly the sealing edge of the dust cover into the sleeve seat.

For rear calliper

Figure 134



Immerse pistons partially into brake fluid to lubricate them.

Fit the piston (2) as previously described for the front calliper. Insert the dust boot into the upper piston edge (6).

Press slightly and keeping the piston perfectly perpendicular to its seat, screw by hand piston (6) until fitting properly the thread. Use wrench (1) to tighten to stop limit and loosen half turn the internal ring nut by pressing slightly in arrow direction.

Fit dust covers (3). Fit the sliding sleeves (4) and the pins (5). Position properly the dust cover sealing edge into sleeve seats.

During brake overhauling, the brake calliper manufacturer specifies to replace the two guide pin screws.

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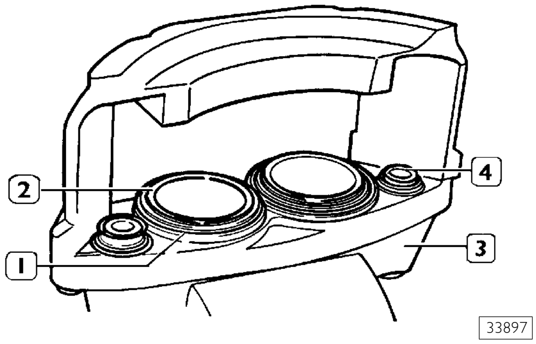
For front and rear calliper

Figure 135



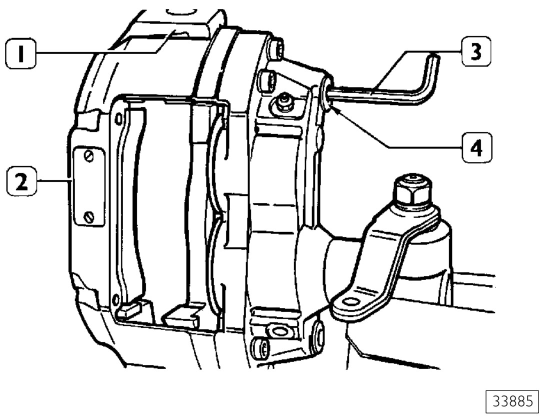
Check proper positioning of dust boots (1) into piston seats (2).

Check smooth sliding of guide pin sleeves (4) into brake calliper seats (3). Check also proper positioning of the dust covers on the sleeves.

Refit the opposite hydraulic brake calliper.

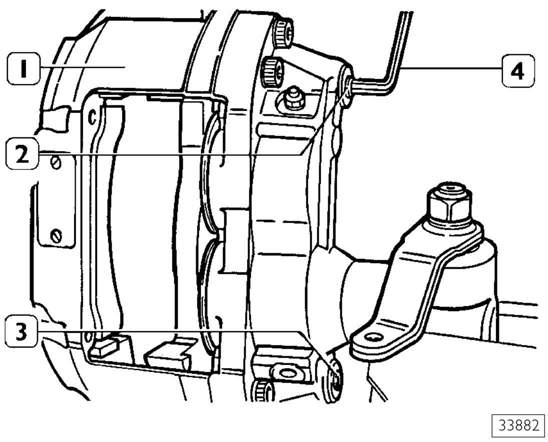
For rear calliper

Figure 136



Fit the supporting plate (1) to the brake calliper (2). Use wrench (3) to lock the guide pins (4).

Figure 137

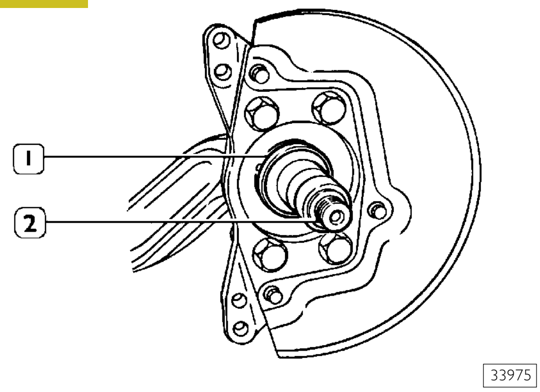


Fit in the brake calliper (1): plugs (2 and 3) and tighten using wrench (4).

REFITTING BRAKES

520620 REFITTING THE FRONT WHEEL HUBS

Figure 138



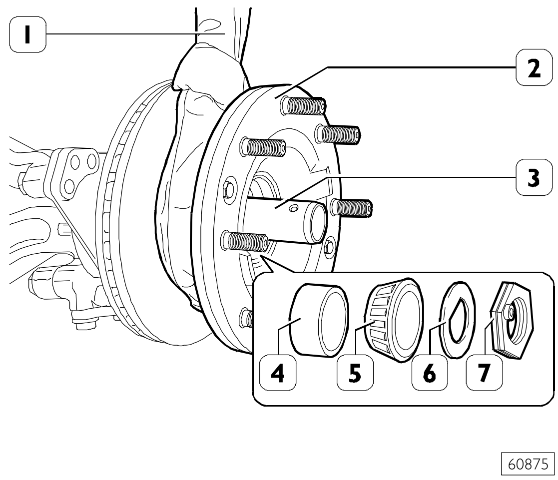
Visually inspect the sealing ring (1) diameter to check absence of accidental abrasions or damage.

Replace wheel hub internal gaskets following the procedure described in section "Front axle".

Check absence of thread (2) hardening using the adjusting ring nut, otherwise remove using proper tools.

NOTE Make sure that the surfaces of all parts inside the hub are accurately clean, free from slags and burrs.

Figure 139



Screw on stub axle pin tool 99370713 (3) and lubricate its external surface with TUTELA W140/M–DA oil.

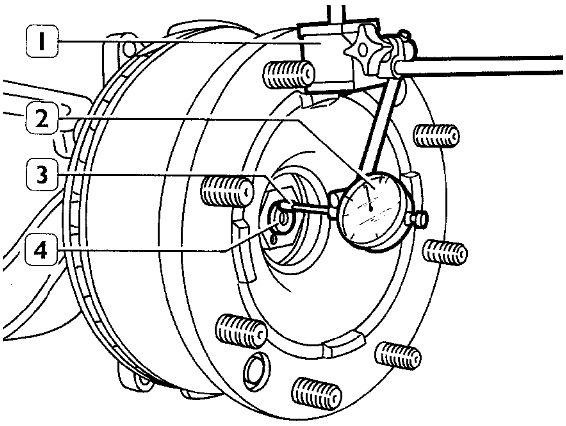
Sling with a rope (1) the wheel hub (2) and support it with the lifting device. Carefully key wheel hub (2) on stub axle pin, in order not to damage the sealing ring.

Assemble spacer (4), internal ring (5) of the tapered roller bearing.

Unscrew tool 99370713 (3).

Key washer (6) and screw adjustment ring nut (7) at the required closing torque.

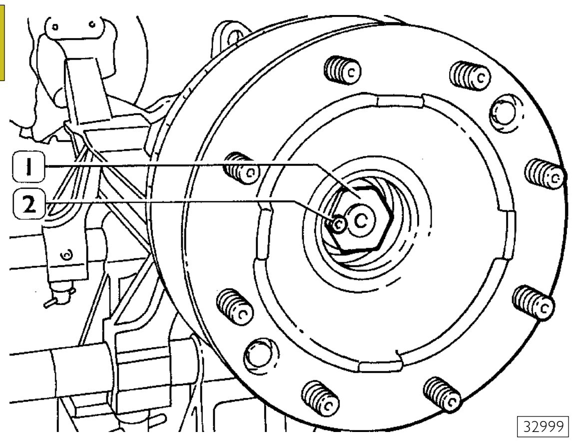
Figure 140



32998

Axially strike some mallet blows on wheel hub, rotate it in both directions to free bearing rollers.
Apply magnetic base (1) completed with comparator (2) to wheel hub.
Arrange comparator rod (3) perpendicular to stub axle tang (4).
Reset the comparator with a 1.5 – 2 mm pre–load.
Axially move the wheel hub, with the help of a lever, and measure axial clearance that must be 0.16 mm (maximum value).
If the measured value does not correspond to the required one, replace bearings assembly and proceed with a new adjustment operation.

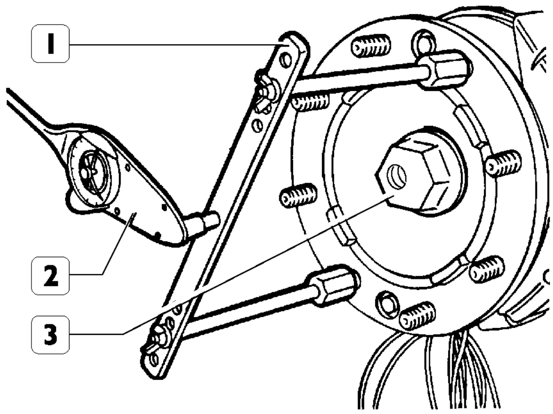
Figure 141



32999

After having obtained the required axial clearance, lock check screw (1) of adjustment ring nut (2) at the required torque.

Figure 142



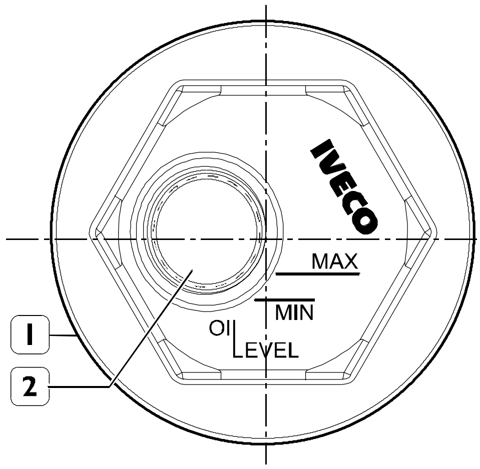
77202

Apply on wheel hub risers tool 99395026 (1) and through dynamometer 99389819 (2), check that the wheel hub rolling torque is 0.23 daNm.

Deposit a sealant seam (Loctite type 574) exclusively on hub cover abutment surface protecting its threaded part.

Torque–screw the hub cover.

Figure 143



77203

Turn the wheel hub until the wheel hub cover (1) reaches the illustrated position.
Refill the prescribed oil quantity (0,10 litres) through the filling hole (2).
Tighten the plug on the wheel hub cover (1) to the prescribed torque.

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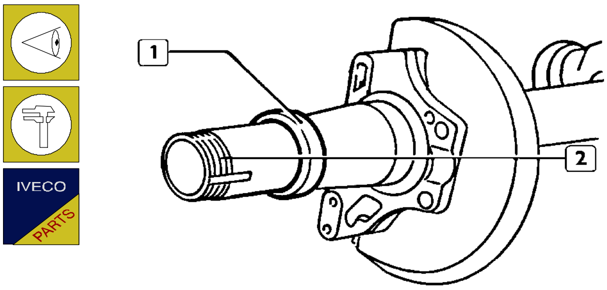
520620 REFITTING THE REAR WHEEL HUBS

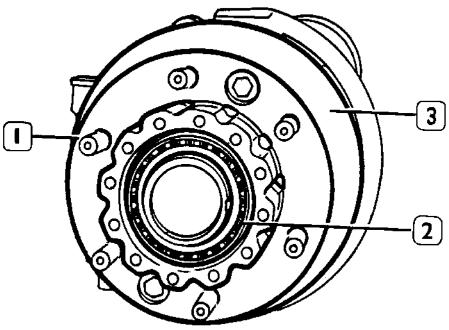
Figure 144



33903

Visually inspect the sealing ring (1) diameter to check absence of accidental abrasions or damage.
Replace wheel hub internal gaskets following the procedure described in section “Rear axles”.
Check absence of thread (2) hardening using the adjusting ring nut, otherwise remove using proper tools.

Figure 145

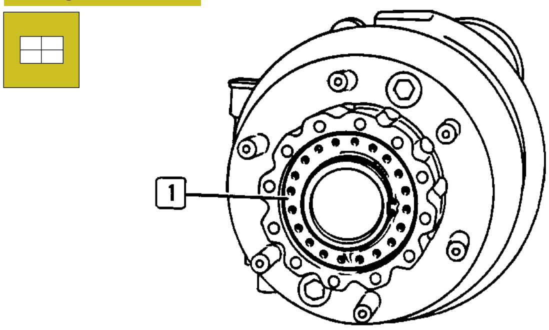


34108

Wet and fit the spacer and the wheel hub (3) including the brake disc (1) on the axle casing sleeve.

Lubricate the front taper roller bearing (2) with SAE W 140 MDA and remove it from its seat on the wheel hub (3).

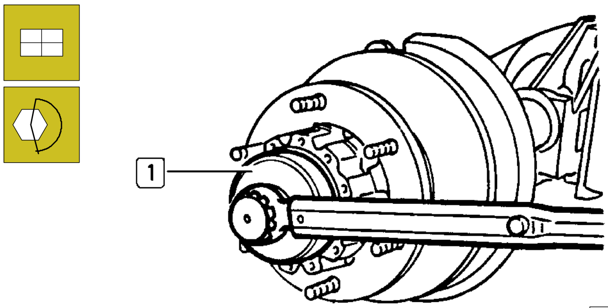
Figure 146



33898

Fit the safety washer (1) so that the clip is properly guided into axle casing sleeve slotted space.

Figure 147

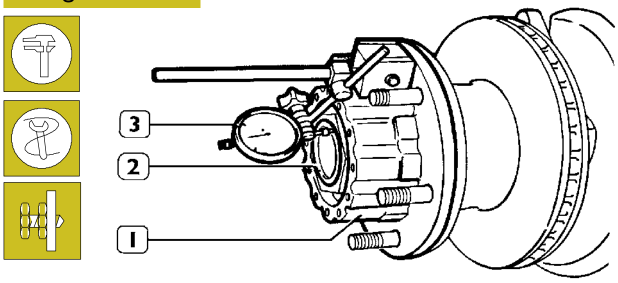


34047

Screw down wheel hub bearing adjusting nut and tighten it with rated torque.

NOTE With wrench 99357080 (1), for rear axle 4517; with wrench 99357071 (1), for rear axle 4521.

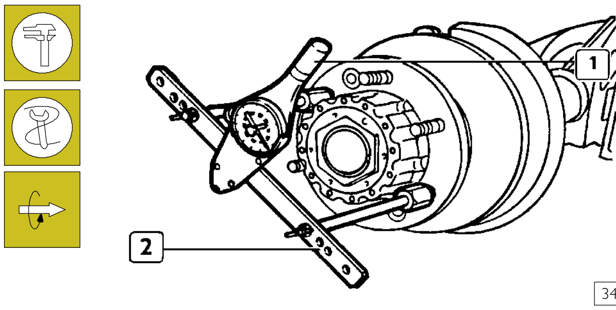
Figure 148



34108

Set the magnetic base gauge 99395684 (3) on the wheel hub (1) and rest the rod on the sleeve (2). Check that wheel hub end play is falling between 0 and 0.16 mm.

Figure 149

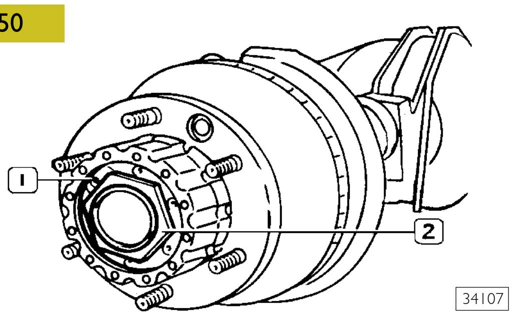


34048

Check with tool 99395026 (2) and dynamometric wrench 99389819 (1) that the wheel hub rolling torque is falling between the following values:

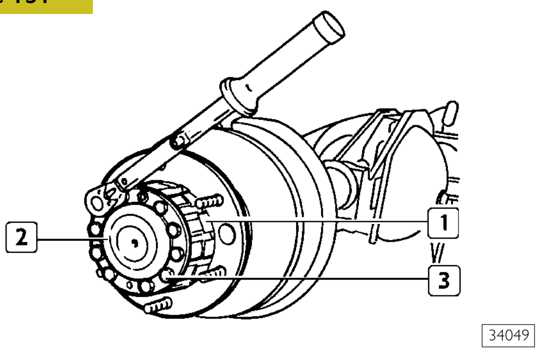
NOTE
- ❑ 0 to 4 Nm (0 – 0.41 kgm) for rear axle 4517;
- ❑ 0 to 4.5 Nm (0 – 0.46 kgm) for rear axle 4521;
- ❑ rolling torque check is performed with propeller shaft disconnected from differential input flange.

Figure 150



Once the required rolling torque and wheel hub end play have been obtained, check that one of the holes on the adjusting nut (2) is coinciding with one of the holes on the safety washer. Otherwise loosen gradually the adjusting nut (2) until the safety screw (1) can be inserted. Tighten the adjusting nut safety screw (1) to 9.1 Nm (0.9 kgm).

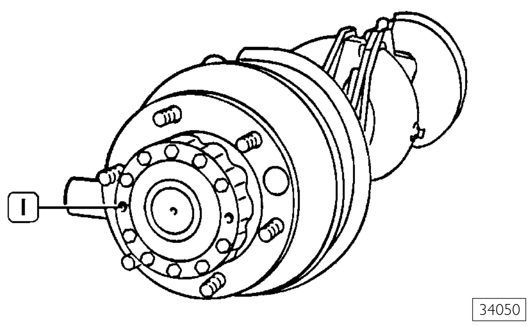
Figure 151



Smear sealant type "B" the contact surface between the axle shaft (2) and the wheel hub (1).

Mount half shaft (2), put in securing screws (3) but the ones marked with OIL, and tighten them with rated torque.

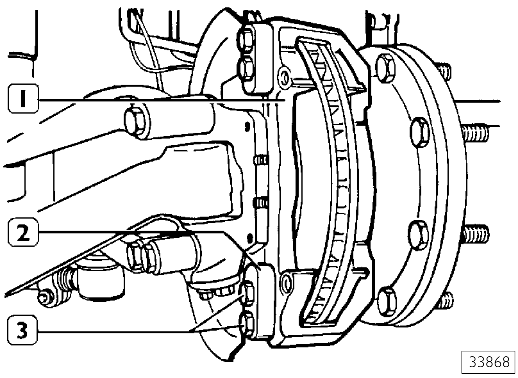
Figure 152



Set the holes (1) marked with OIL horizontal to ground as shown in the figure, and pour 0.2 litres of W 140 MDA oil to each wheel side. Smear with LOCTITE 222 the threaded sections of the screws acting as plug and tighten to the following torque:

527413 REFITTING THE BRAKE CALLIPERS

Figure 153

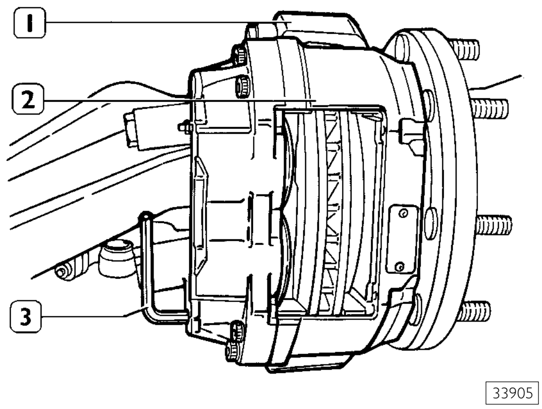


Apply the supporting plate (2) to the support (1) and tighten to contact the self–locking screws (3).

Use the proper dynamometric wrench fitted with box wrench to tighten screws to the specified torque.

Figure 154

During brake overhauling, the brake calliper manufacturer specifies to replace the two guide pin screws (18, Figure 122).



Apply the hydraulic brake calliper (2) to the supporting plate (1), insert the guide pin screws into seat, using the proper wrench (3) tighten slightly to contact then holding the calliper body upwards tighten the screws.

Check whether the hydraulic brake calliper is sliding smoothly on the sleeves.

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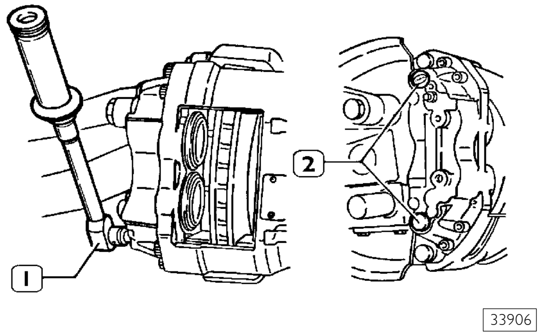
Figure 155

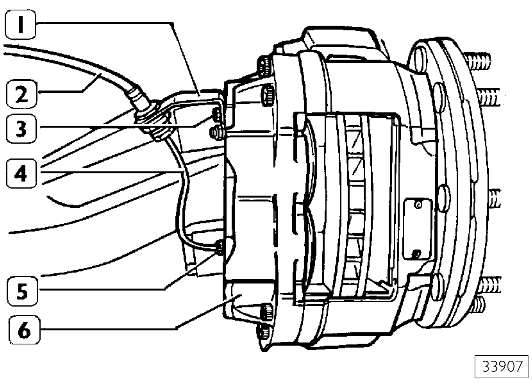


Use the proper dynamometric wrench (1) fitted with box wrench to tighten guide pin screws to the specified torque.

Check again whether the hydraulic brake calliper is sliding smoothly on the sleeves and loosen the guide pin screws if required. Slide the calliper and retighten the screws to the specified torque.

Apply caps (2) to guide pin holes and beat them slightly to fit into relevant seats.

Figure 156



NOTE Brake fluid hoses (2) must not show cracks or swelling, otherwise replace both hoses although just one is damaged.

Apply the brake fluid hose (4) to the brake calliper (6) and tighten fitting (5) to contact; set the bracket (1) and insert the fastening screw (3) and then lock it.
Tighten fitting (5) to the specified torque.

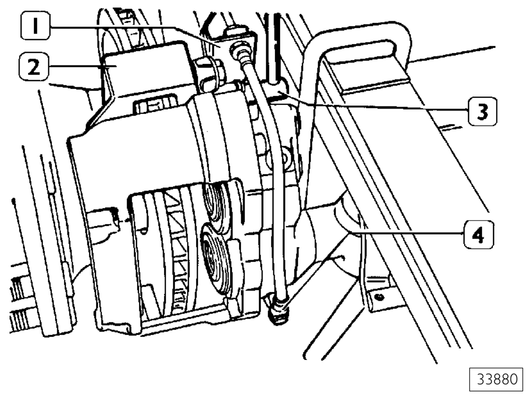
NOTE Should hose (2) be replaced, lock the fittings without causing torsion to piping and complying with procedure described in chapter "pipes and fittings".

For refitting the brake linings, comply with the procedure previously described in the chapter dealing with brake lining replacement.

NOTE After refitting the brake callipers, bleed air from the hydraulic circuit as described in the relevant chapter.

527413 REFITTING THE REAR BRAKE CALLIPERS

Figure 157



NOTE Brake fluid hoses must not show cracks or swelling, otherwise replace both hoses although just one is damaged.

Fit the brake calliper assembly on the stub axle. Tighten the screws to the specified torque using wrench (3). Secure the bracket (1) to the supporting plate (2) using the proper screws. Connect brake fluid hose fitting (4) to the calliper.

NOTE Should hose be replaced, lock the fittings without causing torsion to piping and complying with procedure described in chapter "pipes and fittings".

For refitting the brake linings, comply with the procedure previously described in the chapter dealing with brake lining replacement.

SECTION 12

5501 Body
5001 Chassis

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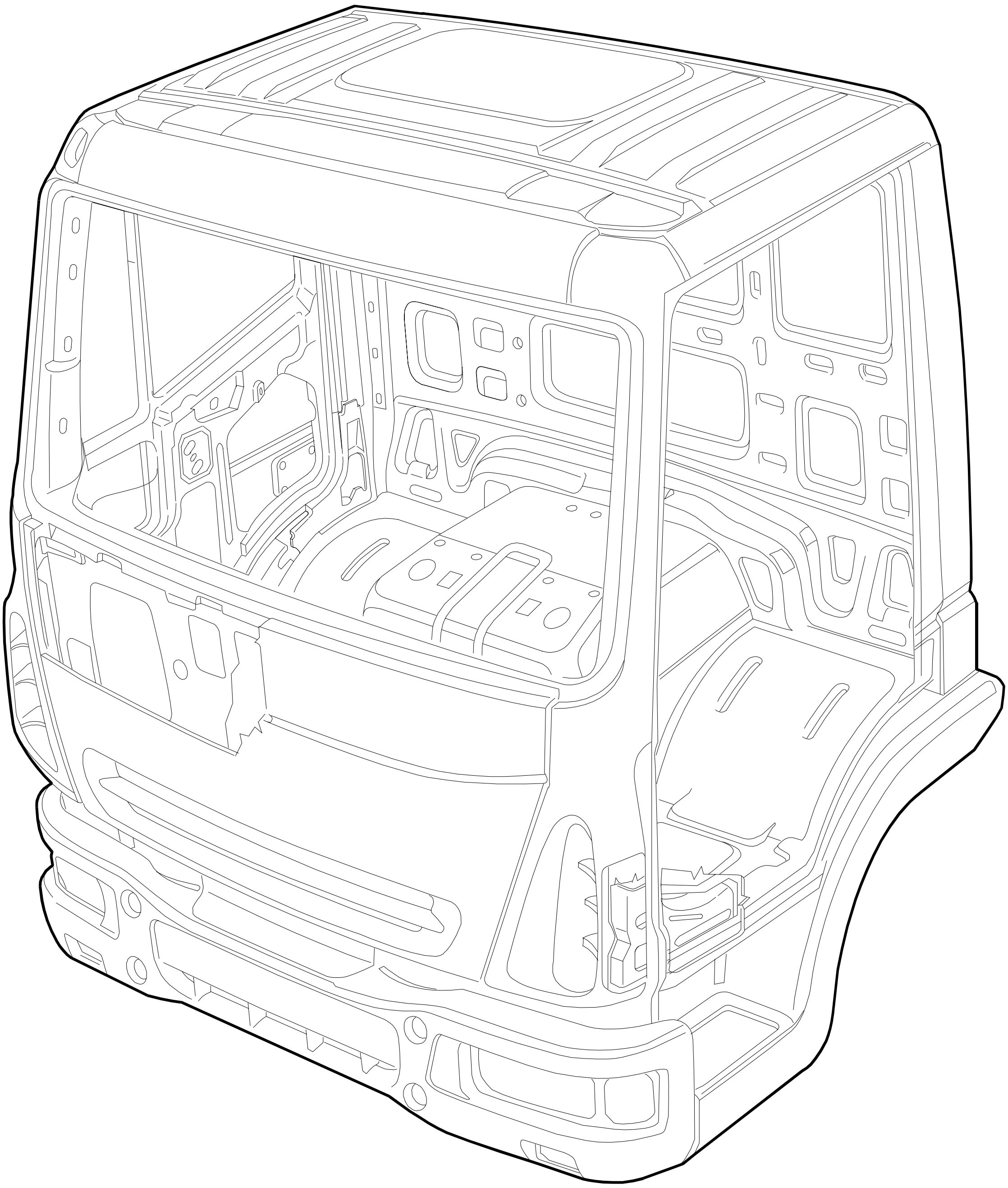
5501 CAB

General information

The cab is an advanced one, it can be tipped up hydraulically with a mechanical control.
Tilting angle 57°.
Pressed and welded steel framework, parts made of electro–galvanized sheet steel.
Sound deadening on the underbody and anticorrosion protection in the boxed compartments.
The cab suspension is mechanical.

Figure 1

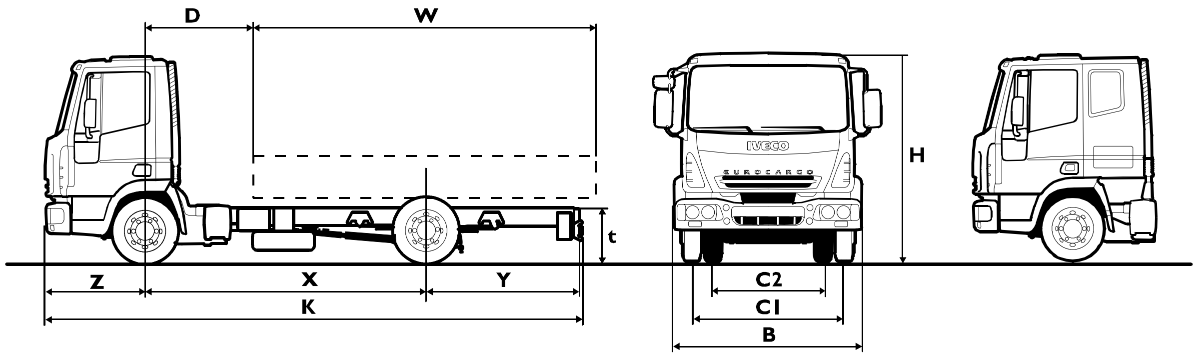


78688

CHARACTERISTICS AND DATA

Models: a) ML 60E.. – 60E../P
b) ML 65E.. – 65E../P
c) ML 75E.. – 75E../P
d) ML 80EL.. – 60EL../P

Figure 2



Dimensions (mm)		Models							
X	Wheel base		2700	3105	3330	3690	4185	4455 (**)	4815
K	Maximum length	a – b – c – d	5290	5718	6460	6820	7630	8035	8620
B	Maximum width (*)	a – b – c – d	2170						
C1	Front track	a – b – c – d	1810						
C2	Rear track	a – b – c – d	1660						
t	No–load chassis height (mechanical suspension)	a – b – c	902						
		d	916						
t	No–load chassis height (pneumatic suspension)	a – b – c	–	740					
		d	–	750					
Y	Rear overhang	a – b – c – d	1290	1313	1830	1830	2145	2280	2505
Z	Front overhang	a – b – c – d	—						
H	No–load maximum height	a – b – c – d	2545						
	Steering minimum diameter	a – b – c – d	990	11100	11800	12900	14400	15200	16300
D	Front axle – body edge distance	a – b – c – d	475			475 (1055)			
W	Practicable maximum length	a – b – c – d	3845	4420	4850	5425 (4845)	6220 (5640)	6650 (6070)	7225 (6645)
	Practicable maximum width	a – b – c – d	2550						

(...) Values between brackets are referred to long cab models.
(*) Side direction indicators and rear–view mirrors not included.
(**) Wheel base not utilised on models ML 80EL.. and ML 80EL../P.

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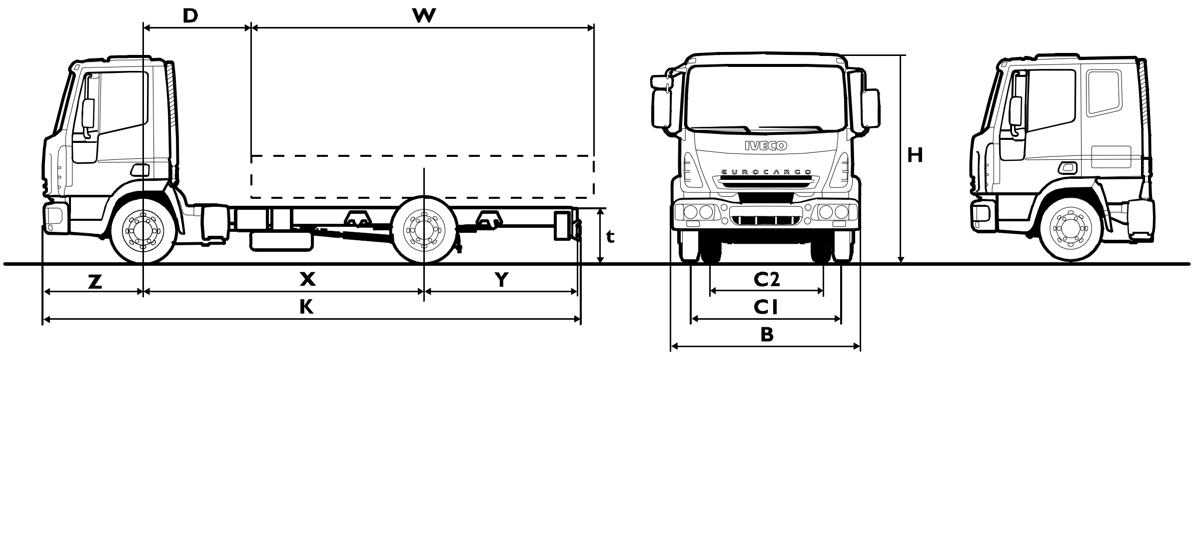
Models: a) ML 80E.. – 80E../P
b) ML 90E.. – 90E../P – 90E../FP
c) ML 100E.. – 100E../P – 100E../FP

Figure 3

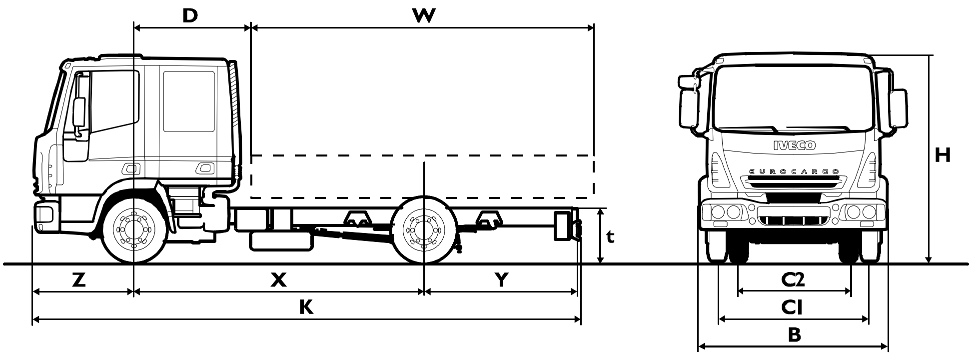


Dimensions (mm)		Models							
X	Wheel base		**2700**	**3105** (**)	**3330** (**)	**3690** (**)	**4185**	**4455**	**4815**
K	Maximum length	a – b – c	5313	5718	6460	6820	7630	8035	8620
B	Maximum width (*)	a – b – c	2200						
C1	Front track	a – b – c	1835						
C2	Rear track	a – b – c	1680						
t	No–load chassis height (mechanical suspension)	a – b	915						
		c	930						
t	No–load chassis height (pneumatic suspension)	a – b	–	750					
		c	–	790					
Y	Rear overhang	a – b – c	1313	1313	1830	1830	2145	2280	2505
Z	Front overhang	a – b – c	—						
H	No–load maximum height	a – b – c	2555						
	Steering minimum diameter	a – b – c	9900	11100	11800	12900	14400	15200	16300
D	Front axle – body edge distance	a – b – c	475			475 (1055)			
W	Practicable maximum length	a – b – c	3845	4420	4850	5425 (4845)	6220 (5640)	6650 (6070)	7225 (6645)
	Practicable maximum width	a – b – c	2550						

(...) Values between brackets are referred to long cab models.
(*) Side direction indicators and rear–view mirrors not included.
(**) Wheel base not utilised on models ML 90E../FP and ML 100E../FP.

Models: a) ML 80 – 90 – 100E17D – D/P
b) ML 80 – 90 – 100E18D – D/P
c) ML 80 – 90 – 100E21D – D/P

Figure 4



Dimensions (mm)							
X	Wheel base		**3105**	**3690**	**4185**	**4455**	**4815**
K	Maximum length	a – b – c	5718	6820	7630	8035	8620
B	Maximum width (*)	a – b – c	2200				
C1	Front track	a – b – c	1835				
C2	Rear track	a – b – c	1680				
t	No–load chassis height (mechanical suspension)	a – c	915				
		b	900				
t	No–load chassis height (pneumatic suspension)	a – b – c	795				
Y	Rear overhang	a – b – c	1313	1830	2145	2280	2505
Z	Front overhang	a – b – c	—				
H	No–load maximum height	a – b – c	2565 (2575 su ML 100)				
	Steering minimum diameter	a – b – c	11100	12900	14400	15200	11630
D	Front axle – body edge distance	a – b – c	1615				
W	Practicable maximum length (**)	a – b – c	3290	4390	5200	5600	6190
	Practicable maximum width	a – b – c	2550				

(*) Side direction indicators and rear–view mirrors not included.
(**) With series rear overhang.

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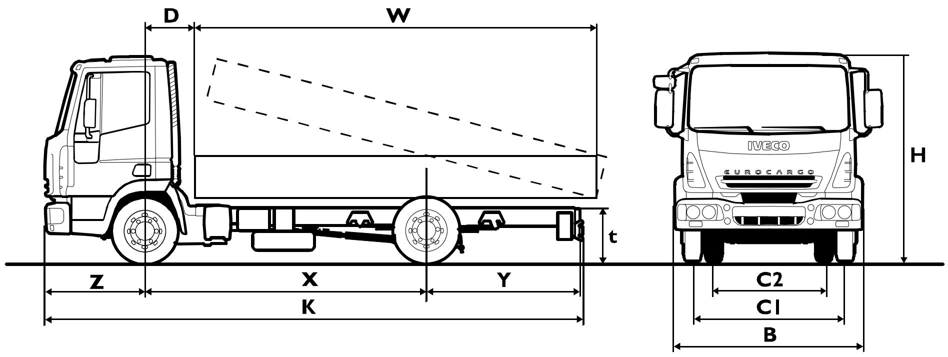
Models: a) ML 60 – 65 – 75E..K
b) ML 80 – 90 – 100E..K

Figure 5



78691

Dimensions (mm)	Models				
X Wheel base		**2700**	**3105**	**3330**	**3690**
K Maximum length	a	5290	5718	6460	6820
	b	5313	5718	6460	6820
B Maximum width (*)	a	2170			
	b	2200			
C1 Front track	a	1810			
	b	1835			
C2 Rear track	a	1660			
	b	1680			
t No–load chassis height	a	900			
	b	930			
Y Rear overhang	a	1290	1313	1830	1830
	b	1313	1313	1830	1830
Z Front overhang	a – b	—			
H No–load maximum height	a	2545			
	b	2590			
Steering minimum diameter	a – b	9900	11100	11800	12900
D Front axle – body edge distance	a – b	475			
W Practicable maximum length	a – b	3845	4420	4850	5425
Practicable maximum width	a – b	2550			

(*) Side direction indicators and rear–view mirrors not included.

PROTECTIVE BODY TREATMENTS

Protective treatment

Figure 6

Double zinc plated sheets

Single zinc plated sheets

Elements in synthetic material

78692

The choice of materials comprising the body is geared to achieving an excellent quality standard so as to offer a product with lasting quality and performance.

The galvanizing is done according to different technological processes:

- Galvanic plating: the sheet metal is immersed or washed, depending on whether it is bi–galvanization or galvanization, in a salt bath providing a high level of surface finishing.
- Fire plating: the molten zinc gets deposited on the sheet metal by the effect of the heat. With this process, which is mainly used for the structural elements of the body, thicknesses of up to 20 microns can be reached, against 7 microns obtained with the galvanic process.

The wheel arches made of synthetic material also have an anti–corrosion function.

All the boxes are protected by using galvanized sheet steel that, after painting, are sprayed on the inside with waxy oil to prevent internal oxidation.

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Preparing the sheet metal (bonderizing)

After assembly, the body undergoes a range of treatments to cleanse it of grease, oxidation and to preserve it from corrosion.

The cycle comprises the following phases:

- Pre–degreasing: washing with an acid solution (deoxidine) to eliminate the oily substances on the metal.
- Degreasing: washing with a water–surfactant solution. This solution is sprayed at a temperature of approximately 60°C.
- Rinsing: this is done with industrial water to eliminate the alkaline residues.
- Activation: washing at ambient temperature with a titanium salt solution (exposing the crystals, ''pickling'').
- Phosphatizing: washing with zinc phosphates at a temperature of approximately 55°C. The electrolytic plating of these metals forms and multiplies the crystalline cores, creating a uniform and protective micro–crystalline layer on the body (decontamination).
- Passivating: washing with a chromium–based solution that provides an additional layer of protection and levelling of the crystals.
- Rinsing: using deionized water eliminates the residues of the previous solutions.
- Drying: in an oven at a temperature of approximately 110°C.

Applying the protective paint (electrophoresis)

Electrophoresis treatment is performed by dipping the body in a bath of an electro–conductive solution to which particles of paint have been added in suspension.

CHECKING THE GEOMETRY OF THE CHASSIS FRAME

Before doing any work it is wise to make sure that the chassis frame is perfectly level, that is with no deformation or stress due to the weight of the various assemblies.

GENERAL RULES FOR WORKING ON THE CHASSIS FRAME

The criteria for performing the work permitted by IVECO on the chassis frames are subordinate to observance of the following instructions:

- Welding on the flanges of the structural members and on the structural members of the chassis frame is strictly prohibited.
- Drilling the flanges of the structural members is not permitted.
- The characteristics of the chassis frame must not be altered without IVECO approval.

Preparing the chassis frame for maintenance, checking and repair work authorized by IVECO

Parts fitted on the chassis frame that are removed before checking and repairing the chassis frame must be suitably stored and protected.

Likewise, the wirings and terminal installations must be well positioned on the chassis frame to prevent damage (from any welding, painting or rubbing on the ground).

Protect the entire installation of the chassis frame, placing suitable protection on it for workers and operators to tread on.
Should welding be required, keep to the instructions.

Arc welding with weld material

The weld must be good for the effects of penetration with no cracks or inclusions and with a non–porous appearance.

The thickness of the weld material must be in proportion to the thickness of the material to weld and must be no less than 2 mm even after any grinding.

When making the weld beads, they must be parallel to the direction of the stress; transverse beads must be avoided.

For elements that bend, the weld must be located along the neutral area, with a bead width in proportion to the thickness of the sheet metal. For elements with axial compression, the weld must be made at the end and with a concave bead.

Sudden changes in cross–section due to weld accumulation must be avoided.

Spot welding

This must be workmanlike. Take special care over the setting of the device so as to make spot welds that ensure a fully efficient join. Avoid positioning spots near the edge of the parts to weld.

NOTE The areas of the chassis frame involved in welding must be thoroughly cleaned and, after welding, protected with two–component epoxy rust–proofing or another similar product, and with another coat of single– or two–component paint.

The earth cable of the welding system must be connected on the chassis frame as close as possible to the welding zone, and never near a rotating part (transmission, wheel hubs, etc.) nor above or under an assembly with moving parts (compressor, bearings, etc.).

Welding instructions

Before welding, which must be done so as to minimize the tension and deformation that may be created, remove the paint and carefully deoxidize the surfaces involved.

Classification of corresponding steels in the EU:

French standards A 35 501	German standards DIN 17 100	British standards BS 4360	American standards A S T M
E 24.2	R–St. 37.2	40 B	A 283 gr. D
E 26.3	St. 42.3	43 C	A 284 gr. C
E 36.4	St. 52.3	50 D	–
Italian standards UNI – 7070	**Swedish standards MNC – 810**	**Spanish standards UNE – 36 080**	**Belgian standards NBN 631**
Fe 37.B	13.12.00	A 360.B	AE 22B or AE24B
Fe 42.C	14.13.00	A 410.C	AE 26 C
Fe 52.D	21.34.01	A 510.D	AE 36 D

Bodybuilder work on the structural members of the IVECO chassis frame

No modification (lengthening, shortening, drilling and/or welding on a significant scale) is authorized to the frameworks of the IVECO chassis frame or warranty for the chassis frame is forfeit. If, when specifically requested in writing, IVECO Engineering authorizes specific work to be performed, there are some rules of a general nature to follow in designing and performing these operations that are stated on the following pages.

Drilling the chassis frame

When it is necessary to fit auxiliary parts or assemblies on the chassis frame, the existing holes made when making the chassis frame must, as a rule, be used.

Drilling the flanges of the vehicle's structural members is strictly prohibited.

In special cases (fitting brackets, angle sections, etc.) where it is necessary to make fresh holes, these must be made on the vertical rib of the structural member and must be carefully deburred and bored.

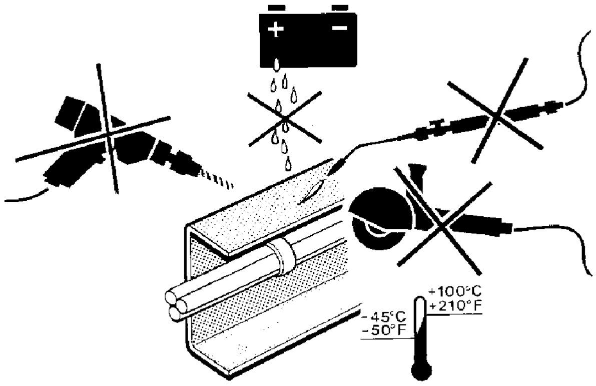
The new holes must not be made in the areas of greatest stress (such as the spring mountings for example) and of changes to the cross–section of the structural member.

The diameter of the holes must be suited to the thickness of the sheet metal; in no case may it exceed 15 mm. The distance from the axis of the holes from the edges of the structural member must be no less than 40 mm. In any case, the axes of the holes must be at a distance of no less than 50 mm from each other or from the existing holes. The holes must be staggered as shown in the figure.

When moving the crosspiece or spring mountings, their drilling patterns must be maintained.

PRECAUTIONS

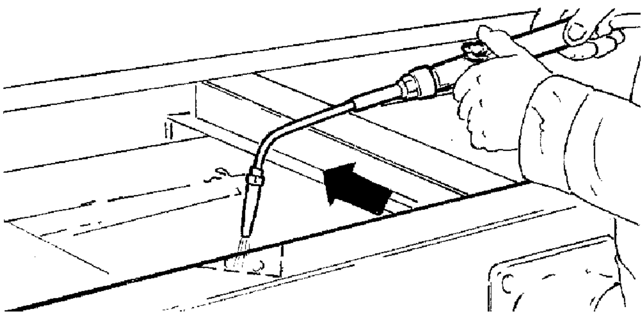
Figure 7



17358

During the work of welding, drilling, grinding, cutting near brake system piping, especially if this is made of plastic, and electric cables, take the appropriate precautions to protect them, contemplating their removal if required. All the parts of the chassis frame subject to reconditioning will need to be protected against oxidation and corrosion.
This protection and painting will need to be done carefully on all the parts concerned, as per any relevant instructions, methods and precautions of the paint manufacturers.

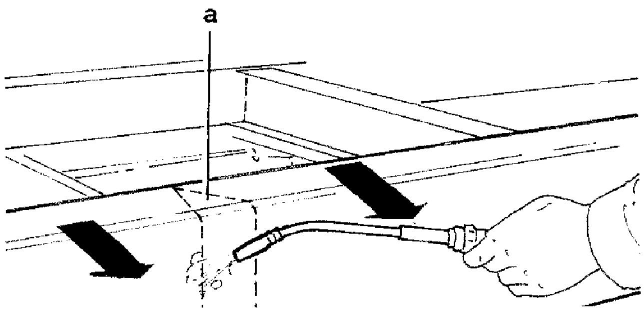
Figure 8



17359

The chassis frame is reconditioned by wedge heating the relevant part with a blowpipe.
During this operation the metal needs to turn cherry red, which corresponds to a temperature of 600 – 680 °C.
The heated points must undergo no further heating.
Let the treated parts cool slowly without using any water, compressed air or the like.

Figure 9

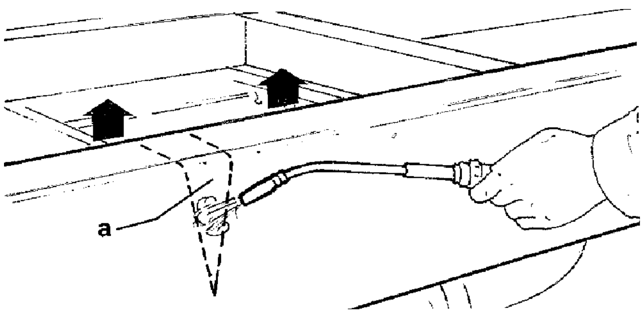


17360

Straighten the side bend of the chassis frame with wedge heating on the top and bottom waist of the part concerning the chassis frame.
The tip of the heating wedge has to lie in the direction of the required bend.

If the base of the two heating wedges is in the top plate of the structural member, then the plate also needs to be heated, but last.

Figure 10

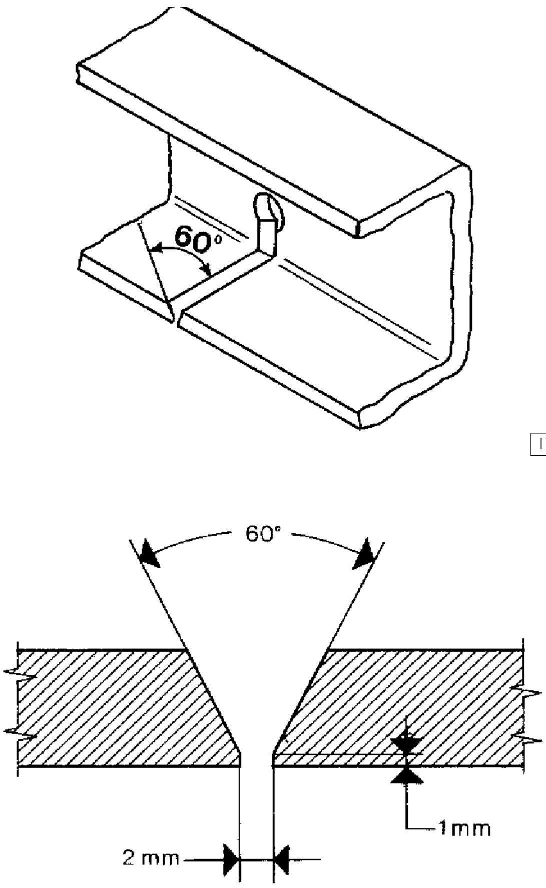


17361

Straighten the sag in the chassis frame downwards or upwards with wedge heating on the top plate of the structural member. In the case of downward bending, the base (a) of the heating wedge is at the bottom. In the case of upward bending, do the opposite.
The relevant bottom or top waist of the structural member has to be heated last in the area of the base of the heating wedge.

Welds on the chassis frame

Figure 11



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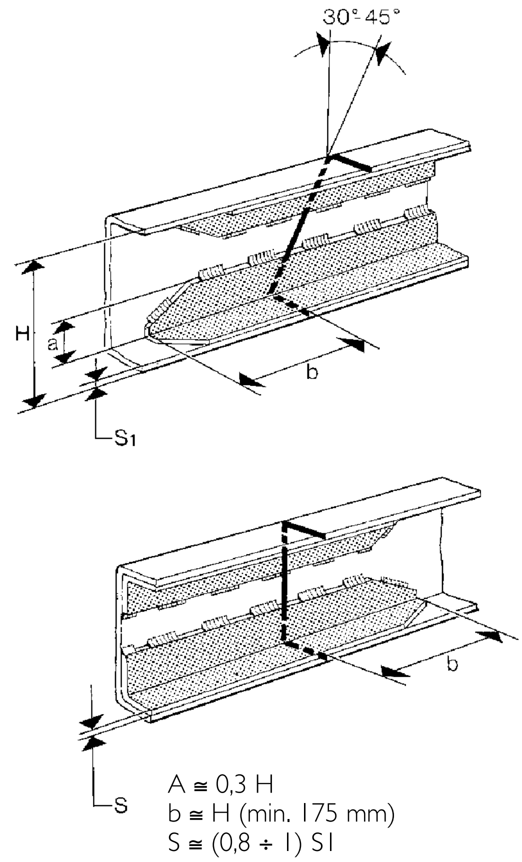
17363

Figure 12



17364

17365

Before starting work, disconnect the negative battery terminal and connect the earth of the welding machine straight onto the piece to weld. Plastic pipes will need to be protected or removed.
Welds will have to be made solely by skilled, trained personnel, with suitable equipment and in workmanlike fashion.
Remove the paint and deoxidize the parts to weld. At the point of breakage, on the inside of the structural member and along the full length of the relevant section, make a V bevel of 60°.

NOTE No cuts are permitted on the structural members at areas of changes in profile or at points with a high concentration of stresses; additionally, the line of separation must not concern the holes already in the structural member.

Here we give the operating instructions for proper welding:

a) Heat all around the area to weld (except for QST E 420 material). Do the arc welding with several passes, using thoroughly dried basic electrodes, or MIG–MAG procedures with suitable weld material. Do not overload with current. The weld must have no edge cuts or dross.

b) Start back welding as specified in point (a).

c) Leave the structural members to cool slowly and evenly. It is not permissible to use jets of air or other means.

d) Grind off the excess material.

e) Apply angular steel strengthening, with the same specifications as the steel used in the chassis frame. The approximate minimum dimensions are given in the above illustrations. They are to be fixed solely on the vertical rib of the structural member and it is possible to use bead welding, dummy spots, screws or rivets. The cross section and length of the weld bead, the number and distribution of the dummy spots, screws or rivets must be suited to transmit the bending and cutting moments of the section. On completing the work, the part involved in welding must be effectively protected with rust proofing.

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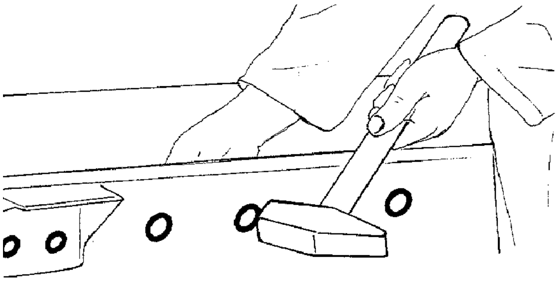
5001 CHASSIS FRAME REPAIRS AND CHECKS

Inspect the chassis frame, checking its alignment.
If already at this stage you detect any deformation you then need to free the relevant part of the chassis frame to help make an exact measurement.

Before the test you need to check all the parts that, with their imperfections, affect the exact measurements (for example, tyre pressure, weak or broken leaf springs, etc.).

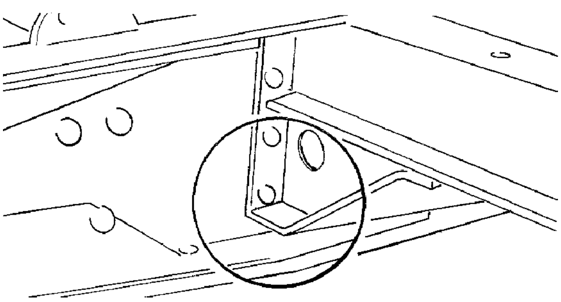
Figure 13



17344

Check the rivets by striking their heads with a mallet and touching the opposite side with your fingers.
Mark any loose rivets with paint to help identify them during the repair work.

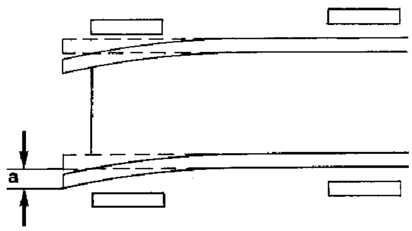
Figure 14



17345

Carefully check for any peeling or cracking all over the chassis frame, paying special attention to joints under great strain, such as: chassis frame cross members, brackets, mounts of leaf springs and chassis frame structural members.
Mark any peeled or cracked points straight away.

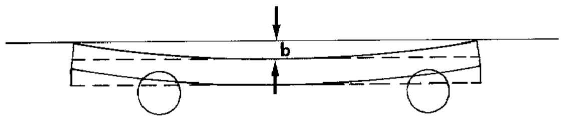
Figure 15



17347

Laterally permissible curvature of chassis frame
"a" = 3 mm/m

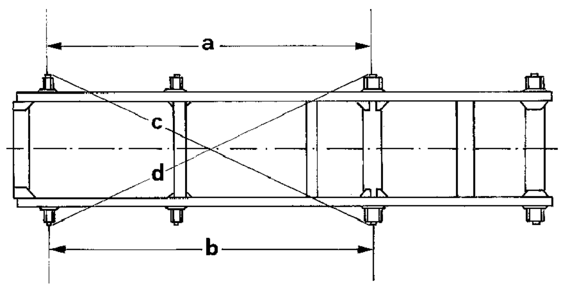
Figure 16



17348

Permissible curvature of chassis frame
"b" = 1 mm/m
Max. 10 mm.

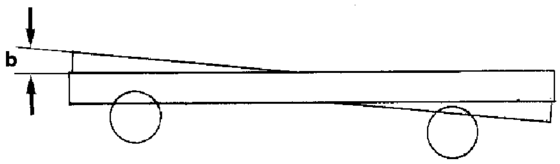
Figure 17



17349

Permissible difference between "a" and "b" = 3 mm.
With diagonal measurement between "c" and "d" = 6 mm.

Figure 18

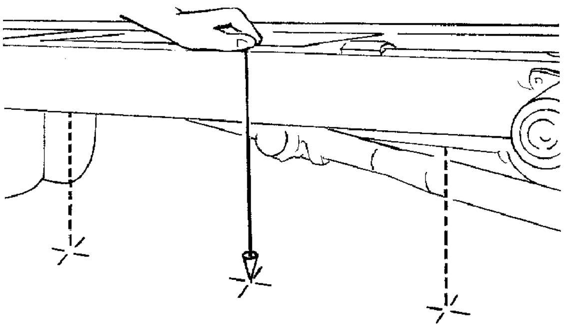


17350

Permissible torsion on the chassis frame
"b" = 1 mm each side.

Measuring the side bend of the chassis frame

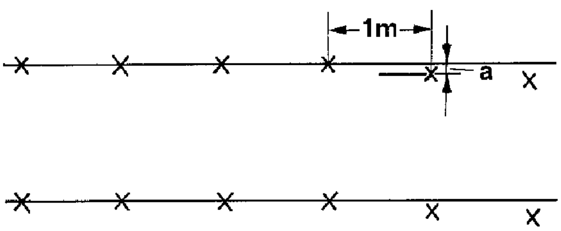
Figure 19



17351

To measure the side bend of the chassis frame you need to plumb the supporting surfaces starting with the two structural members at an interval of approximately 1 m.
The points obtained in this way need to be marked accurately on the floor.

Figure 20

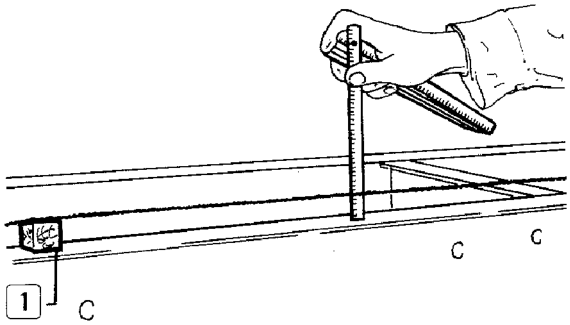


17352

To use the plumbed points you need to stretch out a string passing through the marked points in a line.
The points outside the line indicate the start and extent of the actual deformation (a).

Measuring the bend of the chassis frame downwards or upwards

Figure 21

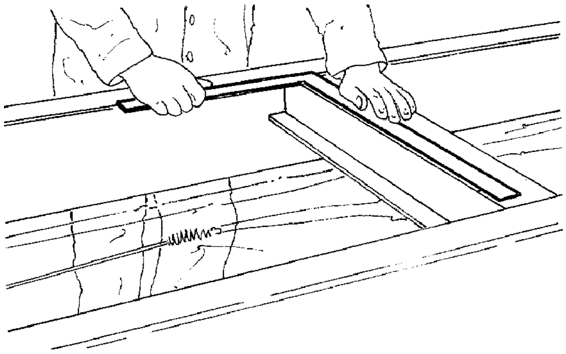


17353

Take two shims (1) of such a size that a string can be stretched along the full length from the straight portion of the bottom or top waist on the structural member of the chassis frame.
Measure the distance of the structural member from the string at 1–metre intervals. A different string distance indicates the position and extent of an actual bend in the structural member.

Measuring the movement of the chassis frame

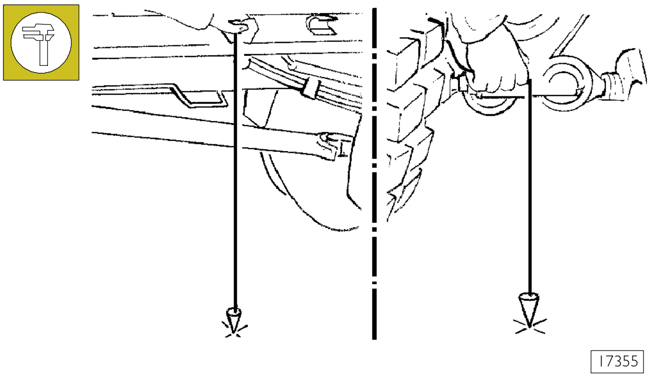
Figure 22



17354

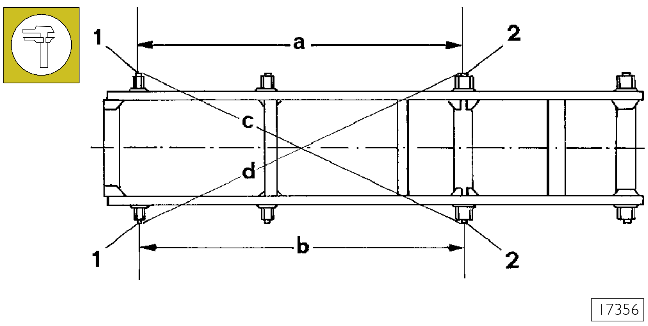
A movement of the chassis frame can be measured by means of a set square.
To do this, place the set square at 90° to the structural member of the chassis frame and check the squareness of the cross members of the chassis frame.

Figure 23



A movement in the position of the axes can be checked by making a diagonal measurement. To do this, plumb the centre of the front mount of the front suspension and the centre of the front support of the rear leaf spring on the flat supporting surface, on both sides.

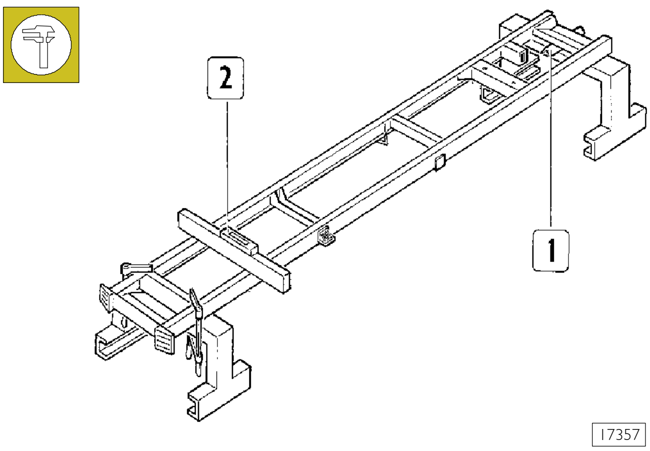
Figure 24



Firstly compare the distance of the points "a" and "b". Then make the diagonal measurement (distance "c" and "d") from point (1) in front to the right to point (2) behind to the left and the opposite.

Measuring the torsion of the chassis frame

Figure 25



A slight torsion can only be measured with the chassis frame freed of the cab and mechanical assemblies.
To do this check, proceed as follows:

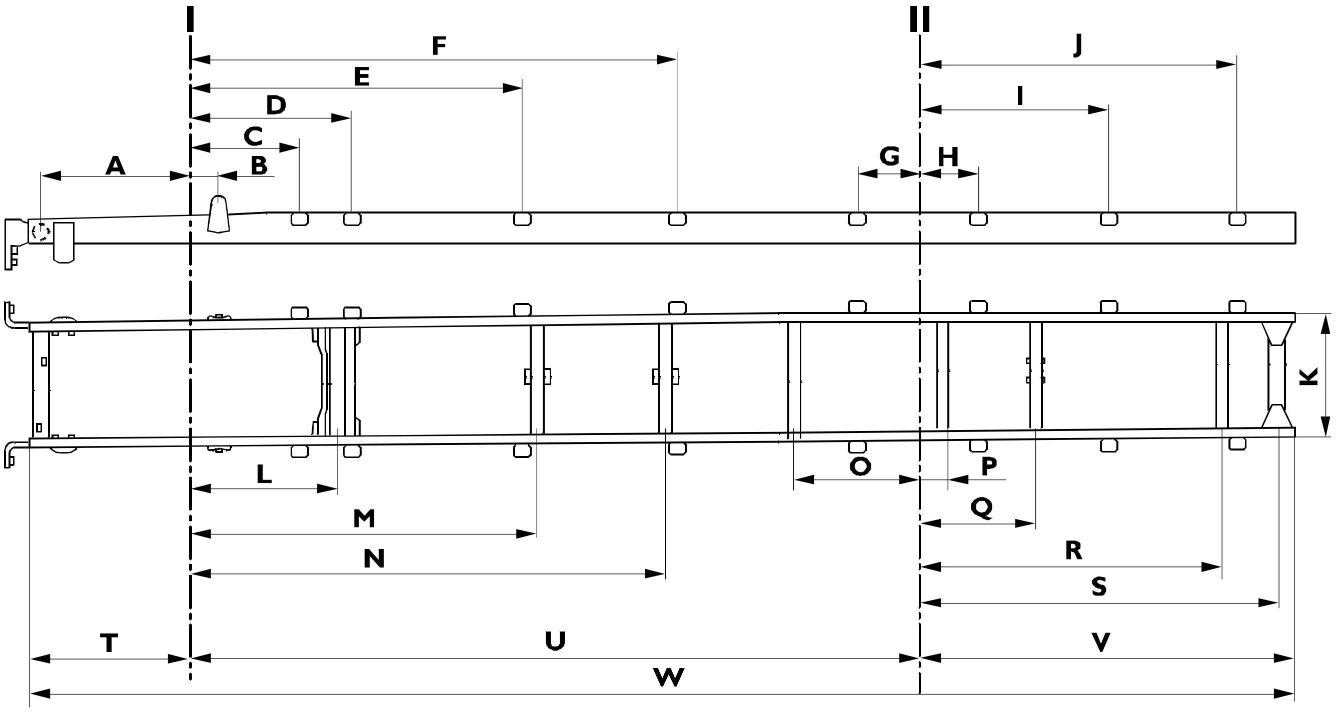
- set the chassis frame on two stands;
- using two clamps, secure one side of the chassis frame to the stand.
- position the other side of the chassis frame, in a central position under the rear cross member, on the knee of an L–shaped iron (1);
- set a rule crosswise and put a spirit level (2) on this, checking the reading.

At each check point you will need to have the same reading or the chassis frame is out of shape.

CHASSIS REFERENCE DIMENSIONS

Models: 60 to 75 (pneumatic suspensions)

Figure 26



78281

I = Front axle axis

II = Rear axle axis

Dimension (mm)	Wheel base (mm)					
	3105	**3330**	**3690**	**4185**	**4455**	**4815**
A	1001.25	1001.25	1001.25	1001.25	1001.25	1001.25
B	180	180	180	180	180	180
C	720	720	720	720	720	720
D	1080	1080	1080	1080	1080	1080
E	1912.5	1912.5	2182.5	2182.5	2182.5	2182.5
F				2992.5	3262.5	3217.5
G	405	405	405	405	405	405
H	405	405	405	405	405	405
I						1260
J	990		1440	1755	1890	2115
K	840	840	840	840	840	840
L	967.5	967.5	967.5	967.5	967.5	967.5
M			2272.5	2272.5	2272.5	2272.5
N						3127.5
O	832.5	832.5	832.5	832.5	832.5	832.5
P	202.5	202.5	202.5	202.5	202.5	202.5
Q	787.5	787.5	787.5	787.5	787.5	787.5
R				1665	1800	2025
S	1192,5	1710	1710	2025	2160	2390
T	1080	1080	1080	1080	1080	1080
U	3105	3330	3690	4185	4455	4815
V	1313	1830	1830	2145	2280	2505
W	5498	6240	6600	7410	7815	8400

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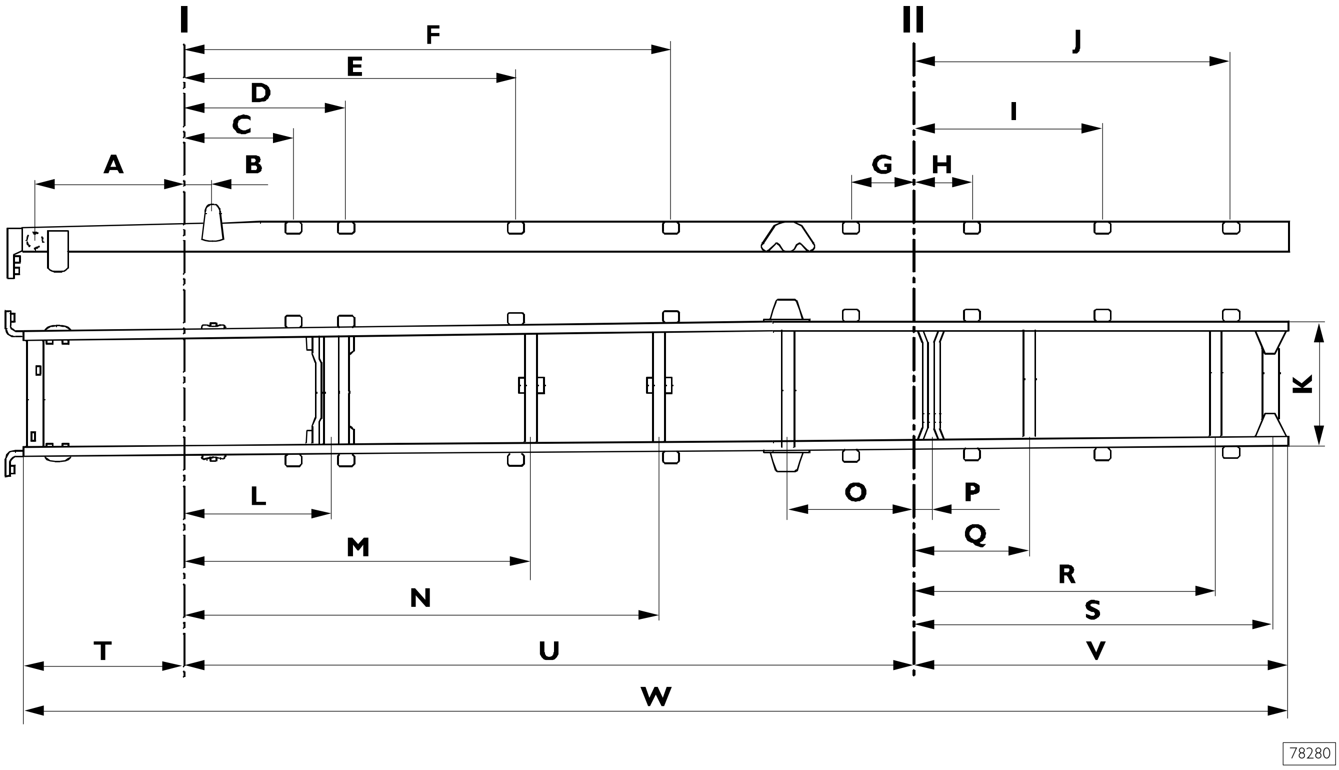
Models: 60 to 75 (mechanic suspensions)

Figure 27



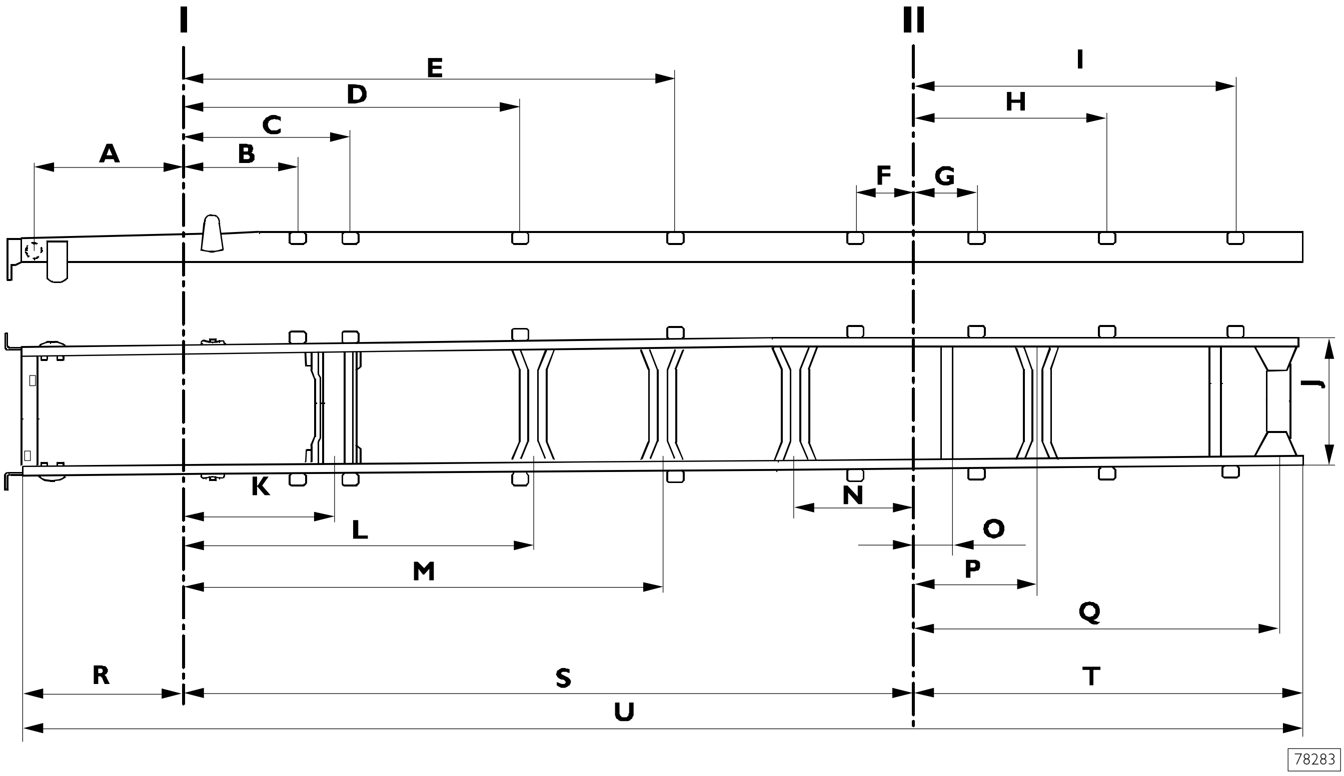
I = Front axle axis

II = Rear axle axis

Dimension (mm)	Wheel base (mm)						
	2700	**3105**	**3330**	**3690**	**4185**	**4455**	**4815**
A	1001.25	1001.25	1001.25	1001.25	1001.25	1001.25	1001.25
B	180	180	180	180	180	180	180
C	720	720	720	720	720	720	720
D	1080	1080	1080	1080	1080	1080	1080
E		1912.5	1912.5	2182.5	2182.5	2182.5	2182.5
F					2992.5	3262.5	3217.5
G	405	405	405	405	405	405	405
H	405	405	405	405	405	405	405
I							1260
J	990	990		1440	1755	1890	2115
K	840	840	840	840	840	840	840
L	967.5	967.5	967.5	967.5	967.5	967.5	967.5
M				2272.5	2272.5	2272.5	2272.5
N							3127,5
O	832.5	832.5	832.5	832.5	832.5	832.5	832.5
P	135	135	135	135	135	135	135
Q	787.5	787.5	787.5	787.5	787.5	787.5	787.5
R					1665	1800	2025
S	1175	1192.5	1710	1710	2025	2160	2390
T	1080	1080	1080	1080	1080	1080	1080
U	2700	3105	3330	3690	4185	4455	4815
V	1290	1313	1830	1830	2145	2280	2505
W	5070	5498	6240	6600	7410	7815	8400

Models: 80 to 100 (pneumatic suspensions)

Figure 28



I = Front axle axis

II = Rear axle axis

Dimension (mm)	Wheel base (mm)					
	3105	3330	3690	4185	4455	4815
A	1001.25	1001.25	1001.25	1001.25	1001.25	1001.25
B	720	720	720	720	720	720
C	1080	1080	1080	1080	1080	1080
D	1912.5	1912.5	2182.5	2182.5	2182.5	2182.5
E				2992.5	3262.5	3217.5
F	405	405	405	405	405	405
G	405	405	405	405	405	405
H						1260
I	990		1440	1755	1890	2115
J	840	840	840	840	840	840
K	967.5	967.5	967.5	967.5	967.5	967.5
L			2272.5	2272.5	2272.5	2272.5
M						3127.5
N	832.5	832.5	832.5	832.5	832.5	832.5
O	202.5	202.5	202.5	202.5	202.5	202.5
P	787.5	787.5	787.5	787.5	787.5	787.5
Q	1147.5		1665	1980	2115	2340
R	1080	1080	1080	1080	1080	1080
S	3105	3330	3690	4185	4455	4815
T	1313	1830	1830	2145	2280	2505
U	5498	6240	6600	7410	7815	8400

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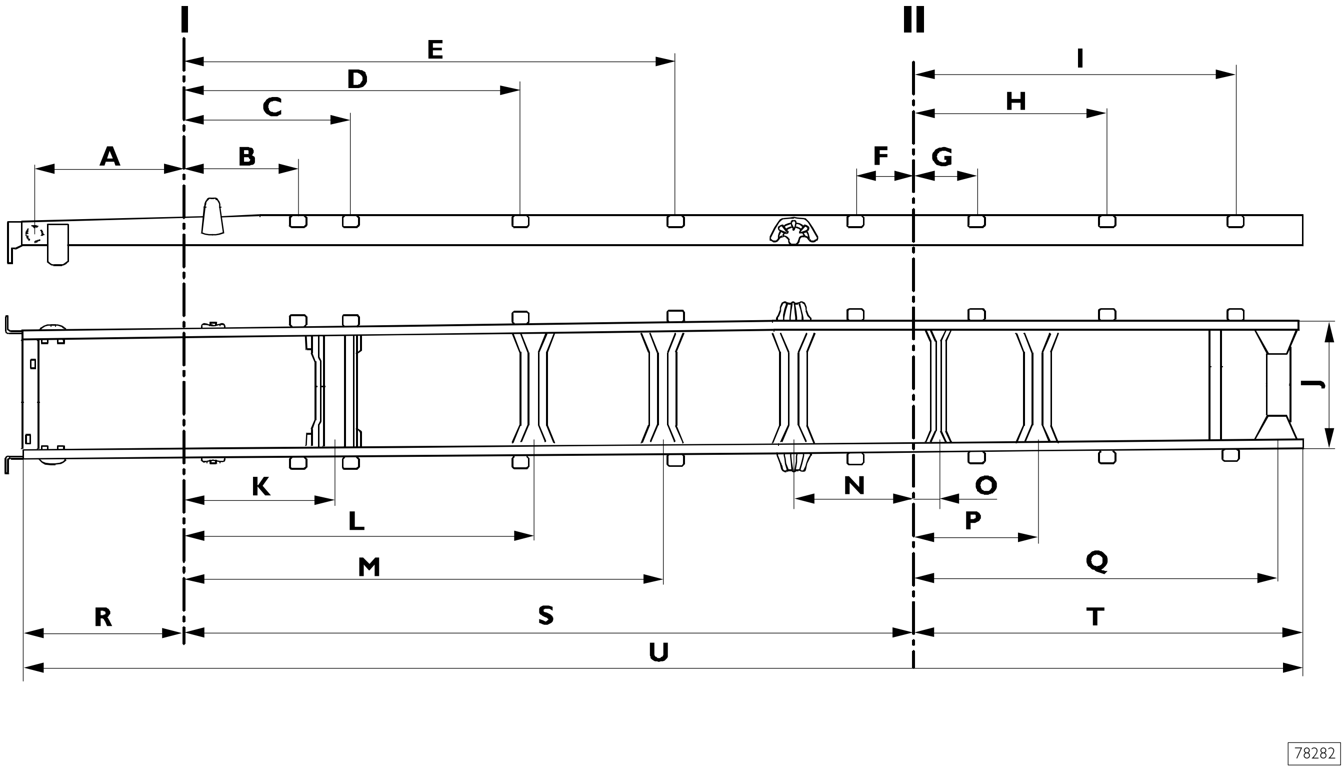
Models: 80 to 100 (mechanic suspensions)

Figure 29



I = Front axle axis

II = Rear axle axis

Dimension (mm)	Wheel base (mm)						
	2700	**3105**	**3330**	**3690**	**4185**	**4455**	**4815**
A	1001.25	1001.25	1001.25	1001.25	1001.25	1001.25	1001.25
B	720	720	720	720	720	720	720
C	1080	1080	1080	1080	1080	1080	1080
D		1912.5	1912.5	2182.5	2182.5	2182.5	2182.5
E					2992.5	3262.5	3217.5
F	405	405	405	405	405	405	405
G	405	405	405	405	405	405	405
H							1260
I	990	990		1440	1755	1890	2115
J	840	840	840	840	840	840	840
K	967.5	967.5	967.5	967.5	967.5	967.5	967.5
L				2272.5	2272.5	2272.5	2272.5
M							3127.5
N	832.5	832.5	832.5	832.5	832.5	832.5	832.5
O	135	135	135	135	135	135	135
P	787.5	787.5	787.5	787.5	787.5	787.5	787.5
Q	1147.5	1147.5		1665	1980	2115	2340
R	1080	1080	1080	1080	1080	1080	1080
S	2700	3105	3330	3690	4185	4455	4815
T	1313	1313	1830	1830	2145	2280	2505
U	5093	5498	6240	6600	7410	7815	8400

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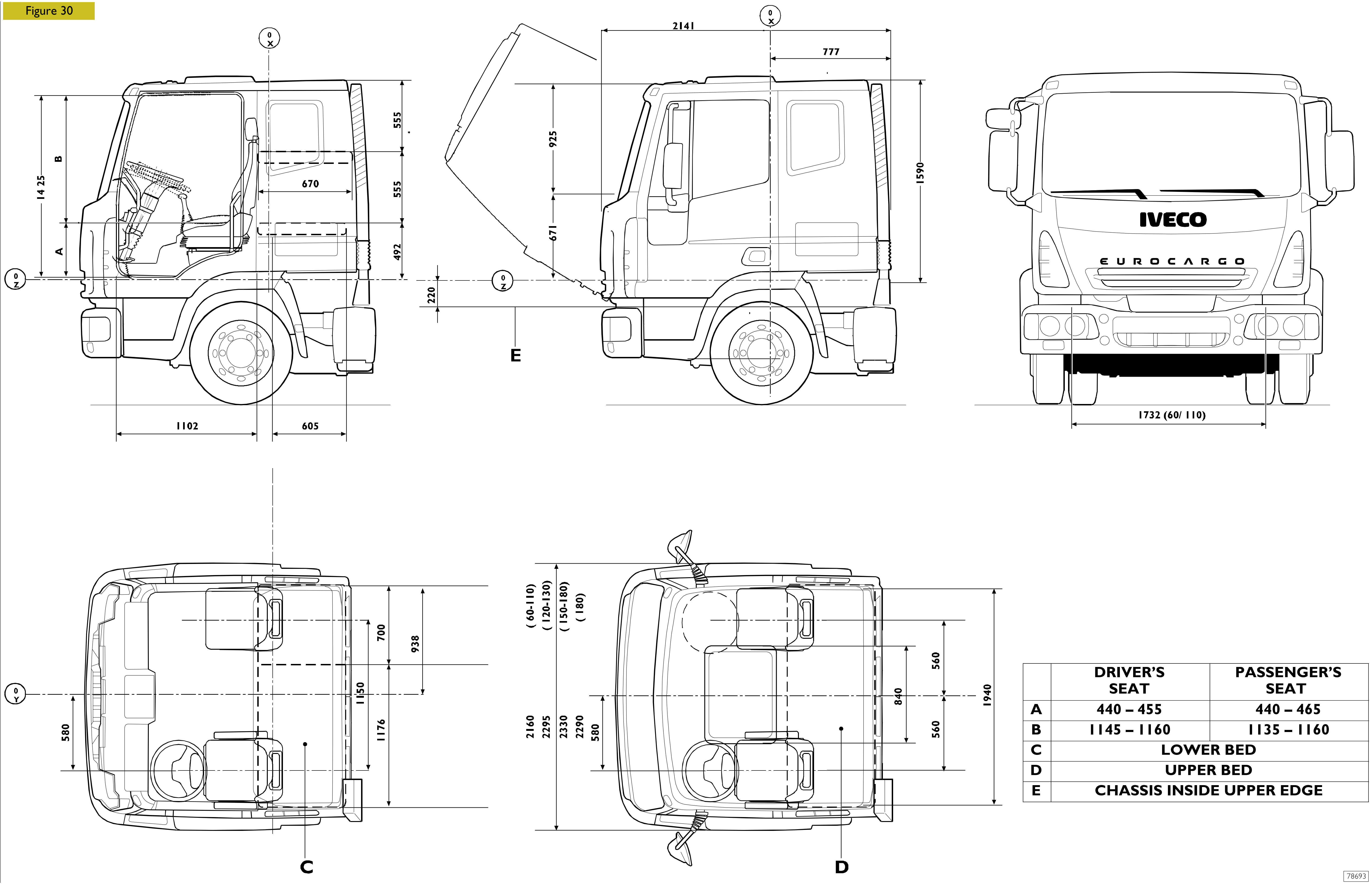
CAB GEOMETRY

Figure 30



	DRIVER'S SEAT	PASSENGER'S SEAT
A	440 – 455	440 – 465
B	1145 – 1160	1135 – 1160
C	LOWER BED	
D	UPPER BED	
E	CHASSIS INSIDE UPPER EDGE	

SEAL APPLICATION DIAGRAM

Figure 31

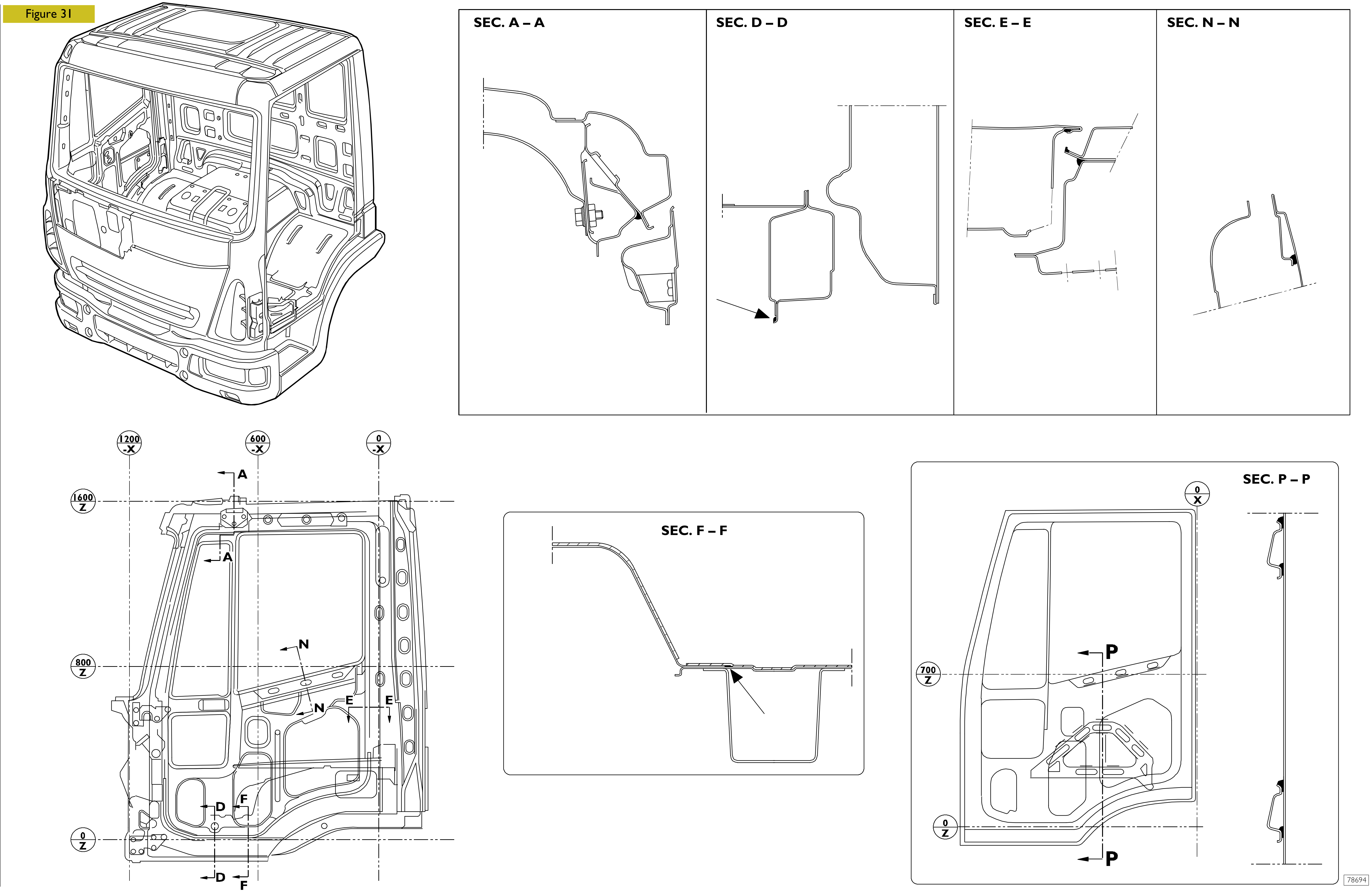


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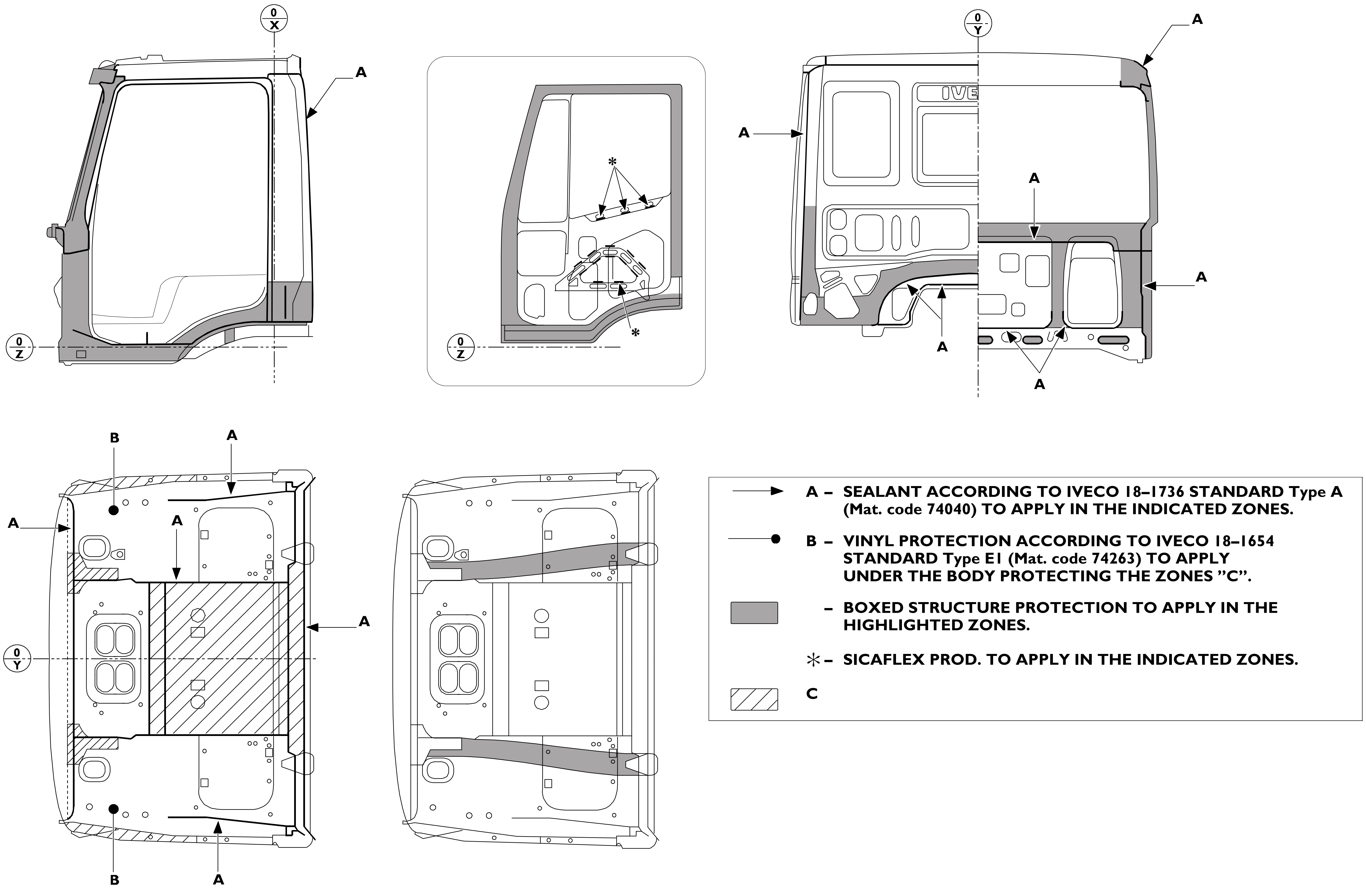
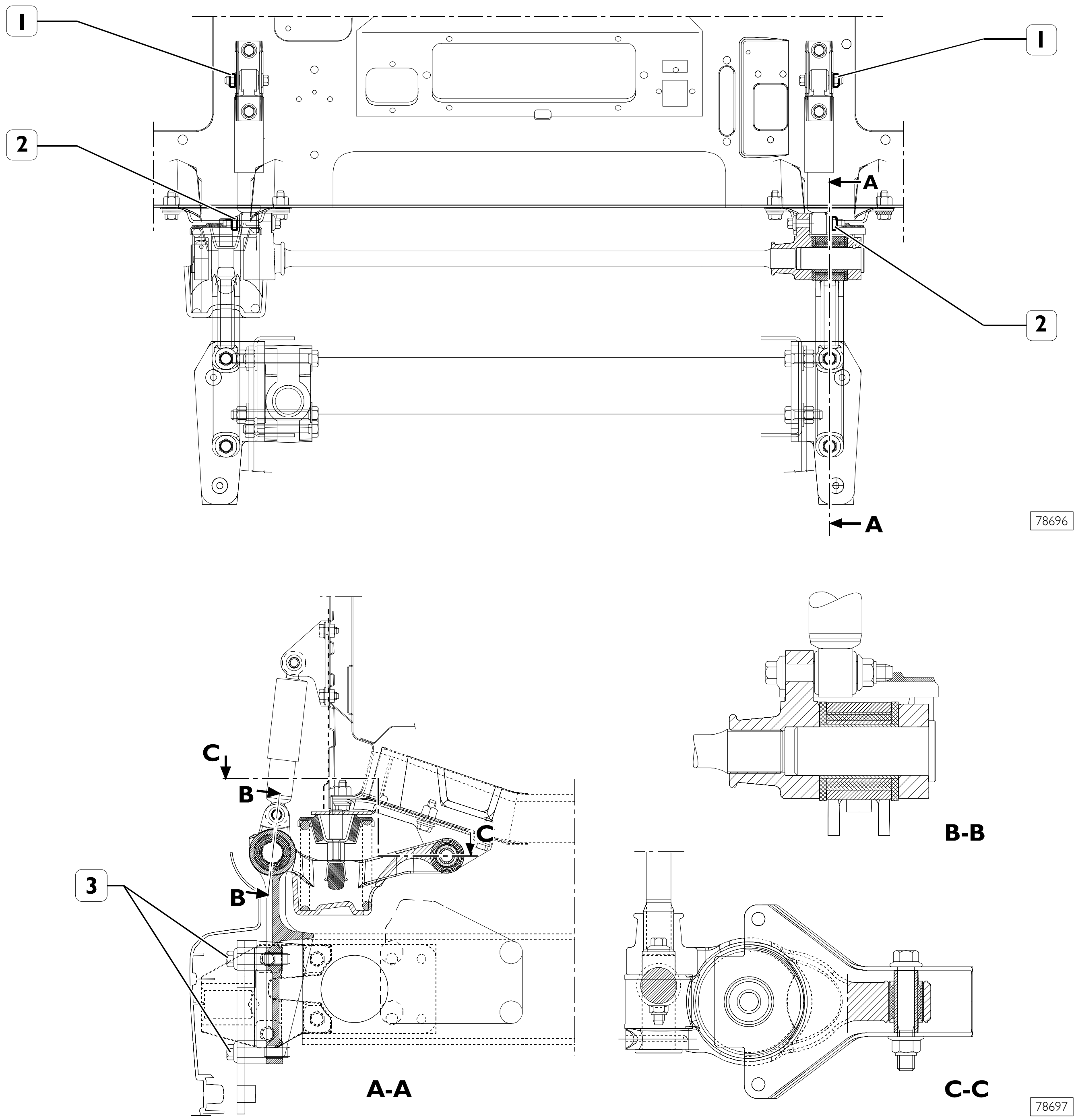
Figure 32


A – SEALANT ACCORDING TO IVECO 18–1736 STANDARD Type A (Mat. code 74040) TO APPLY IN THE INDICATED ZONES.
B – VINYL PROTECTION ACCORDING TO IVECO 18–1654 STANDARD Type E1 (Mat. code 74263) TO APPLY UNDER THE BODY PROTECTING THE ZONES "C".
– BOXED STRUCTURE PROTECTION TO APPLY IN THE HIGHLIGHTED ZONES.
* – SICAFLEX PROD. TO APPLY IN THE INDICATED ZONES.
C
A
B
0 X
0 Y
0 Z
IVE
78695

5542 CAB ANCHORING AND TIGHTENING TORQUES

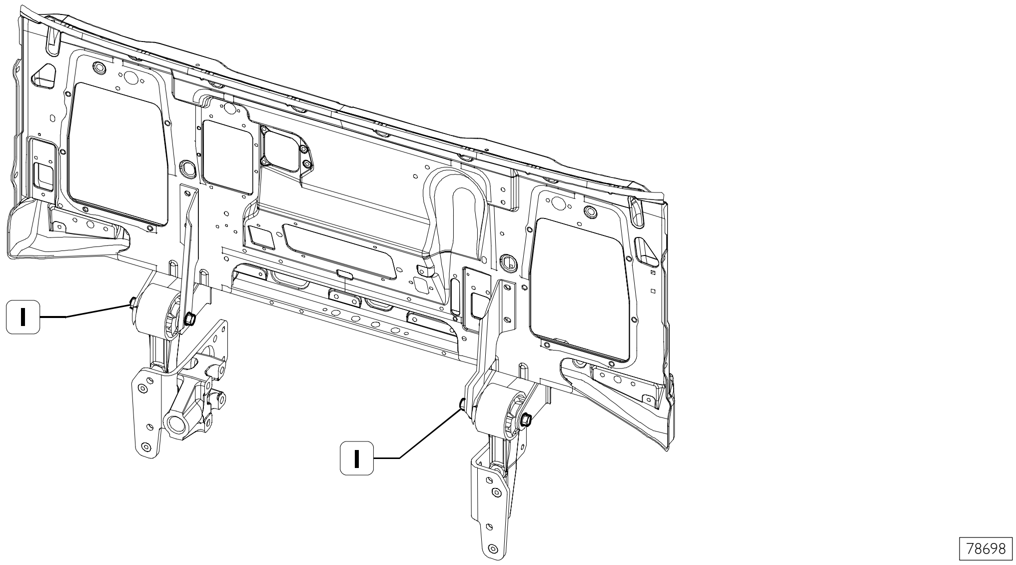
Figure 33

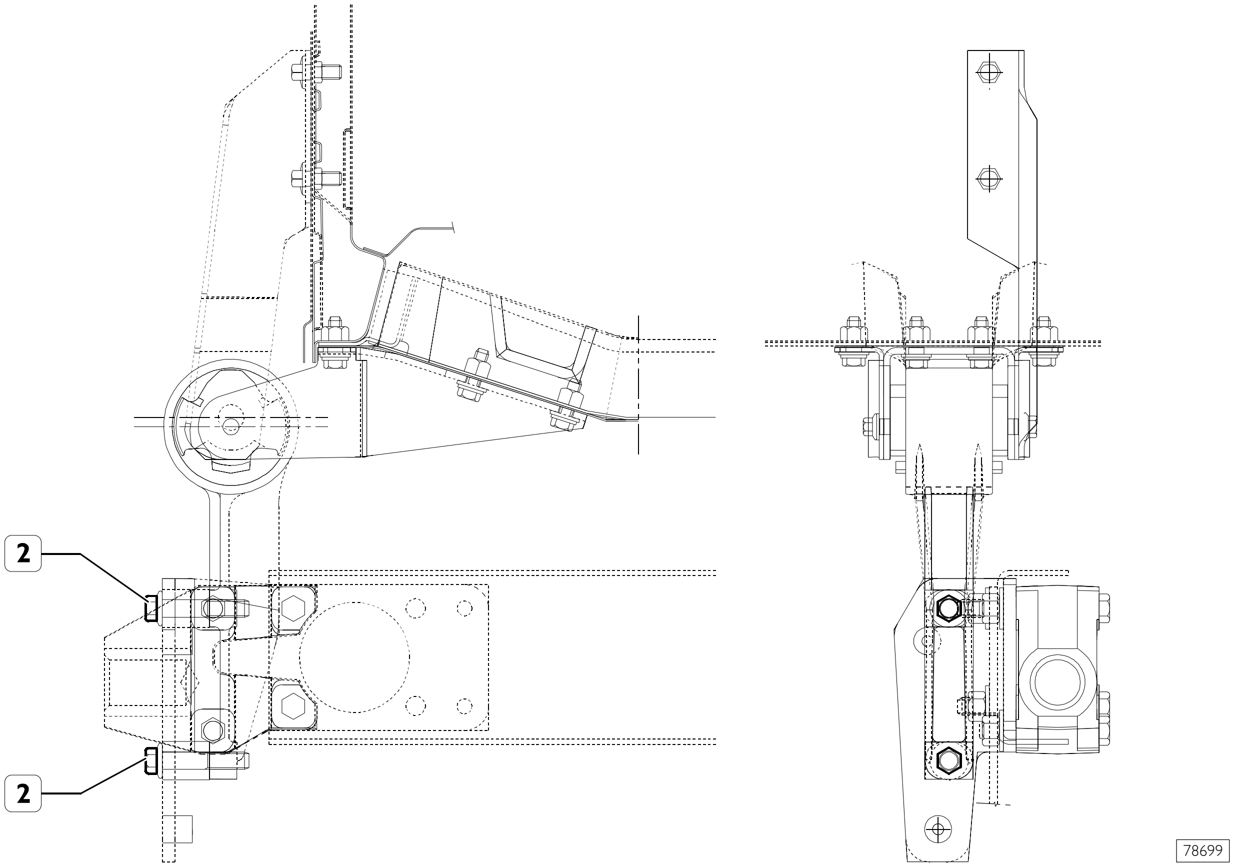


CAB FRONT SUSPENSION (8–10 t)

PART		TORQUE Nm	(Kgm)
1	Hexagonal nut with flange for shock absorber upper fastening	122.5 ± 12.5	(12.2 ± 1.2)
2	Hexagonal nut for shock absorber lower fastening	122.5 ± 12.5	(12.2 ± 1.2)
3	Hexagonal screw with flange to secure bracket to cab on chassis side	296 ± 29	(29.6 ± 2.9)

Figure 34

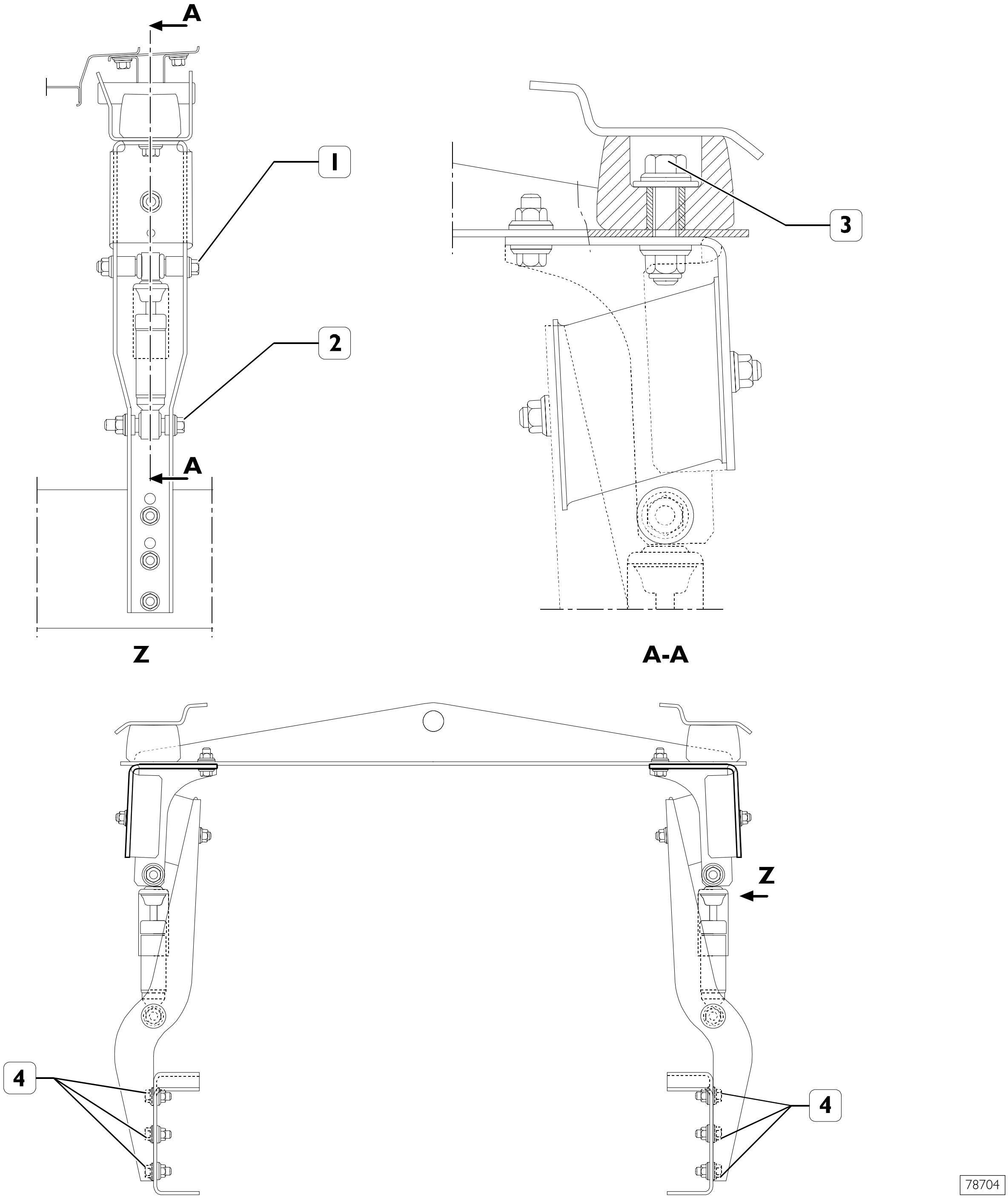




(SHORT AND LONG) CAB FRONT SUSPENSION

PART		TORQUE	
		Nm	(Kgm)
1	Hexagonal screw with flange for block fastening	187 ± 37	(18.7 ± 3.7)
2	Hexagonal screw with flange to secure bracket to block	296 ± 29	(29.6 ± 2.9)

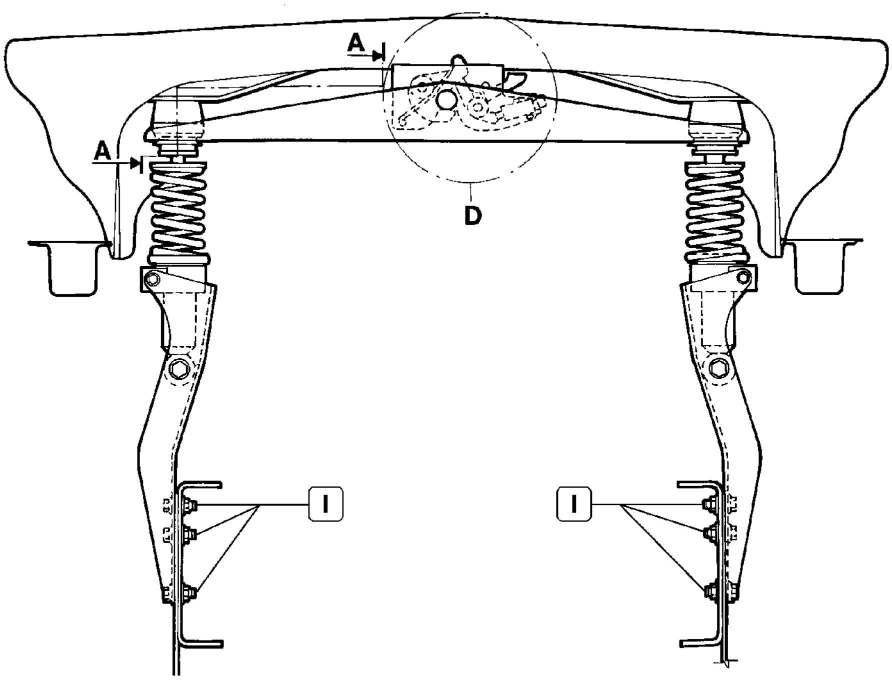
Figure 35



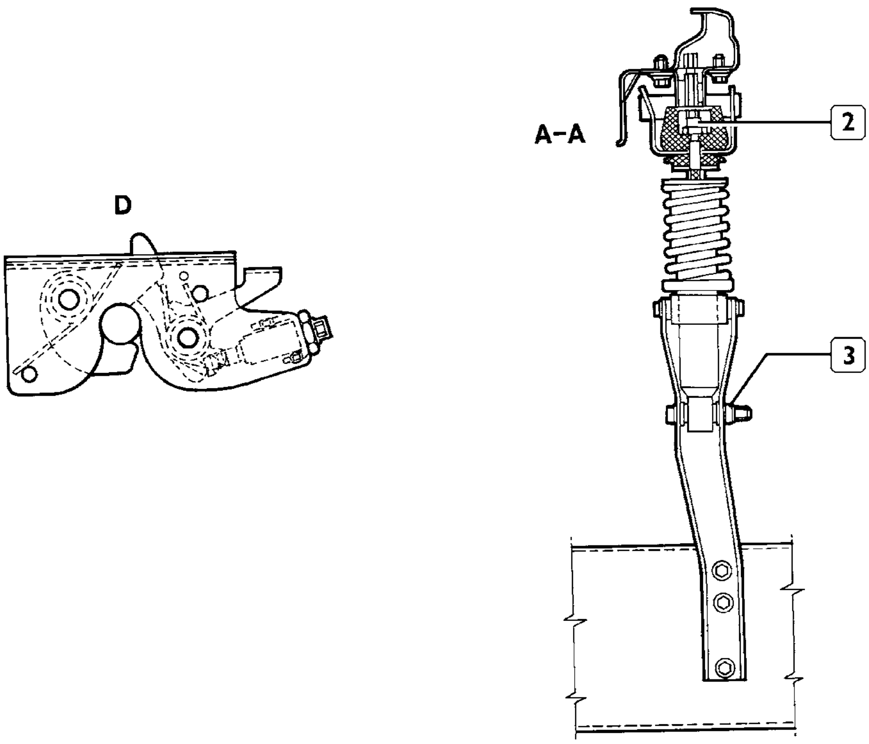
(6–8 t) CAB FRONT SUSPENSION

PART		TORQUE	
		Nm	(Kgm)
1	Bumper securing screw	120 ± 24	(12 ± 2.4)
2	Upper shock absorber securing screw	120 ± 24	(12 ± 2.4)
3	Lower shock absorber securing screw	120 ± 24	(12 ± 2.4)
4	Screw to secure bracket to chassis	75 ± 15	(7.5 ± 1.5)

Figure 36



78700



78701

(8–10 t) SHORT CAB REAR SUSPENSION

PART		TORQUE	
		Nm	(Kgm)
1	Self–locking hexagonal nut with flange and hexagonal screw with flange to secure bracket to chassis	179 ± 18	(17.9 ± 1.8)
2	Self–locking hexagonal nut to secure shock absorber and elastic bumper to cross member on upper side	216.5 ± 21.5	(21.6 ± 2.1)
3	Self–locking nut and hexagonal screw for shock absorber fastening on lower side	189 ± 19	(18.9 ± 1.9)

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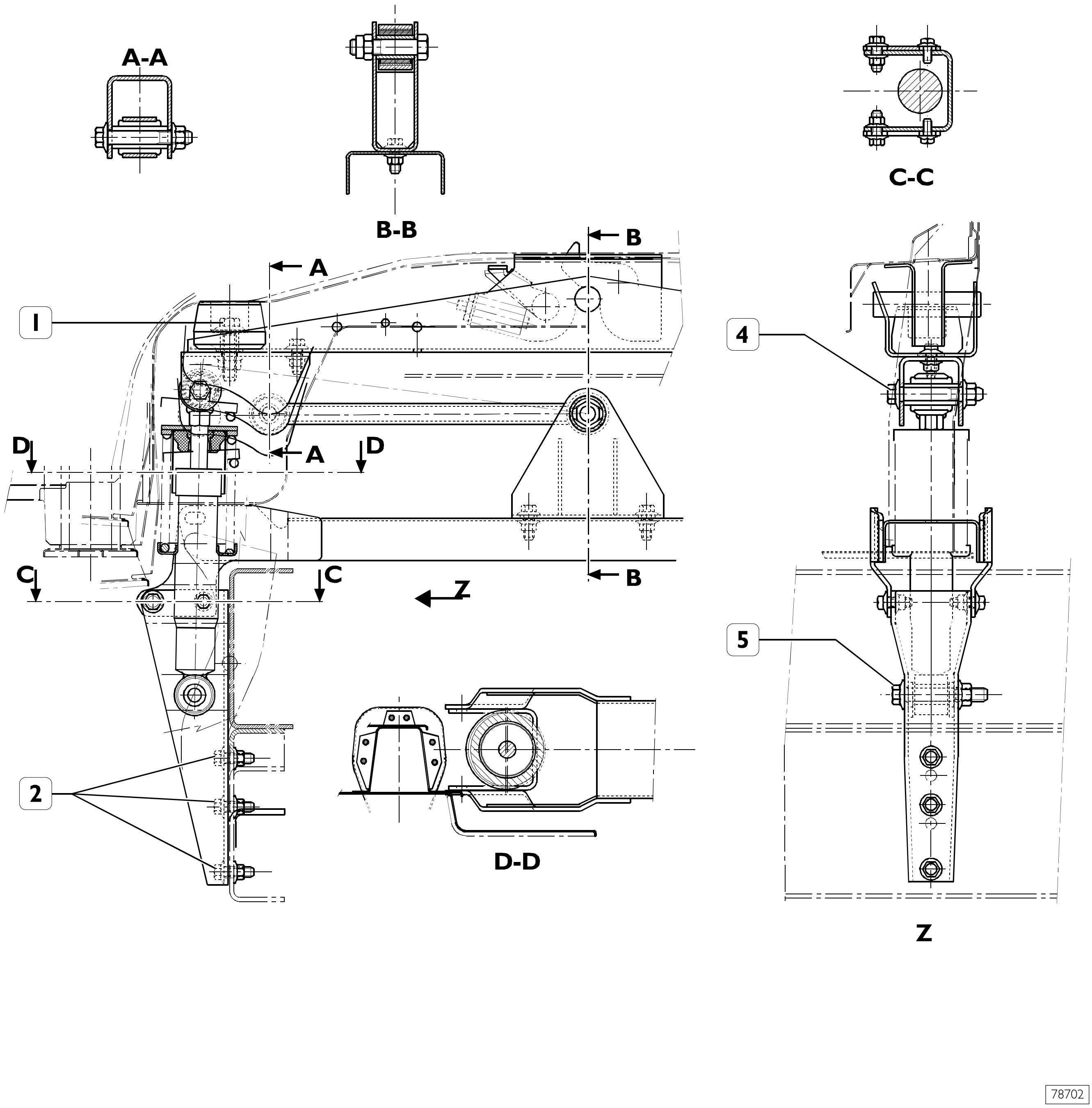
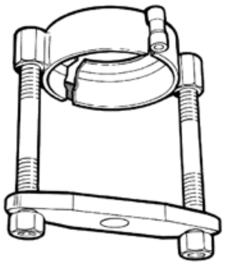
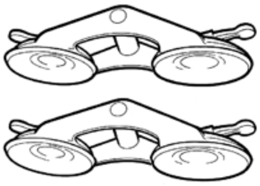
Figure 37



(8–10 t) DOUBLE AND LONG CAB REAR SUSPENSION

PART		TORQUE	
		Nm	(Kgm)
1	Bumper securing screw	128 ± 52	(12,8 ± 5,2)
2	Screw to secure bracket to chassis	105 ± 21	(10,5 ± 2,1)
3	Screw to secure cross member connecting pipe	263 ± 53	(26,3 ± 5,3)
4	Screw to secure shock absorber	128 ± 52	(12,8 ± 5,2)

TOOLS

TOOL No.		DENOMINATION
99370147		Cab mechanic suspension spring check tool
99378031		Two–vacuum cup grip pair to lift windows

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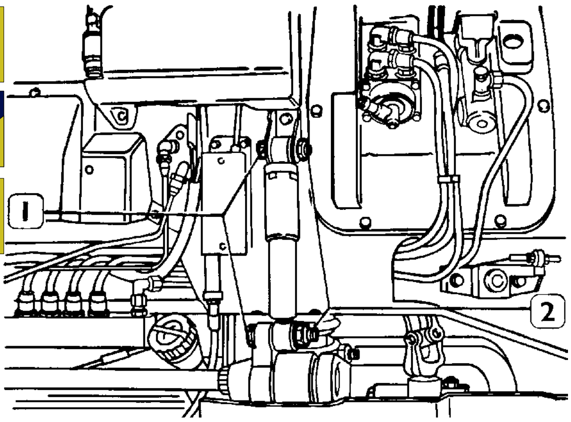
REPAIRS

5542 Cab anchoring

Repairs are limited to replacing broken parts.

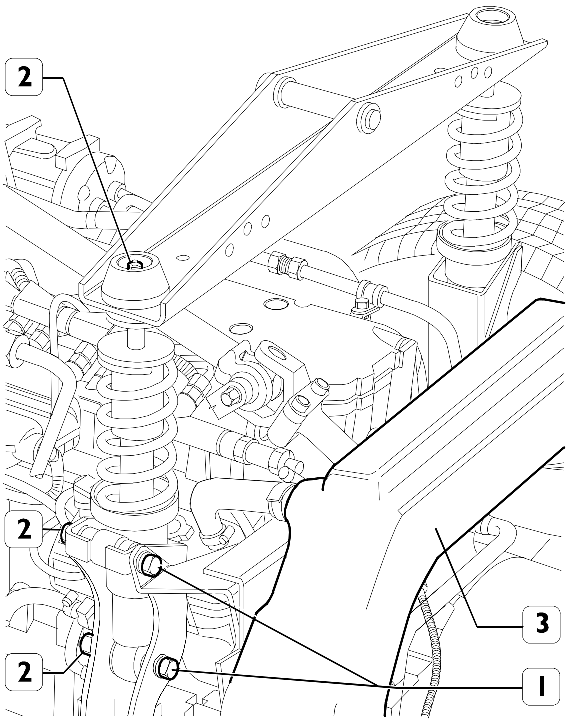
554243 Replacing cab suspension front and rear shock absorbers

Figure 38



41851

Figure 39



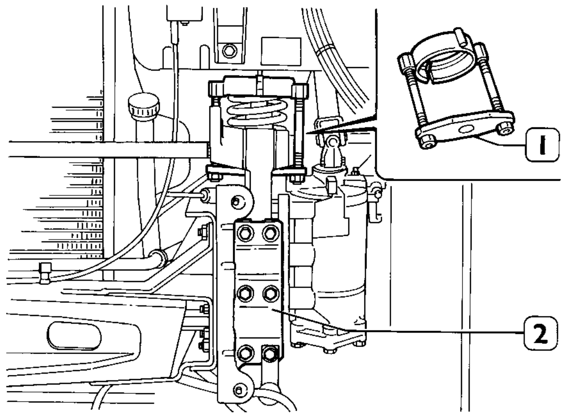
78706

In order to disassemble front shock absorbers (Figure 38), just unscrew nuts (2) end take out screws (1). In order to disassemble rear shock absorbers, it is needed to unscrew fastenings and dodge aspiration duct (3), as well as take out screws (1).

To fit them, carry out the above steps in the appropriate reverse order.

554215 Removing–refitting front mounts and cab stabilizer bar

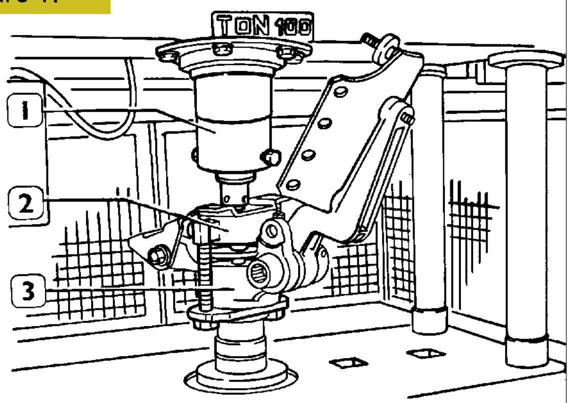
Figure 40



38600

Remove the bumper bar assembly.
Disconnect the shock absorber.
Support the cab with the specific prop.
Arrange the appropriate tool 99370147 (1) to compress the mount spring.
Unscrew the mount fixing screws.
Unscrew the screws fixing the top mount to the cab and the ones fixing the bracket (2) to the chassis frame. Then extract the mount together with the stabilizer bar.

Figure 41



33911

The tool (2) compressing the spring of the mount (3) is removed and refitted with a press (1).

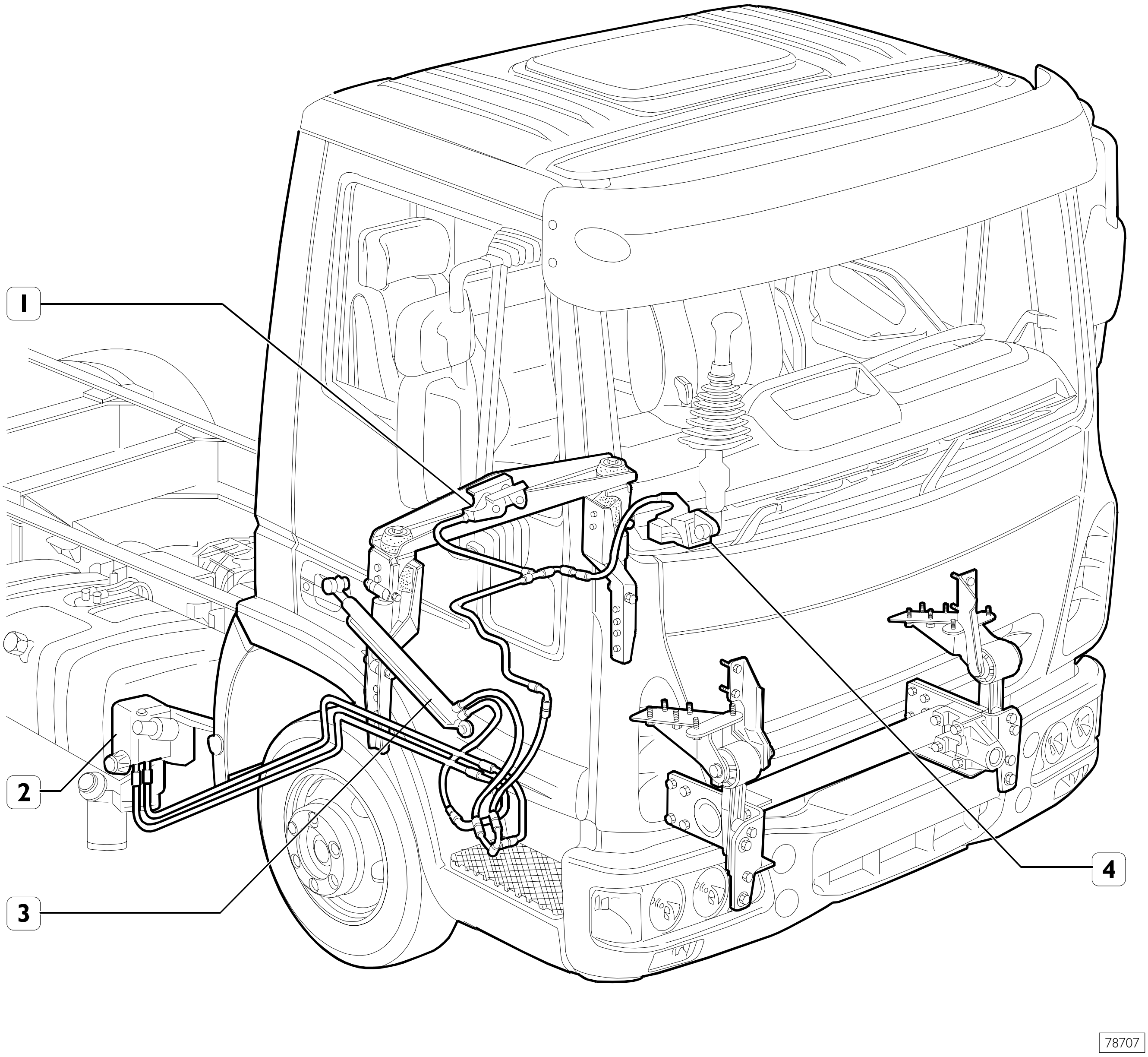
Replace all worn or broken parts.

For refitting, carry out the steps performed for removal in reverse order.

NOTE When mounting the stabilizer bar, grease the grooves of the bar with TUTELA Z2 grease to prevent noise and wear.

HYDRAULIC CAB LIFTING SYSTEM

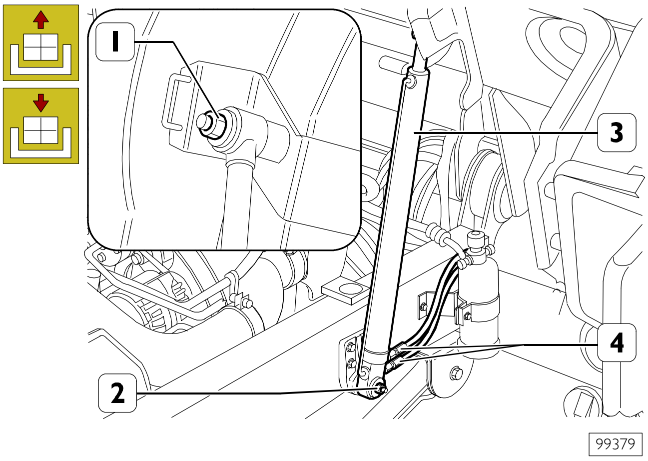
Figure 42



1. Lock – 2. Cab lifting pump – 3. Cab lifting cylinder – 4. Supporting box.

554255 Replacing hydraulic cylinder for cab tilting

Figure 43



Unscrew the oil fittings (4); unscrew the nuts (1 and 2) for the connecting pins and extract the cylinder (3).

NOTE This operation has to be carried out with the cab lowered.

REPLACING WINDSCREEN WINDOW

General

New EuroCargo Tector windscreen windows observe the industrial standard which concerns fixed (glued) window fastening.

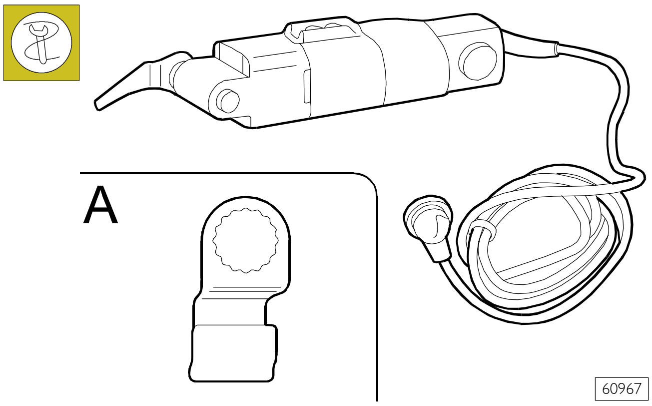
This is a great advantage, both in quality, because it assures perfect impermeableness and resistance to water, and in safety, because it makes structure more integral and lighter.

To detach the windscreen window, it can be operated with either a vibration cutter provided with a suitable cutting blade or harmonic wire.

NOTE Do not use lubricants while cutting.
Blades must be always sharp.

Vibration knife

Figure 44



A vibration cutter is made up of special shears and a suitable set of vibrating blades with a number of oscillations electrically adjustable.

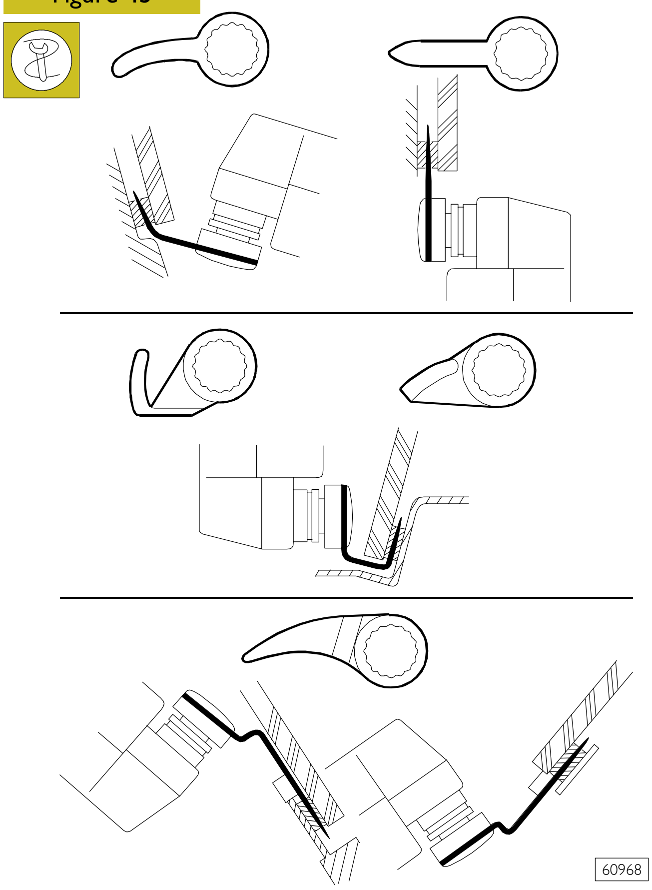
It can be used to cut polyurethane sealants.

It is important that, while cutting, the blade goes on parallel both to the window and body, in order to prevent the blade from breaking.

In order to prevent the shears from overheating, it is useful to adjust both advance and number of oscillations depending on use conditions.

In detail (A) it is shown the scraper to be applied to vibration shears to level sealant residue.

Figure 45

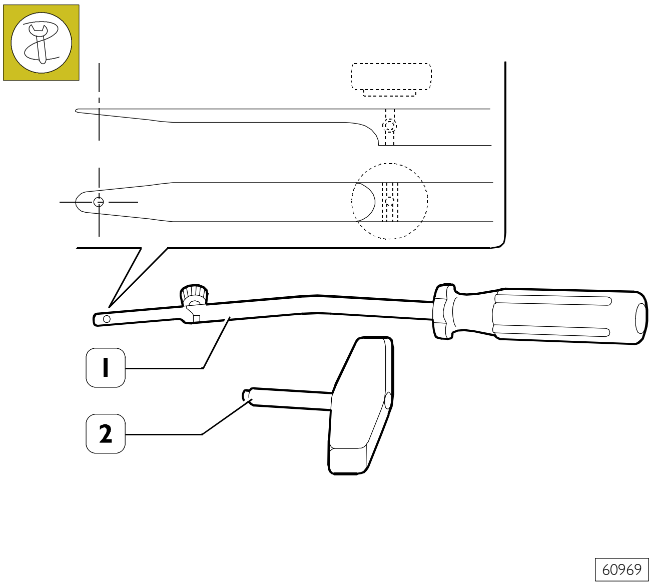


Examples of some situations occurring on cutting glued windows by matching blade type needed.

Harmonic wire

For cutting the sealant bead with the harmonic wire, it is necessary to use a tool as illustrated in Figure 47.

Figure 46



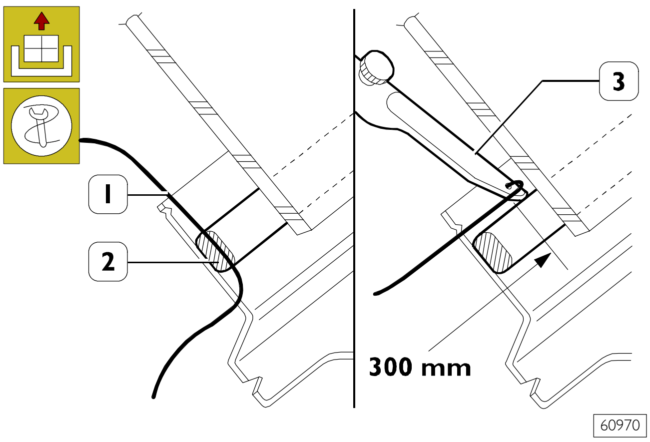
1. Check tool – 2. Draw handle

Removal (with harmonic wire)

Before performing windscreen detaching operation, it is needed to remove, from the vehicle, those components which would hinder operations or could suffer damage while executing these operations.

NOTE Before starting the cutting procedure, it is needed to protect, though an adhesive tape, the painted area, in order to avoid possible damages.

Figure 47

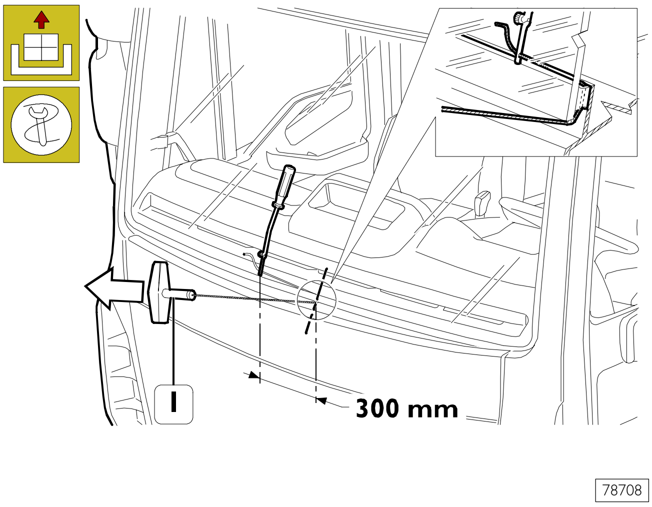


Cut a wire section about 500 mm long and, using a check tool (3), put in a wire end (1) through sealant bead (2), starting from windscreen window lower centre (see Figure 48).

Fix the wire end to check tool (3), operating inside the vehicle, and the other end to the draw handle outside the vehicle.

The inside operator has to point the check tool at sealant bead (2), about 300 mm from where wire (1) runs through.

Figure 48

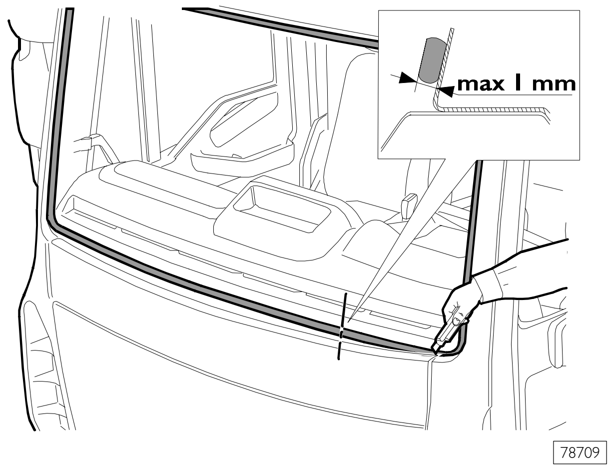


The other operator, who is outside the vehicle, has to pull the draw handle (1) while following the windscreen profile, and cut the sealant bead.

Repeat the operation for 300 mm sections throughout the profile, properly decreasing their length along the corners of the window, until a sealant bead complete cut is achieved, then remove the window using the vacuum cups.

Preparing the windscreen opening

Figure 49



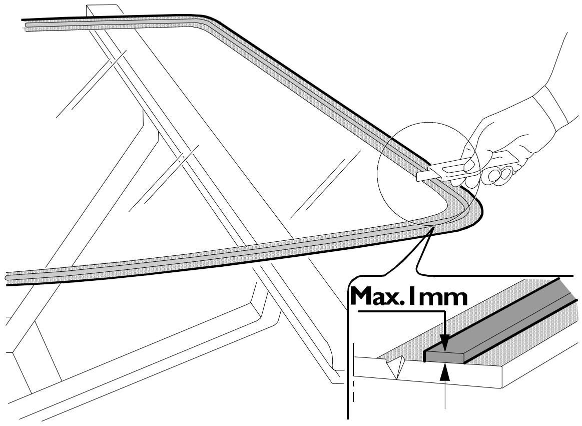
By using a suitable blade, cut and level the windscreen opening sealant so as to leave 0.25 to 1 mm thickness in order not to scratch paint.

Remove sealant residue through compressed air, then degrease thoroughly with heptane and expendable paper.

NOTE The sealant film left on the windscreen opening will serve as a support for next gluing.

Preparing the windscreen

Figure 50

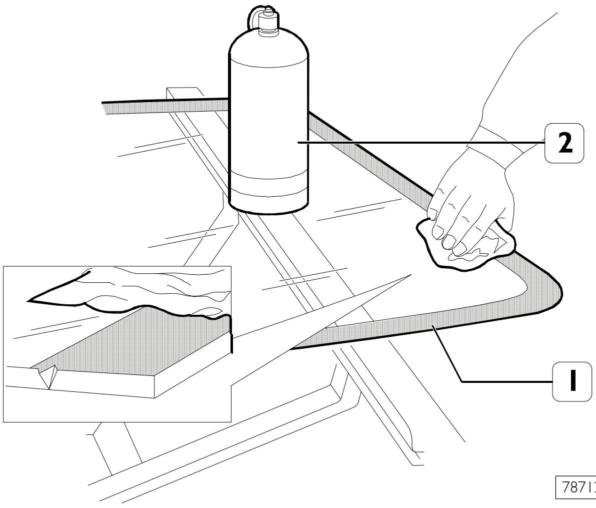


78710

In case of recovery of the original window detached:

❑ by using a suitable blade, cut and level the sealant bead trying to reduce thickness as much as possible. It is not necessary to take off the sealant thoroughly. Avoid to touch the surface of residual sealant. Pay attention not to damage the black silk screen on window perimeter.

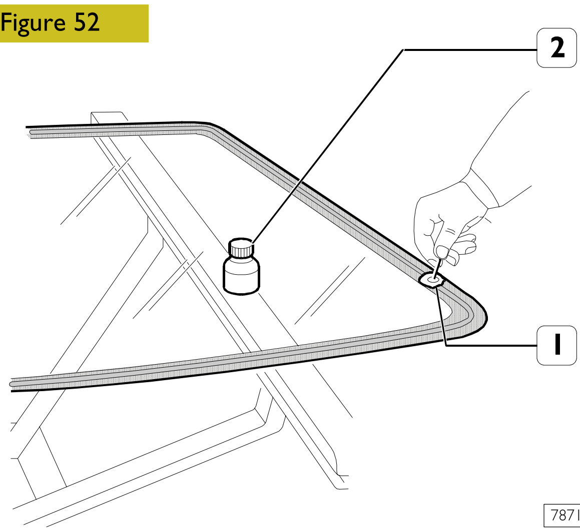
Figure 51



78712

Degrease windscreen silk screen portion (1) with heptane (2) and expendable paper.

Figure 52



78713

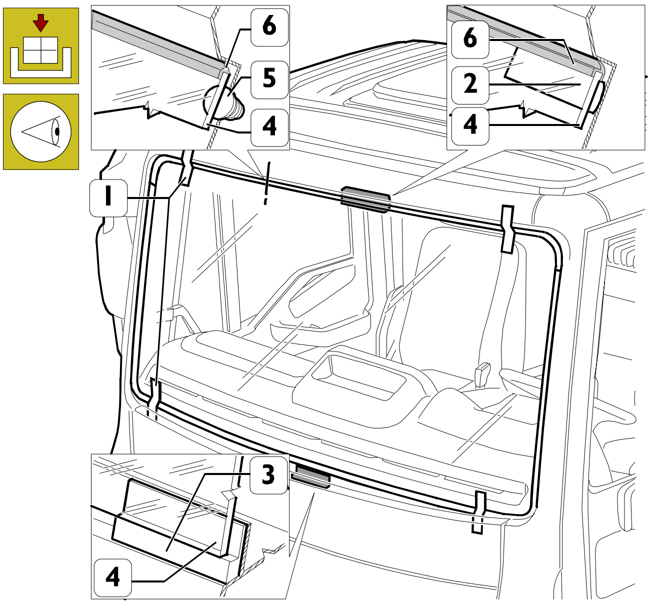
❑ Apply glass adhesion promoter (2) on silk screen portion by applicator (1).

NOTE In case of recovery of the windscreen window, it is not needed to apply the adhesion promoter on sealant left.

Wait 15 minutes before going on with operations, so as to let the adhesion promoter solvent evaporate.

Refitting

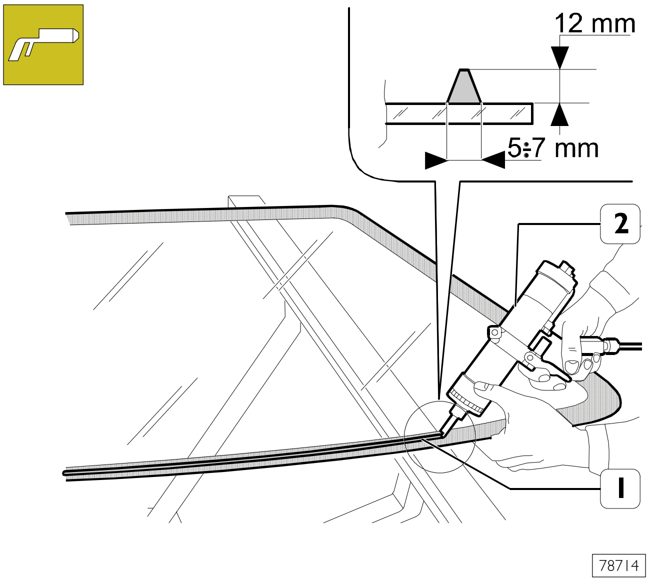
Figure 53



78711

Put in windscreen window (4) upper seal (6). Position plugs against horizontal sinking (5) on the windscreen window opening. Position pads against vertical (3) and horizontal (2) sinking. Make a test assembling and perfectly center the windscreen window. Once windscreen window centering has been completed, mark windscreen and seat mutual position with adhesive tape strips (1). Cut the adhesive tape strips and remove the windscreen.

Figure 54

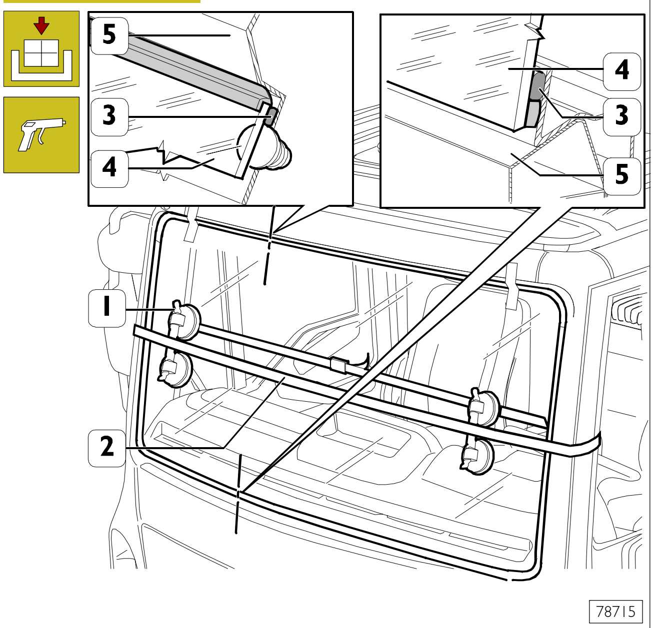


Extrude a Betamate 7185 Quik–Fix Silicon adhesive bead (1) with air gun (2) along the windscreen perimeter as regularly as possible.

Start operation from the middle of the lower side and go on without interrupting throughout the windscreen perimeter.

Cut the adhesive cartridge spout in such a way that extrusion shape is a triangle with 5 x 7 mm base and 12 mm height.

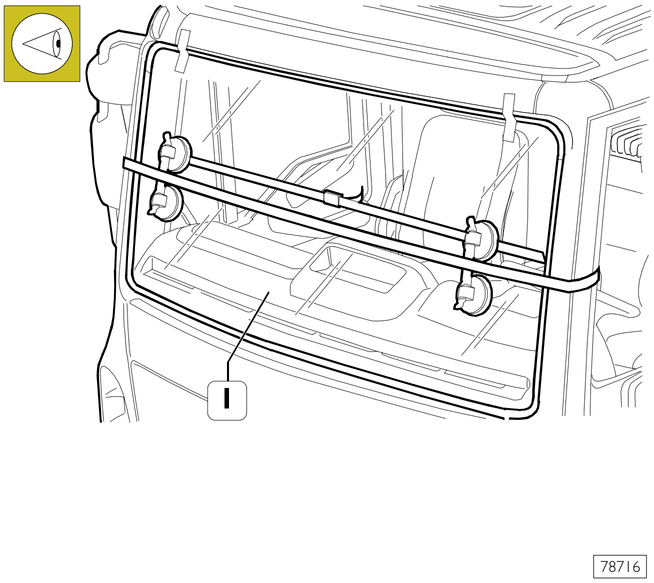
Figure 55



By dedicated vacuum cups (1), place the windscreen in its seat immediately after applying sealant, then settle its position.

Position a belt (2) by using vacuum cups (1) as shims, then tension it in such a way that an even pressure is applied throughout the windscreen to the purpose of assuring correct matching among window (4), adhesive (3) and windscreen opening (5).

Figure 56



NOTE Hold window (1) under pressure for at least 10 minutes.

Before re–attaching previously detached portions, check for lack of infiltration points.

Apply suds with a sponge along the outer perimeter and blow compressed air from inside in order to highlight possible infiltration.

When bubbles are in, degrease affected portion and fill it with the adhesive.

Possible sealant overflowed portions inside can be removed, once the sealant has hardened, by cutting them with a blade and detaching them with a pair of pliers.

NOTE Pay attention not to damage silk screen on the window with the blade.

Re–attach detached portions and clean the window.

Do not move or deliver the vehicle before 10 minutes have elapsed at 23 °C and 50% RU (Relative Humidity) climatic conditions.
When either temperature or humidity are lower, the dwell time has to be increased.

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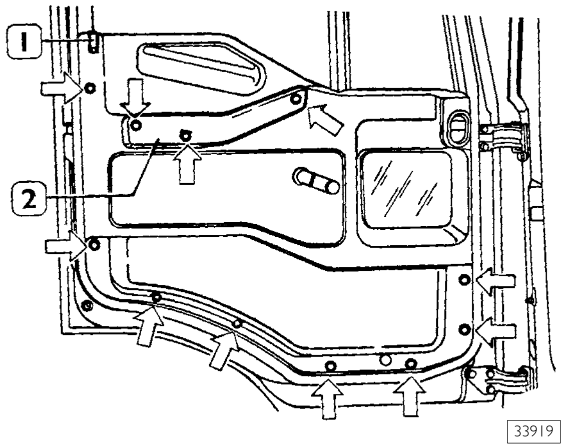
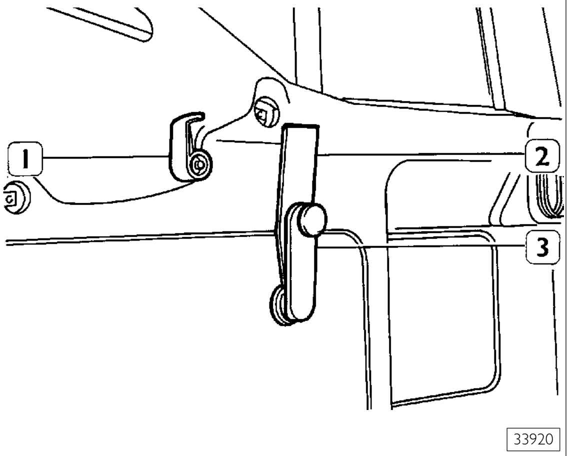
550740 Replacing the winding window

Figure 57



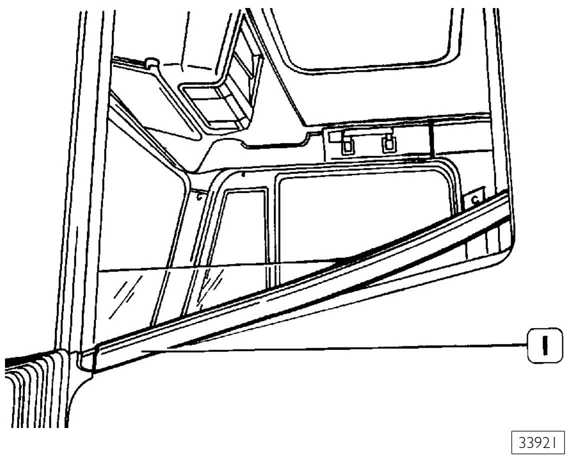
Take off the screw caps (arrows), unscrew the screws and extract the armrest (2). Remove the push–button (1).

Figure 58



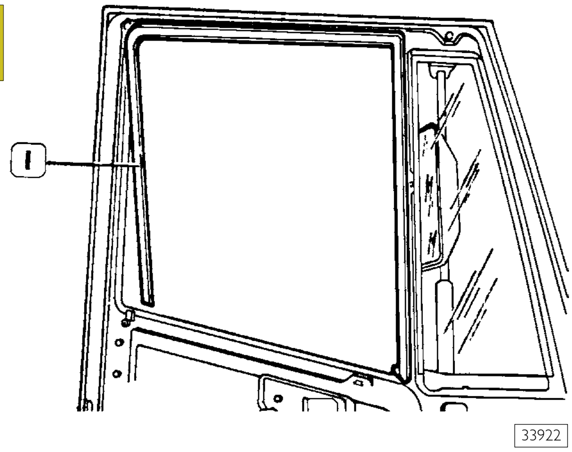
Using proper tool (2), take off the safety ring and dismount handle (3). Using the pliers, dismount handles (1). Remove the whole panel.

Figure 59



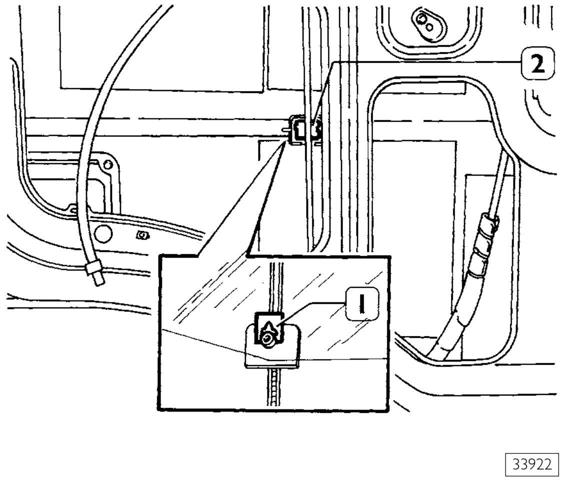
Lower the window, extract the internal and external seals (1).

Figure 60



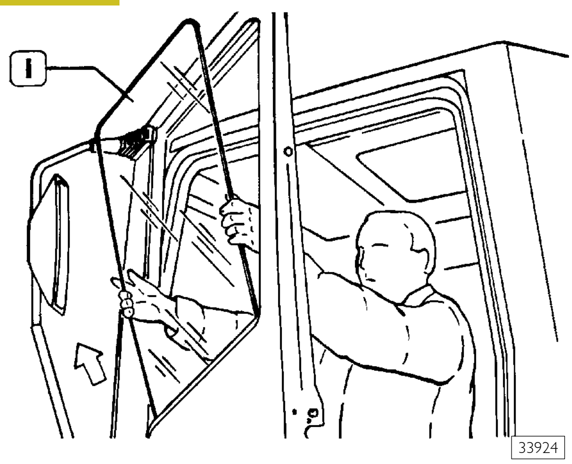
Extract the window guide seal (1).

Figure 61



Unhook the safety clip (1) from the lifting device (2).

Figure 62



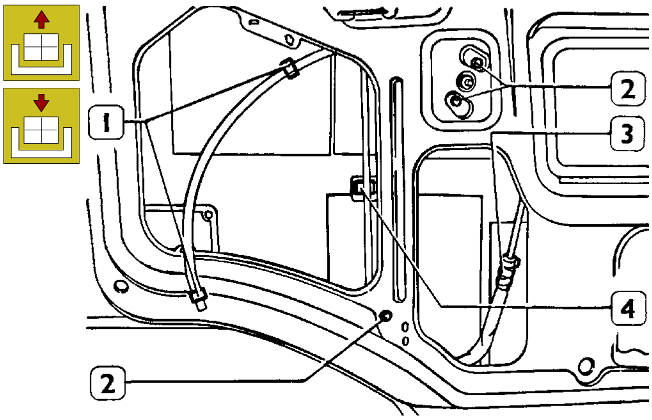
Lift the window (1) and extract it from the top (arrow).

For refitting, simply carry out the steps described for removal in reverse order.

550730 Replacing the window winder

Take the inside trim off the door as described above.

Figure 63

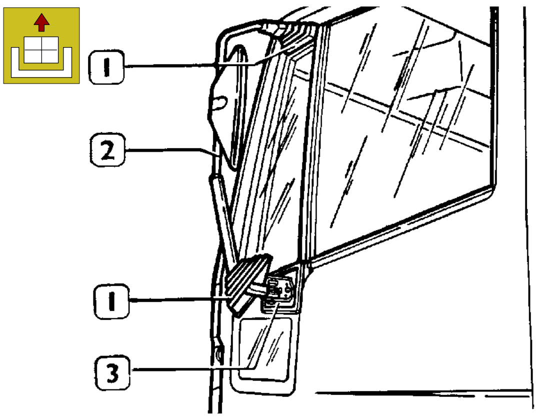


33925

Unhook the clips (1), unscrew the screws (2), unhook the window from its lifting device (4) and extract the window winder (3).
To fit it, carry out the steps described for removal in reverse order.

550478 Replacing the fixed window

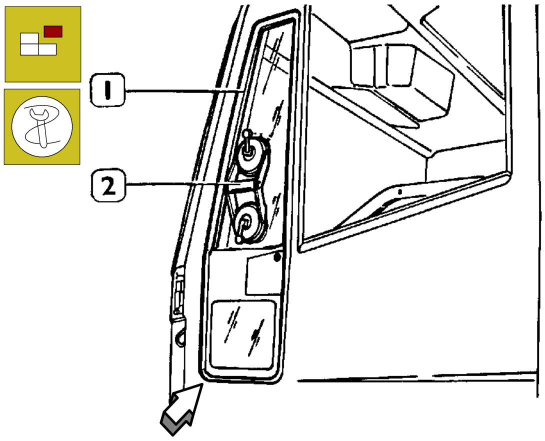
Figure 64



33926

Lift the shields (1), unscrew the screws and remove the rearview mirror (2). Take off the shield (3).
Remove the inside door trim.

Figure 65



33927

Extract the outside seal (1), apply the suction cup 99378031 (2).

NOTE Before starting to cut, you need to protect the paintwork with adhesive tape to prevent any damage.

Insert a suitable tool through the sealant by a corner (arrow) of the window.
Make the cut all along the perimeter. Remove the window with a suction cup handle (2).
Using a specific tool, level the bead of sealant remaining in the seat of the window in the door: clean with compressed air then fully degrease with heptane and disposable paper.

NOTE If refitting the window, it is necessary to remove the old sealant without damaging the screen– printed area of the window.

Position the window in its seat correctly, register its position and mark it with adhesive tape. Cut the tape and take out the window.

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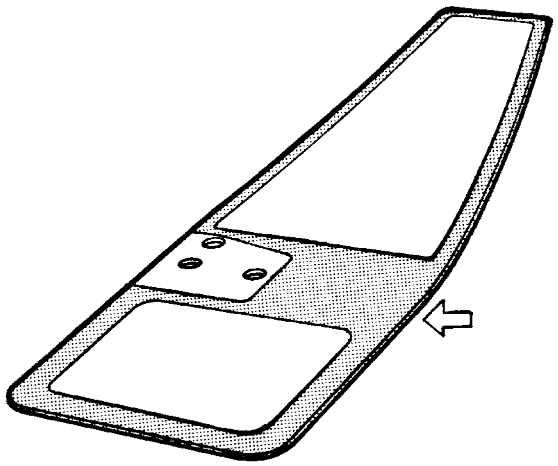
Figure 66



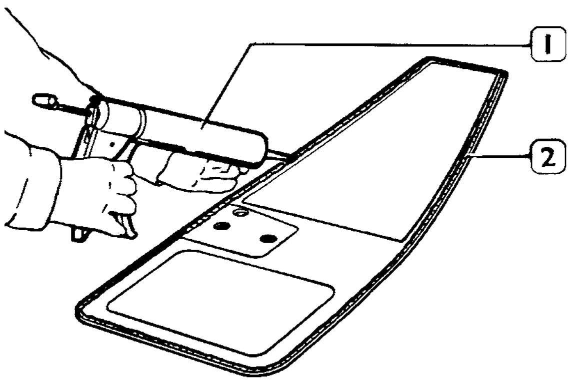
33928

Clean the screen–printed area (arrow) with a paper pad soaked in degreasing adhesion promoter.
Using a suitable pad, apply the glass primer taking care not to go outside the screen–printed area.

NOTE Leave the glass primer to dry at ambient temperature for at least 15 min. and anyhow for no longer than 24 hours.

Fit the seals on the inside of the door.
Fit the rubber seal on the window.

Figure 67

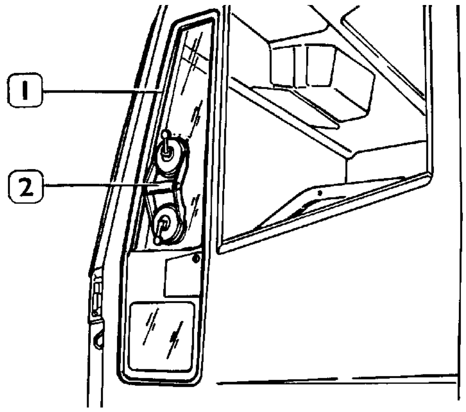


33929

Using an appropriate gun (1), apply the adhesive (2) on the window.

NOTE The bead of adhesive must be neither too big nor too small, and it must be continuous. In addition, the end portion must join the start in order to form a sealing ring.

Figure 68



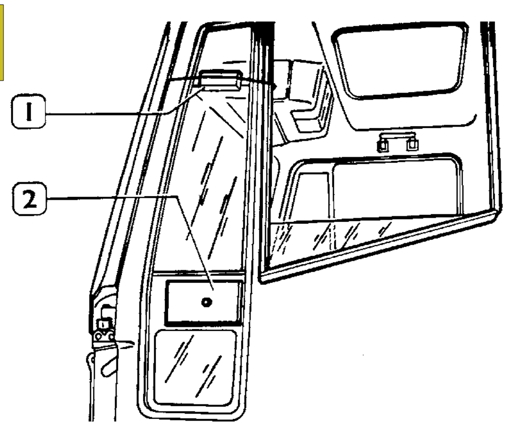
33921

Place the windscreen in its seat with the suction cup handle (2).

- ❑ Align the window with its housing bay, using the adhesive tape applied beforehand as a reference.

NOTE The window must be positioned within 15 minutes of applying the adhesive..

Figure 69



33930

Keep the window under pressure with two wooden plugs (1 – 2) positioned as shown in the figure.

It is necessary to wait at least 3 hours before moving the vehicle in the workshop.
For delivery to the customer, it is anyhow necessary to wait 24 hours.

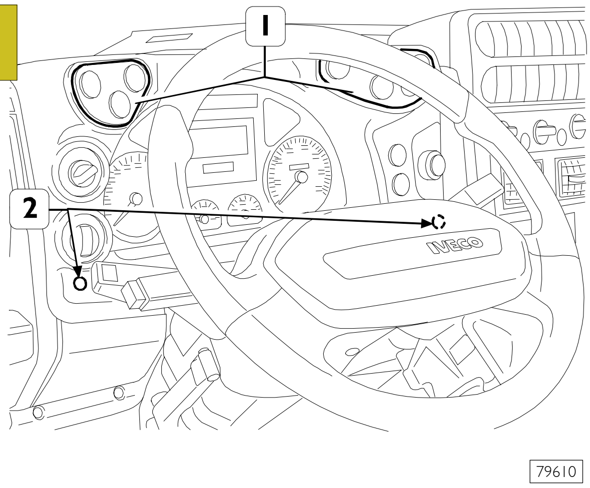
Take out the plugs, fit the rearview mirror and the internal door trim back on.

553710 INSTRUMENT PANEL

Removal

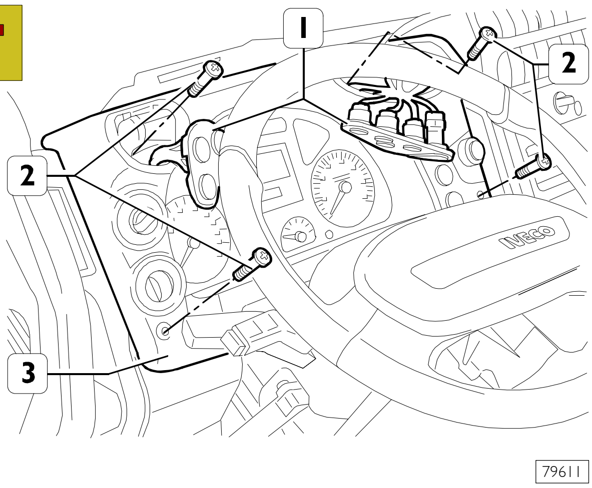
Before performing repair interventions, disconnect batteries and observe safety rules.

Figure 70



- ❑ Pull plugs (2) out of the seat;
- ❑ operate on check tongues and remove switches (1) from their opening.

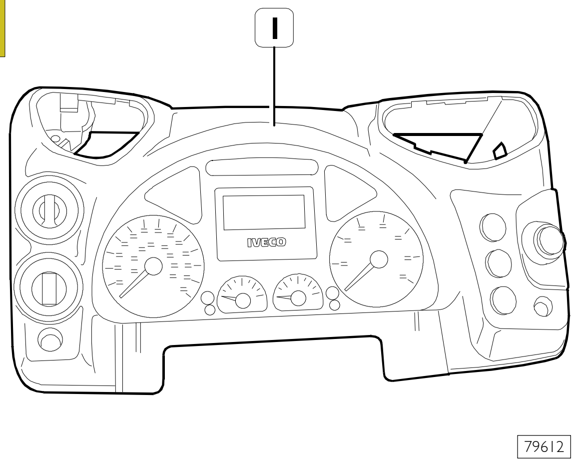
Figure 71



- ❑ Disconnect electric connectors and remove switch (1) sets;
- ❑ unscrew instrument panel (3) securing screws (2).

NOTE Mark electric wiring harness to make re–attaching operations easier.

Figure 72



- ❑ Detach instrument panel (1) from its seat.

Refitting

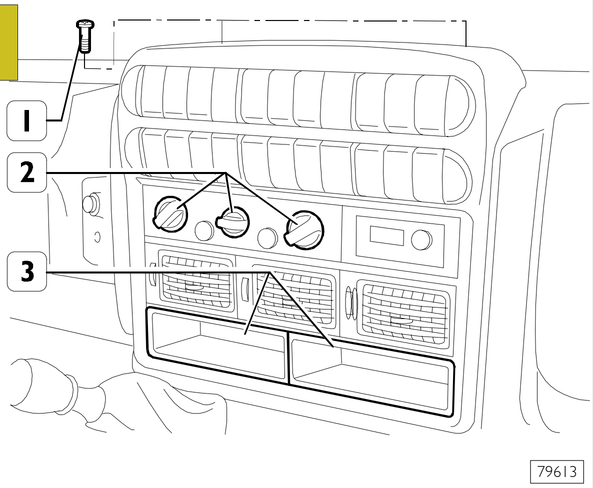
Perform re–attaching operations inverting described detaching operations.

553710 MIDDLE INSTRUMENT PANEL

Removal

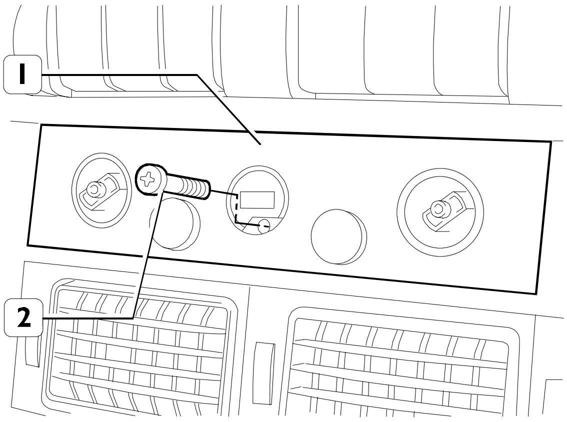
Before performing repair interventions, disconnect batteries and observe safety rules.

Figure 73



- ❑ Unscrew middle instrument panel securing screws (1);
- ❑ operate on check tongues and remove lower glove compartments (3) to access the screws underneath;
- ❑ remove the knobs (2) of air–conditioner controls in order to access the screw underneath.

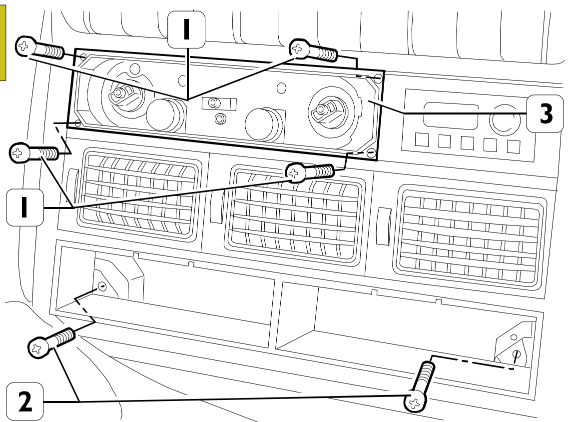
Figure 74



79614

❑ Unscrew securing screw (2) and detach the panel of air–conditioner controls.

Figure 75

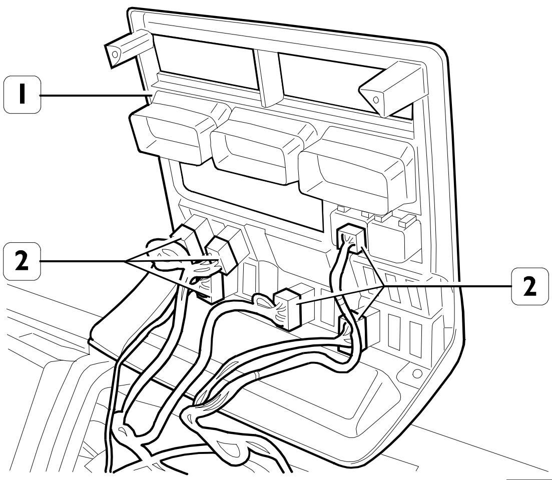


79615

❑ Unscrew screws (1) securing the device of air–conditioner controls (3) to middle instrument panel;

❑ unscrew screws (2) securing the middle instrument panel on the lower side to the covering.

Figure 76



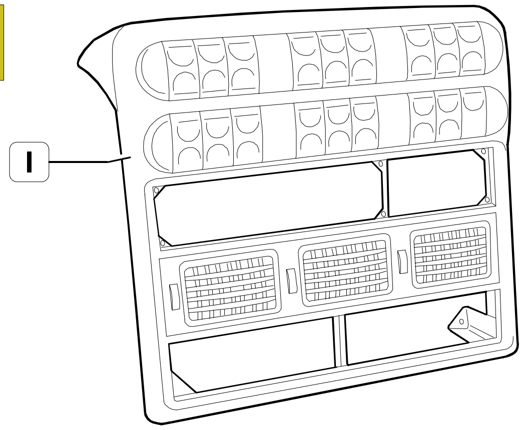
79616

❑ Pull out middle instrument panel (1);

❑ disconnect electric connections (1).

NOTE Mark electric wiring harness to make re–attaching operations easier.

Figure 77



79617

❑ Detach middle instrument panel (1) from the vehicle.

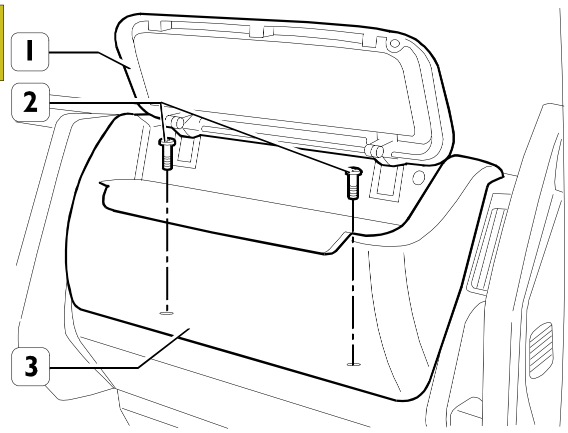
Refitting

Perform re–attaching operations inverting described detaching operations.

552211 INSTRUMENT PANEL COVERING

Removal

Figure 78



79618

Perform detaching procedure:

❑ instrument panel (OP. 553710) and middle instrument panel;

❑ let off engine cooling water and drain conditioning system (if present);

❑ lift lid (1), unscrew securing screws (2) and remove glove compartment from the vehicle (3).

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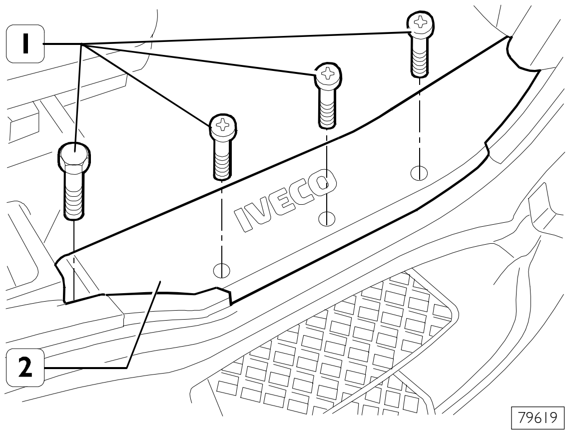
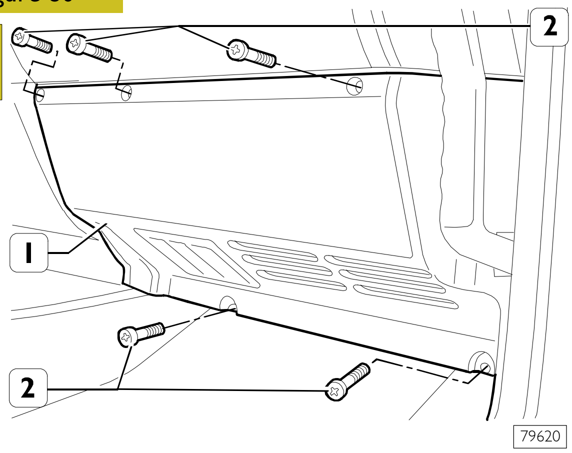
Figure 79



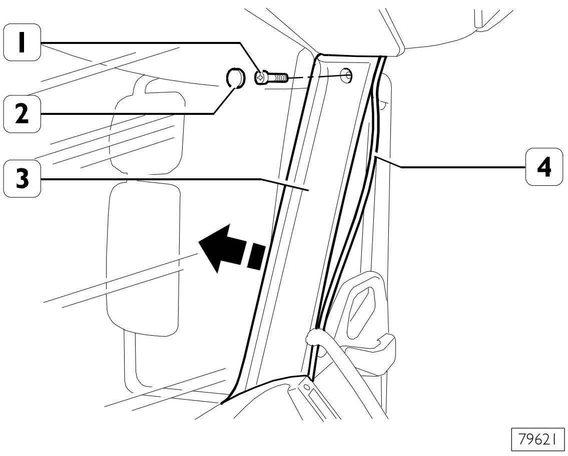
❑ Unscrew securing screws (1) and remove sill board (2) from both sides.

Figure 80



❑ Unscrew securing screws (2) and remove plastic coverings (1) under instrument panel (the figure shows one of coverings to be removed).

Figure 81



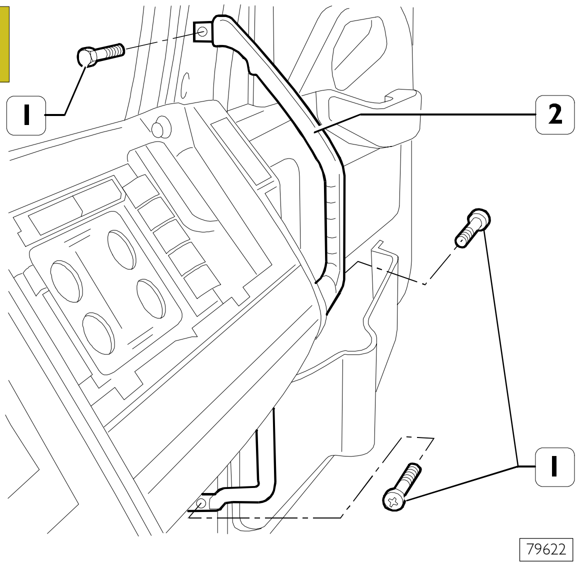
❑ Pull out door opening ring seal (4);

❑ pull out pressure plug (2) to access the screw underneath;

❑ unscrew securing screw (1);

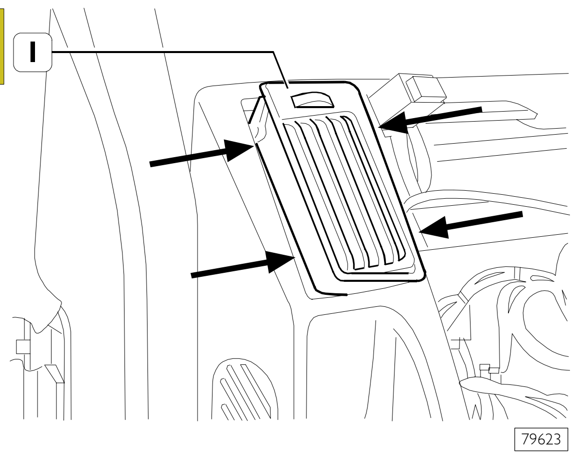
❑ detach windscreen pillar covering (3) operating (from both sides) according to the direction of the arrow.

Figure 82



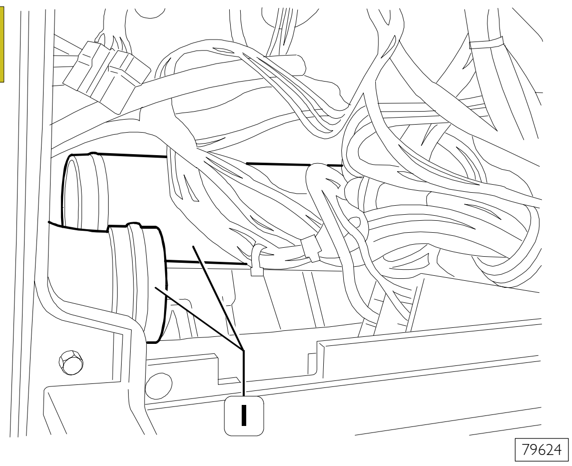
❑ Unscrew securing screw (1) an detach rising grip handle (2) from both sides.

Figure 83



❑ Operate on check tongues (←) and pull out air diffusion opening (1) from both sides.

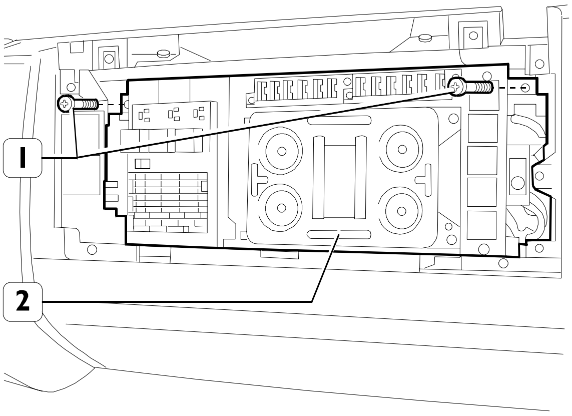
Figure 84



❑ Operate from instrument panel opening, release, from check clamps, and detach piping (1) to deliver air to diffusion openings.

Print 603.93.381

Figure 85

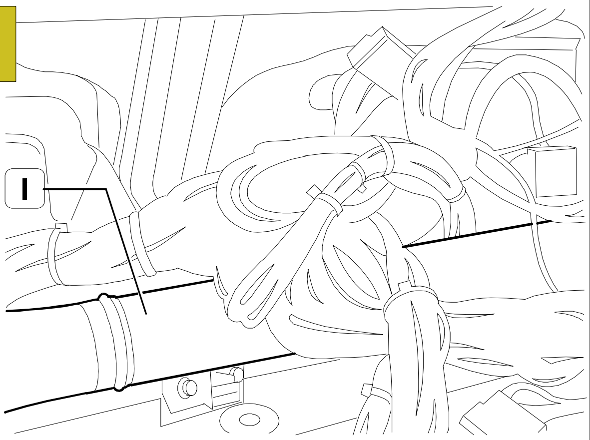


79625

❑ Unscrew Body Control securing screws (1);

❑ remove Body Control (2) and set aside.

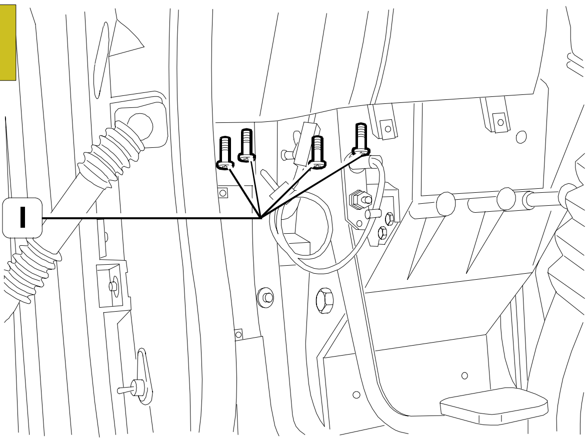
Figure 86



79626

❑ Operate from (Body Control) opening, disconnect and remove piping (1) to deliver air to diffusion openings.

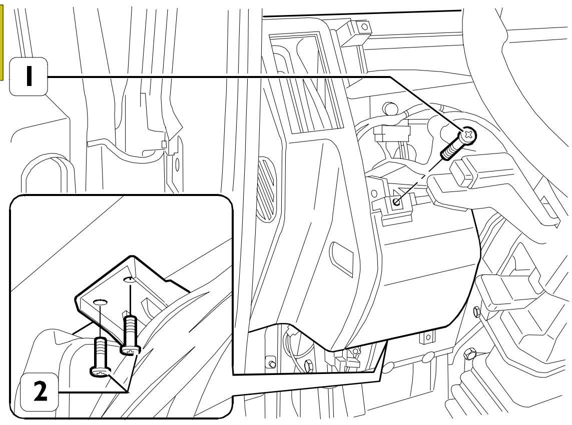
Figure 87



79627

❑ Unscrew side securing screws (1) from both sides of instrument panel covering the body.

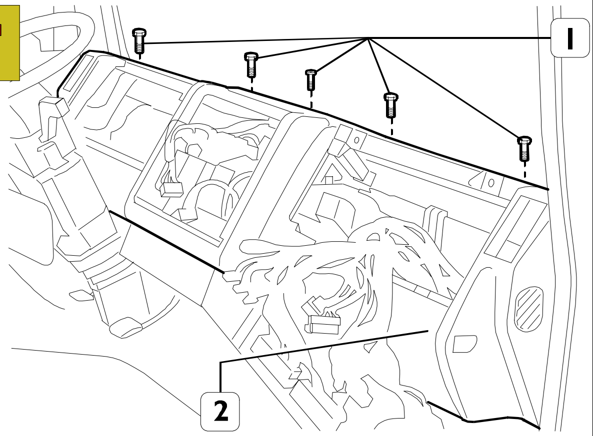
Figure 88



78628

❑ Unscrew instrument panel covering securing screws (1) in instrument board opening and screws (2) for fastening to support bracket.

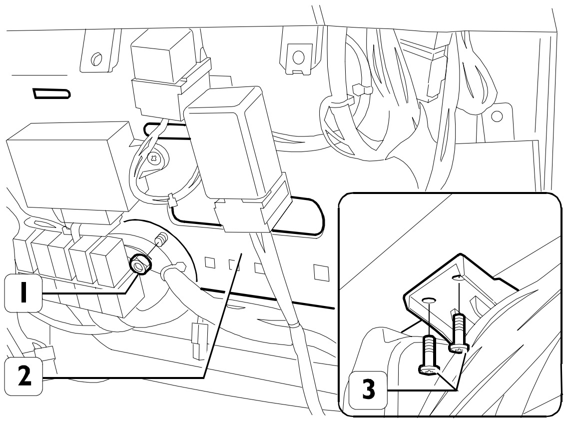
Figure 89



79629

❑ Unscrew instrument panel covering (2) upper securing screws (1) along windscreen edge perimeter.

Figure 90

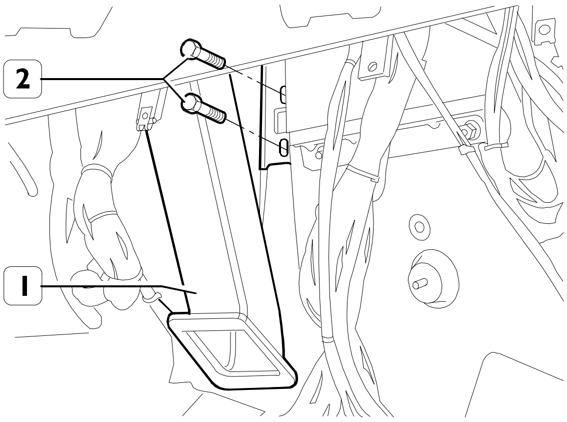


79630

❑ Operate from Body Control lower side and unscrew securing nut (1), and set aside electric components support panel (2) to access fastening underneath;

❑ unscrew screws (3) securing instrument panel covering to support bracket.

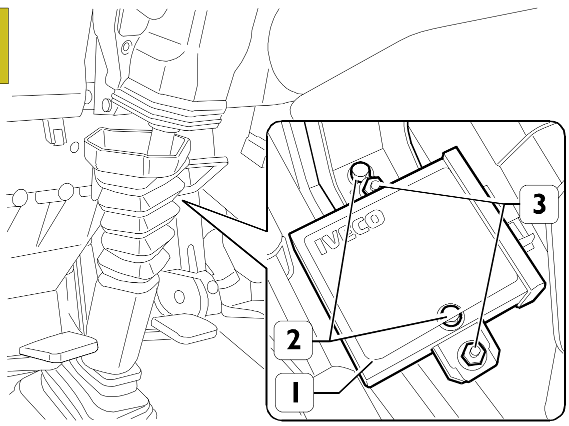
Figure 91



79631

- ❑ Unscrew screws (2) securing instrument panel support bracket located at air conveyor (1) side.

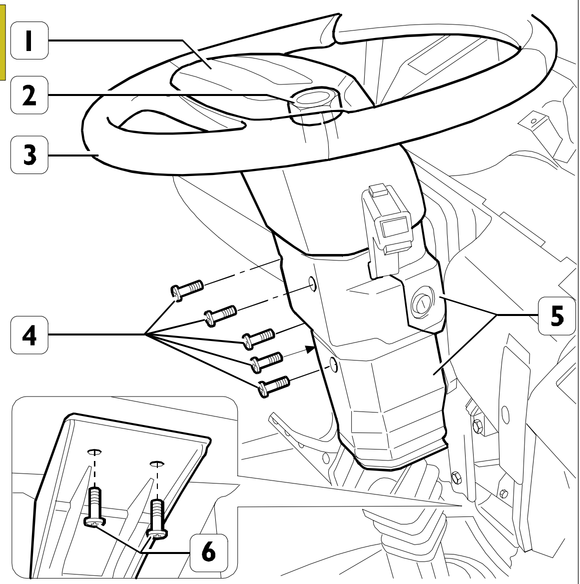
Figure 92



79632

- ❑ Unscrew securing nuts (3) and detachcode central unit (1);
- ❑ unscrew screws (2) of instrument panel bracket support to body.

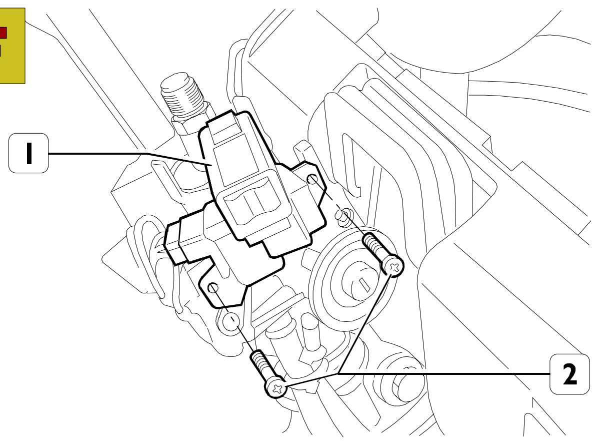
Figure 93



79633

- ❑ Pull out steering wheel hub cap (1);
- ❑ unscrew nut (2) and detach steering wheel (3);
- ❑ unscrew securing screws (4) and remove steering column covering (5);
- ❑ operating from steering column side, unscrew instrument panel support bracket securing screws (6) (see LENS).

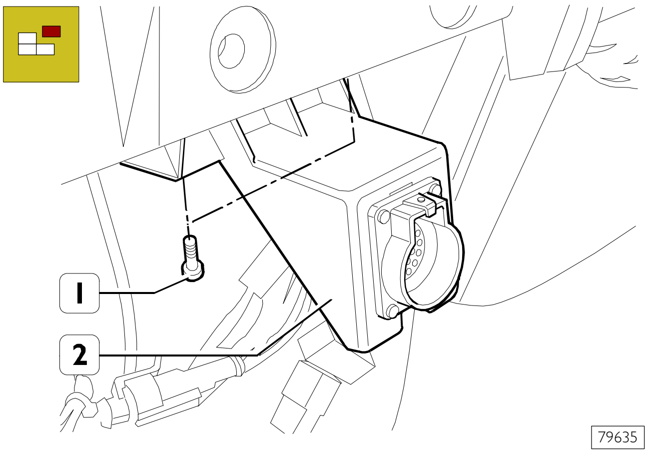
Figure 94



79634

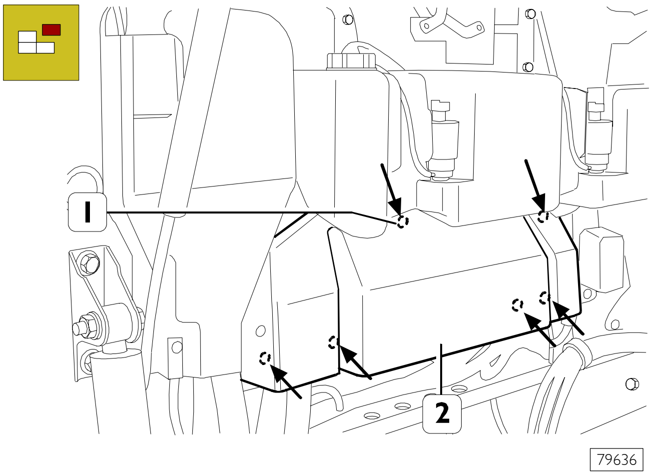
- ❑ Unscrew securing screws (2), disconnect electric connections and remove windscreen drive lever (1).

Figure 95



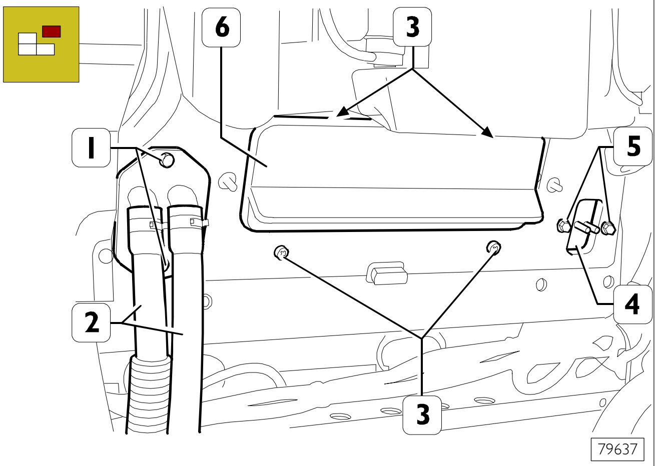
❑ Unscrew securing screws (1) and detach diagnosis socket (2).

Figure 96



❑ Lift radiator cowling, unscrew securing screws (1) and detach guard (2).

Figure 97

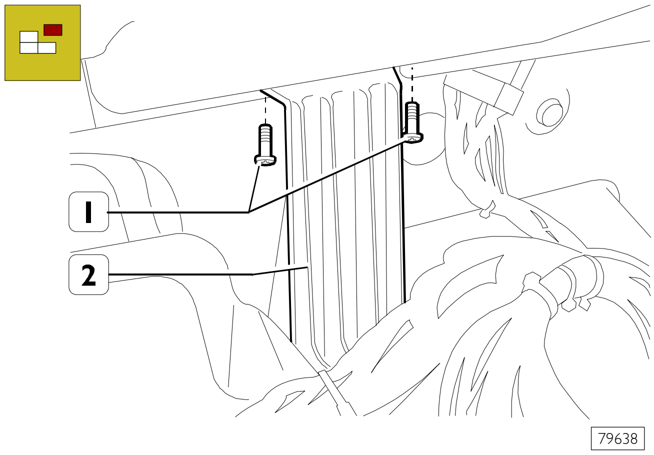


❑ Unscrew screws (3) securing conditioner (6) to cab front wall;

❑ unscrew expansion valve (4) securing screws (5);

❑ disconnect heater piping (2) and unscrew securing screws (1).

Figure 98

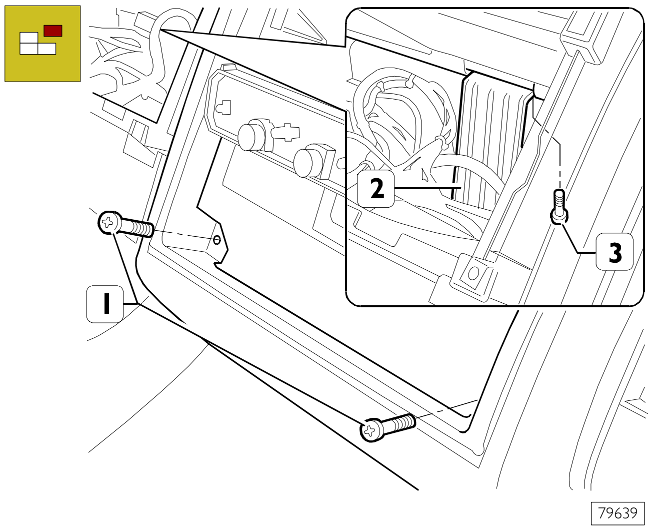


❑ Operate inside Body Control opening, unscrew instrument panel covering bracket (2) securing screws (1);

❑ remove door open light wiring harness;

❑ remove duct diffusing air to feet.

Figure 99

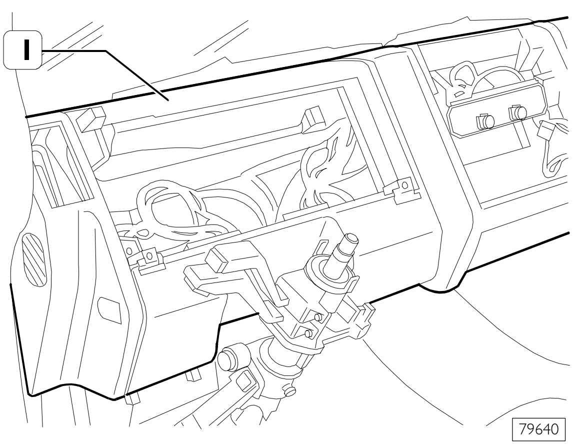


❑ Unscrew screws (1) securing heater to instrument panel;

❑ unscrew securing screws (3) and remove instrument panel support bracket (2) operating from instrument board opening (as shown in box);

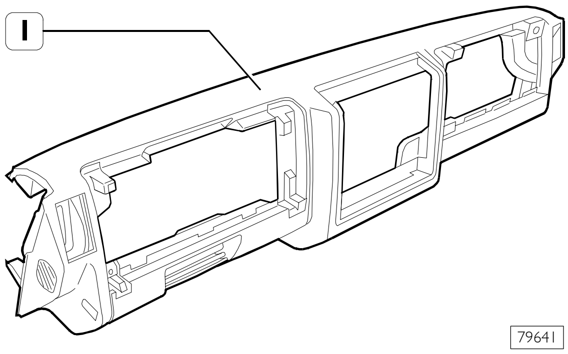
❑ remove air duct from heater to instrument panel.

Figure 100



- With help from a second operator, properly detach instrument panel (1) covering from the vehicle.

Figure 101



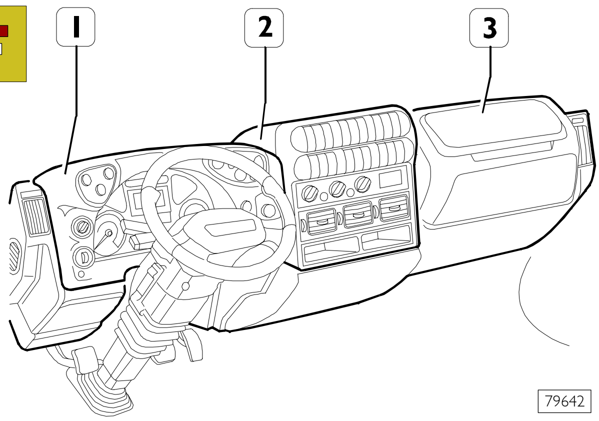
Refitting

Perform instrument panel (1) covering re–attaching operations properly inverting described detaching operations.

533210 HEATING AND VENTILATION

Removal

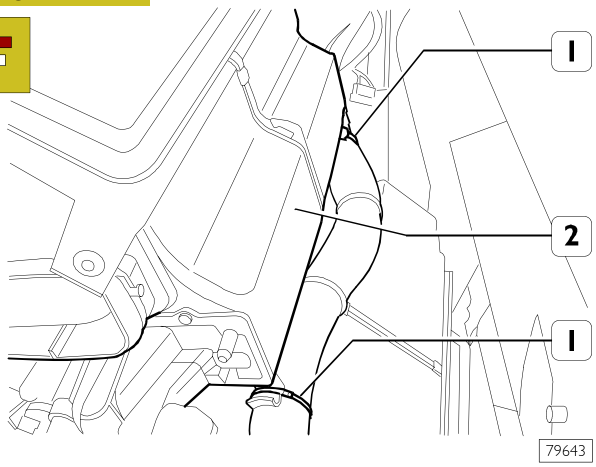
Figure 102



Perform detaching procedure on:

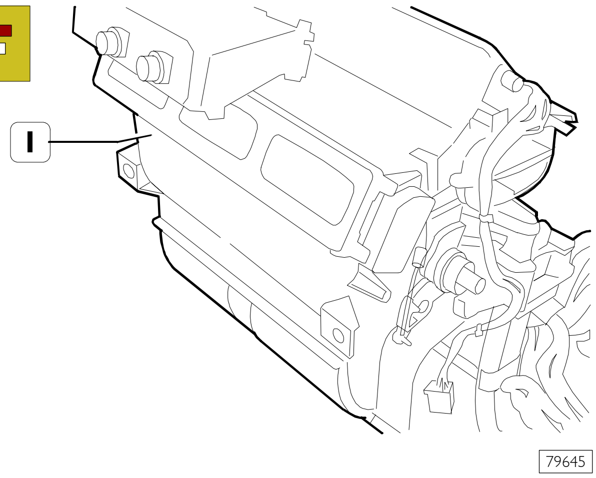
- instrument panel (1) (OP. 553710);
- middle instrument panel (2) (OP. 553710);
- instrument panel covering (3) (OP. 552211);
- remove interfering parts.

Figure 103



- Operate from heater (2) rear side and disconnect electric cable bundle check clamps (1).

Figure 104



- Remove vehicle heating and ventilation unit (1).

Refitting

Perform heating and ventilation unit re–attaching operations inverting described detaching operations.

SECTION 13

Programmed maintenance

SERVICING

Service plan

The checks, maintenance interventions and adjustments required at regular frequency on vehicle parts to ensure optimal working conditions are illustrated on the following pages.

NOTE The engine lubricant frequency in kilometres refers to a percentage of sulphur in fuel lower than 0.5%.
Halve the oil replacement frequency if fuel with a percentage of sulphur higher than 0.5% is used.

Engine lubricant oil – ACEA E5 (URANIA LD5)

NOTE

- ❑ In the case lower class lubricant is used, for example ACEA E2 (Urania Turbo), halve the oil replacement frequency.
- ❑ Change the engine lubricant oil in any case every 12 months in the event of very low distance, less than 800 hours/80.000 kilometres per year.
- ❑ Change the transmission and axle oil at least once every two years in the event of very low yearly distances.
- ❑ Carry out the general greasing procedure at least once a year in the event of very low yearly distances.

SERVICE FREQUENCY

<table>
<tr><th>Type of use</th><th>M1</th><th>M2</th><th>M3</th><th>M4</th><th>EP1</th><th>EP2</th><th>EP3</th><th>EP4</th><th>EP5</th></tr>
<tr><td>Long distance hauls: national or international, mainly motorway</td><td>80,000 km/ 3200 hours</td><td>160,000 km/ 6400 hours</td><td>240,000 km/ 9600 hours</td><td>480,000 km/ 19200 hours</td><td rowspan="2">40,000 km</td><td rowspan="3">6 months</td><td rowspan="3">1 months</td><td rowspan="3">2 months</td><td rowspan="3">3 months</td></tr>
<tr><td>Short–to–medium distance hauls: regional or interregional</td><td>60,000 km/ 2400 hours</td><td>120,000 km/ 4800 hours</td><td></td><td>240,000 km/ 9600 hours</td></tr>
<tr><td>Demanding use, mainly in city traffic: tippers, compactors, road cleaning services, distribution, off–road.</td><td>40,000 km/ 1600 hours/ 1 year</td><td>80,000 km/ 3200 hours/ 2 years</td><td></td><td>160,000 km/ 6400 hours/ 4 years</td><td>800 hours</td></tr>
</table>

M1, M2, M3, M4: PLANNED SERVICE OPERATIONS

EP1, EP2, EP3, EP4, EP5: EXTRA PLAN OPERATIONS

EXTRA PLAN OPERATIONS

The Extra Plan (EP) operations are additional service interventions, which are complementary with respect to standard servicing, to be carried out at regular time or distance frequencies referred to options not fitted in all vehicles.

Extra plan operation (to be carried out possibly at the same time as a planned service operation)

EP1

EVERY 20,000 km or 800 hours – for urban or off–road use.
EVERY 40,000 km – for long, medium or short distance hauls.

- Change automatic transmission filter and oil.
- Remove–refit and clean automatic transmission oil breather.

EP2

EVERY 6 MONTHS – particularly at the beginning of spring

- Clean radiator curtain.

EP3
EVERY YEAR
- Replace pneumatic system drier filter.

EVERY YEAR – before winter
- Check coolant density
- Replace supplementary heater fuel filter.

EVERY YEAR – before summer
- Check conditioner coolant conditions through the gauge.

EP4
EVERY TWO YEARS
- Replace air cleaner cartridge and clean container.
- Change engine coolant.

EP5
EVERY THREE YEARS
- Oil change and clutch hydraulic system bleeding.
- Oil change and brake hydraulic system bleeding.

PROGRAMMED MAINTENANCE OPERATIONS

		M1	M2	M3	M4
–	Cabin tilting, calender opening and closing, engine guard removal/refitting	●	●	●	●
–	Transport operations	●	●	●	●
–	Road test	●	●	●	●
–	Cooling system pipe tightness check	●	●	●	●
–	Underbody general lubrication	●	●	●	●
1	Blow–by filter replacement	●	●	●	●
13	Clutch hydraulic system fluid level check	●	●	●	●
5/11	Brake pad and disc wear check	●	●	●	●
14	Headlight beam orientation check		●		●
12	Steering column and steering knuckle rod check		●		●
6	Mechanical transmission oil replacement		●		●
10	Axle hub oil replacement		●		●
4	Rear axle oil replacement		●		●
7	Mechanical transmission oil breather cleaning		●		●
3	Rear axle oil breather cleaning		●		●

OPERATIONS NOT INCLUDED IN THE PLAN

		EP1	EP2	EP3	EP4	EP5
–	Automatic transmission oil and filter replacement	●				
–	Automatic transmission oil breather removal/refitting and cleaning	●				
15	Radiator curtain cleaning		●			
2	Air system drier filter replacement			●		
16	Engine coolant density check			●		
9	Cartridge replacement and air filter container cleaning				●	
16	Engine coolant replacement				●	
8	Oil change and brake hydraulic system bleeding					●
13	Oil change and clutch hydraulic system bleeding					●

Figure 1

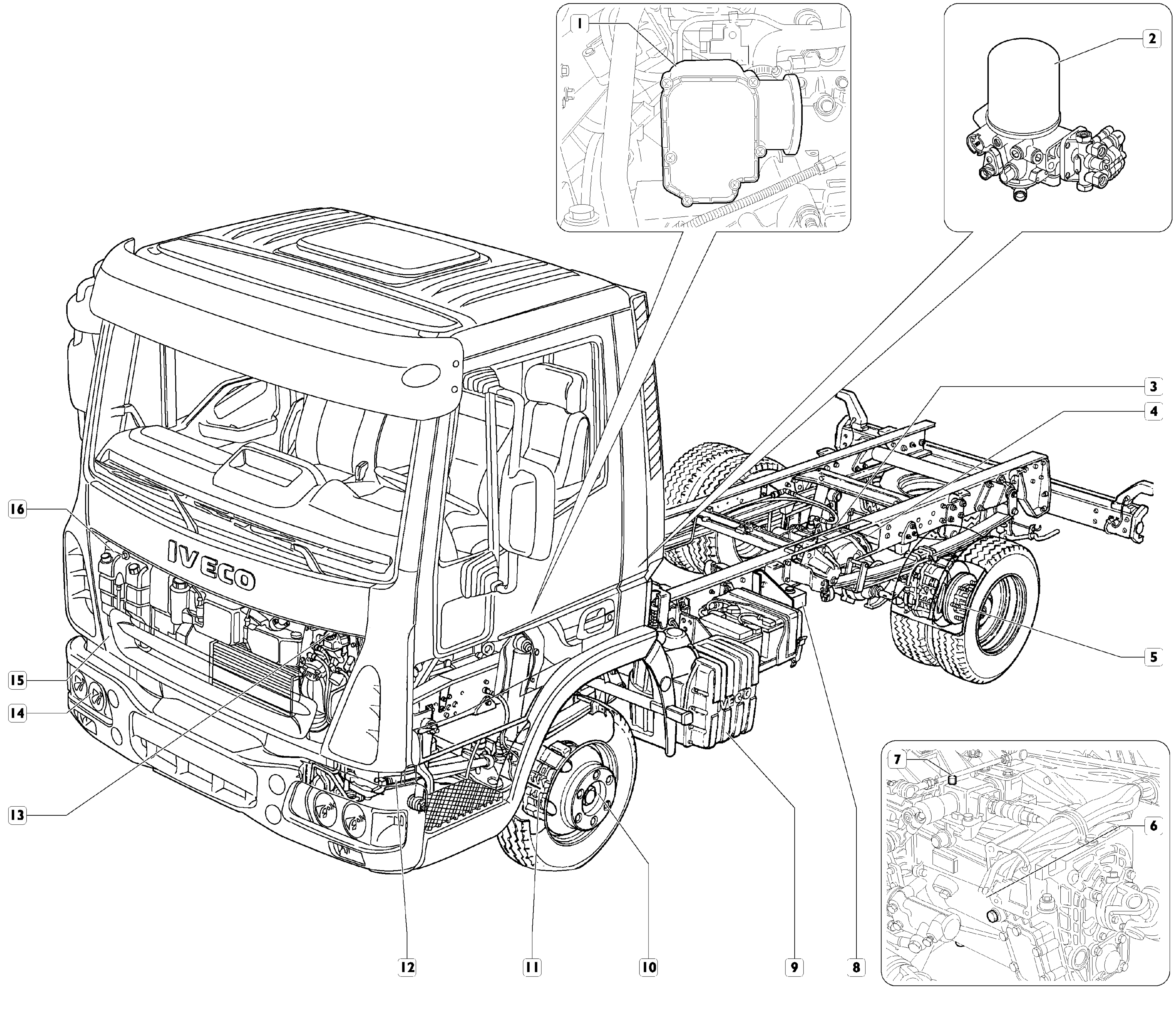
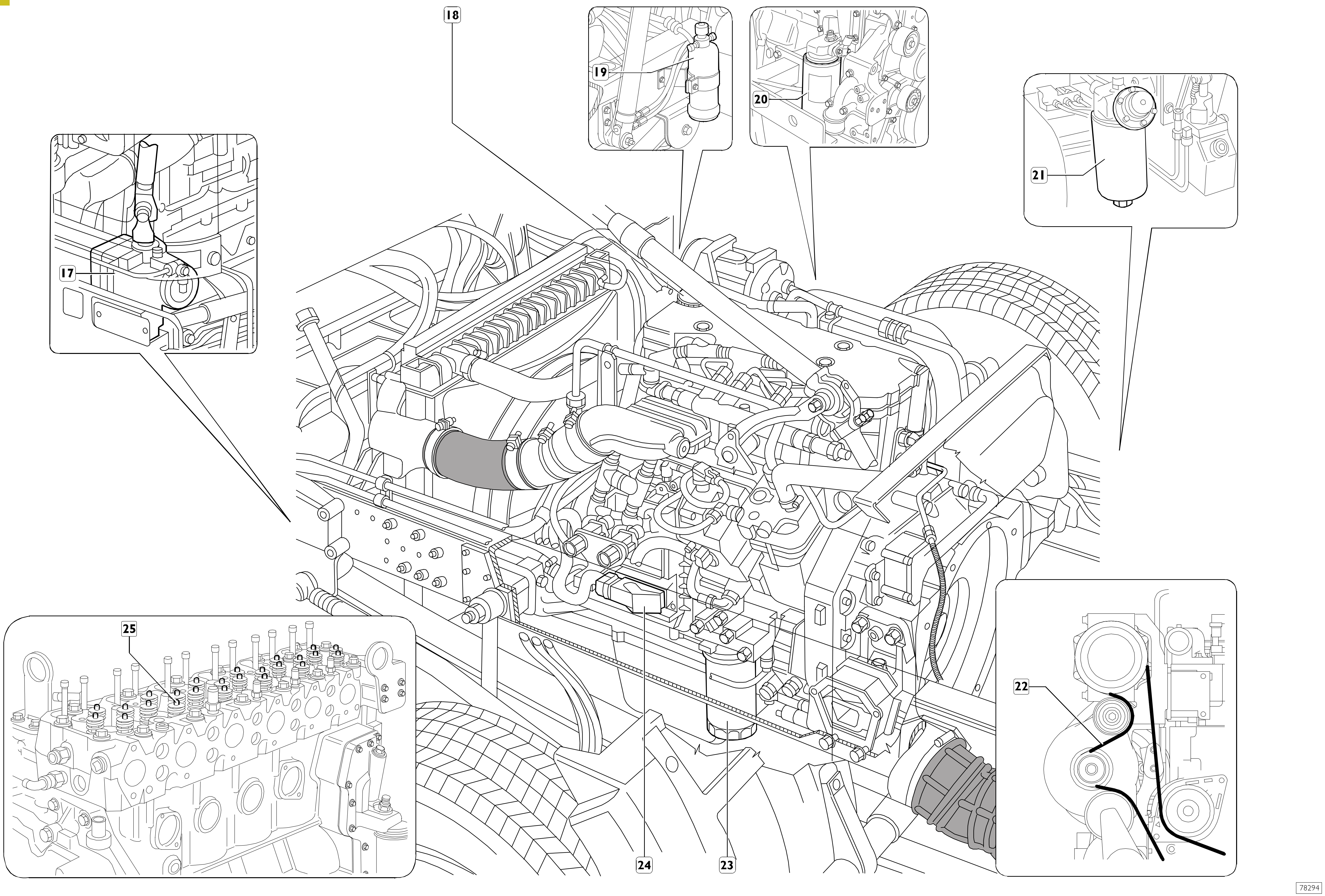


Figure 2



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PROGRAMMED MAINTENANCE OPERATIONS

		M1	M2	M3	M4
18	Engine oil change	●	●	●	●
20	Engine oil filter replacement	●	●	●	●
22	Check of different control belt conditions	●	●	●	●
23	Fuel filter replacement		●		●
21	Fuel pre–filter replacement		●		●
17	Steering box fastening and support check		●		●
22	Replacement of different control belts			●	●
25	Check valve clearance and adjust it, if needed			●	●
24	Check engine EDC system with MODUS or IT 2000			●	●

OPERATIONS NOT INCLUDED IN THE PLAN

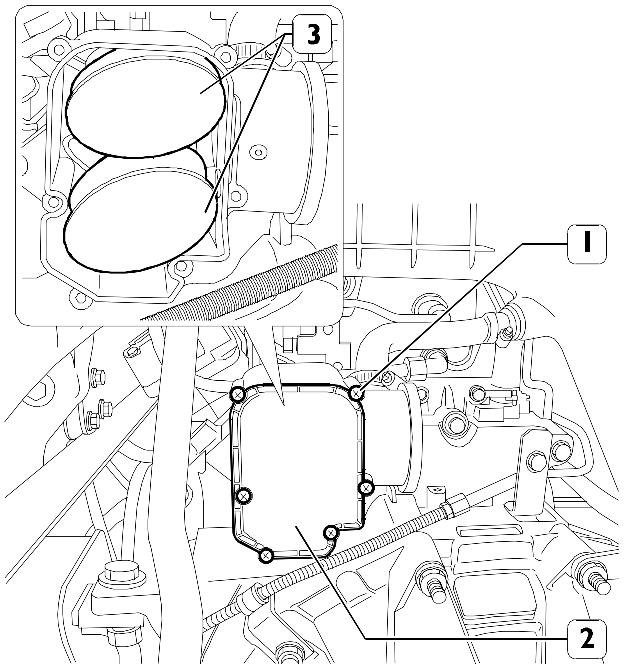
		EP1	EP2	EP3	EP4	EP5
19	Check cooling system coolant conditions on the display			●		
–	Supplementary heater fuel filter replacement			●		

M1 SERVICE

- **Handling operations**
- **Functional testing on road**
- **General chassis greasing**
- **Checking cooling system and hydraulic brake pipe seal**

1 - Blow–by filter replacement

Figure 3



77835

Unloose the 6 screws (1) and remove the cover (2).

Remove blow–by filters (3).

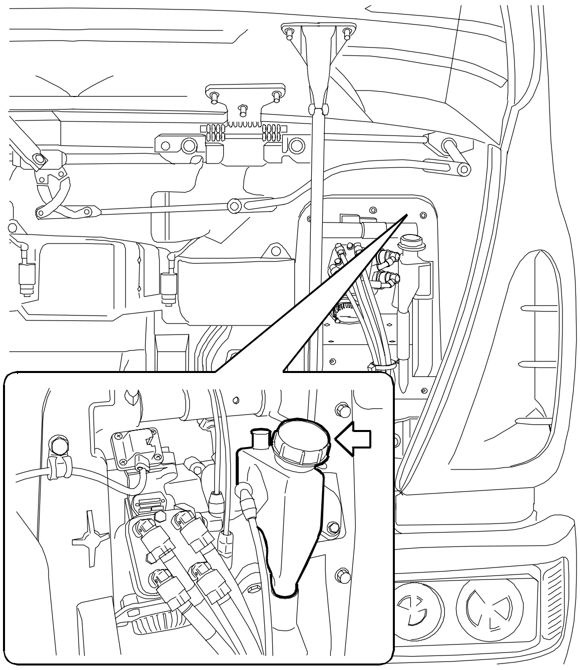
Before refitting the new filters, clean their housing.

5/11 – Checking wear of discs, pads

If you find too much wear, replace the worn components as described in the relevant section "BRAKES".

13 – Clutch hydraulic system oil level check

Figure 4



84410

Check the level of the clutch fluid. Top it up if it is too low (see the fluids table in the GENERAL section).

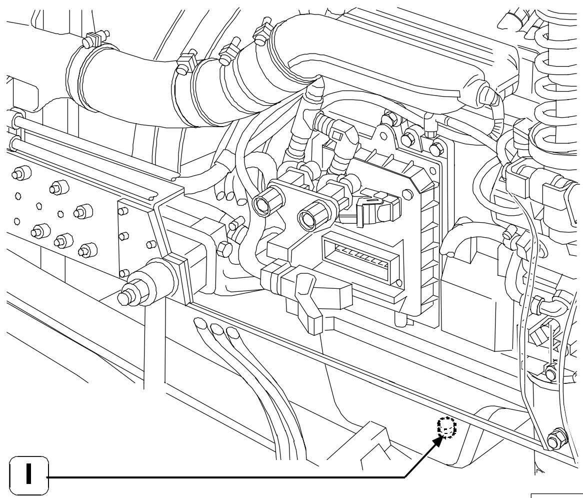
The clutch fluid is poisonous and corrosive: if you accidentally come into contact with it, wash immediately with water and a neutral soap.

18 – Changing engine oil

Take out the oil level dipstick.

Remove the plug (1) from the oil sump and drain the engine oil off into a specific container.

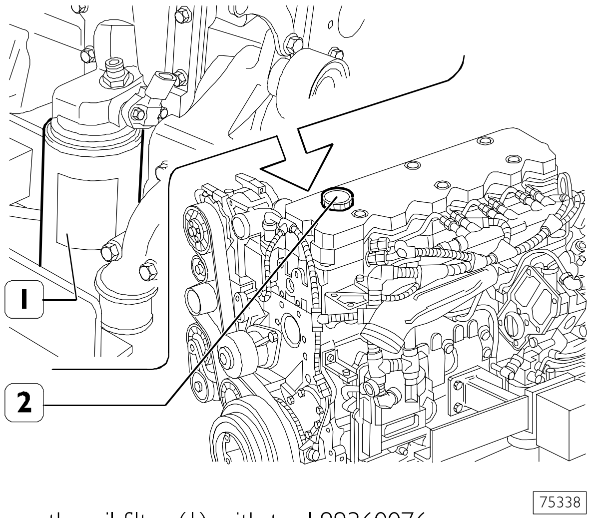
Figure 5



77836

20 – Changing engine oil filters

Figure 6



Remove the oil filter (1) with tool 99360076.

NOTE Before refitting the new cartridges, moisten the seal with engine oil.

Screw the oil filter (1) on by hand until it is in contact with the mounting and then tighten by 3/4 of a turn to the required tightening torque.

Screw the plug back on under the sump and tighten it to the required torque.

Pour oil into the engine through the filling–pipe (2) of the required grade and quantity (see fluids table in the GENERAL section).

22 – Checking miscellaneous drive belts

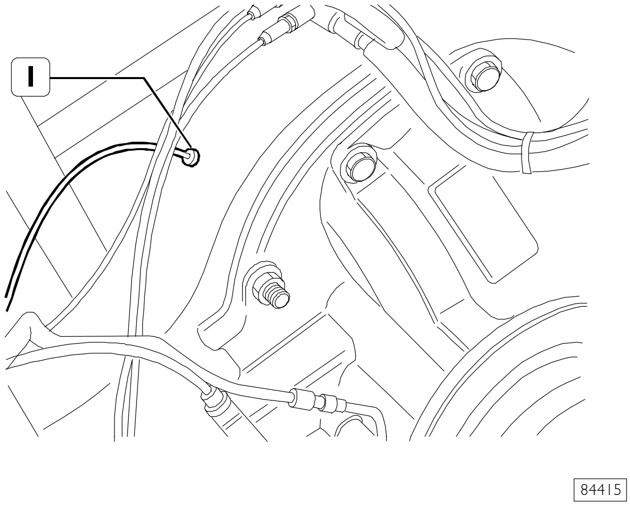
See that the belts are not worn or deteriorated; if they are, replace them as described under the relevant headings.

M2 SERVICE

NOTE The M2 service comprises the operations of the M1 service plus the ones listed here.

3 – Rear axle breather cleaning

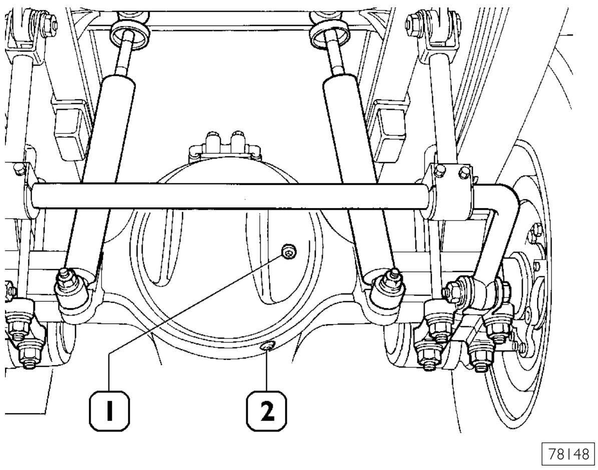
Figure 7



Remove the oil vapour breather (1) and clean it thoroughly. Mount it, making sure it is in the right position and tighten it to the prescribed torque.

4 – Changing rear axle oil

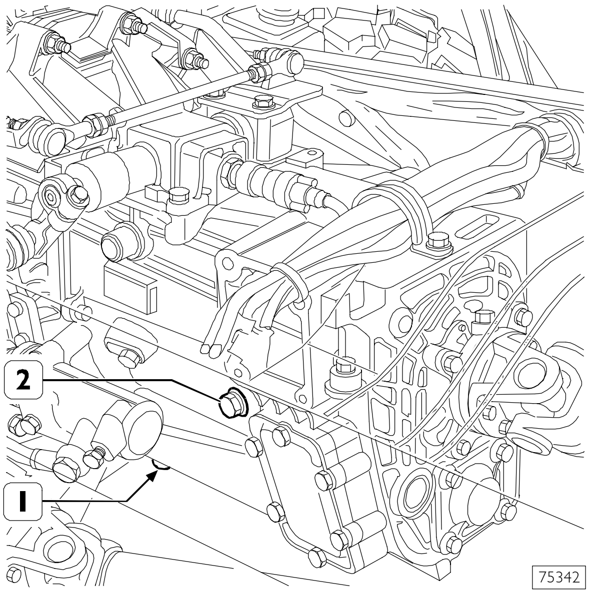
Figure 8



- ❑ With the axle warm, drain off the oil into a specific container by taking out the plug (2).
- ❑ Replenish with fresh oil through the hole closed by the plug (1) (see the FLUIDS section under the heading GENERAL INFORMATION).
- ❑ Clean the rear axle oil vapour breather.
- ❑ Tighten the plugs to the prescribed torque.

6 – Mechanical transmission oil replacement

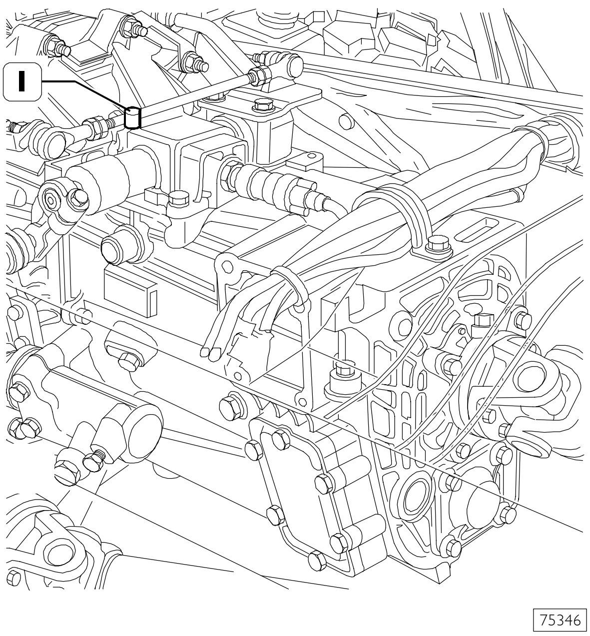
Figure 9



The lubricating oil must be drained off while it is warm. Place a container under the plug (1). Take out the plug and drain off the oil. Fit the plug (1) back on. Unscrew the filler cap (2) and replenish the gearbox with lubricating oil in the quantity and grade prescribed in the GENERAL INFORMATION section.

7 – Mechanical transmission oil breather cleaning

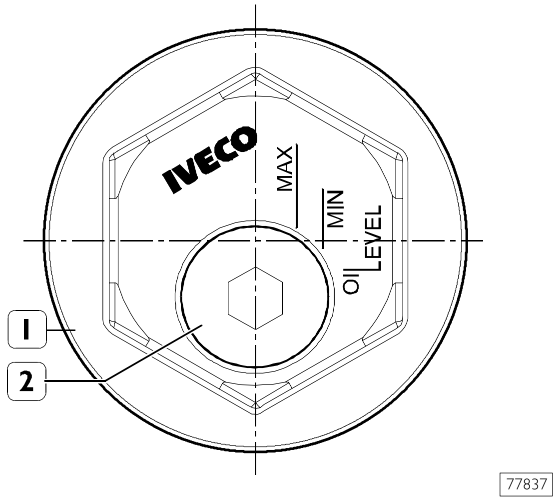
Figure 10



Remove the oil vapour breather (1) and clean it thoroughly. Mount it, making sure it is in the right position and tighten it to the prescribed torque.

10 – Axle hub oil replacement

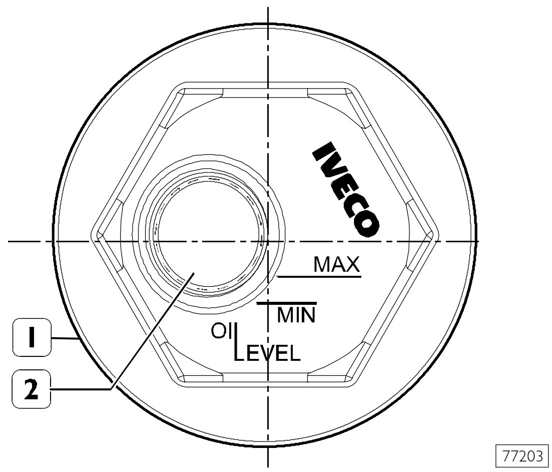
Figure 11



Change oil in the following way:

- ❑ Turn the wheel hub until the hub cover (1) reaches the position illustrated in Figure 11;
- ❑ unloose the plug (2) and drain oil in the appropriate container;
- ❑ suck the remaining oil with the suitable syringe.

Figure 12



- ❑ Turn the wheel hub until the hub cover (1) reaches the position illustrated in Figure 12;
- ❑ refill with the prescribed quantity of new oil (see SPECIFICATIONS AND DATA) through the hole (2);
- ❑ refit and tighten the plug (2) illustrated in Figure 11 and the hub cover (1) to the prescribed torque.

12 – Checking steering column articulation and linkage

Steering control linkage

Check that the screws and nuts fixing the clamps to the tie rods have not deteriorated and are tightened to the required torque.

The tie rods must not be damaged and the threaded portion must be integral.

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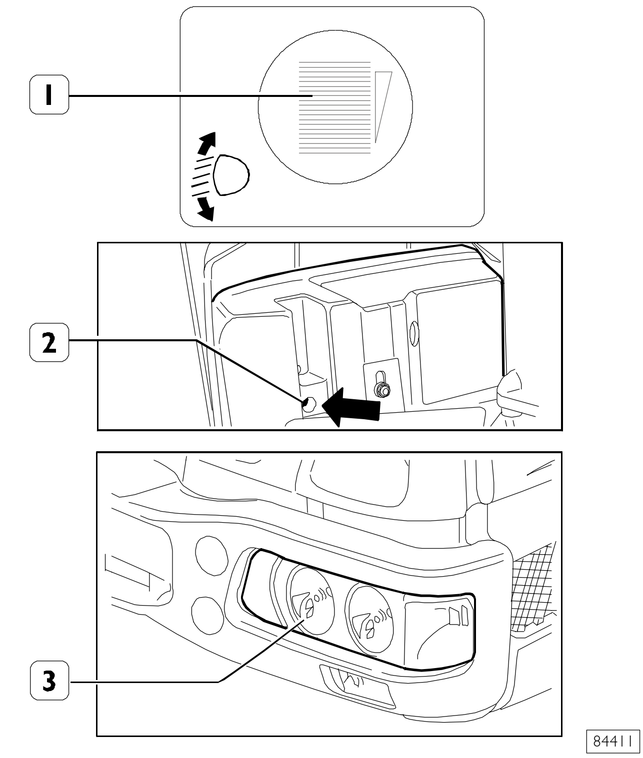
Ball joints

- ❑ Clean the ball joints of the tie rods.
- ❑ This must be done with dry rags or raw cotton; use no solvents.
- ❑ Check that the ball joints, in their components, have no points of corrosion with sections of depth greater than 1 mm. In particular, check the sheet metal cover close to the rolled section.
- ❑ Check the protective casing: it has to be secured to the body and to the pin of the articulation with the split ring and it must not turn.
- ❑ The casing must be neither deteriorated nor damaged.
- ❑ Manually crush the protective casings and check that lubricating grease comes out.
- ❑ Check that the nuts and split pins are not deteriorated.

14 – Checking headlight adjustment

Figure 101

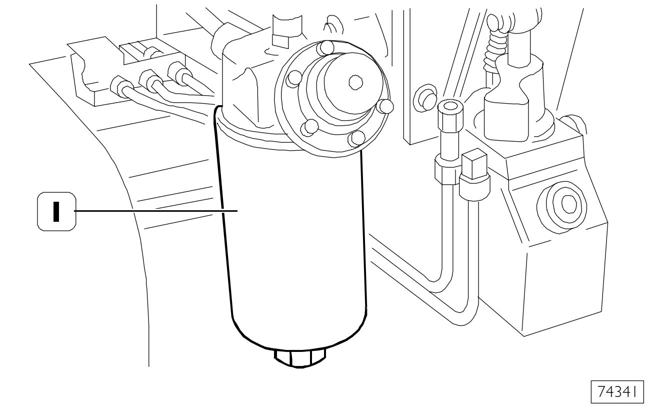


- ❑ Light beam (3) vertical direction regulation switch (1) located on instrument panel.
- ❑ With cab tilted, operate on light beam (2) horizontal direction regulation screw (2).

17 – Checking steering box fixing and mounting

21 – Changing fuel pre–filter

Figure 102



Unscrew the pre–filter (1) and replace it.

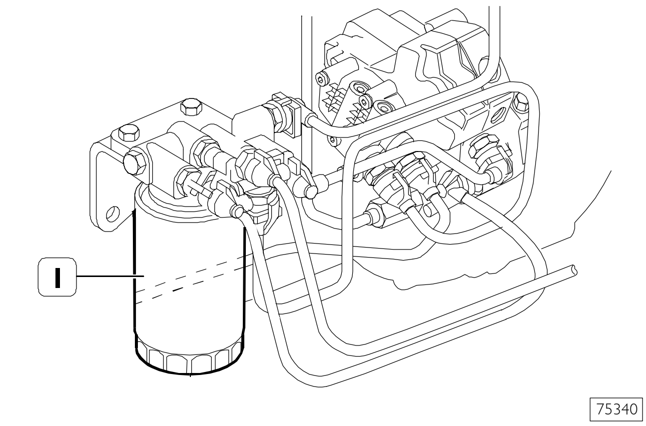
Before refitting the new cartridge, moisten the seal with diesel or engine oil.

Screw the cartridge on by hand until it is in contact with the mounting and then tighten by 3/4 of a turn to the required tightening torque.

When replacing the cartridge, it must not have been pre–filled. This is to prevent impurities getting into circulation that could damage the system components, injectors/pump.

23 – Changing fuel filter

Figure 103



Remove the fuel filter (1) with tool.

Before refitting the new cartridge, moisten the seal with diesel or engine oil.

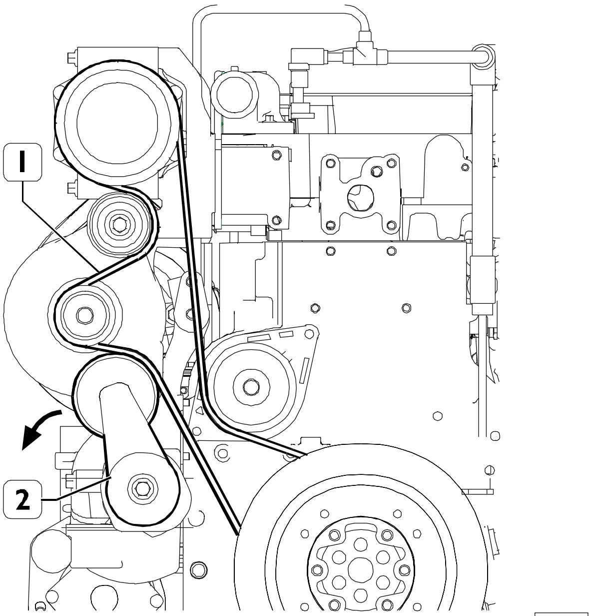
Screw the new one on by hand, taking care to check that the rubber seal and the mating surface are clean and in a perfect state of repair. Screw the cartridge on by hand until it is in contact with the mounting and then tighten by 3/4 of a turn to the required tightening torque.

M3 SERVICE

NOTE The M3 service comprises the operations of the M1 services plus the ones listed here.

22 – Changing miscellaneous drive belts

Figure 16



To remove and fit the belt (1) back on, you need to use an appropriate tool on the tightener (2) in the direction shown by the arrow.

NOTE The tighteners are automatic, so they are not to be adjusted after assembly.

24 – EDC system check–up using MODUS or IT2000

25 – Checking valve clearance and adjustment if necessary

To perform these operations correctly, proceed as described under "ENGINE" in the relevant section.

M4 SERVICE

NOTE Service M4 includes all operations.

MAINTENANCE NOT INCLUDED IN THE SERVICE

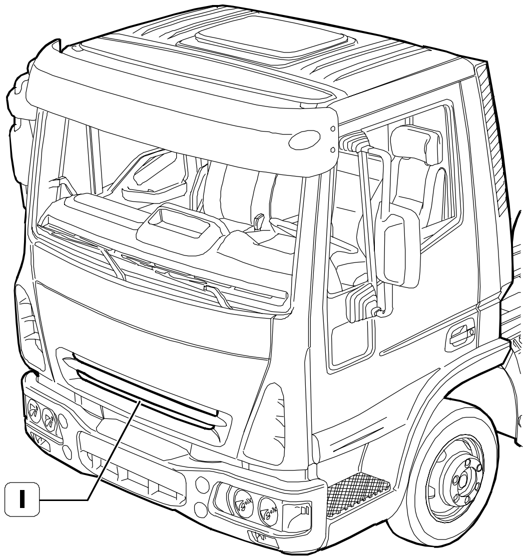
EP1 SERVICE

- **Automatic transmission filter and oil replacement**
- **Automatic transmission oil breather removal/refitting and cleaning**

EP2 SERVICE

15 – Cleaning the radiator shade

Figure 17

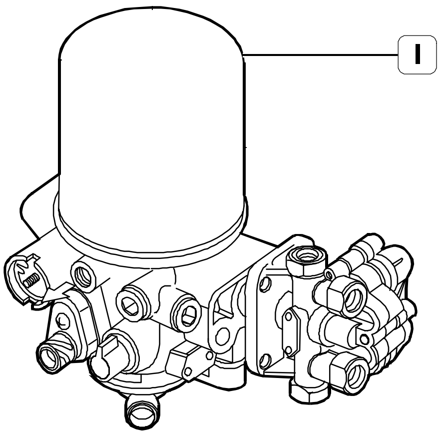


Remove any dirt from the radiator shade (1) to let air flow towards the radiator.

EP3 SERVICE

2 – Changing pneumatic system drier filter

Figure 18

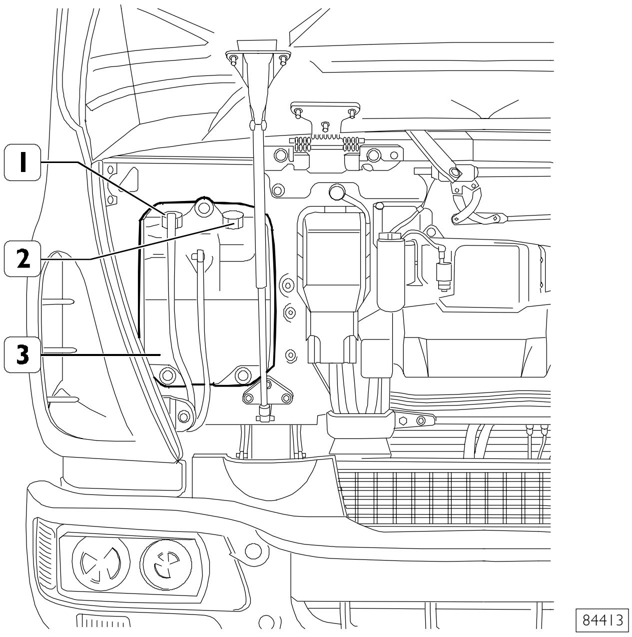


Discharge the pressure of the compressed air system.

Unscrew the drier filter (1) and change it; tighten it to the prescribed torque, checking there is no air leakage when pressure is restored.

16 – Checking density of antifreeze in the engine coolant

Figure 19



The plug (1) must never be taken out for any reason whatsoever.
With the engine warm, the cooling system is in overpressure, therefore take care when taking off the cap (2).

Take off the cap (2) and draw off a sample of the coolant from the expansion tank (3) with the densimeter 99395858.

Depending on the temperature of the liquid, check the percentage of antifreeze in the liquid on the scale of the instrument. The percentage has to be higher than 40% and must not exceed 50%.

If necessary, restore the percentage of antifreeze, bearing in mind that the liquid needs to be replaced every 2 years.

NOTE For vehicles fitted with an additional heater, the percentage of antifreeze must never exceed 50%.

19 – Checking the state of the air–conditioning system refrigerant

- **Supplementary heater fuel filter replacement**

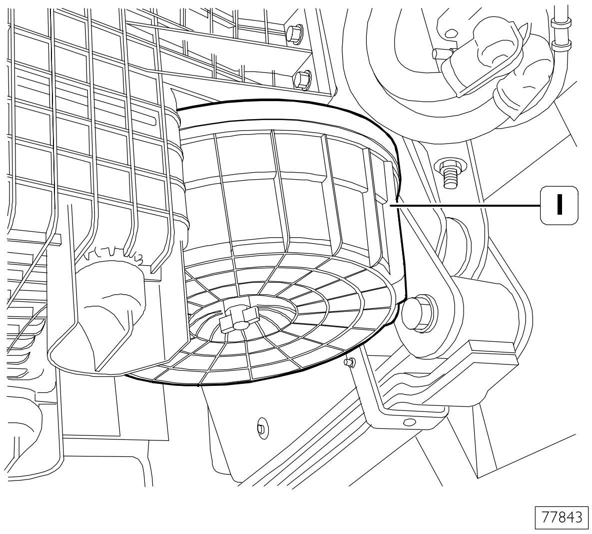
EP4 SERVICE

9 – Changing the cartridge of the dry air filter and cleaning its container (even if no clogging signalled)

Once a year (servicing with frequency in hours)

Once every two years (servicing with frequency in km)

Figure 20



❑ Operate fastenings and remove the cover (1).

❑ Take the cartridge out of the air filter.

Before fitting the new cartridge, clean its housing thoroughly.

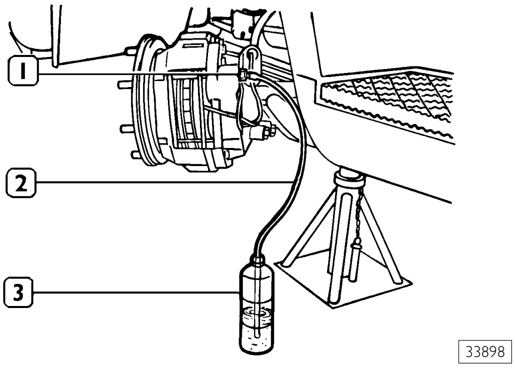
16 – Changing engine coolant

Carry out the procedure described under the relevant heading in the ”ENGINE” section.

OIL REPLACEMENT AND BRAKE HYDRAULIC SYSTEM BLEEDING

Front brake circuit

Figure 21



Apply to the bleeder screw (1) a transparent plastic hose (2) with one end immersed into a container (3) filled partially with brake fluid.

Depress the brake pedal repeatedly.

Press down the brake pedal and loosen 1 turn the bleeder screw at the same time.

Screw again the bleeder screw and depress the brake pedal repeatedly.

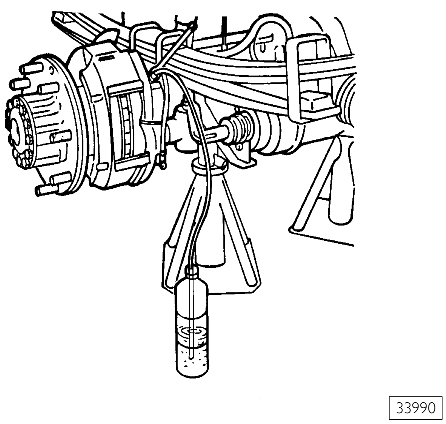
Repeat the above operation until the brake fluid flows homogeneous.

Bleed air from the opposite brake circuit. Check that brake fluid level in the tank is always sufficient.

These operations enable to bleed the air contained in the hydraulic circuit fluid pipes.

Rear brake circuit

Figure 22



Disconnect load sensing valve control rod and lock it upwards to set the load sensing valve in max. opening position.

Bleed air from the hydraulic circuit.

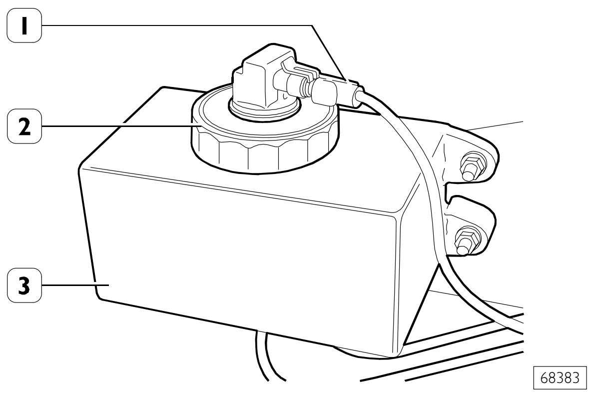
Operate as previously described for the front brake circuit.

Once bleeding is over, reconnect the load sensing valve control rod.

NOTE After completing the bleeding operations, top up the tank fully with **Tutela TRUCK DOT SPECIAL**.

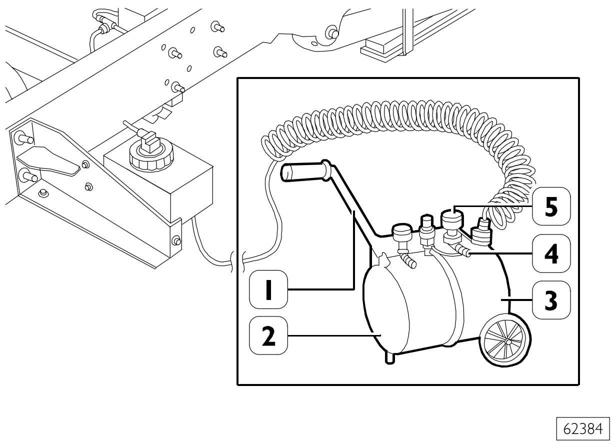
Air bleeding from the hydraulic circuit using the deaerating device

Figure 23



Disconnect cable (1) from low brake fluid warning indicator cover connection.
Remove the cover (2) from front brake circuit tank (3).

Figure 24



Connect the deaerating device (1) 99306010 to front brake circuit tank and bleed air from the brake circuit proceeding as follows:

- ❑ charge the air tank (2);
- ❑ fill the tank (3, Figure 23) with **Tutela TRUCK DOT SPECIAL**;
- ❑ remove protection caps from bleeder screws;
- ❑ fir the suitable box wrench on the bleeder screw;
- ❑ apply to the bleeder screw (1, Figure 21) a transparent plastic hose (2, Figure 21) with one end immersed into a container (3, Figure 21) filled partially with brake fluid.

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- ❑ loosen the bleeder screw on the brake calliper by approx. one turn;
- ❑ open cock (4) until the gauge (5) indicates 1 to 1.2 bar pressure.

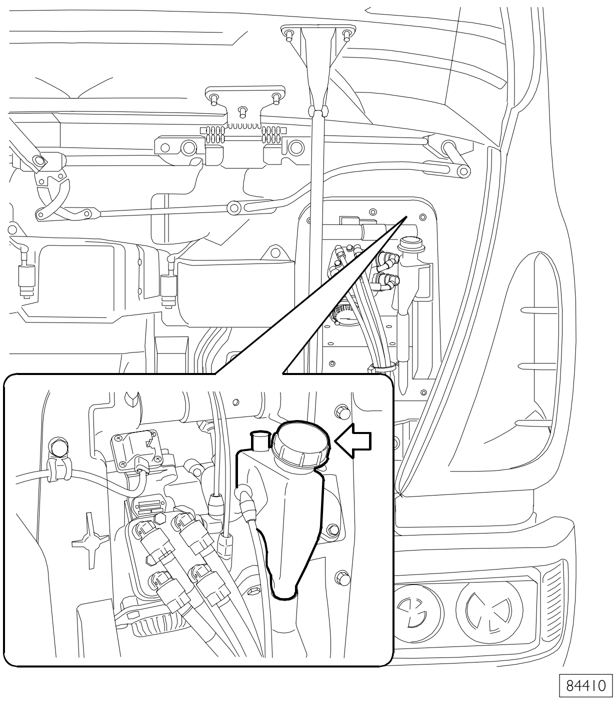
Close the bleeder screw when brake fluid comes out homogeneous from the plastic hose.

Bleed air from the opposite brake circuit.

After completing the bleeding operations, disconnect the de–aerating device, check brake fluid level in the tank and low brake fluid sensor electrical connections.

EP5 SERVICE
13 – Oil replacement and clutch hydraulic system bleeding

Figure 25



Drain off the clutch control fluid and change it (see Fluids table in GENERAL section).

The clutch fluid is poisonous and corrosive: if you accidentally come into contact with it, wash immediately with water and a neutral soap.

Bleed air from the clutch hydraulic system through the bleeding valve on the deaerator operator cylinder 99306010.

SECTION 14

Electric/Electronic system

PRELIMINARY REMARKS

Manuals for repairs are split into Sections, each one of which is marked by a numeral; the contents of these sections are indicated in the general table of contents.
Each section is generally dedicated to a main Unit (e.g.: engine, gearbox, electric system, etc.).
Sections with mechanical contents include technical data, tightening torque collections, tool lists, connections – disconnections of units to/from the vehicle, overhauls at the bench and relating troubleshooting.
On the electric/electronic system section there are the descriptions of the electric network and vehicle electronic systems, electric schemes, components electric characteristics, components codes and troubleshooting relating to the central units specific of the electric system.
The manual uses proper symbols in its descriptions; the purpose of these symbols is to classify contained information. In particular, there have been defined a set of symbols to classify warnings and a set for assistance operations.

SYMBOLS – WARNINGS

Danger for persons
Missing or incomplete observance of these prescriptions can cause serious danger for persons' safety.

Danger of serious damage for the vehicle
Partial or complete non observance of these prescriptions can cause serious damages to the vehicle and sometimes guarantee lapse too.

General danger
It includes the dangers of above described signals.

Environment protection
It indicates correct behaviour in order that vehicle use is environmentally friendly as much as possible.

NOTE It indicates an additional explanation for a piece of information.

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SYMBOLS – ASSISTANCE OPERATIONS

	Removal Disconnection
	Refitting Connection
	Removal Disassembly
	Fitting in place Assembly
	Tighten to torque
	Tighten to torque + angle value
	Press or caulk
	Regulation Adjustment
	Visual inspection Fitting position check
	Measurement Value to find Check
	Equipment
	Surface for machining Machine finish
	Interference Strained assembly
	Thickness Clearance
	Lubrication Damp Grease
	Sealant Adhesive
	Air bleeding
IVECO PARTS	Replacement Original spare parts
	Intake
	Exhaust
	Operation
ϱ	Compression ratio
	Tolerance Weight difference
	Rolling torque
	Rotation
	Angle Angular value
	Preload
	Number of revolutions
	Temperature
bar	Pressure
>	Oversized Higher than.... Maximum, peak
<	Undersized Less than.... Minimum
	Selection Classes Oversizing
	Temperature < 0 °C Cold Winter
	Temperature > 0 °C Hot Summer

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PRODUCT CODE

Each title or subtitle concerning operations being performed is preceded by a six–figure number named PRODUCT CODE. This number represents the **PRODUCT CODE** referred to by the repair operation contained in both REPAIR TIMES and TROUBLE CODE document.
As a quick reference there are shown below the guide lines to read this code (see Repair Timing, too).

Product Code:	5 0			7 6		
	PRODUCT	UNIT	SUB–ASSEMBLY COMPONENT	PRODUCT	UNIT	SUB–ASSEMBLY COMPONENT

The first and second figures identify the PRODUCT within motor vehicle.

Example :

Product	50	=	Vehicle chassis;
Product	52	=	Axles;
Product	53	=	Transmission;
Product	76	=	Electric ssystem.

Unit Code:		0 1			0 3	
	PRODUCT	UNIT	SUB–ASSEMBLY COMPONENT	PRODUCT	UNIT	SUB–ASSEMBLY COMPONENT

The third and fourth figures identify the UNIT within the PRODUCT.

Example :

Product	50	=	Vehicle chassis;
Unit	01	=	Chassis;
Unit	02	=	Bumpers;
Unit	03	=	Alternator.

Sub–assembly Code:			4 0			1 3
	PRODUCT	UNIT	SUB–ASSEMBLY COMPONENT	PRODUCT	UNIT	SUB–ASSEMBLY COMPONENT

The fifth and sixth figures exactly identify the SUB–ASSEMBLY and Component of a Unit within a PRODUCT.

Example :

Product	50	=	Vehicle chassis;
Unit	01	=	Chassis;
Sub–assembly	40	=	Chassis cross members;
Sub–assembly	13	=	Rotor.

GENERAL WARNINGS

Warnings shown cannot be representative of all danger situations possibly occurring. Therefore, it is suggested to contact immediate superiors where a danger situation occurs which is not described.

Use both specific and general–purpose toolings according to the prescriptions contained in respective use and maintenance handbooks. Check use state and suitability of tools not subjected to regular check.

The manual handling of loads must be assessed in advance because it also depends, besides weight, on its size and on the path.

Handling by mechanical means must be with hoisters proper as for weight as well as for shape and volume. Hoisters, ropes and hooks used must contain clear indications on maximum carrying capacity acceptable. The use of said means is compulsorily permitted to authorised personnel only. Stay duly clear of the load, and, anyhow, never under it.

In disassembling operations, always observe provided prescriptions; prevent mechanical parts being taken out from accidentally striking workshop personnel.

Workshop jobs performed in pairs must always be performed in maximum safety; avoid operations which could be dangerous for the co–operator because of lack of visibility or of his/her not correct position.

Keep personnel not authorised to operations clear of working area.

Learn operation and safety knowledge necessary relating to the vehicle prior to each intervention on it. Scrupulously observe all safety warnings on the vehicle. Apply suitable signals for the vehicles being repaired. Once the repair intervention has been completed, before starting up the vehicle, perform all checks indicated on paragraph "Controls care of user" of Use and Maintenance handbook.

In lack of visibility in operating from the vehicle, charge a person on the ground with assistance. Do not leave unmanned a vehicle in motion during repair interventions.

Keep the vehicle stationary by proper chocks.

In the case of an intervention on a vehicle lifted from the ground, check the vehicle to be quite steady on special support stands and, in the case of lifting by means of a lift, check manual/automatic safeties to be activated.

When it is necessary to perform an intervention on methane–fed vehicles, observe the indications contained inside the document, as well as all specific safety regulations provided.

Only remove radiator cap when the engine is cold by cautiously unscrewing it in order to let system residual pressure out.

Inflammable fuel and all inflammable fluids and liquids must be handled with care, according to what contained on harmful materials 12–point cards. Refuelling must be performed outdoors with the engine off, avoiding lit cigarettes, free flames or sparks in order to prevent sudden fires/bursts. Adequately store inflammable, corrosive and polluting fluids and liquids according to what provided by regulations in force. Compulsorily avoid to use food containers to store harmful liquids. Avoid to drill or bore pressurised containers, and throw cloths impregnated with inflammable substances into suitable containers.

Worn out, damaged or consumable parts must be replaced by Iveco original spares.

During workshop activity, always keep the work place clean; timely clear or clean floors from accidental liquid or oil spots. Electric sockets and electric equipment necessary to perform repair interventions must meet safety rules.

For every intervention on vehicle hydraulic, pneumatic, conditioning and AIR – BAG systems, scrupulously observe indications specified in relating manual sections.

GENERAL WARNINGS

Put on, where required by the intervention, garments and protections provided in accident prevention rules; contact with moving parts can cause serious injuries. Use suitable, preferably tight–fitted garments, and avoid to use jewels, scarves, etc.

Do not leave the engine in motion at workshop locations not provided with a pipe to scavenge exhaust gas outside.

Avoid to breathe fumes coming from heating or from paint welding because they can cause damages to health; operate outdoors or in suitably ventilated areas. Put on proper inspirator if paint powder is present.

Avoid contact with hot water or steam coming from the engine, radiator and pipings because they could cause serious burns. Avoid direct contact with liquids and fluids present in vehicle systems; where an accidental contact has occurred, refer to 12–point cards for provisions to make.

Clean units or assemblies detached from the vehicle and carefully check their integrity before overhaul. Tidy up detached or disassembled parts with their securing elements (screws, nuts, etc.) into special containers.

Check for the integrity of the parts which prevent screws from being unscrewed: broken washers, dowels, clips, etc. Self–locking nuts with an insert made of nylon must always be replaced.

Avoid contact of rubber parts with diesel oil, petrol or other not compatible substances.

Before washing under pressure mechanical parts, protect electric connectors, and central units, if present.

Tightening screws and nuts must always be according to prescriptions; IVECO commercial and assistance network is available to give all clarifications necessary to perform repair interventions not provided in this document.

Before welding:

- ❑ Disconnect all electronic central units, take power cable off battery positive terminal (connect it to chassis bonding) and detach connectors.
- ❑ Remove paint by using proper solvents or paint removers and clean relevant surfices with soap and water.
- ❑ Await about 15 minutes before welding.
- ❑ Equip with suitable fire resistant protections to protect hoses or other components where fluids or other materials flow which may catch fire easily on welding.

Should the vehicle be subjected to temperatures exceeding 80°C (dryer ovens), disassemble drive electronic central units.

The disposal of all liquids and fluids must be performed with full observance of specific rules in force.

GENERAL WARNINGS ON THE ELECTRIC SYSTEM

If an intervention has to be made on the electric/electronic system, disconnect batteries from the system; in this case, always disconnect, as a first one, the chassis bonding cable from batteries negative terminal.

Before connecting the batteries to the system, make sure that the system is well isolated.

Disconnect the external recharging apparatus from the public utility network before taking apparatus pins off battery terminals.

Do not cause sparks to be generated in checking if the circuit is energised.

Do not use a test lamp in checking circuit continuity, but only use proper control apparatuses.

Make sure that the electronic devices wiring harnesses (length, lead type, location, strapping, connection to screening braiding, bonding, etc.) comply with IVECO system and are carefully recovered after repair or maintenance interventions.

Measurements in drive electronic central units, plugged connections and electric connections to components can only be made on proper testing lines with special plugs and plug bushes. Never use improper means like wires, screwdrivers, clips and the like in order to avoid the danger of causing a short circuit, as well as of damaging plugged connections, which would later cause contact problems.

To start up the engine, do not use fast chargers. Start up must only be performed with either separate batteries or special truck.

A wrong polarisation of supply voltage in drive electronic central units (for instance, a wrong polarisation of batteries) can cause them to be destroyed.

Disconnect the batteries from the system during their recharging with an external apparatus.

On connecting, only screw up connector (temperature sensors, pressure sensors etc.) nuts at prescribed tightening torque.

Before disconnecting the junction connector from an electronic central unit, isolate the system.

Do not directly supply electronic central units servo components at nominal vehicle voltage.

Cables must be arranged such as to result to be parallel to reference plane, i.e. as close as possible to chassis/body structure.

Once the intervention on the electric system has been completed, recover connectors and wiring harnesses according to original arrangement.

Key memorisation procedures are influenced by electromagnetic jamming (mobile phones, etc.). Therefore, during key memorisation:

1 Pay attention that jamming sources are not present in the cab or near the keys.
2. Keys not insered in the panel must be at least 1 meter away.

NOTE Connectors present must be seen from cable side. Connectors views contained in the manual are representative of cable side.

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CONCEPT OF GROUND AND ELECTROMAGNETIC COMPATIBILITY

The electrical system is traditionally uni–polar. The body, the frame, the metal cases of the electromechanical components serve as equipotential return conductors to the generators, since any point in their metal structure or any non–insulated negative terminal is at the same reference potential, or GROUND. This is why the ground has been chosen as the reference term for the entire system and has been assigned, conventionally, the value of zero.

For obvious construction needs, the negative network of the system includes a number of grounding points situated on the vehicle as a function of the location of the components on the frame, the engine and the bodywork.

Ideally, all the units should be connected to a single grounding points so as to ensure that each of them, and in particular each of the electronic devices, has a clearly defined ground reference.

For the foregoing reasons, we should distinguish between the power ground, or system ground, characterised by high direct current intensity (> 1 A for the electromechanical components), and the analogue ground, characterised by wave shapes at given frequencies and very modest current intensity (mA, µA of the electronic systems).

The definition of the analogue ground (or signal ground) depends on the sensitivity of the electronic systems to EMC (electromagnetic compatibility), since eddy signals, which may be generated either by on–board or by extraneous systems, cause the malfunctioning and/or deterioration of the systems themselves.

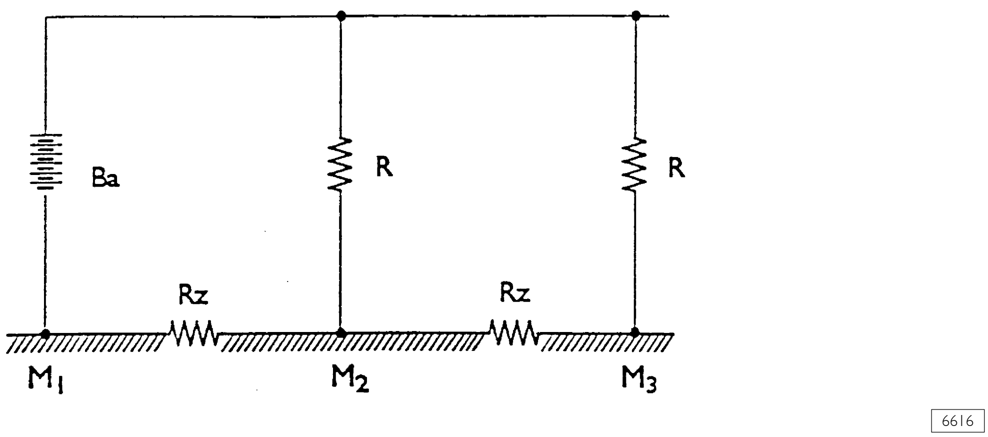
In order to minimise noise or interference, whether continuous or transient, generated by eddy radiation, it is essential to keep in mind that the efficiency of the system's reference plane or ground depends, at each connecting point, on excellent conductivity characteristics (contact resistance approaching zero).

To sum up, we can say that the ground, understood as equipotential electrical conductor, or as potential reference term for all on–board electrical/electronic components, is subdivided into system ground and analogue ground.

The system's grounding points are established by the Manufacturer and must obviously be free of paint, oxidation, grease, dust, etc.

The system's grounding points are established by the Manufacturer and must obviously be free of paint, oxidation, grease, dust, etc.

Figure 1



IDEAL EQUIPOTENTIAL GROUND NETWORK
Ba. Battery – R. Loads – Rz Frame impedance – M. Ground

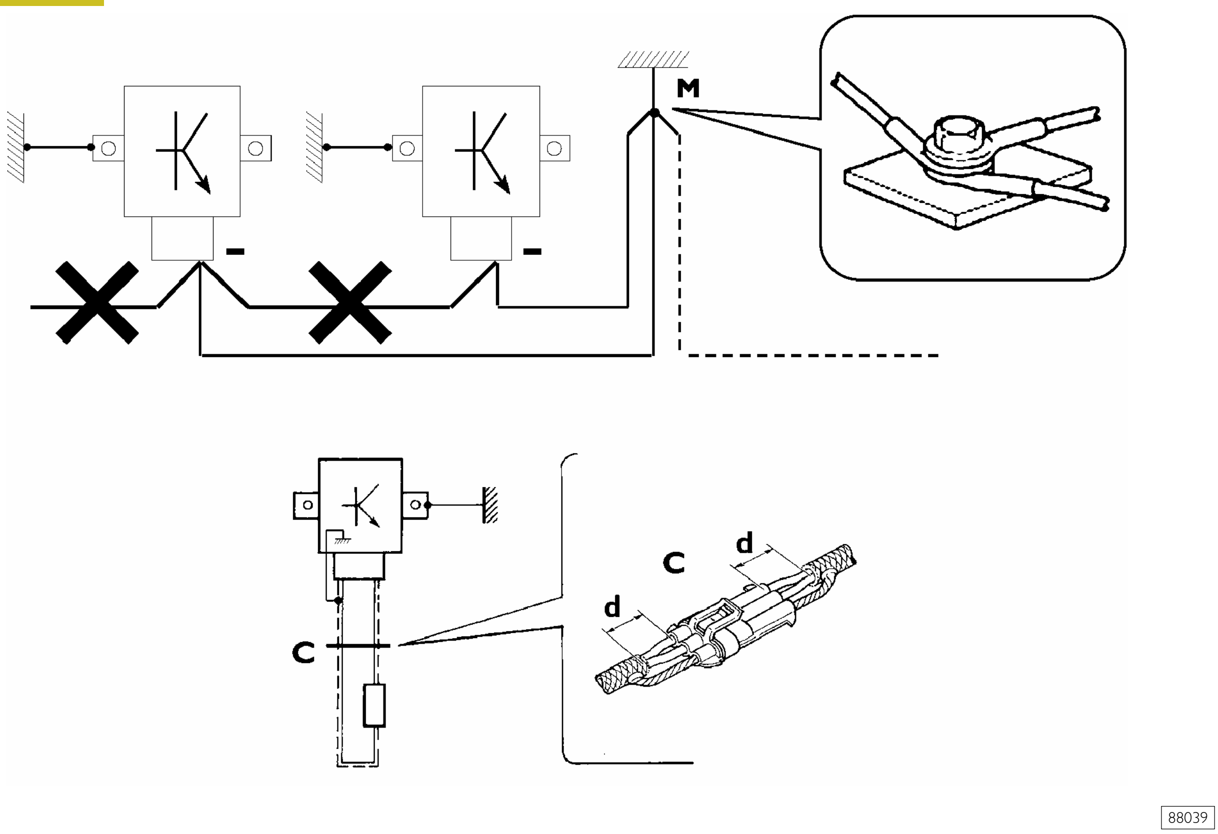
Practical tips

The negative leads connected to a system grounding point must be as short as possible and connected to one another in "star" configuration; make sure that they are tightened in an orderly and adequate manner (Figure 2, ref. M).

Furthermore, for electronic components, the instructions to be followed very carefully are:

- ECU's must be connected to the system ground if they are provided with a case.
- ECU negative cables must be connected both to a system grounding point, such as for instance the dash compartment ground (with no "serial" or "chain" connections) and to the negative terminal(s) of the battery/batteries.
- Even though they are not connected to the system ground/battery negative terminals, analogue ground elements (sensors) must have excellent insulation. As a result, special care must be devoted to the eddy resistances of the cable terminals: oxidation, seam–folding defects, etc.
- The metal braid of shielded circuits must be in electrical contact at either end with system components.
- Only one end of the shielding braid must be connected to the system ground.
- In the presence of jointing connectors, the non–shielded portion, **d**, must be as short as possible in the proximity of the connectors (Figure 2).
- The cables must be arranged so as to run parallel to the reference plane, i.e., as close as possible to the frame/body structure.
- Additional electromechanical systems must be connected with the greatest care to the system ground and must not be placed alongside the cables of electronic components.

Figure 2



SHIELDING BY MEANS OF A METAL BRAID OF A CABLE LEADING TO AN ELECTRONIC COMPONENT
C. Connector – d. Distance → 0.

CAN LINE

The term CAN stands for Controller Area Network. It is a dedicated cable linking together the (ECU)'s of a vehicle so as to create a structure resembling the nervous system.

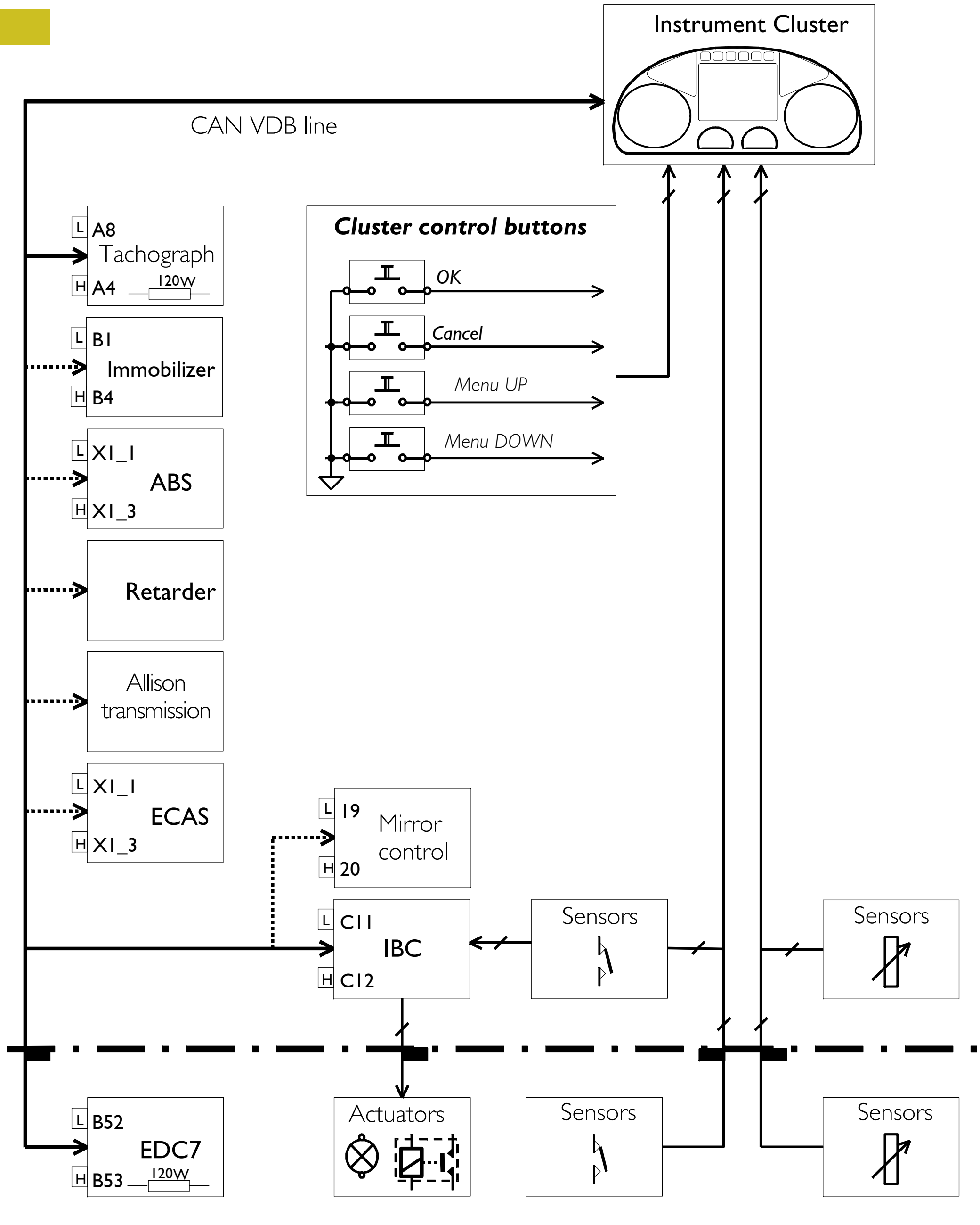
This system makes it possible to exchange large quantities of data between the various on–board electronic systems instantaneously.

It represents a TWO–DIRECTIONAL communication mode which is gaining ground in the automotive field, thanks to the reduction in the number of conductors and reduced noise.

The data travel in keeping with a protocol that defines the communication mode:

- Data synchronisation
- Call and reply modes between the various systems
- Identification and correction of possible transmission errors

Figure 3



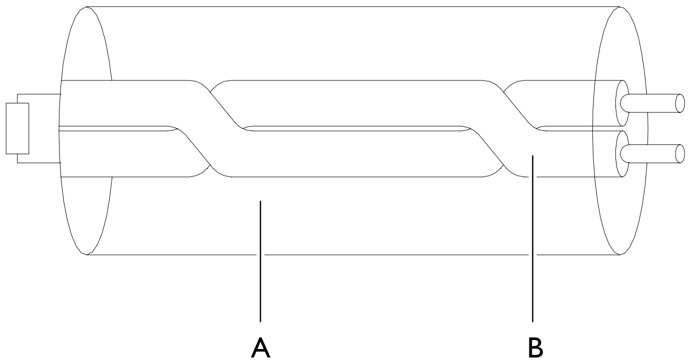
Efficiency tests on the CAN line

The cable used for the CAN line available on the vehicle is of the twisted type.

This ensures that no electrical noise affects signals.

Grey is the colour of the sheath.

Figure 4



A. Sheath (gray) – B. Twisted wires (white/green)

Efficiency tests on the CAN line

In order to check the perfect working order of the CAN line available on the vehicle, a few measurements must be made.

To make these measurements, it is necessary to connect to 30–pole diagnosis connector pins 22 and 21, and measure the following:

Values to be gathered during measurements (VDB)

0 Ω	~ 60 Ω	~ 120 Ω	0.L.
CAN line short–circuited	CAN line OK	One resistor shut off	CAN line shut off

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DESCRIPTION OF BASIC SYSTEM
ELECTRICAL CHARACTERISTICS

1. Unipolar system with negative pole connected to frame ground

2. Rated power supply voltage of 24 V_{dc}, with two 12 V / 110 Ah batteries connected in series

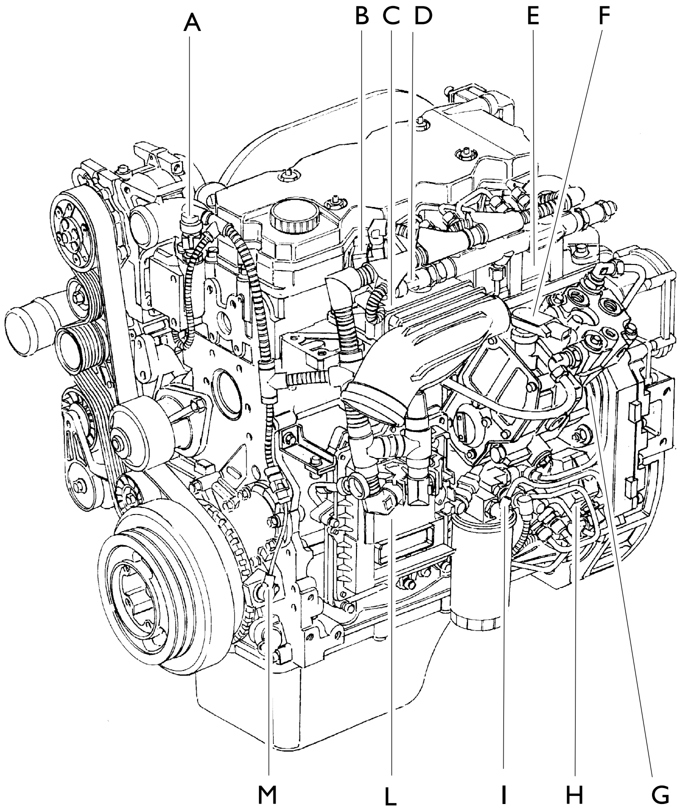
3. Power supply of electrical system and battery recharging with alternator 28V / 70A (BOSCH) (90A – OPT).

4. Starting by means of starter motor: 24V / 4.0 kW (BOSCH)

ENGINE COMPONENTS

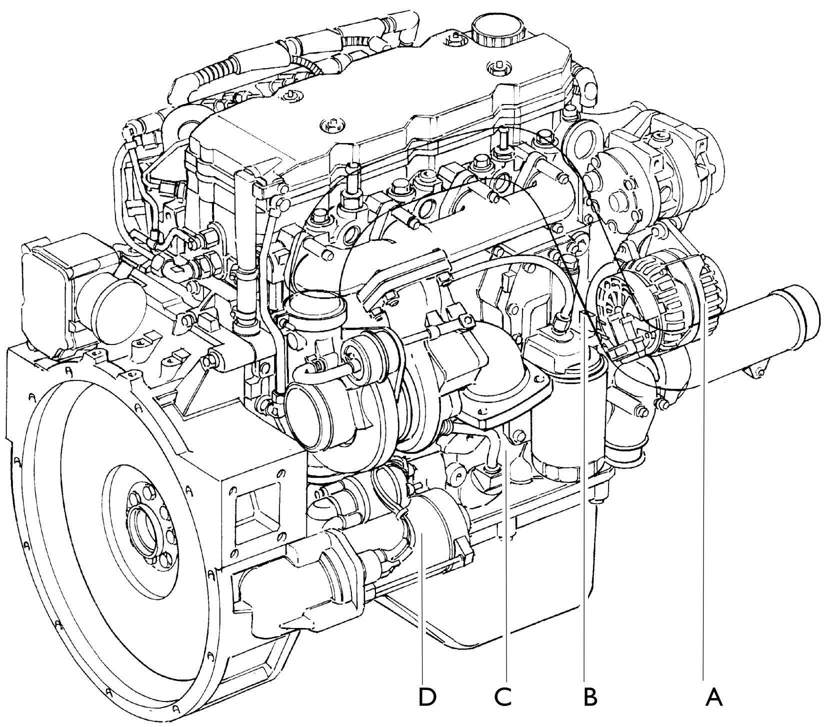
Engine F4AE0481

Figure 5



ENGINE VIEW LEFT SIDE
A. coolant temperature sensor – B. electrinic injection electro valve – C. engine preheat resistor – D. fuel pressure sensor – E. oversupply air temperature/fuel pressure sensor – F. hydraulic control low fluid level indicator – G. distribution pulse sensor – H. fuel pressure adjuster electro valve – I. fuel temperature sensor – L. edc 7 electronic center – M. engine rpm sensor

Figure 6



ENGINE VIEW EIGHT SIDE
A. Alternator – B. Oil temoerature/pressure sensor – C. Oil level transmitter – D. Starter motor

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POWER NETWORK

Positive network

Never disconnect the system batteries when the internal–combustion engine is running. Prior to connecting the batteries to the system, make sure that the latter is properly insulated. The batteries must be disconnected from the system when they are to be recharged.

The aim of the electric system is to generate, control, store and distribute the power necessary for vehicle component operation.

To this purpose, the electronic base system power supply is delivered by a generator (alternator 28V – 70A) and two batteries (12V, 110Ah each) connected in series.

A "positive pin" is located inside the cab, behind the dashboard (just next to the bulkhead). A 16 mm^2 cable from the battery is connected to this pin. Here, the following inputs are available:

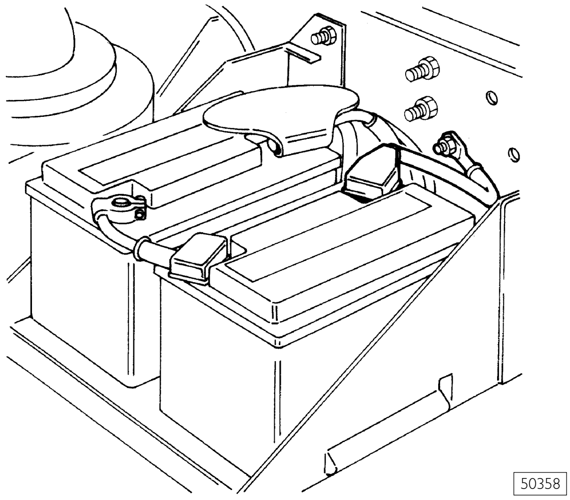
- Control unit interconnecting connector G and terminal A – 10 mm^2
- Starting switch (+30 / 4 mm^2)
- Fuse holder 70000/1, fuse 1–4 mm^2
- Fuse holder 70000/2, fuse 1–4 mm^2

Power cable sections

- cable direct from the battery = 16 mm^2
- cable to the UCI = 10 mm^2
- cables to the fuses = 1/2,5/4mm^2
- alternator cable = 16 mm^2
- starting motor cable = 70 mm^2

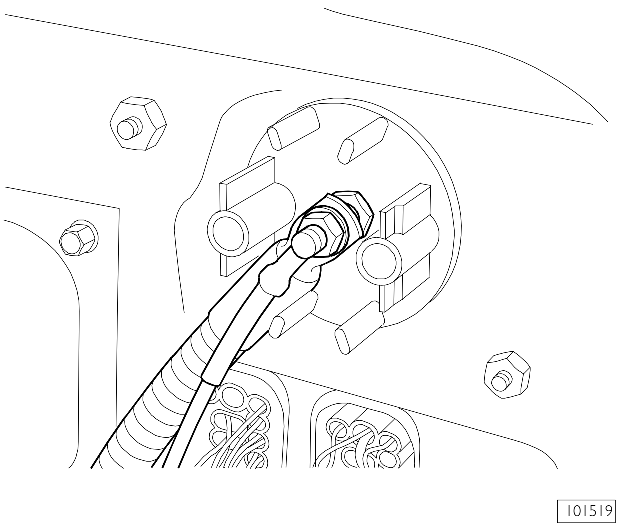
NOTE In case work has to be carried out on the vehicle's electric/electronic network, it is recommended that the battery positive pole be disconnected.

Figure 7



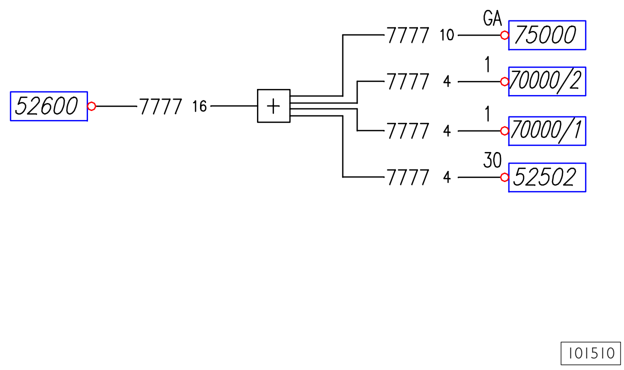
POWER SUPPLY BATTERIES

Figure 8



POSITIVE PIN (CAB INNER SIDE)

Figure 9



POSITIVE PIN ELECTRIC CONNECTIONS

Negative network

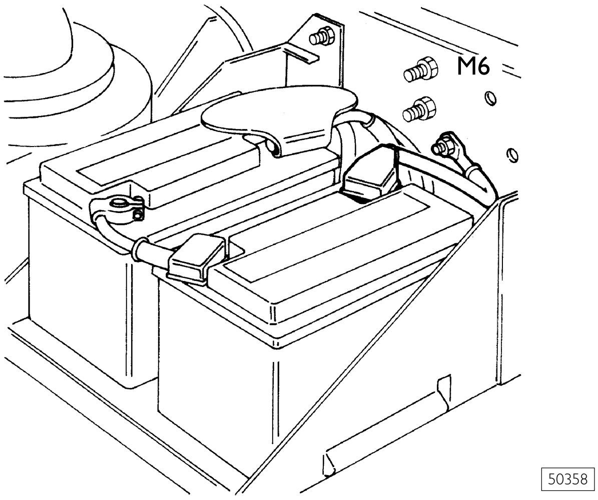
The batteries are connected to the chassis ground by means of a brown, 70 mm^2 cable, at earth point (M6) on the right side member.

The starting motor is connected to chassis ground (M8) by means of a 70 mm^2 cable fastened onto the right side member just next to the motor itself. The same cable is used to bond the complete internal–combustion engine assembly to the chassis ground.

The same electric, negative equipotentiality of the chassis is provided to the vehicle cab, by means of a stranded wire connected onto the cab front and onto the front right side member.

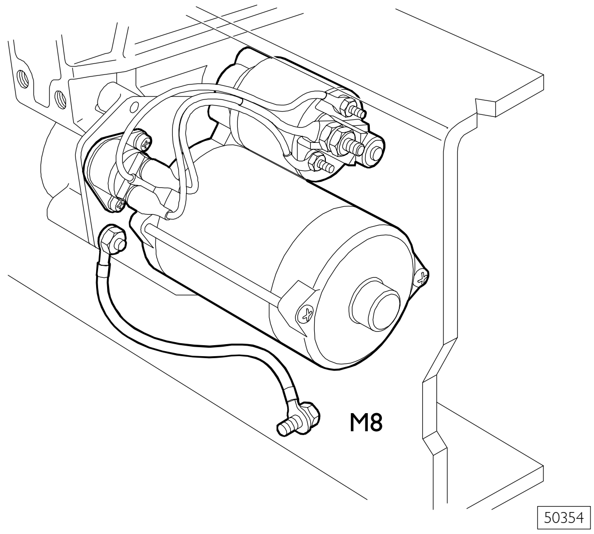
Inside the cab (behind the Body Controller) is an earth point marked "S" and called "SIGNAL EARTH". Here, the earths for the electronic control units located inside the cab and the 30–pole diagnosis connector earth are available.

Figure 10



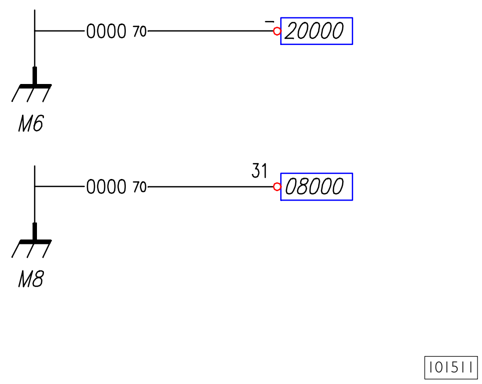
BATTERY GROUND POINT ON THE LEFT SIDE–MEMBER (M6)

Figure 11



STARTING MOTOR EARTH POINT

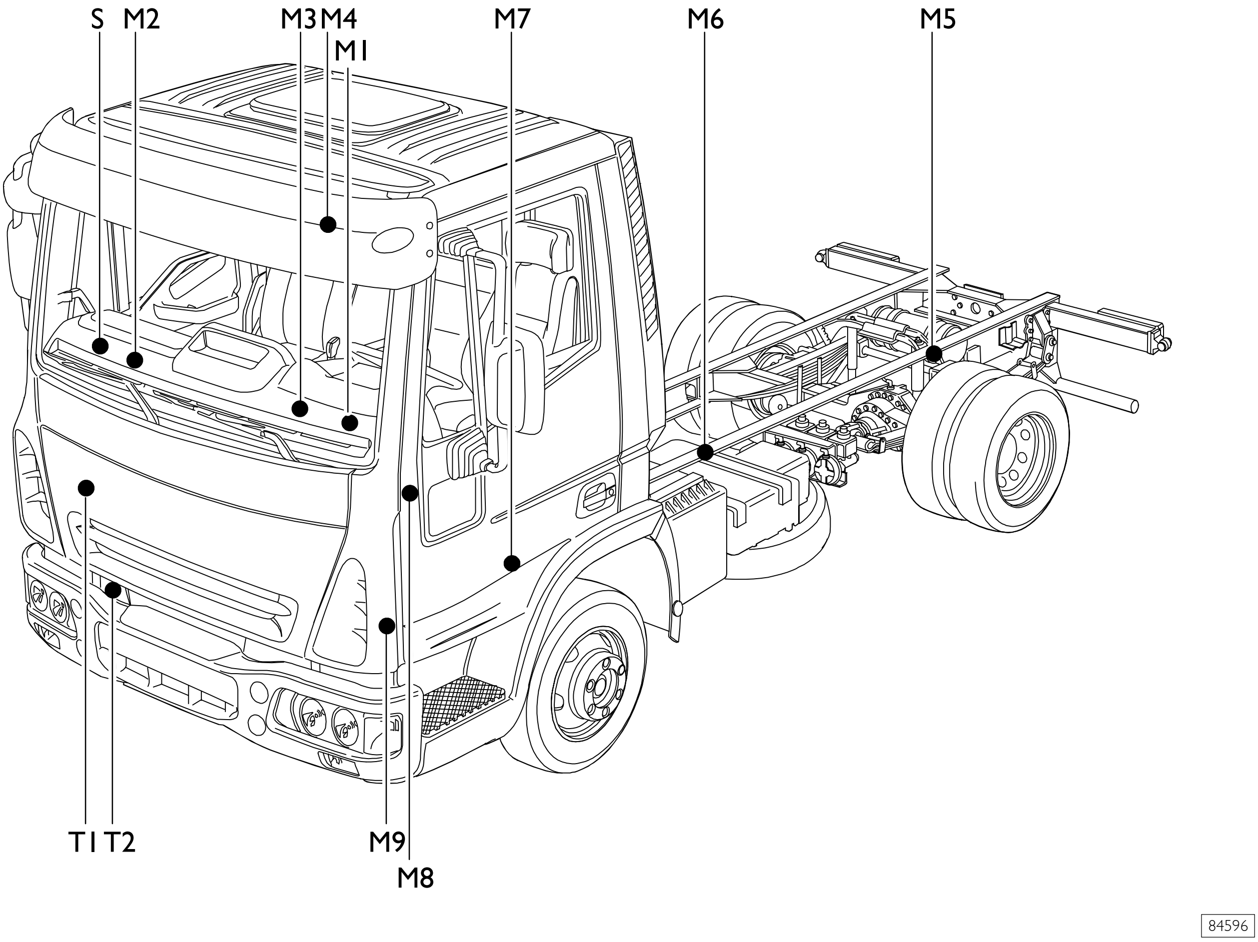
Figure 12



ELECTRIC CONNECTIONS M6, M8

Ground point identification

Figure 13



M1/M3. Left side cab internal ground – M2. Right side cab internal ground – M4. Roof panel ground – M5. Rear chassis ground – M6. Battery ground – M7. Front part left side–member ground – M8. Starting motor ground – M9. Front part left side–member ground – S. Cab interior ground (signal ground) – T1/T2. Negative electric unipotential plait

Earth points behind the Body Controller

The earth cable (*) from the BODY CONTROLLER is connected DIRECTLY to earth point M2.

Figure 14

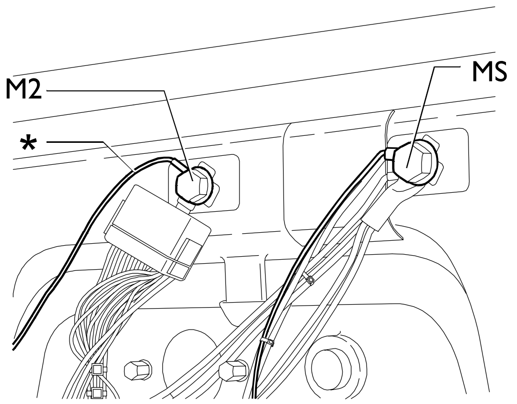


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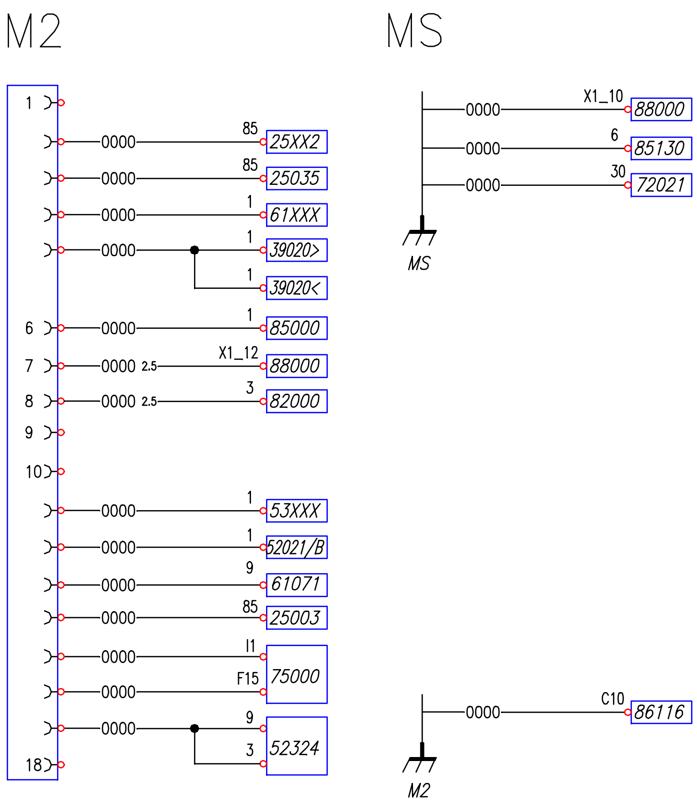
Figure 15



ELECTRIC CONNECTIONS M6, M8

101512

Earth point	Description
M2	Body builder light remote–control switch. Power supply (+15) remote–control switches for diagnosis connector. Roof panel cable earth. Slow gear engagement switch. ABS resistor. Switch on the right–hand pillar. Ash–tray compartment lighting. Interconnecting control unit (I) (F). Body builder connector. Fog light remote–control switch. ABS control unit (I). Exhaust brake switch. Electric heater.
*	Body Controller
S	30–pole diagnosis connector. Immobilizer. ABS (I)

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Roof panel ground point

Figure 16

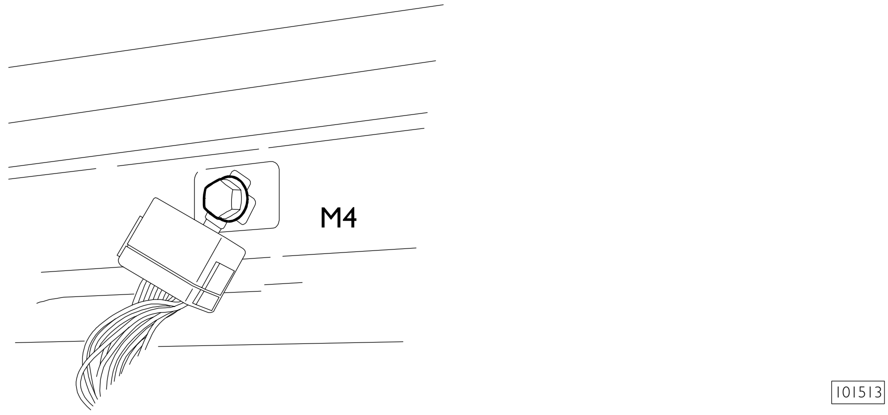
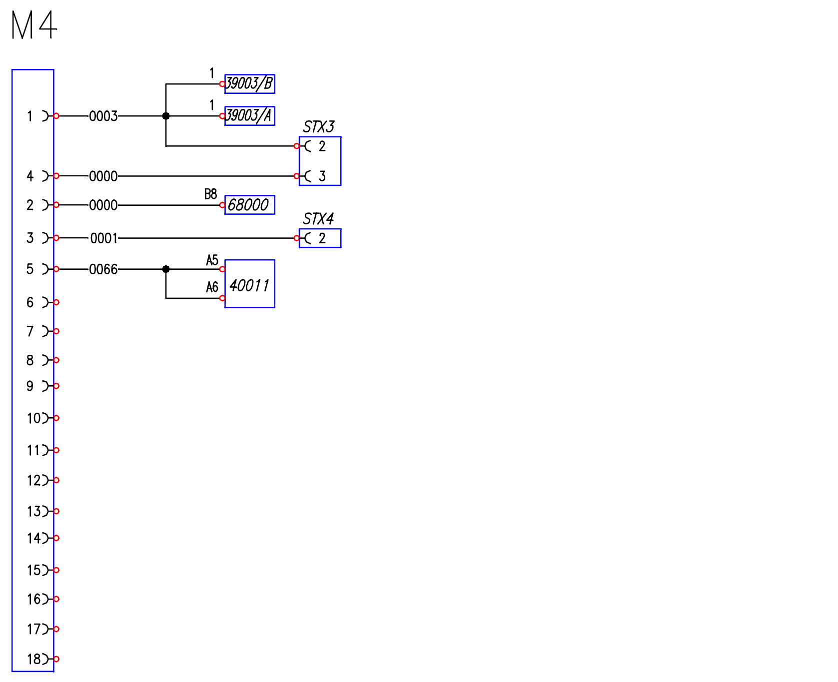


Figure 17



ELECTRIC CONNECTIONS M4

Ground point	Description
M4	Tachograph, step lighting ceiling light, car radio, internal lighting ceiling light, voltage reducer, CB.

Earth points behind the Cluster

Figure 18

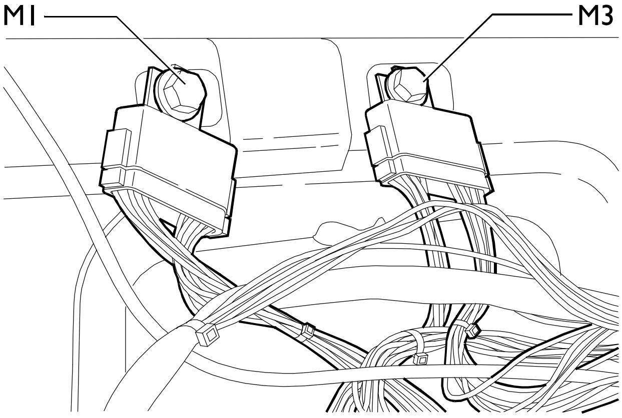
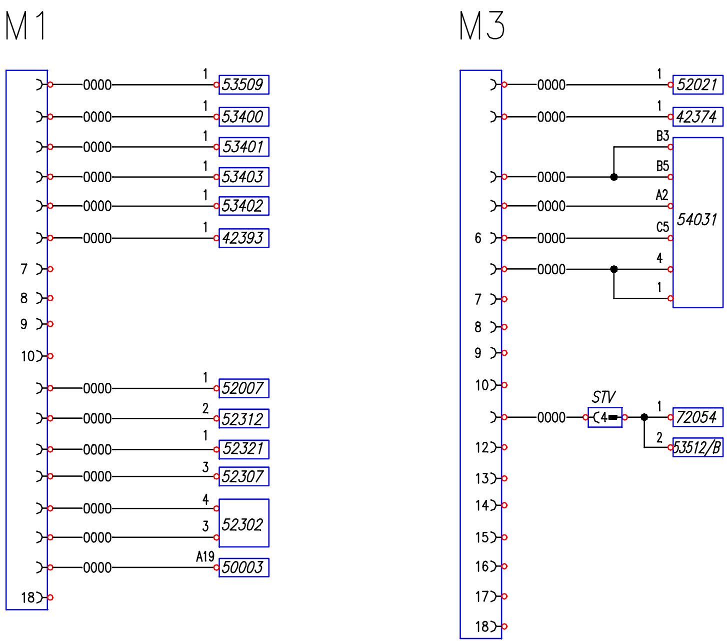


Figure 19



ELECTRIC CONNECTIONS M1, M3

101515

Earth point	Description
M1	Internal ceiling light. "MENU UP" button. "MENU DOWN" button. "MENU G" button. "MENU OK" button. Rear fog light switch. Headlamp trim control. Fog light switch. Internal light switch. Emergency light switch. Cluster (A19).
M3	Switch on the left–side pillar. Floor cable earth. Steering column stalk (B)/(A)/(C). Cruise Control (control). Clutch ON signalling switch.

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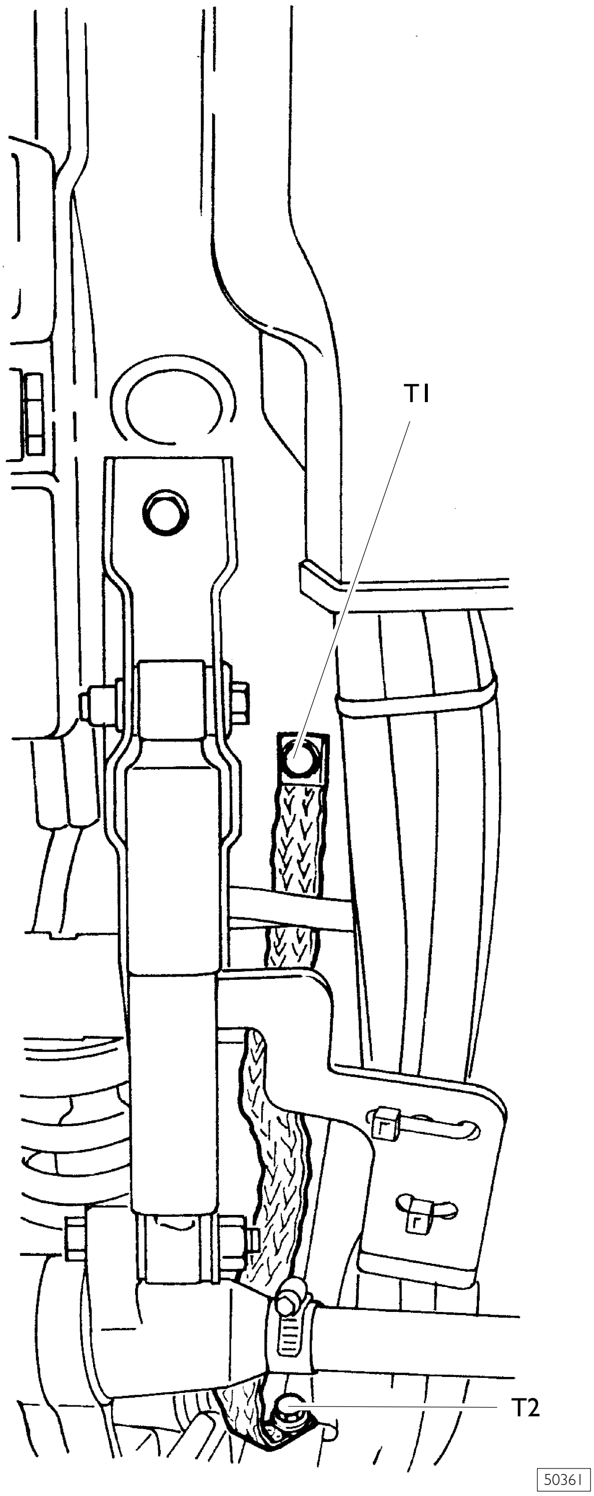
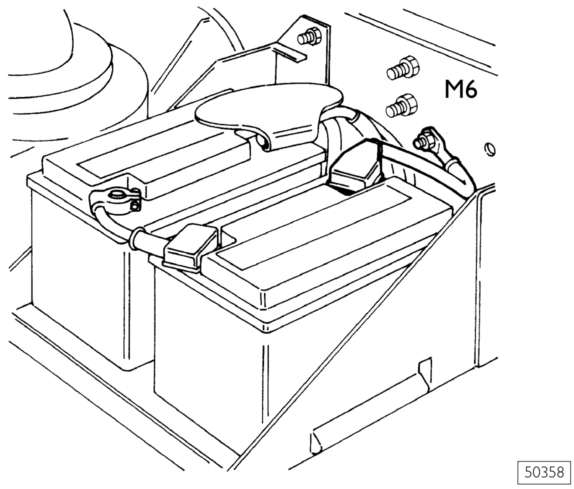
Figure 20



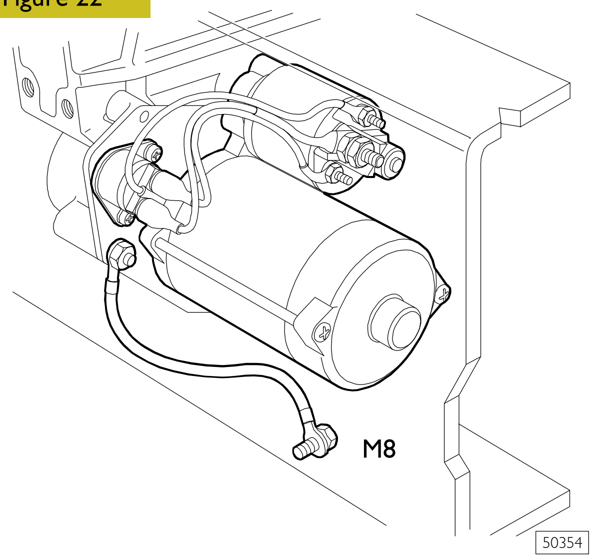
EQUIPOTENTIALITY STRANDED WIRE

Figure 21



BATTERY EARTH POINT ON RIGHT SIDE MEMBER (M6)

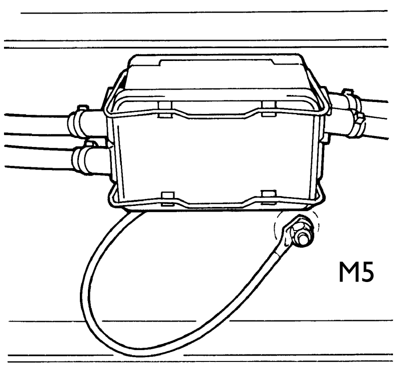
Figure 22



STARTING MOTOR EARTH POINT (M8)

Rear left side–member ground point (M5)

Figure 23

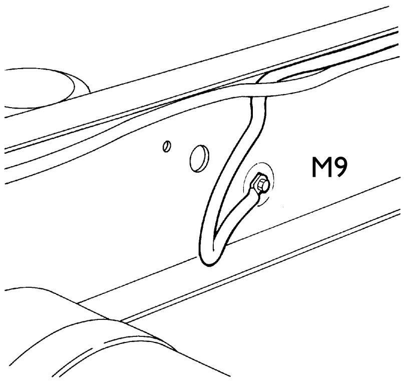


50362

Earth point	Description
M5	Rear lights ground

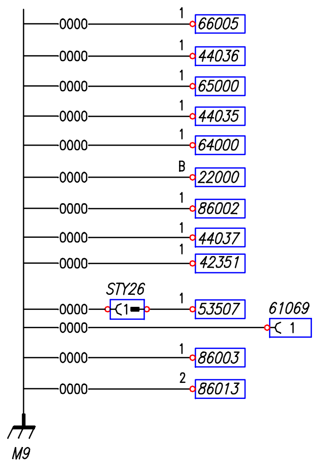
Front left side–member ground point (M9)

Figure 24



50360

Figure 25



ELECTRIC CONNECTIONS M9

101516

Earth point	Description
M9	Headlamp washer pump, windscreen wiper unit, windscreen washer electric pump, radiator water low level sensor, windscreen washer fluid low level sensor, power steering fluid low level sensor, air filter clogging sensor, geared–down speed ON switch, sensor for signalling the presence of water in the fuel filter, front and rear wheel shoe wear sensor, horn, body–builder connector

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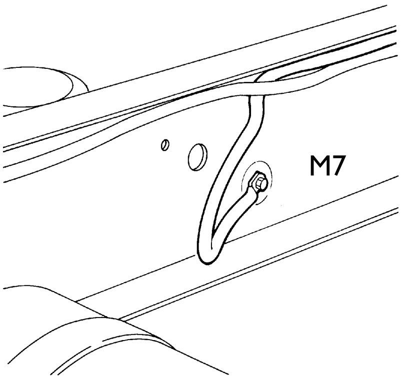
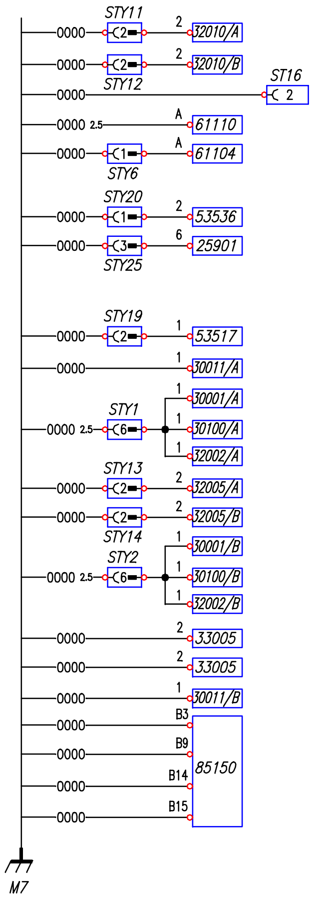
Front left side–member ground point (M7)

Figure 26



50360

Figure 27

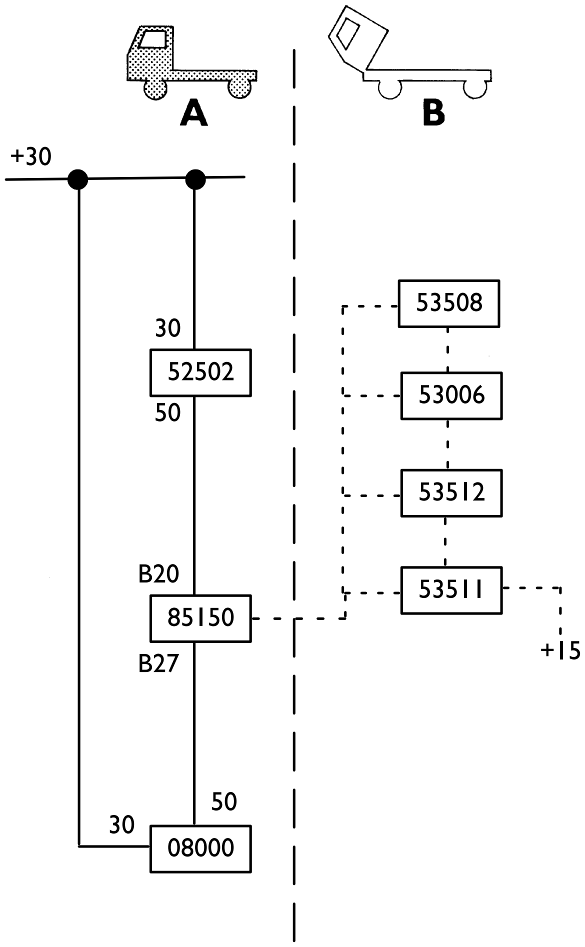


101517

ELECTRIC CONNECTIONS M7

Earth point	Description
M7	EDC control unit, fog headlamps, side indicator lamp (right/left), front indicator lamp (right/left), front clearance lamp (right/left), low/high–beam headlamp (right/left), headlamp trim corrector actuator, transverse lock switch ON, TGC, power take–off ON switch, rotary lamp, brake air drier resistor, diesel fuel pre–filter heating resistor

Figure 28



52502 Key switch
85150 EDC 7 control unit
08000 Starting motor
25224 Switch for start lock with gears engaged
53006 Button for engine start from engine compartment
53512 Switch for start lock with handbrake OFF
53511 Cab unhooked signalling switch

STARTING
General remarks

Prior to acting on the vehicle, place the wedge to prevent the vehicle from moving accidentally.
Prior to tilting the cab, make sure that the space in front of the vehicle is enough.
Starting from the engine compartment must only be performed when the cab is firmly secured to its maximum opening position, with the parking lever ON and the gear lever in neutral.

Starting from the driver's seat (Cab hooked)

Starting from the driver's seat (synoptic in the figure – unbroken line) is performed by setting key switch 52502 to position 50.

Thus, positive voltage is supplied to EDC7 85150 electronic control unit pin B20.

The same control unit controls, by means of pin B27, the starting motor supply remote–control switch.

The EDC7 control unit, programmed with the new software during the starting phase, checks whether the gear lever is put in neutral; therefore, if the gear turns out to be engaged, it will not allow starting to be enabled.

If the clutch pedal is pressed, the above control will be inhibited.

Starting from the engine compartment (Cab tilted)

> ⚠ To tilt the cab, it is always required that the parking brake is actuated; make sure that the gear lever is put in neutral, and the grill is fully open.

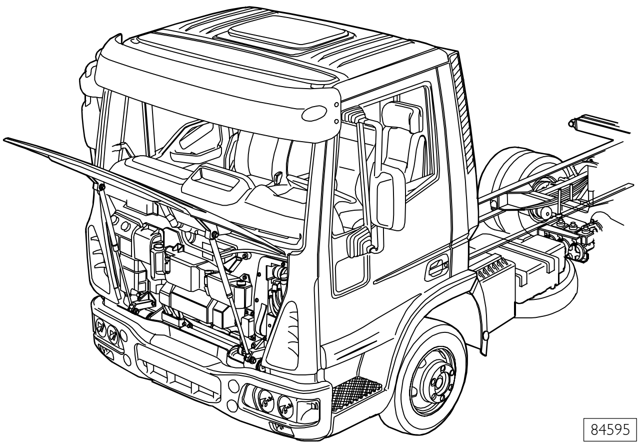
To tilt the cab, the following operations shall be performed:

- ❑ turn the knob clockwise until it stops; (by means of the lever available)
- ❑ insert the available lever into the hand pump;
- ❑ act on the pump actuating lever.

Starting from the engine compartment can only be performed if the following conditions exist:

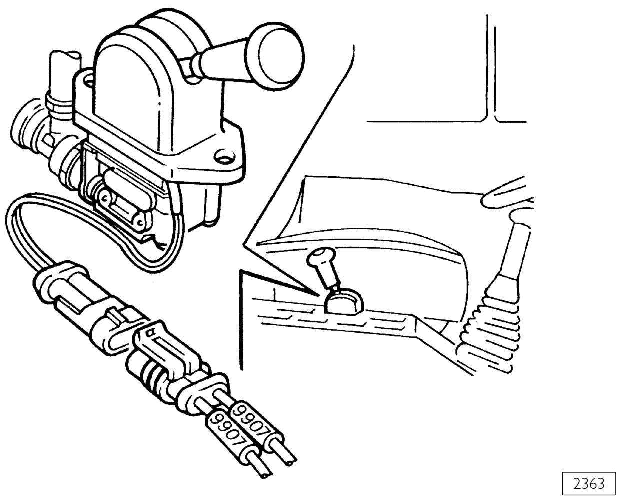
- ❑ the switch for start lock with the handbrake OFF 53512 is closed, i.e. with the handbrake ON;
- ❑ the switch for start lock with the gears engaged and reversing light lighting 53508 is closed, i.e. with the gear lever in neutral;
- ❑ the switch for signalling the unhooked cab 53511 with the cab tilted is closed towards the ground;
- ❑ key switch set to running position (+15).

Figure 29



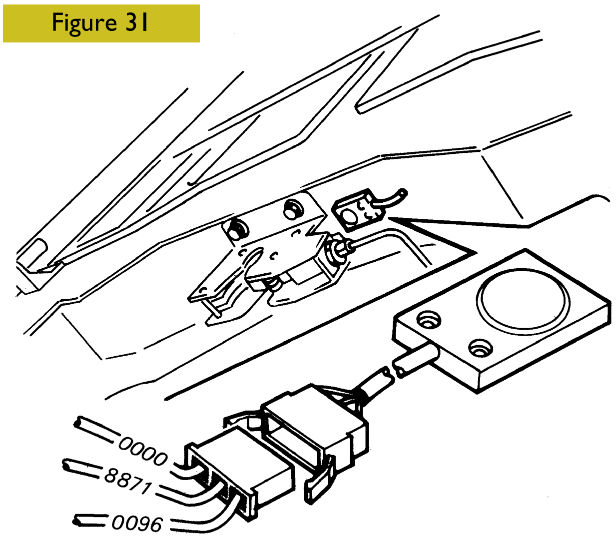
POSITION OF THE GRILL FOR CAB TILTING

Figure 30



SWITCH FOR START LOCK WITH THE HANDBRAKE OFF (53512)

Figure 31

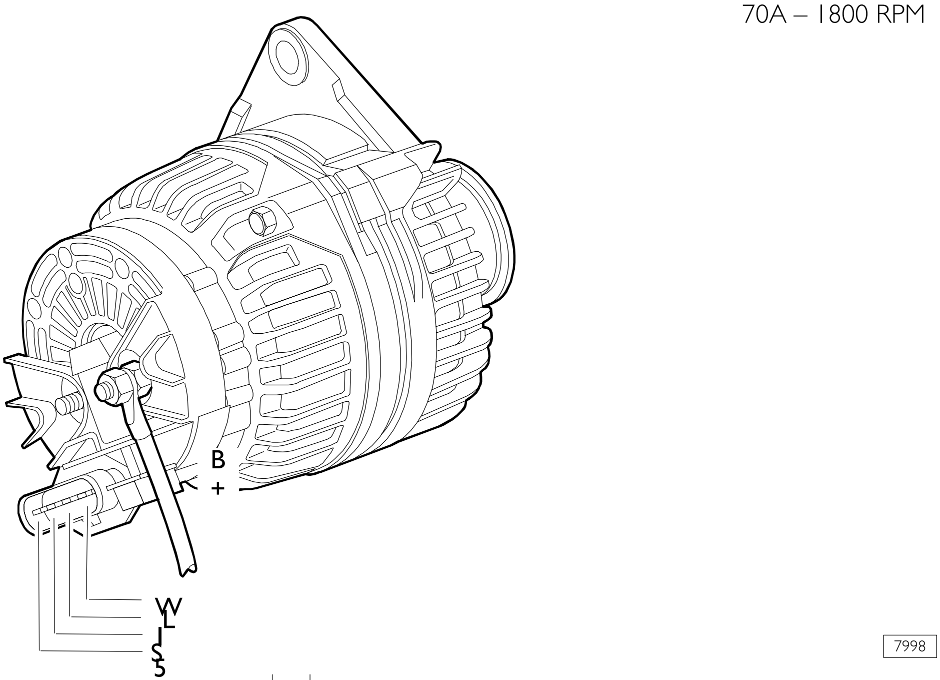


SWITCH FOR SIGNALLING THE UNHOOKED CAB (53511)

ALTERNATOR

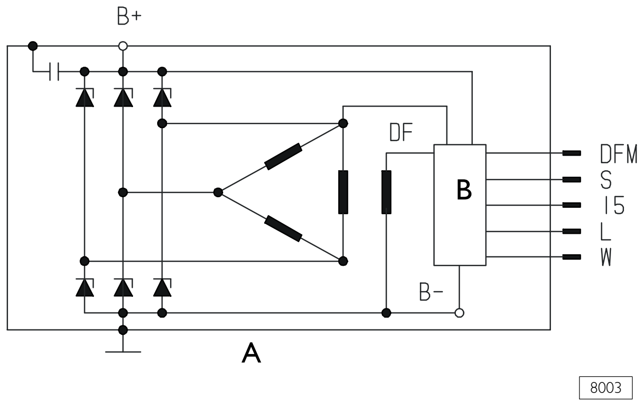
Supplier	BOSCH
Rated voltage	28V
Current	70A – 1800 RPM

Figure 32



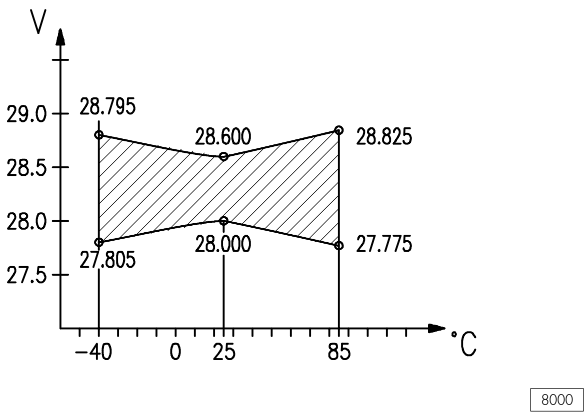
TECHNICAL VIEW

Figure 33



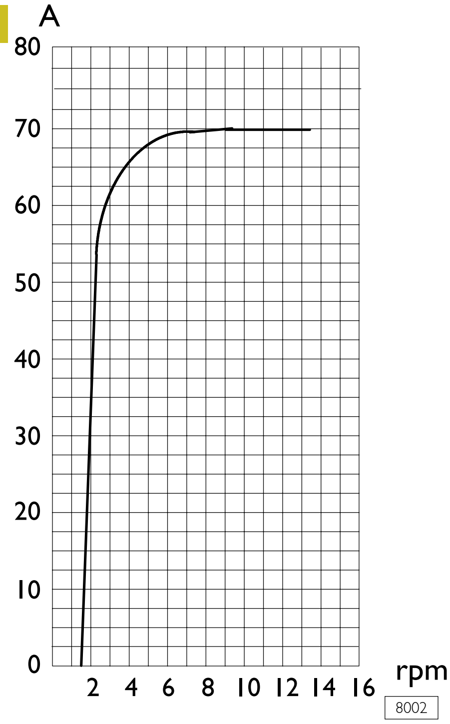
WIRING DIAGRAM
A. Alternator B. Voltage regulator

Figure 34



VOLTAGE REGULATOR TEMPERATURE CHARACTERISTICS (6000 RPM)

Figure 35



ALTERNATOR CURRENT DELIVERY CURVE

Characteristics

Rated voltage	28 V
Rated power	70 A
Current at environment temperature	1800 RPM/35 A
At 25 °C and rated voltage	6000 RPM/70 A
Direction of rotation	clockwise, seen from pulley
Weight	6.4 kg

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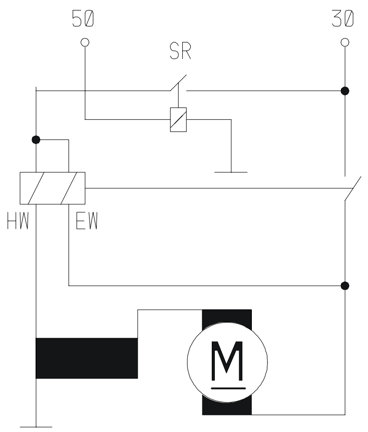
STARTER MOTOR

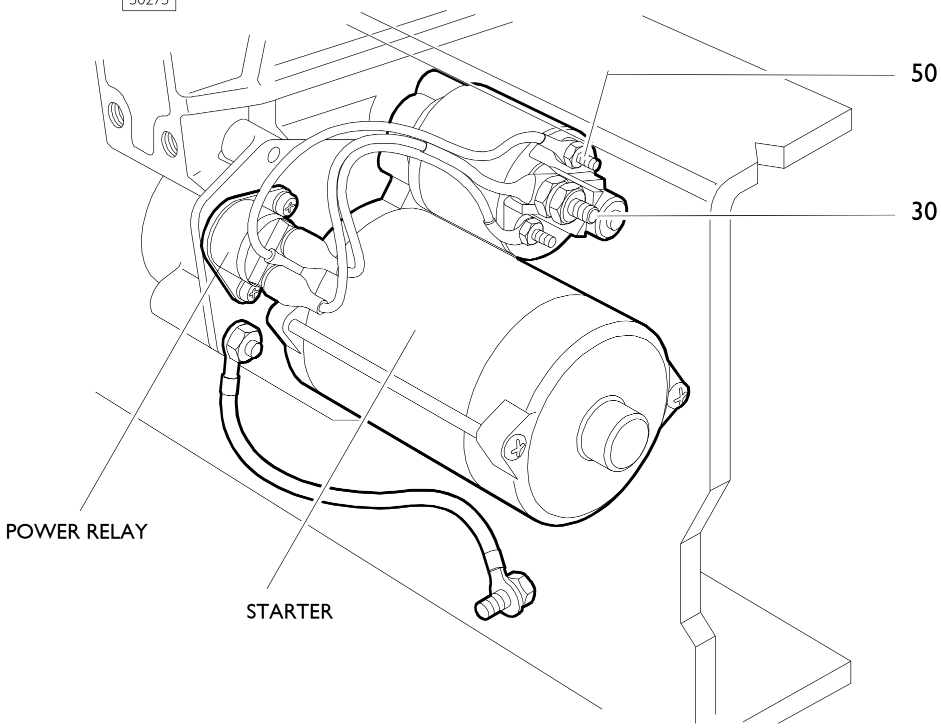
Supplier	BOSCH
Rated voltage	24V
Rated power	4kw

Figure 36



50275

WIRING DIAGRAM



50354

Starting

EDC7 system features a peculiar characteristic that distinguish it from previous electronic injection systems.
ECU can control engine starting function.
When turning key 52502 to starting position 50, positive voltage is provided to EDC7 PIN 20.

EDC7 PIN 37 controls a power relay providing power to starter remote switch coil thus enabling, through terminal 30, the positive voltage required for its operation. In case of SR remote switch coil cut–off or wiring cutoff to terminal 50, the vehicle cannot be started since EDC control unit detects on pin 37, the presence of remote switch coil resistance.

The vehicle cannot be started even if disconnecting terminal 50 and connecting it directly to +24V, for the above mentioned reason (SR remote switch resistance not recognised).

COMPONENT CODE

03000	Self–rectifying alternator with built–in voltage regulator
08000	Starter motor
12011	Motor, lh door closing
12012	Compressor, air–conditioning system
12010	Motor, rh door closing
12019	Motor,cab tilting
19005	Thermostarter
20000	Starting battery
22000	Horn
25003	Relay, fog lights
25007	Relay for switching on reversing lights
25013	Relay for switching off low beam lights with high beams on
25035	Relay for switching on external lights
25104	Relay for switching off retarder and/or exhaust brake with ABS on
25202	Relay, G.C.R. energizing
25207	Relay, alternator D+ earthing
25213	Relay for supply of users connected to ignition switch through battery positive
25222	Relay for allowing connection of thermal starter
25307	Relay for air–conditioning compressor
25348	Remote–control switch for auxiliary heater cut–out with power take–off ON
25546	Remote–control switch for ECAS control from the box (power supply)
25547	Remote–control switch for ECAS control from the box (ground)
25548	Remote–control switch for ECAS control from the box (clock)
25549	Remote–control switch for ECAS control from the box (date)
25551	Remote–control switch for loading gate warning light actuation
25704	Relay for switching NC/NO signal for third steering axle
25709	Relay for switching off Allison diagnostics with Iveco diagnostics on
25805	Relay, horns
25810	Relay, fuel heating circuit
25813	Relay, heated rearview mirrors
25818	Relay, heated windshield
25847	Relay for cab tilting motor
25893	Relay for connection of total power takeoff
25900	General Current Relay
25xx1	Remote–control switch for headlamp washer or windscreen wiper enable
25xx2	Actuating remote–control switch (+15) from the diagnosis connector
25xx3	Remote–control switch for TGC actuation with auxiliary heater
25xx4	Remote–control switch for Telma decelerator warning light control
25xx5	Remote–control switch for Telma decelerator signalling for EDC
30001	High/low beam headlight with parking light
30011	Fog headlight
30100	Headlight alignment unit actuator
32002	Front turn signal light
32005	Front marker light
32010	Rotary beacon

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33006	Right direction indicator
34000	Rear headlight cluster
35000	Number plate light
37002	Rear marker light
39000	Cab interior ceiling lamp
39003	Inspection lamp with rechargeable battery
39020	Cigar lighter light
39027	Bunk ceiling spotlight
39xx1	Glove compartment light
40011	Electronic tachograph
40032	Tachometer/tachograph sender unit
40047	Inductive type chassis height sensor (front axle)
42031	Sender unit, front brake air pressure gauge
42032	Sender unit, rear brake air pressure gauge
42200	Switch, air suspension failure signal
42351	Switch, air cleaner restriction
42379	Switch for allowing connection of transmission power take–off
42393	Speed limiter control switch
42608	Coolant pressure signalling 3–switch assembly
44031	Sender unit, fuel level indicator with w/lamp contact
44032	Engine oil indicator control
44035	Windshield fluid level indicator control
44036	Radiator waterlevel indicator control
44037	Power steering fluid level indicator control
44039	Rear brake fluid level indicator control
47033	Sender unit, thermometer, external temperature
47041	Water temperature sender for retarder control unit
48037	Automatic transmission input rpm sensor
48040	Automatic transmission output rpm sensor
50003	Electronic dashboard with microprocessor for instrument and warning light displaying
52007	Switch with built–in w/lamp, rear fog light
52019	Switch, power take–off
52021	Switch, interior lighting
52035	Switch with built–in w/lamp, rotary beacons
52306	Switch with built–in w/lamp, heated windshield
52048	Switch for retarder cutoff (from brake pedal)
52075	Switch for opening General Current Relay
52219	Loading gate actuation enable switch
52302	Switch with built–in w/lamp, hazard lights
52307	Switch, exterior lighting
52312	Switch, headlight alignment control
52321	Switch with built–in w/lamp for fog lights and rear fog lights enablement
52324	Switch, exhaust brake prearrangement
52502	Ignition key switch, starting–interlocked services
52522	Lever switch for engaging electric retarder
52600	General Current Relay

53003	Switch, windshield washer unit
53006	Switch, starting from engine compartment
53007	Switch, engine stopping from engine compartment
53008	Switch for closing General Current Relay
53040	Switch for assisted cab tilting system
53300	Switch, power window on driver's side
53302	Switch, power window on passenger's side
53306	Switch for sunroof motor
53309	Switch for 3rd axle raising system
53310	Switch for engaging transmission total power takeoff
53312	Switch box, Cruise Control device
53400	Switch for cluster menu control (up)
53401	Switch for cluster menu control (down)
53402	Switch for cluster menu control (c)
53403	Switch for cluster menu control (ok)
53507	Switch for signalling splitter gears engaged
53508	Switch for preventing engine starting with gear engaged and reversing light on
53511	Switch, cab unlatched signal
53512	Switch for preventing engine starting with parking brake off
53514	Limit switch, front brake system converter cylinder
53515	Limit switch, rear brake system converter cylinder
53517	Switch, cross differential lock signal
53521	Switch for signalling longitudinal differential lock
53536	Switch for signalling transmission power takeoff engaged
53541	Switch for allowing cab tilting with grille open
53592	Brake pedal switch for retarder
535xx	Telma pressure switch
53800	Switch, stop signal
53801	Switch, cross differential lock (Rockwell rear axles)
53xxx	Geared–down speed ON signalling switch
54031	5–function steering wheel switch
54033	6–function steering wheel switch
61000	1A 3–diode holder container (2 with common cathode)
61005	1A 1–diode holder container
61069	4–pole chassis connector for body builders (lights)
61070	5–pole chassis connector for body builders (EDC signals)
61071	20–pole cab connector for body builders
61101	Resistance, fuel heating
61104	Resistance, brake system air drier
61106	Resistance, heated windshield system
61108	Current limiting resistance, heated windshield system
61110	Resistance for prefilter heating and fuel settler
61129	Resistor holder container for retarder lever switch
61130	Resistor holder container for brake pedal pressure switch for retarder
64000	Windshield washer electric pump
65000	Windshield wiper unit
66005	Headlight washer pump
66010	Headlight washer unit timer

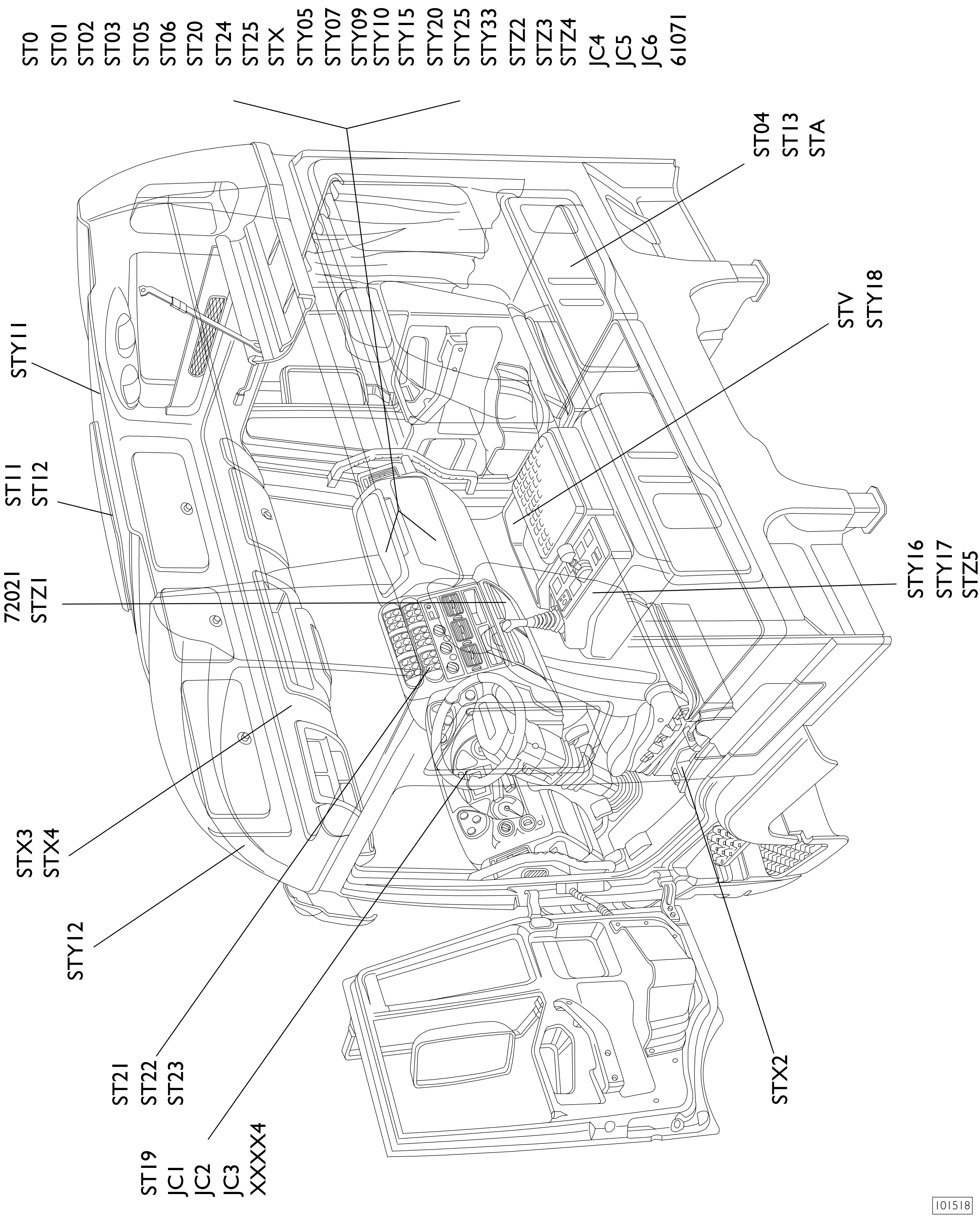
68001	Loudspeaker
68007	City Band
6xxxx	Resistor cluster for power take–off
70000	6–fuse holder
70xx1	Cab tilting fuse
72000	Standard 7–pole coupling for electrical connection to trailer
72001	Auxialiry 7–pole coupling for electrical connection to trailer
72006	7–pole coupling for ABS tractor/trailer electrical connection
72021	Ground diagnostic equipment 30–pole electrical coupling connector
72054	6A current outlet
75000	Central Interconnecting Unit
78052	ABS system solenoid valve
78054	Solenoid valve for engaging retarder
78055	Solenoid valve for retarder oil accumulator
78174	Solenoid valve for engaging normal gears
78175	Solenoid valve for engaging splitter gears
78208	Transmission total power take–off solenoid valve
78242	Front axle electropneumatic distributor
78243	Electropneumatic distributor
78245	Solenoid valve for switching off transmission total power take–off
7xxxx	Allison body builder connector
80000	Power window motor on driver's opposite side
80001	Power window motor on driver's side
82000	Windshield defroster unit
82005	Auxiliary air heater
84013	Ambient thermostat
84014	Auxiliary fuel pump
84017	Electronic timer
85000	Cigar lighter
85006	Electrically–adjusted heated rearview mirror (main)
85007	Electrically–adjusted heated rearview mirror (draw up)
85008	Electrically–adjusted heated rearview mirror (wide angle)
85010	Rearview mirror control
85031	Voltage dropper unit for current outlet (11 a max)
85036	Heated air–suspended seat (driver's side)
85038	Heated air–suspended seat (driver's opposite side)
85040	Sunroof motor with built–in switch
85100	Solenoid group, electric retarder
85130	Antitheft device control unit
85150	EDC control unit
85160	Chassis alignment control device
86002	Sensors, front brake shoe wear circuit
86003	Sensors, rear brake shoe wear circuit
86004	Electronic control unit, automatic transmission
86013	Sensor, water in fuel filter
86023	Vehicle raising/lowering control unit
86024	Electric retarder control unit
86029	Electronic control unit, centralized door closign system

860xx	Telma decelerator management control unit
86116	Multiplex body computer control unit
86127	Electronic control unit for DMI (data management interface)
88000	Electronic control unit, ABS system
88001	Sensor, ABS system
89000	Food heater
Xxxx5	Switch for loading gate operation warning light
Xxxx6	External box for loading gate control

JUNCTION CONNECTOR

Location of junction connectors – cab

Figure 37



The location of the connectors available (cab – chassis) may be changed due to wiring requirements.

List of connectors

Name	Description
61069	Body builder connector (cab)
XXXX4	Branching from the cluster for optional items
JC1	Ideograph power supply positive
JC2	Ideograph power supply positive
JC3	Cigar lighter power supply positive
JC4	Positive (+15/D+alternator) / ceiling light ground
JC5	Positive (+15/+30) / start lock signal
JC6	Positive (windscreen washer / +30)
ST0	Cruise Control cut–out signal
ST01	Power supply (+50)
ST02	ABS power supply
ST03	Power supply (+15)
ST04	Auxiliary heater remote–control switch power supply
ST05	Alternator excitation
ST06	Auxiliary heater remote–control switch power supply
ST11	Sunroof power supply
ST12	Sunroof power supply
ST13	Auxiliary heater ground
ST19	Geared–down speed ON signal
ST21	Engine stop signal
ST22	Speed limiter signal
ST23	Power supply (+30)
ST24	PTO1 ON signal
ST25	PTO1 ON signal
STA	Insulated ground for auxiliary heater
STV	Cab rear part / dashboard cable junction
STX	Dashboard cable / roof panel cable junction
STX2	Remote control (ECAS)
STX3	Ceiling light cable / roof panel cable junction
STX4	Radio power supply
STY05	Manual conditioner
STY07	Remote–control switch control / diesel fuel pre–heating signal
STY09	Central locking and loudspeaker (driver's side)
STY10	Central locking and loudspeaker (passenger's side)
STY11	Right rotary lamp power supply
STY12	Left rotary lamp power supply
STY15	Central locking arrangement
STY16	Heated mirror control (driver's side)
STY17	Heated mirror control (passenger's side)
STY18	Auxiliary heater control unit cable / cab cable junction
STY20	Power take–off
STY25	ADR
STY33	Body builders (optional DMI control unit)
STZ1	Diagnosis connector (CAN line)
STZ2	ECAS control unit (CAN line)
STZ3	Electric mirror control unit (CAN line)
STZ4	DMI control unit (option) (CAN line)
STZ5	Telma/Allison (CAN line)

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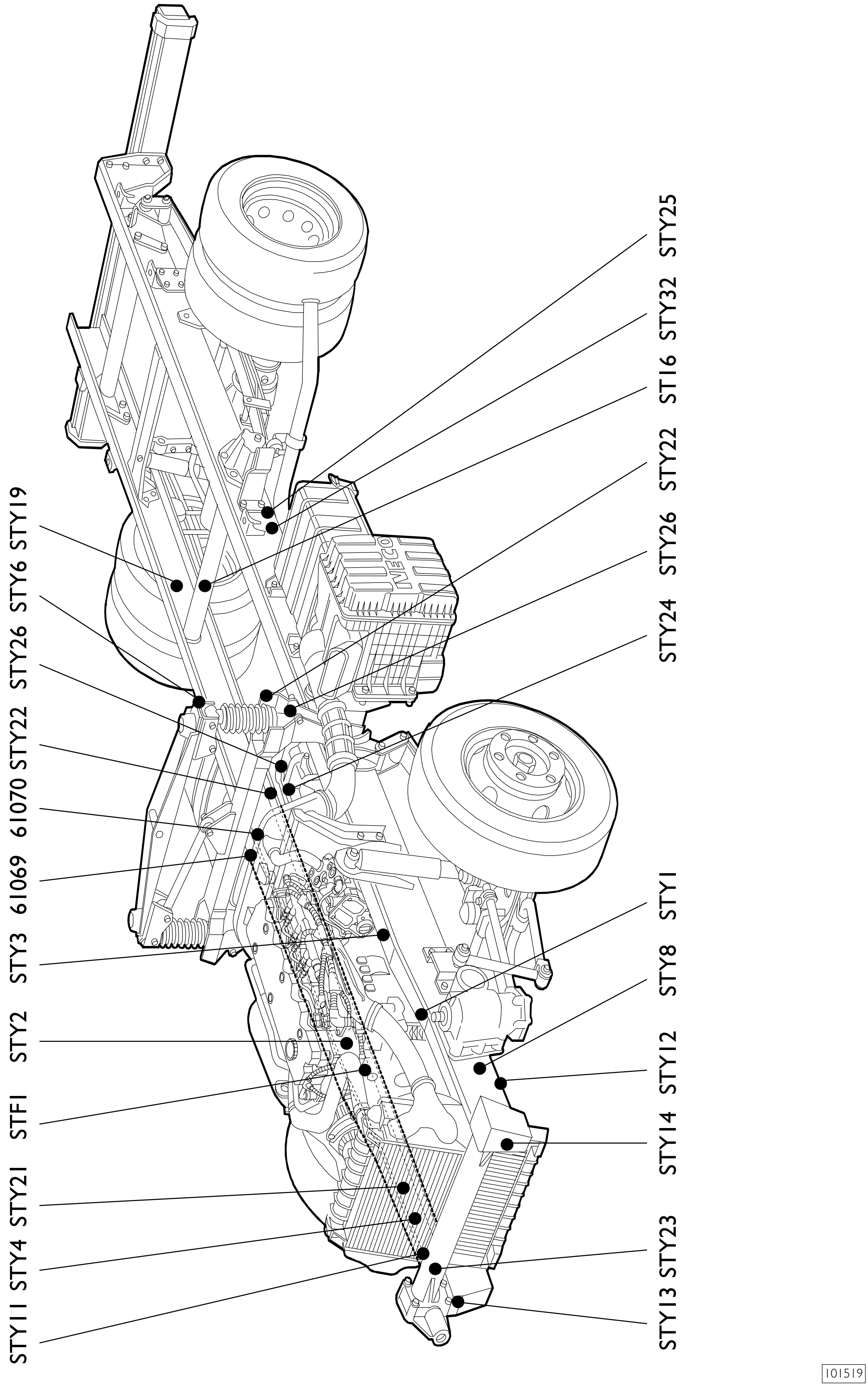
Location of junction connectors – chassis

Figure 38



List of connectors

Name	Description
61070	Connector for body builders (chassis) – EDC signals
61071	Connector for body builders (chassis) – lights
75010/1	Rear lights
75010/2	Trailer rear lights
ST16	Front parking brake arrangement
ST20	Insulated ground
STF1	Front axle arrangement (ECAS)
STY01	Right lights (front)
STY02	Left lights (front)
STY03	Bulkhead C/B–3 (EDC)
STY04	Conditioner arrangement
STY06	Brake air drier
STY08	Cab tilting remote–control switch ground
STY13	Front right clearance lamp
STY14	Front left clearance lamp
STY19	Differential lock (transverse longitudinal)
STY21	Exhaust brake with automatic transmission
STY22	Reversing light ignition
STY23	Stop signalling (Telma)
STY24	Insertion of power take–off on the gearbox
STY26	Geared–down speed ON signalling switch
STY32	TGC ground

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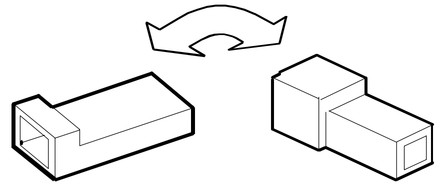
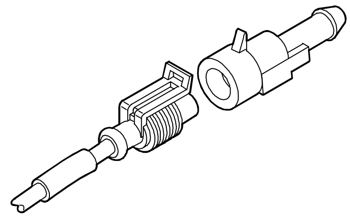
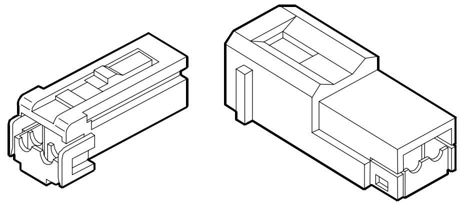
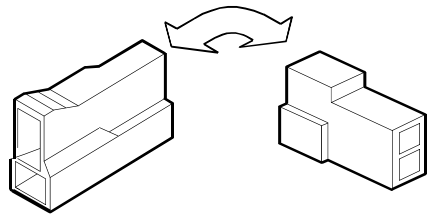
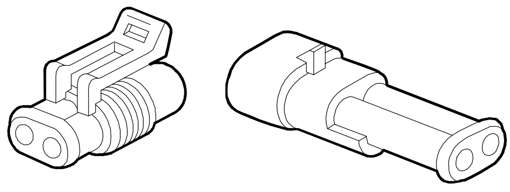
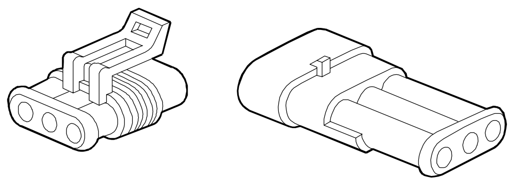
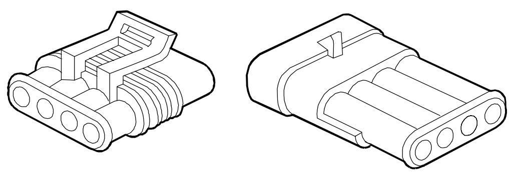
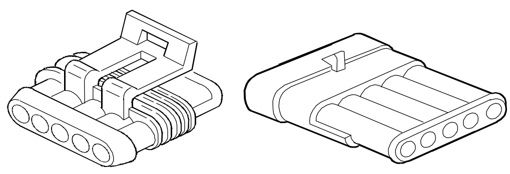
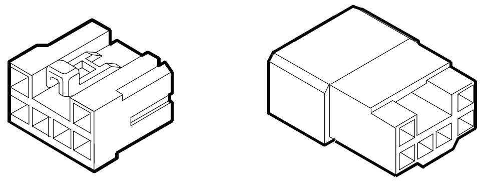
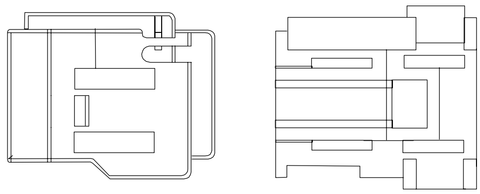
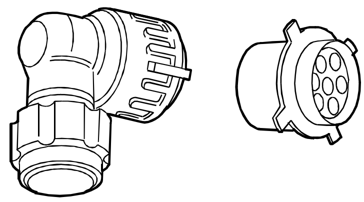
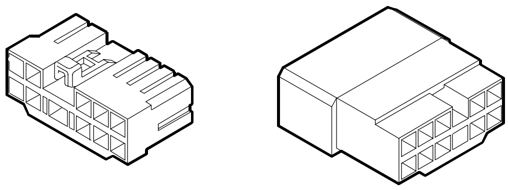
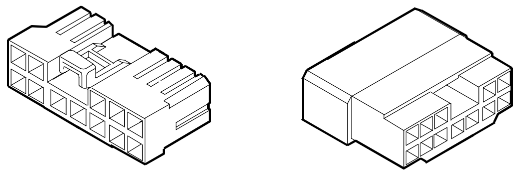
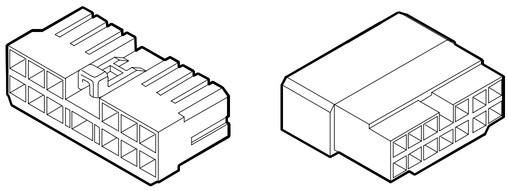
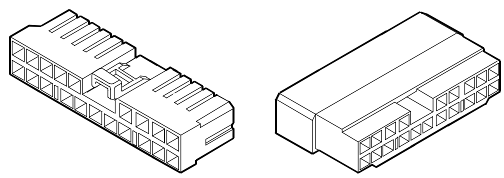
Perspective view

Pin	Name	Connector view
1	ST0 – ST01 – ST02 – ST03 – ST19 – ST22 – ST23	
1	STY8	
2	ST04 – ST05 – ST11 – ST12 – ST13 – ST20 – ST21 – ST24 – ST25 – STA – STX4 – STY7	
2	STY15	
2	ST16 – STY6 – STY11 – STY12 – ST13 – ST14 – STY21 – STY24 – STY26 – STZ1 – STZ2 – STZ3 – STZ4 – STZ5	
3	STY3 – STY4 – STY32	
4	61069 – STF1 – STY19 – STY22 – STY23 – STY25	
5	61070 – STY20	

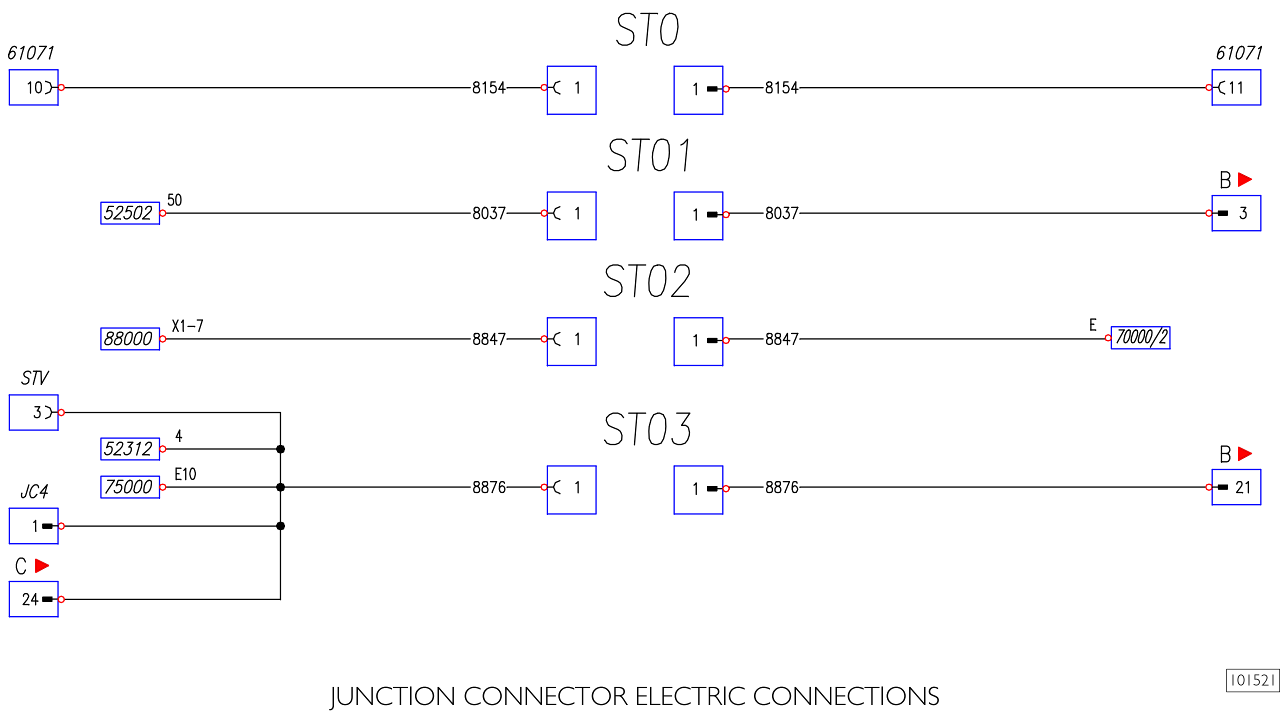
Pin	Name	Connector view
6	STY5	
6	STX2	
7	STY1 – STY2	
11	75010/2	
12	ST06 – STV – STX3 – STY09 – STY10 – STY16 – STY17 – STY18 – XXXX4	
13	75010/1	
20	61071 – STX – STY33	

Junction connector ST0 – ST01 – ST02– ST03

Figure 39

CONNECTOR VIEW (CABLE SIDE)

Figure 40



JUNCTION CONNECTOR ELECTRIC CONNECTIONS

ST0

Pin	Function	Cable colour code
I	Signal from the switch for Cruise Control cut–out for EDC	8154

ST01

Pin	Function	Cable colour code
I	+50 signal from key switch	8037

ST02

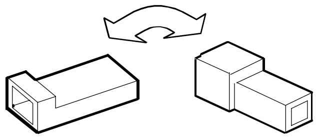
Pin	Function	Cable colour code
I	Power supply after the fuse for ABS	8847

ST03

Pin	Function	Cable colour code
I	+15 alternator	8876

Junction connector ST19 – ST22 – ST23 – STY8

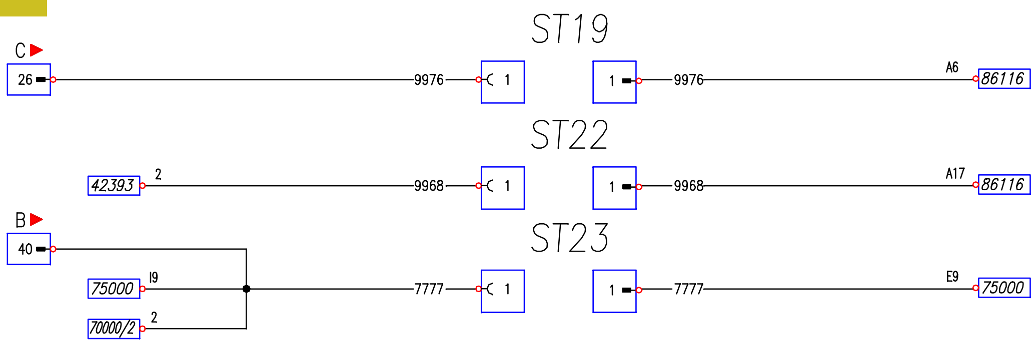
Figure 41



CONNECTOR VIEW (CABLE SIDE)

101520

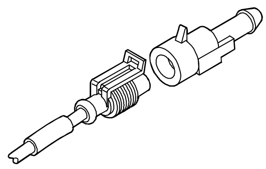
Figure 42



JUNCTION CONNECTOR ELECTRIC CONNECTIONS

101522

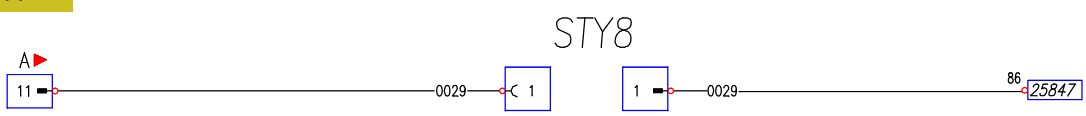
Figure 43



CONNECTOR VIEW (CABLE SIDE)

101523

Figure 44



JUNCTION CONNECTOR ELECTRIC CONNECTIONS

101524

ST19

Pin	Function	Cable colour code
1	Geared–down speed ON warning light signal	9976

ST22

Pin	Function	Cable colour code
1	Speed limiter signal	9968

ST23

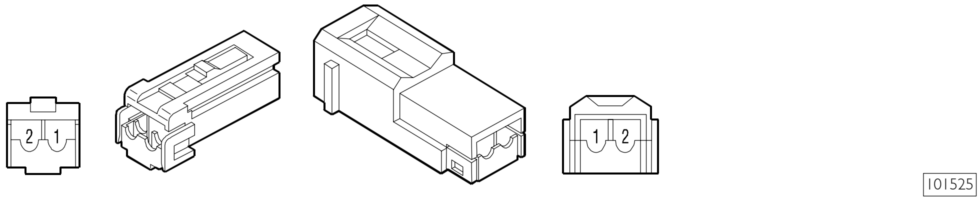
Pin	Function	Cable colour code
1	Battery positive	7777

STY8

Pin	Function	Cable colour code
1	Hydraulic cab tilting relay control ground after grill opening signalling switch	0029

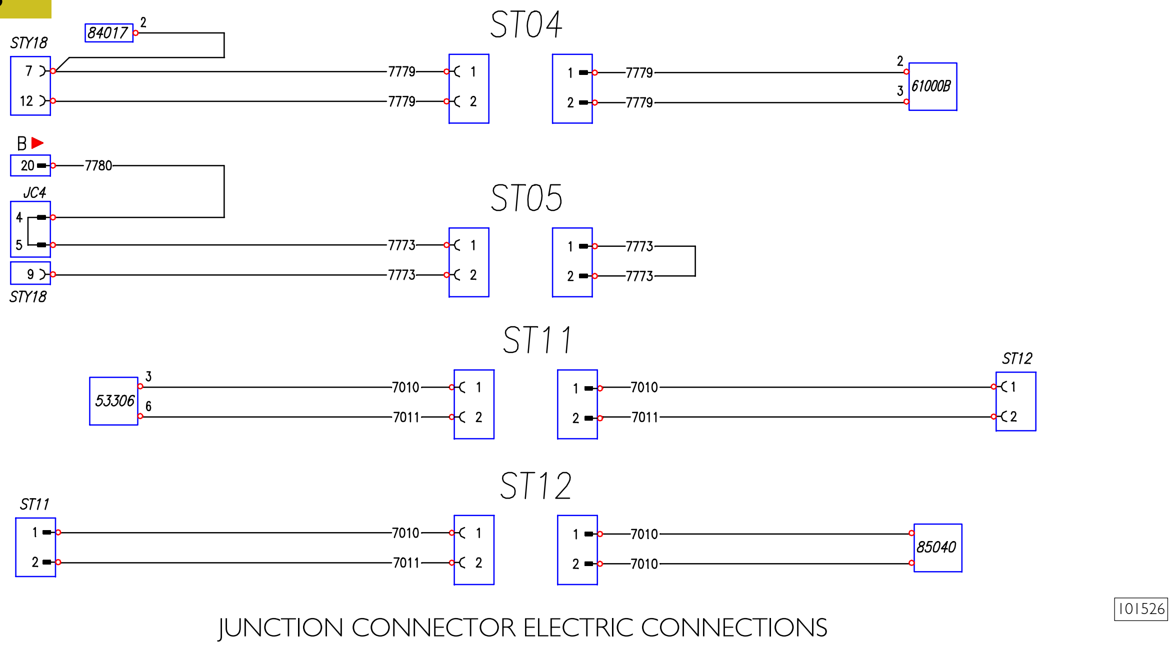
Junction connector ST04 – ST05 – ST11 – ST12

Figure 45



CONNECTOR VIEW (CABLE SIDE)

Figure 46



JUNCTION CONNECTOR ELECTRIC CONNECTIONS

ST04 (black)

Pin	Function	Cable colour code
1	Auxiliary heater remote–control switch power supply throughthe safety control unit	7779
2	Auxiliary heater remote–control switch power supply throughthe safety control unit	7779

ST05

Pin	Function	Cable colour code
1	Alternator excitation	7773
2	Alternator excitation	7773

ST11

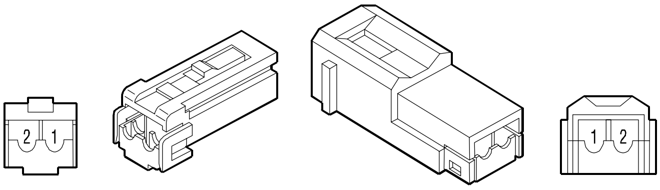
Pin	Function	Cable colour code
1	Trap–door opening control power supply	7010
2	Trap–door closing control power supply	7011

ST12

Pin	Function	Cable colour code
1	Trap–door opening control power supply	7010
2	Trap–door closing control power supply	7011

Junction connector ST13 – ST20 – ST21 – ST24

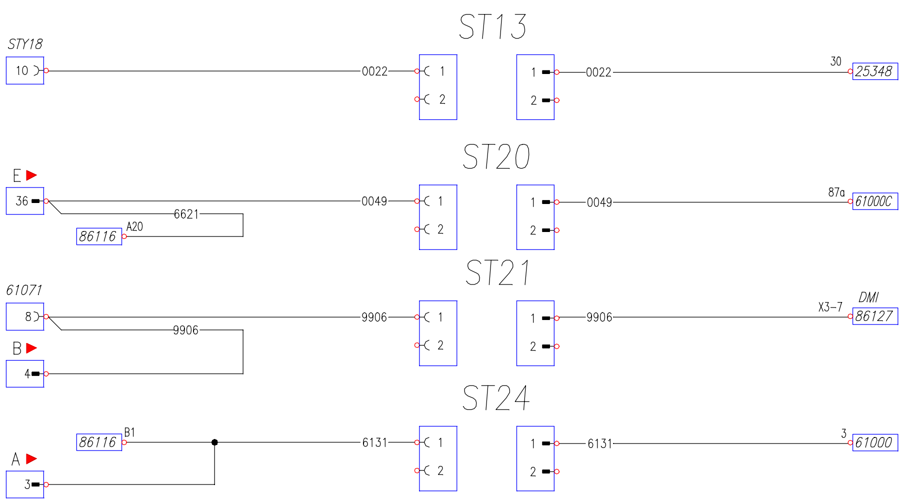
Figure 47



101525

CONNECTOR VIEW (CABLE SIDE)

Figure 48



101527

JUNCTION CONNECTOR ELECTRIC CONNECTIONS

ST13 (black)

Pin	Function	Cable colour code
1	Trap–door closing control power supply	0022
2	–	–

ST20

Pin	Function	Cable colour code
1	ABS disconnection	0049
2	–	–

ST21

Pin	Function	Cable colour code
1	Engine stop control from Master Current Switch	9906
2	–	–

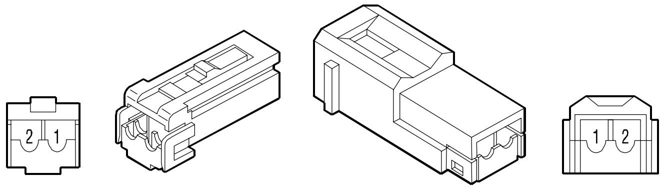
ST24 (white)

Pin	Function	Cable colour code
1	PTO 1 return signal cable ON (rear with semi–automatic transmission)	6131
2	–	–

Print 603.93.381

Junction connector ST25 – STA – STX4 – STY7

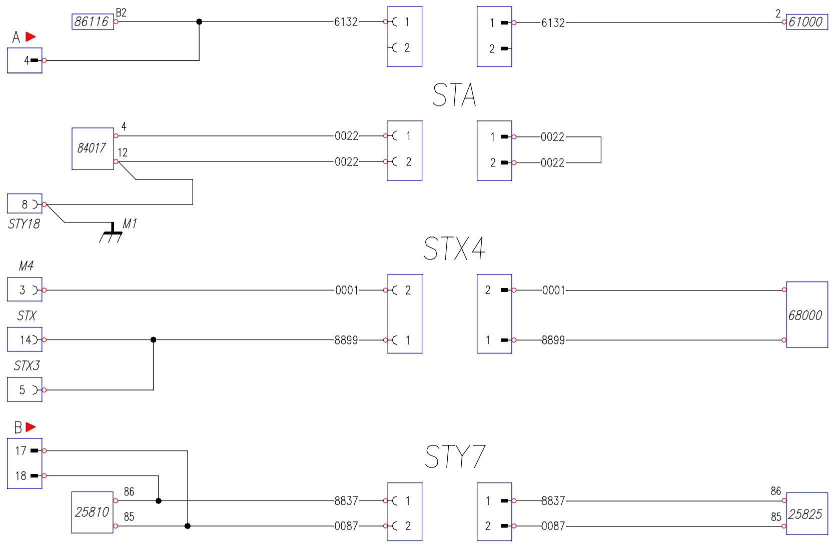
Figure 49



CONNECTOR VIEW (CABLE SIDE)

101525

Figure 50



JUNCTION CONNECTOR ELECTRIC CONNECTIONS

101528

ST25 (white)

Pin	Function	Cable colour code
1	PTO 1 return signal cable ON (lateral with semi–automatic transmission)	6132
2	–	–

STA

Pin	Function	Cable colour code
1	Trap–door closing control power supply	0022
2	Trap–door closing control power supply	0022

STX4

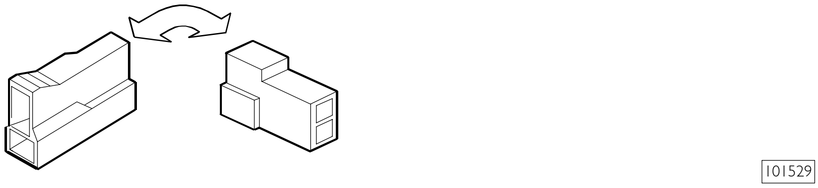
Pin	Function	Cable colour code
1	Radio equipment power supply	8899
2	Ground	0001

STY7

Pin	Function	Cable colour code
1	Diesel fuel heating relay control thermometric switch	8837
2	Diesel fuel pre–heating relay control signal from EDC	0087

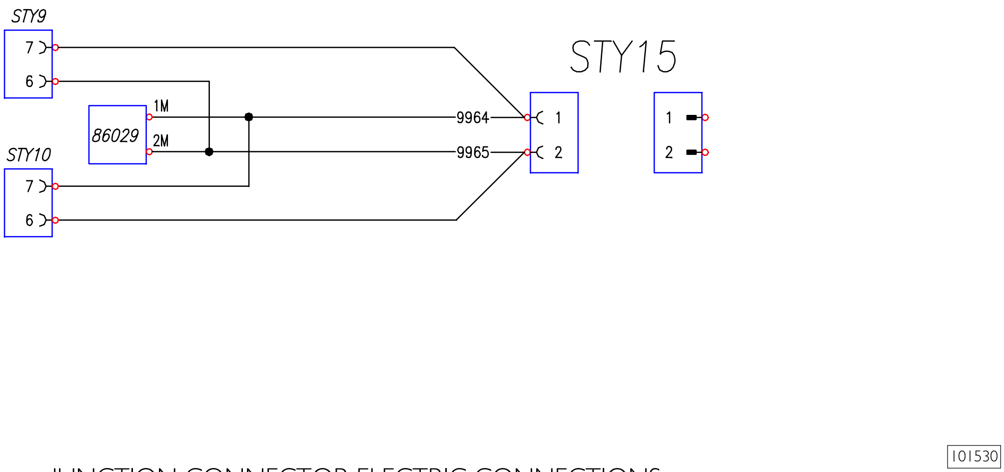
Junction connector STY15 – central locking arrangement

Figure 51



CONNECTOR VIEW (CABLE SIDE)

Figure 52



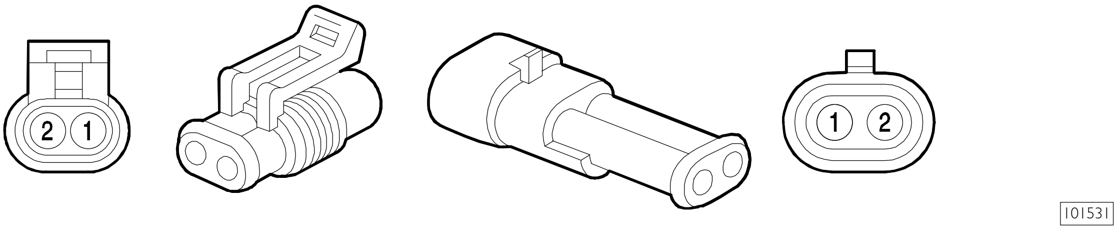
JUNCTION CONNECTOR ELECTRIC CONNECTIONS

Pin	Function	Cable colour code
1	Central locking motor power supply (door closing)	**9964**
2	Central locking motor power supply (door opening)	**9965**

Print 603.93.381

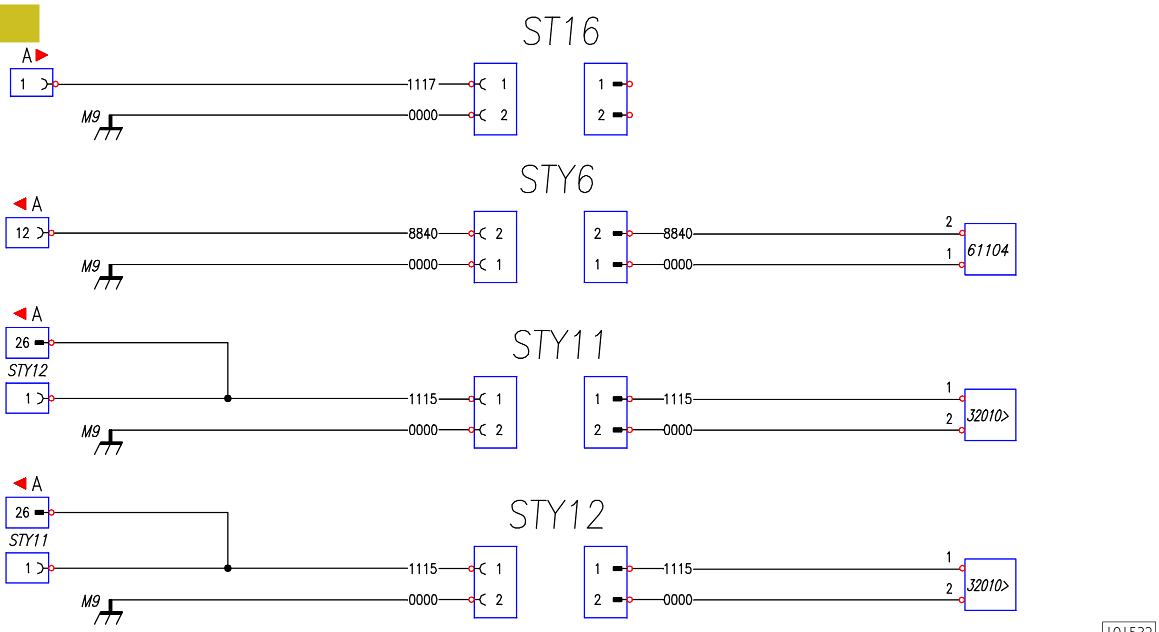
Junction connector ST16 – STY6 – STY11 – STY12

Figure 53



CONNECTOR VIEW (CABLE SIDE)

Figure 54



JUNCTION CONNECTOR ELECTRIC CONNECTIONS

ST16 – front parking brake arrangement

Pin	Function	Cable colour code
1	Signal from front parking brake switch	1117
2	Ground	0000

STY6 – brake air drier

Pin	Function	Cable colour code
1	Ground	0000
2	Braking system air drier resistor power supply	8840

STY11 – right rotary lamp

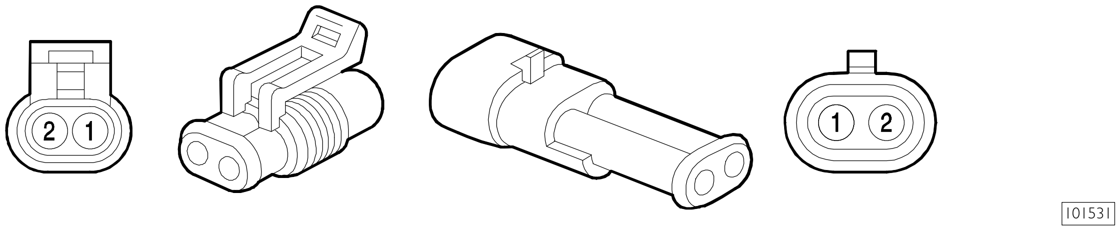
Pin	Function	Cable colour code
1	Rotary lamp power supply	1115
2	Ground	0000

STY12 – left rotary lamp

Pin	Function	Cable colour code
1	Rotary lamp power supply	1115
2	Ground	0000

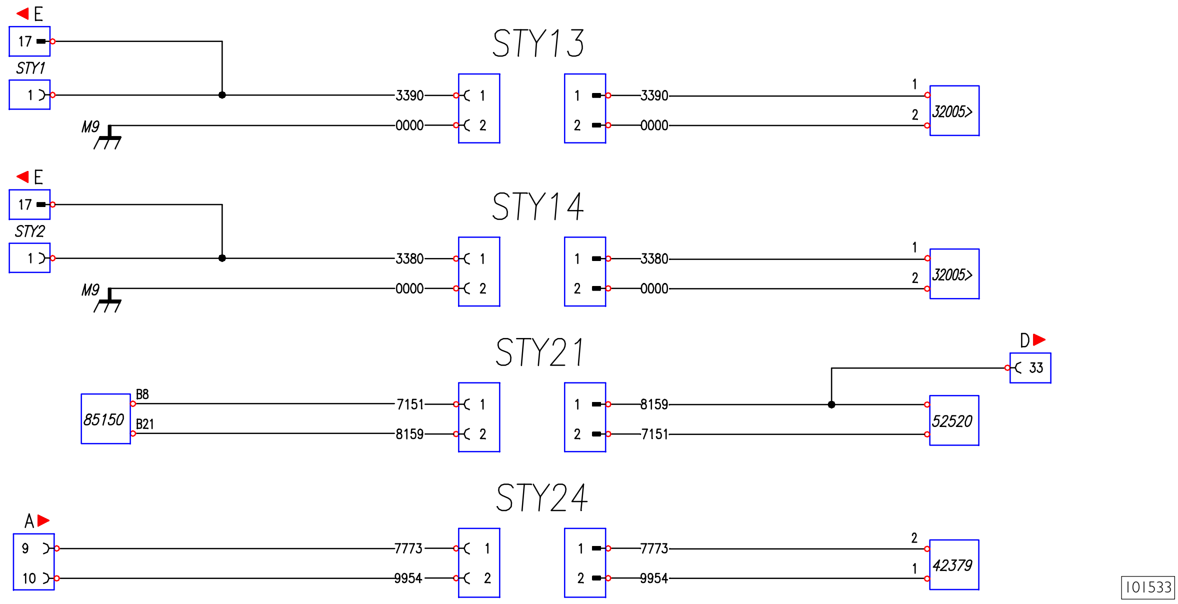
Junction connector STY13 – STY14 – STY21 – STY24

Figure 55



CONNECTOR VIEW (CABLE SIDE)

Figure 56



JUNCTION CONNECTOR ELECTRIC CONNECTIONS

STY13 – front right clearance lamp

Pin	Function	Cable colour code
1	Right sidelight and clearance light power supply	3390
2	Ground	0000

STY14 – front left clearance lamp

Pin	Function	Cable colour code
1	Left sidelight and clearance light power supply	3380
2	Ground	0000

STY21 – exhaust brake with automatic transmission

Pin	Function	Cable colour code
1	Signal from exhaust brake switch for EDC	8159
2	EDC system power supply after the fuse	7151

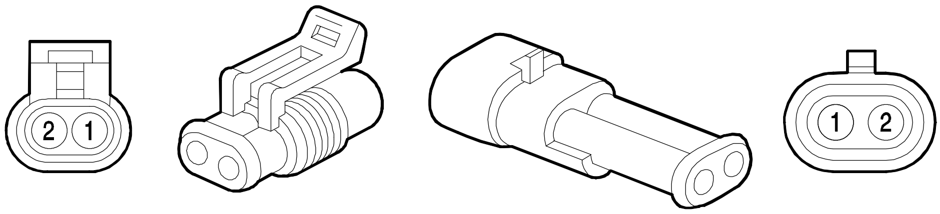
STY24 – power take–off actuation enable switch

Pin	Function	Cable colour code
1	Generator or alternator excitation	7773
2	Running takeoff control solenoid valve power supply	9954

Print 603.93.381

Junction connector STY26 – STZ1 – STZ2

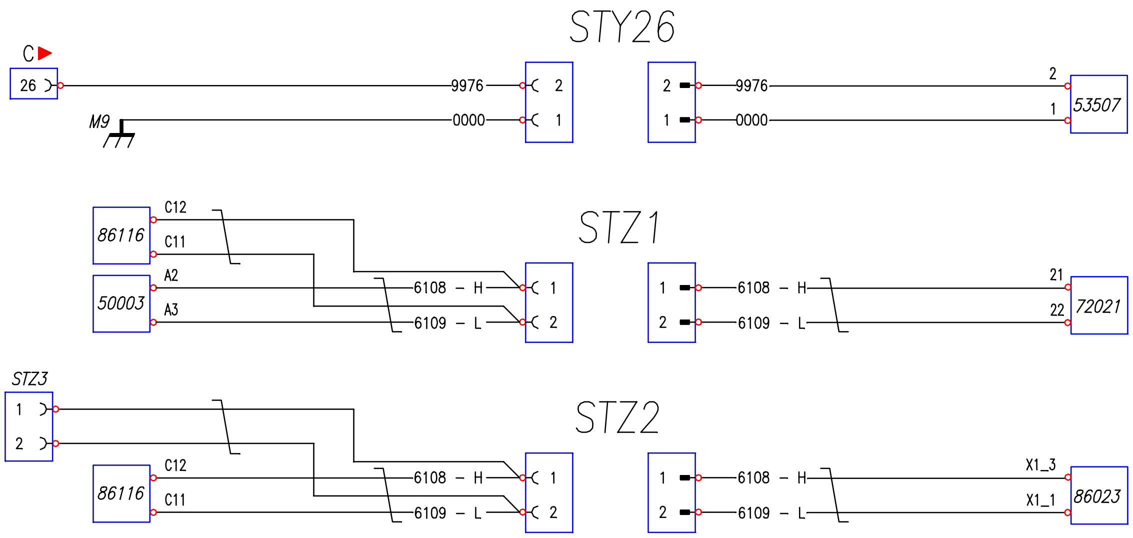
Figure 57



101531

CONNECTOR VIEW (CABLE SIDE)

Figure 58



101534

JUNCTION CONNECTOR ELECTRIC CONNECTIONS

STY26 – geared–down speed ON signalling switch

Pin	Function	Cable colour code
1	Ground	0000
2	Pressure switch actuated when shifting between normal and geared–down speeds	9976

STZ1 – diagnosis connector 72021

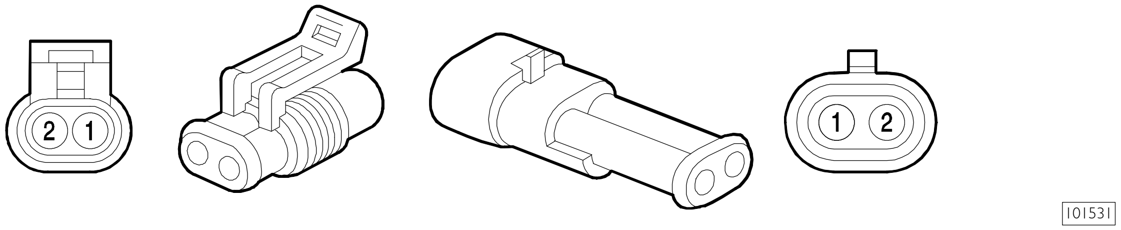
Pin	Function	Cable colour code
1	CAN line – H	6108
2	CAN line – L	6109

STZ2 – ECAS control unit

Pin	Function	Cable colour code
1	CAN line – H	6108
2	CAN line – L	6109

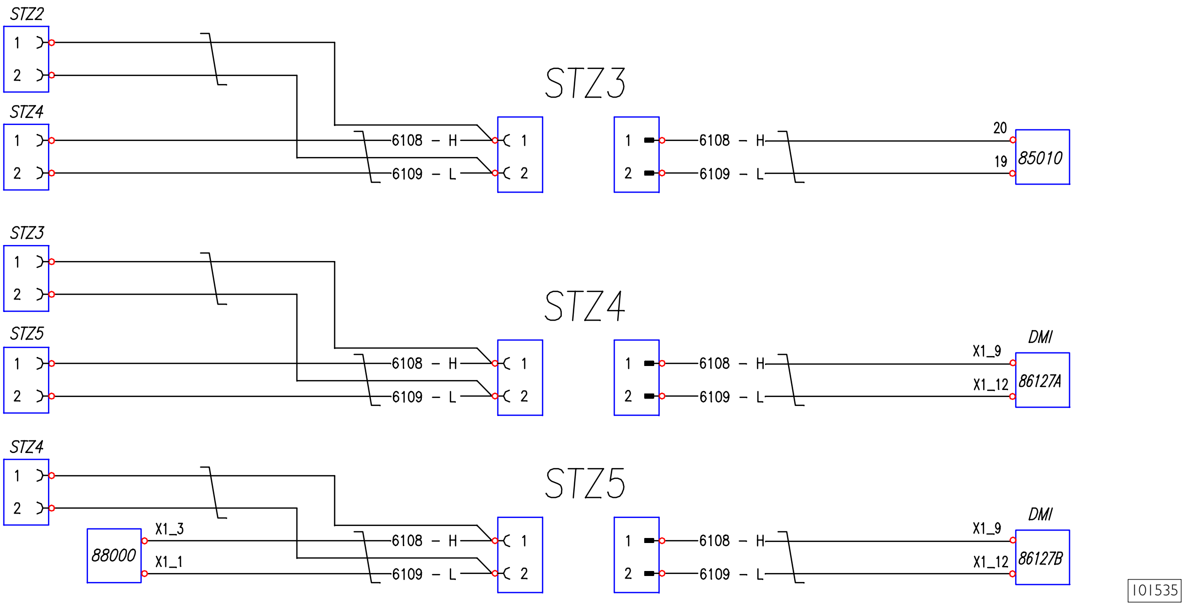
Junction connector STZ3 – STZ4 – STZ5

Figure 59



CONNECTOR VIEW (CABLE SIDE)

Figure 60



JUNCTION CONNECTOR ELECTRIC CONNECTIONS

STZ3 – electric mirror control unit

Pin	Function	Cable colour code
1	CAN line – H	**6108**
2	CAN line – L	**6109**

STZ4 – DMI option

Pin	Function	Cable colour code
1	CAN line – H	**6108**
2	CAN line – L	**6109**

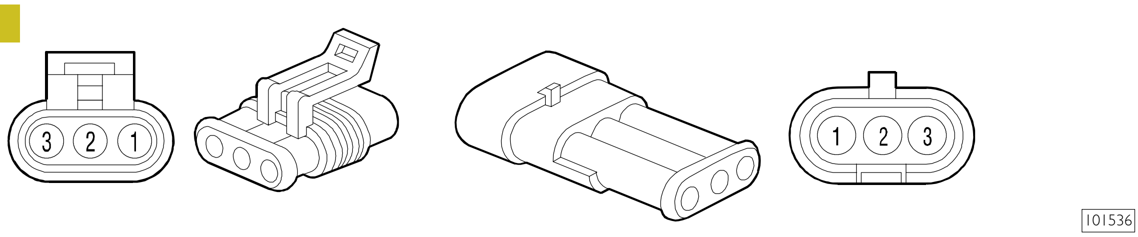
STZ5 – Telma / Allison option

Pin	Function	Cable colour code
1	CAN line – H	**6108**
2	CAN line – L	**6109**

Print 603.93.381

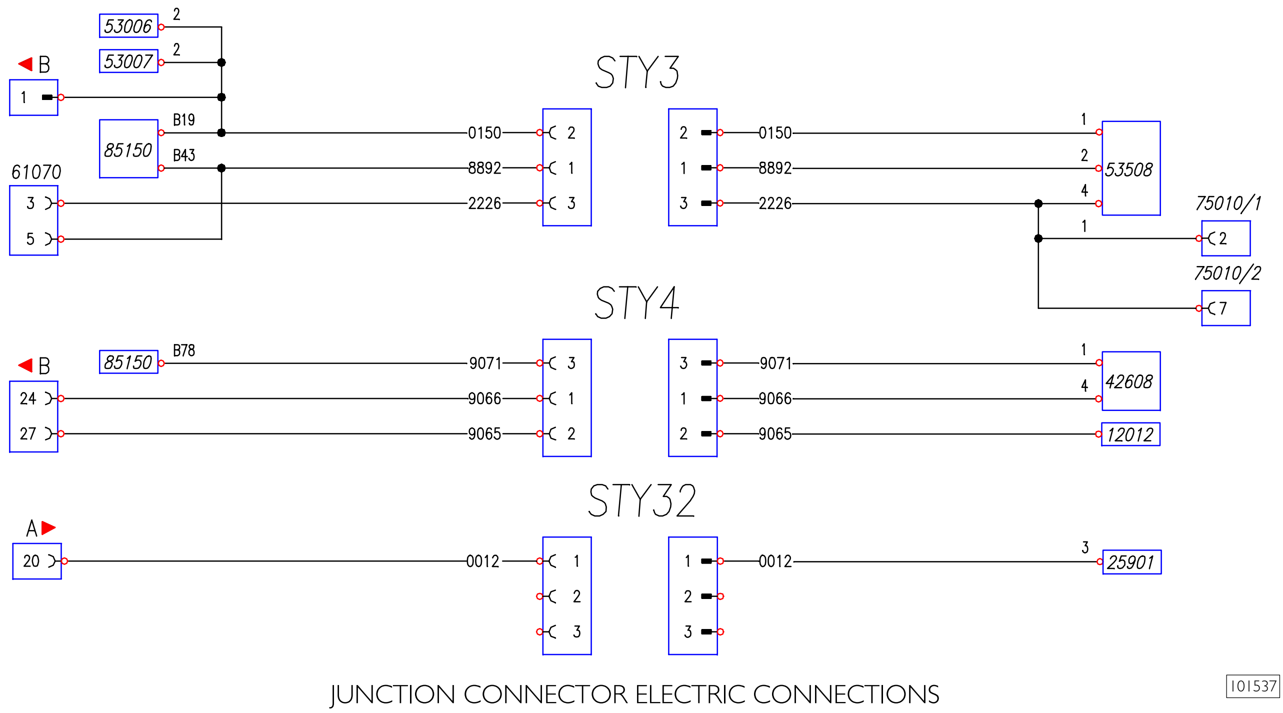
Junction connector STY3 – STY4 – STY32

Figure 61



CONNECTOR VIEW (CABLE SIDE)

Figure 62



JUNCTION CONNECTOR ELECTRIC CONNECTIONS

STY3 – C bulkhead cable / B–E bulkhead cable (EDC)

Pin	Function	Cable colour code
1	Component return connection to the EDC control unit	0150
2	Engine start (from external button)	8892
3	Reversing lamp power supply	2226

STY4 – conditioner arrangement

Pin	Function	Cable colour code
1	Manual conditioner relay control	9066
2	Compressor actuation warning light power supply	9065
3	Fan power supply enable	9071

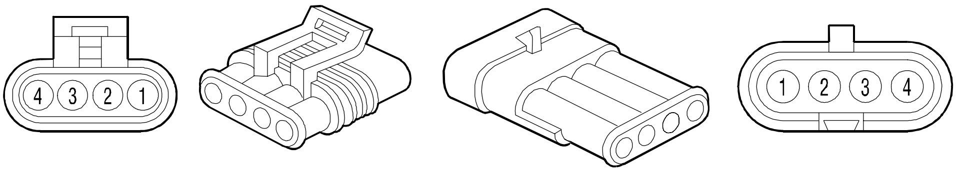
STY32 – TGC

Pin	Function	Cable colour code
1	Master current remote–control switch ground (TGC)	0012
2	–	–
3	–	–

Print 603.93.381

Junction connector 61069 – STF1

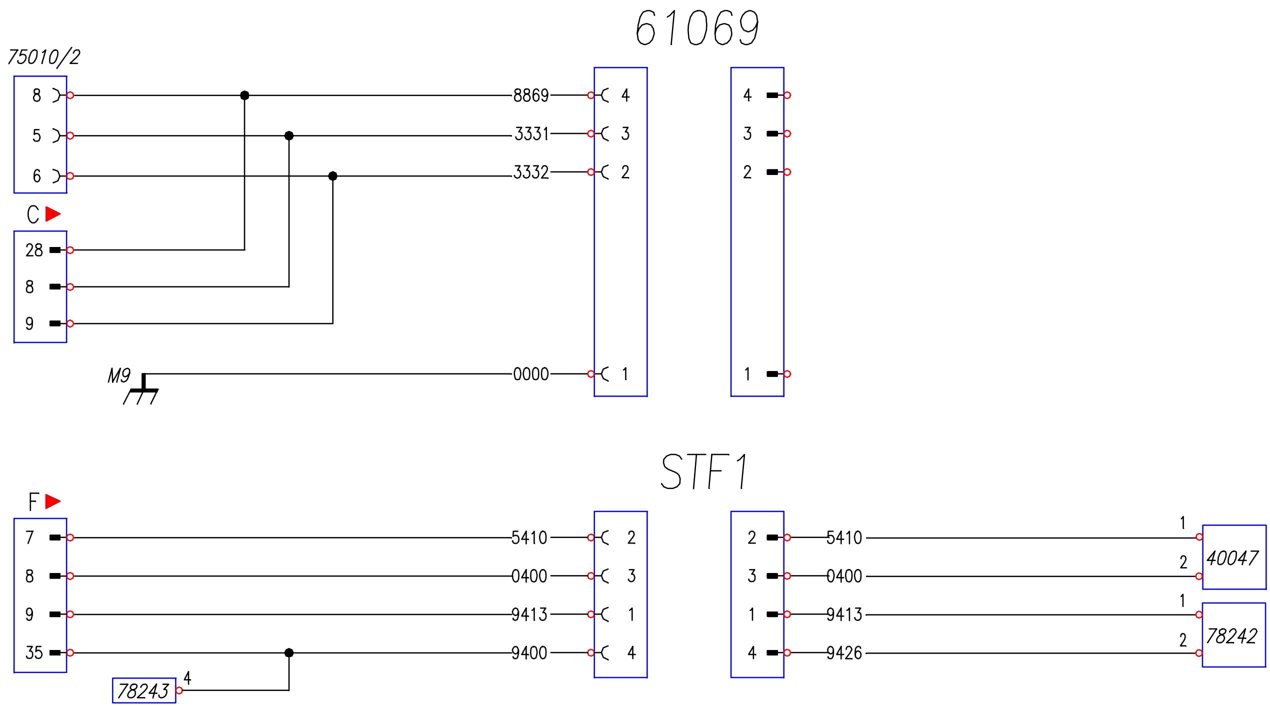
Figure 63



101538

CONNECTOR VIEW (CABLE SIDE)

Figure 64



JUNCTION CONNECTOR ELECTRIC CONNECTIONS

101539

61069 – 4–pole chassis connector for body builders (external lights)

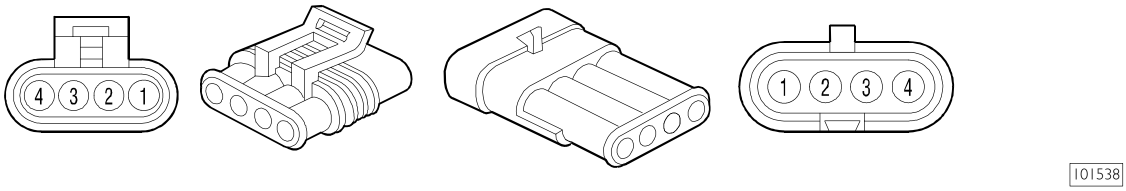
Pin	Function	Cable colour code
1	Ground	0000
2	Left rear sidelights and clearance lights	3332
3	Rear right sidelights and clearance lights	3331
4	Key rotation prevent electromagnet power supply	8869

STF1– front ECAS arrangement

Pin	Function	Cable colour code
1	Front axle ECAS solenoid valve power supply	9413
2	ECAS front axle chassis level control sensor signal	5410
3	ECAS chassis level control sensor ground	0400
4	ECAS solenoid valve power supply after the control unit	9426

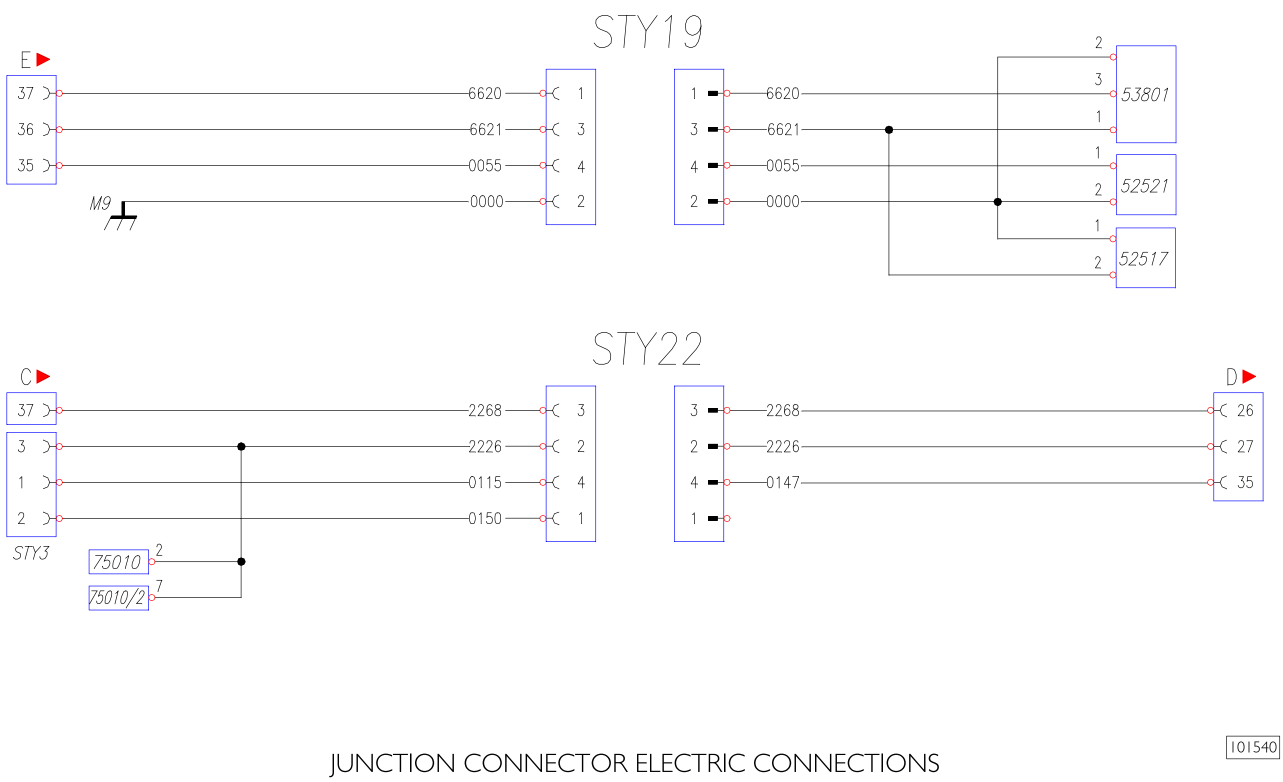
Junction connector STY19– STY22

Figure 65



CONNECTOR VIEW (CABLE SIDE)

Figure 66



JUNCTION CONNECTOR ELECTRIC CONNECTIONS

STY19– transverse and longitudinal locking

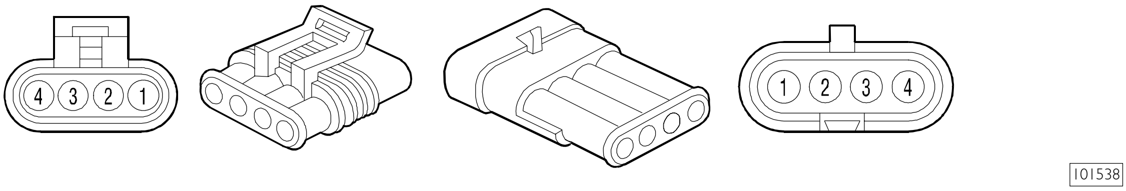
Pin	Function	Cable colour code
1	Signal from Rockwell rear axle transverse locking signalling switch	6620
2	Ground	0000
3	Signal from Iveco and Rockwell rear axle transverse locking signalling switch	6621
4	Signal from longitudinal locking signalling switch	0055

STY22– reversing light ignition with automatic transmission

Pin	Function	Cable colour code
1	Component return connection to the EDC control unit	0150
2	Reversing lamp power supply	2226
3	Reversing lamp switch power supply	2268
4	Signal cable for automatic neutral position with automatic transmission	0147

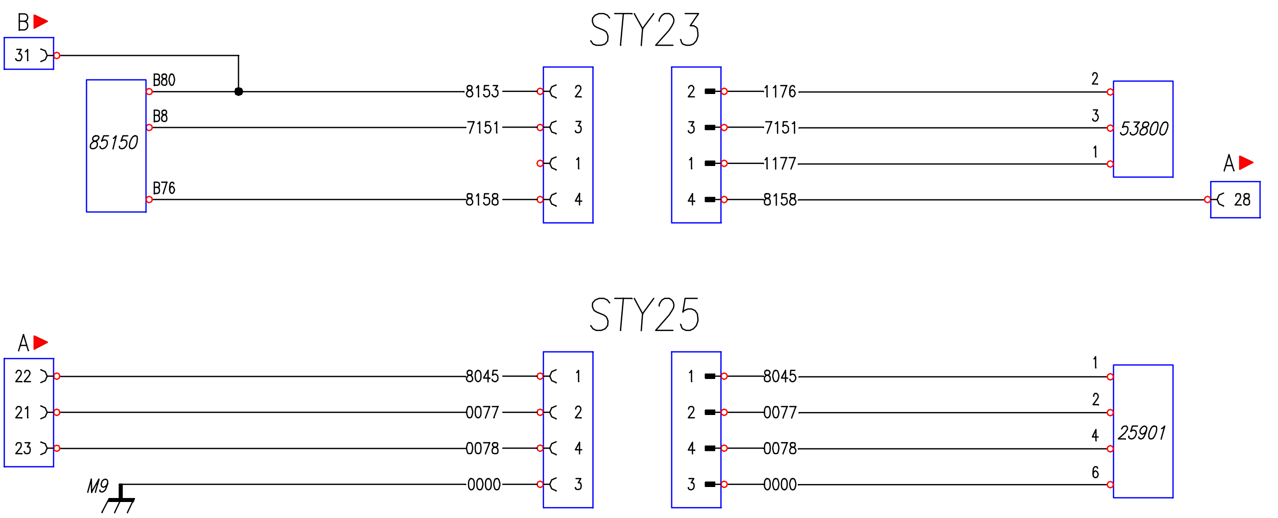
Junction connector STY23– STY25

Figure 67



CONNECTOR VIEW (CABLE SIDE)

Figure 68



JUNCTION CONNECTOR ELECTRIC CONNECTIONS

STY23 – stop signalling switch with Telma decelerator

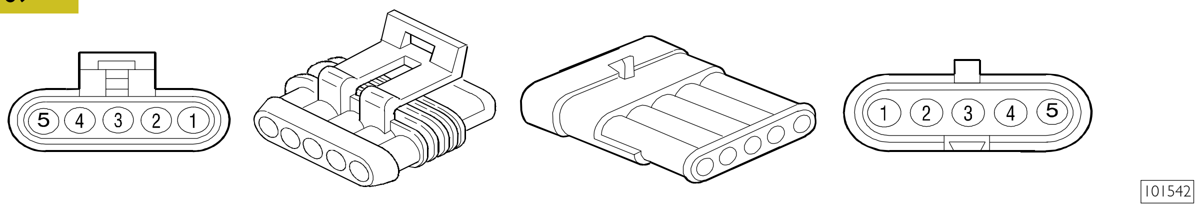
Pin	Function	Cable colour code
1	Left rear stop signalling	1177
2	Brake light relay control	1176
3	EDC system power supply after the fuse	7151
4	Signal from secondary brake light switch for EDC	8158

STY25 - ADR

Pin	Function	Cable colour code
1	TGC excitation through key switch	8045
2	Brake light signal from brake value transmitter with EBS	0077
3	Ground	0000
4	Alternator D+ after the power diode	0078

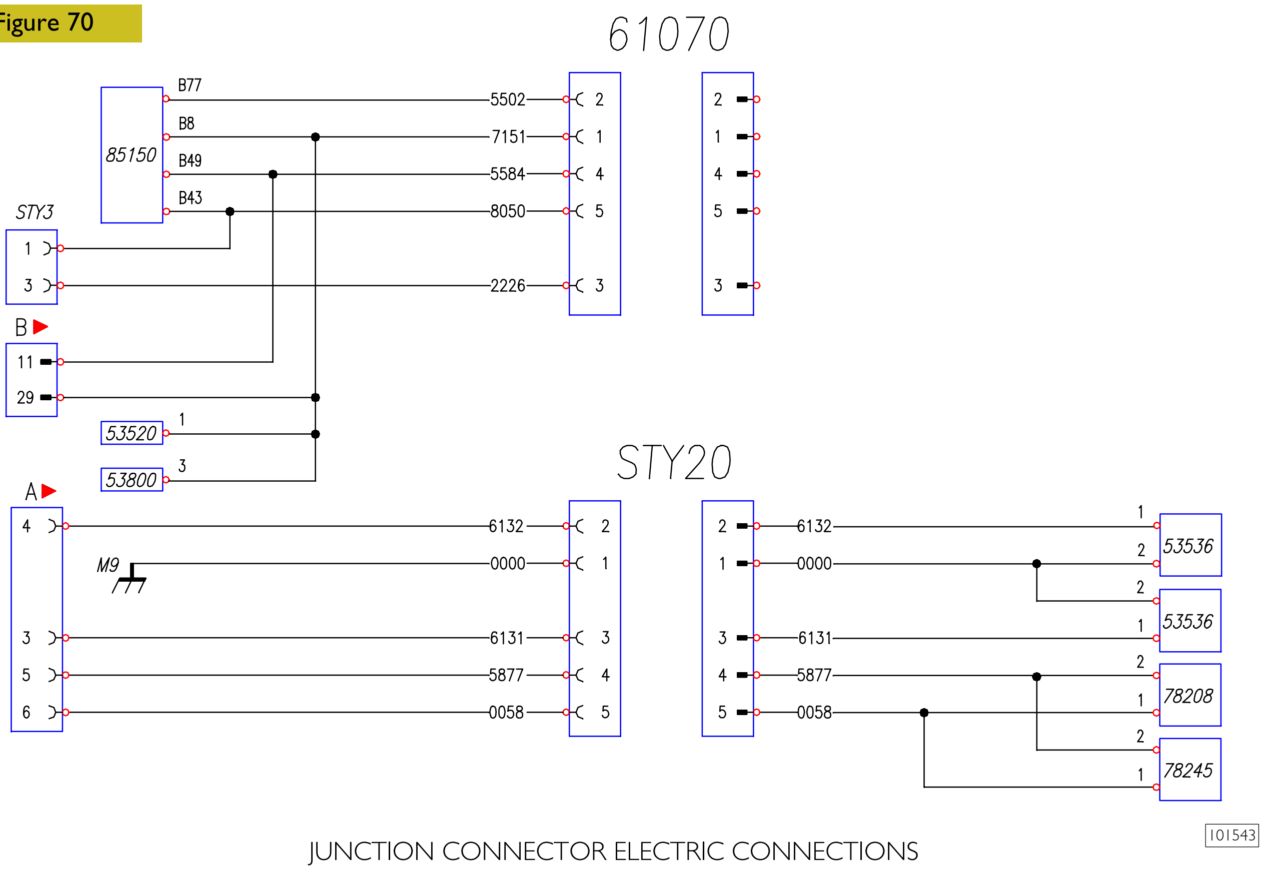
Junction connector 61070 – STY20

Figure 69



CONNECTOR VIEW (CABLE SIDE)

Figure 70



JUNCTION CONNECTOR ELECTRIC CONNECTIONS

61070 – 5–pole chassis connector for body builders (EDC signals)

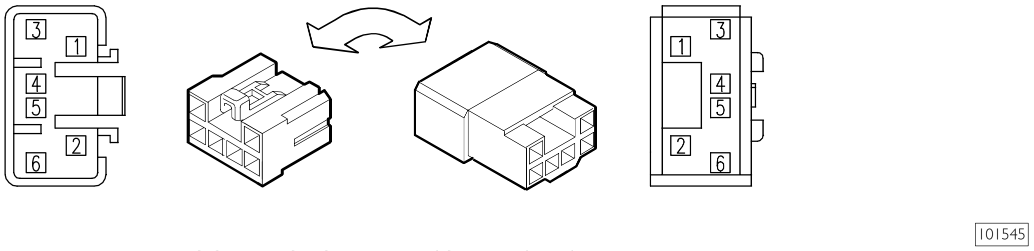
Pin	Function	Cable colour code
1	EDC system power supply after the fuse	7151
2	Speed limiter II signal	5502
3	Sensor 1 signal cable for engine revs diagnostic	5584
4	Gearbox idling signalling switch	8050
5	Reversing lamp power supply	2226

STY20 – power take–off

Pin	Function	Cable colour code
1	Ground	0000
2	Side power take–off signal ON	6132
3	Rear power take–off signal ON	6131
4	Electronic tachograph transmitter signal	5877
5	Electronic tachograph transmitter insulated negative	0058

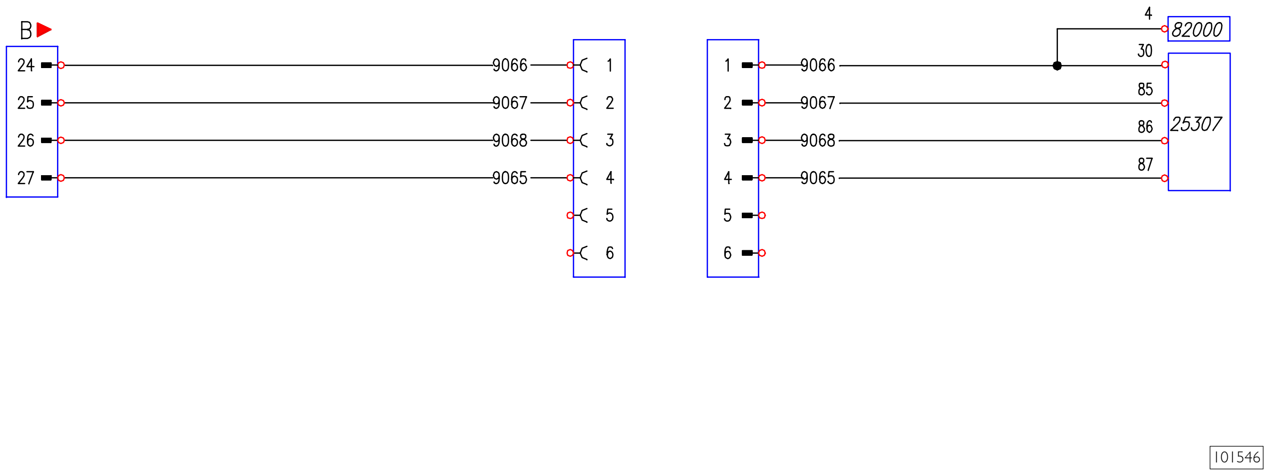
Junction connector STY5 – manual conditioner

Figure 71



CONNECTOR VIEW (CABLE SIDE)

Figure 72

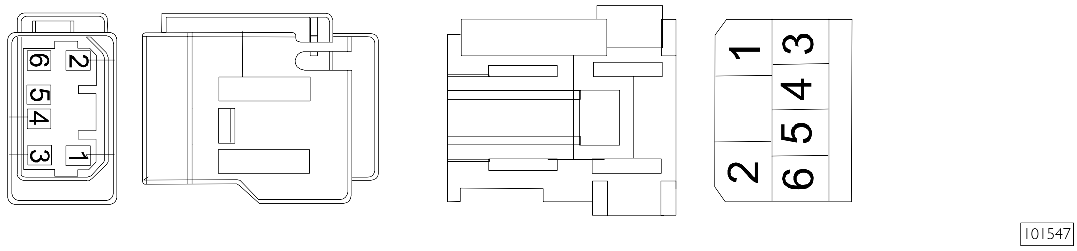


JUNCTION CONNECTOR ELECTRIC CONNECTIONS

Pin	Function	Cable colour code
1	Manual conditioner relay control	**9066**
2	Compressor relay power supply	**9067**
3	Maximum speed relay power supply	**9068**
4	Compressor actuation warning light power supply	**9065**
5	–	–
6	–	–

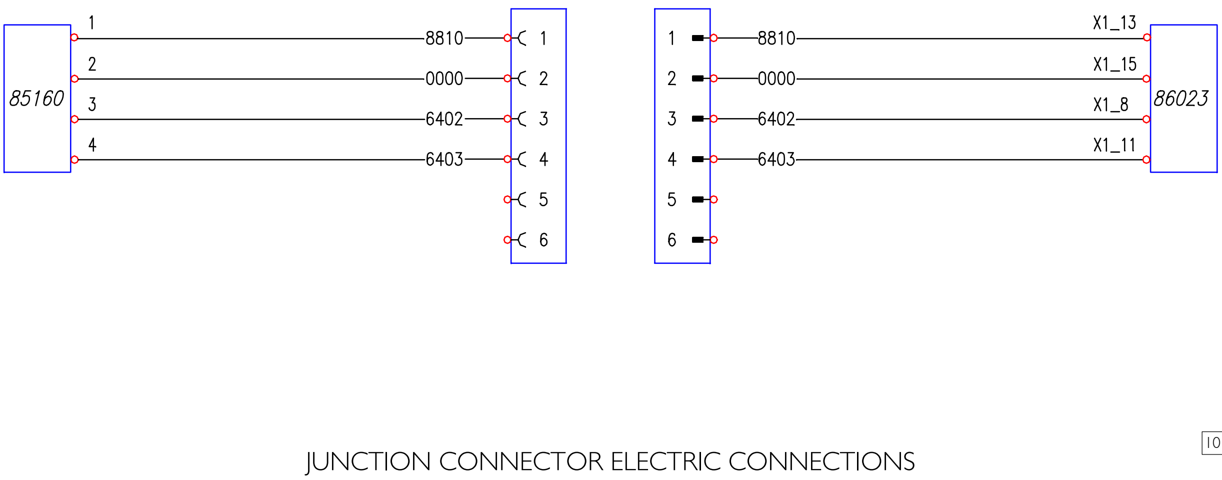
Junction connector STX2 (gray) – remote control / control unit (ECAS)

Figure 73



CONNECTOR VIEW (CABLE SIDE)

Figure 74

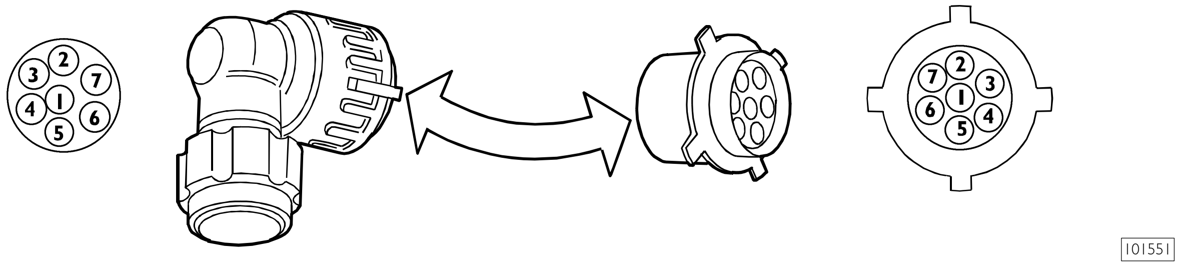


JUNCTION CONNECTOR ELECTRIC CONNECTIONS

Pin	Function	Cable colour code
1	Levelling control system power supply after the fuse	8810
2	Ground	0000
3	Clock line on the ECAS suspension control push–button panel	6402
4	Data line on the ECAS suspension control push–button panel	6403
5	–	–
6	–	–

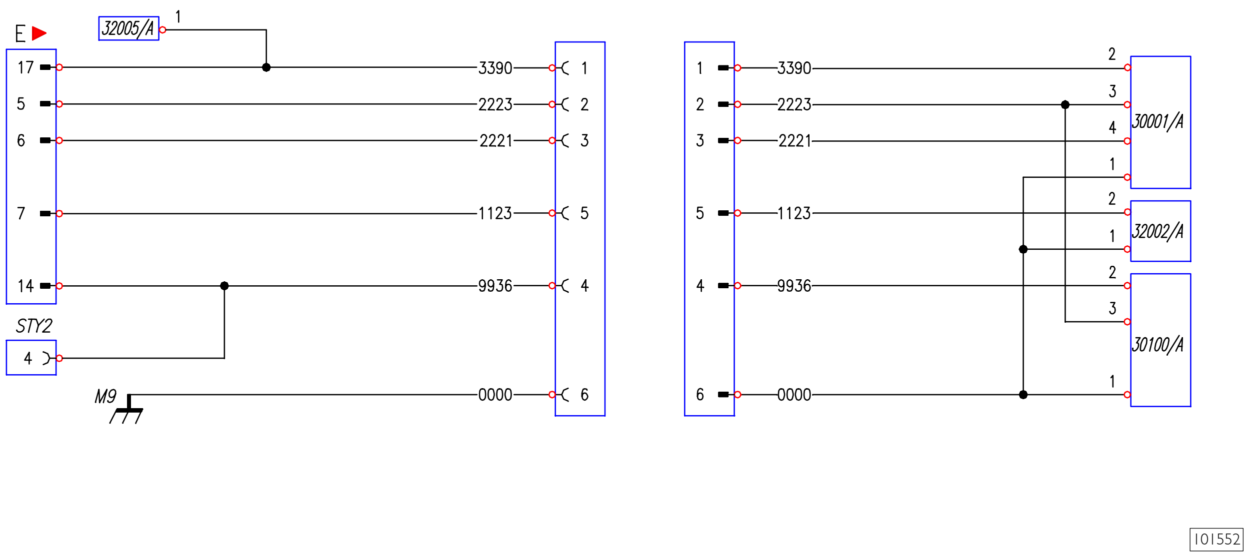
Junction connector STY1 – right lamps cable

Figure 75



CONNECTOR VIEW (CABLE SIDE)

Figure 76



JUNCTION CONNECTOR ELECTRIC CONNECTIONS

Pin	Function	Cable colour code
1	Clearance light and sidelight general power supply	3390
2	Right low–beam headlamp power supply	2223
3	Right high–beam headlamp power supply	2221
4	Headlamp trim corrector (position B)	9936
5	Front right indicator bulb	1123
6	Ground	0000
7	–	–

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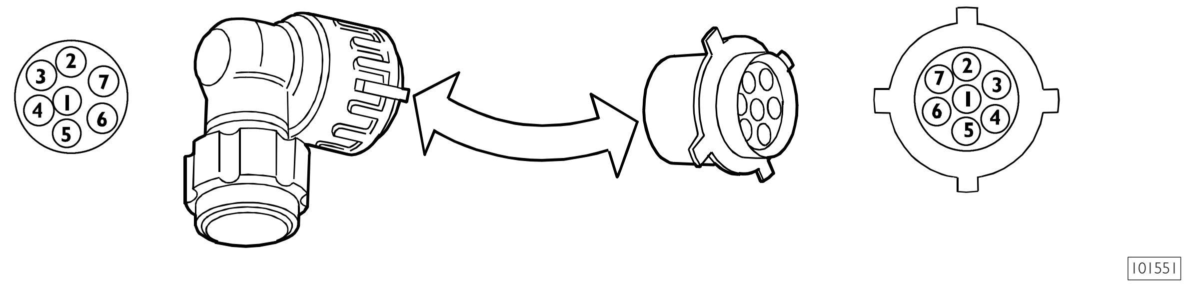
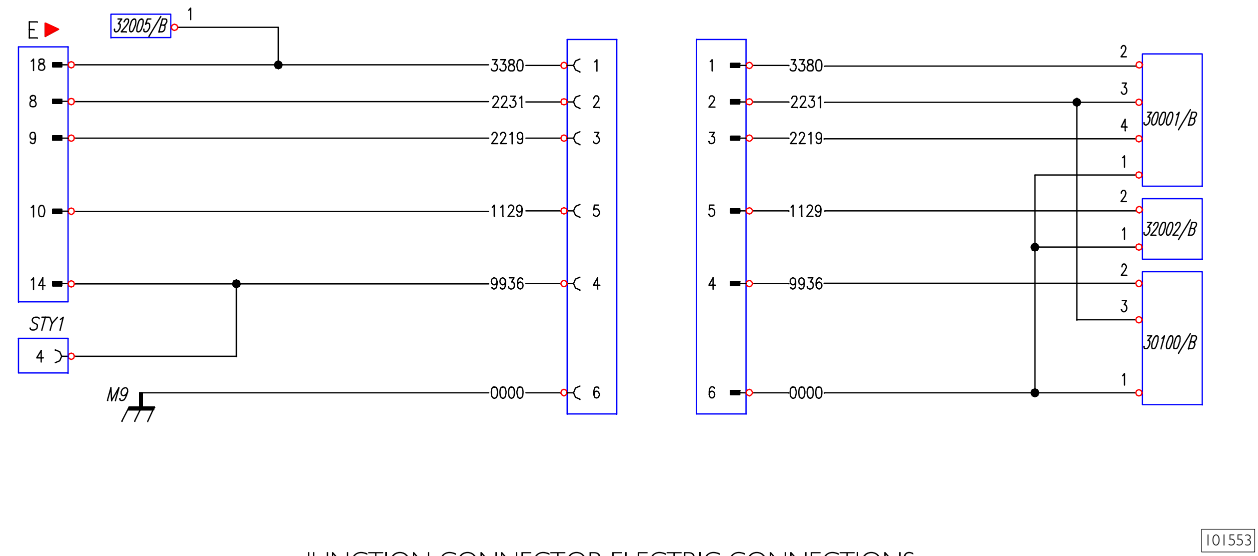
Junction connector STY2 – left lights cable

Figure 77



CONNECTOR VIEW (CABLE SIDE)

Figure 78

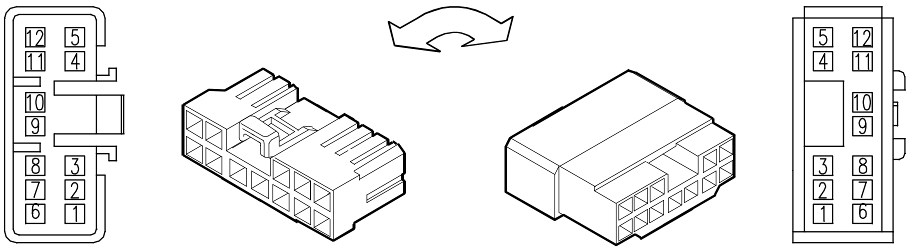


JUNCTION CONNECTOR ELECTRIC CONNECTIONS

Pin	Function	Cable colour code
1	Clearance light and sidelight general power supply	3380
2	Left low–beam headlamp power supply	2231
3	Left high–beam headlamp power supply	2219
4	Headlamp trim corrector (position B)	9936
5	Front left indicator bulb	1129
6	Ground	0000
7	–	–

Junction connector ST06 (black) – ECAS cable arrangement

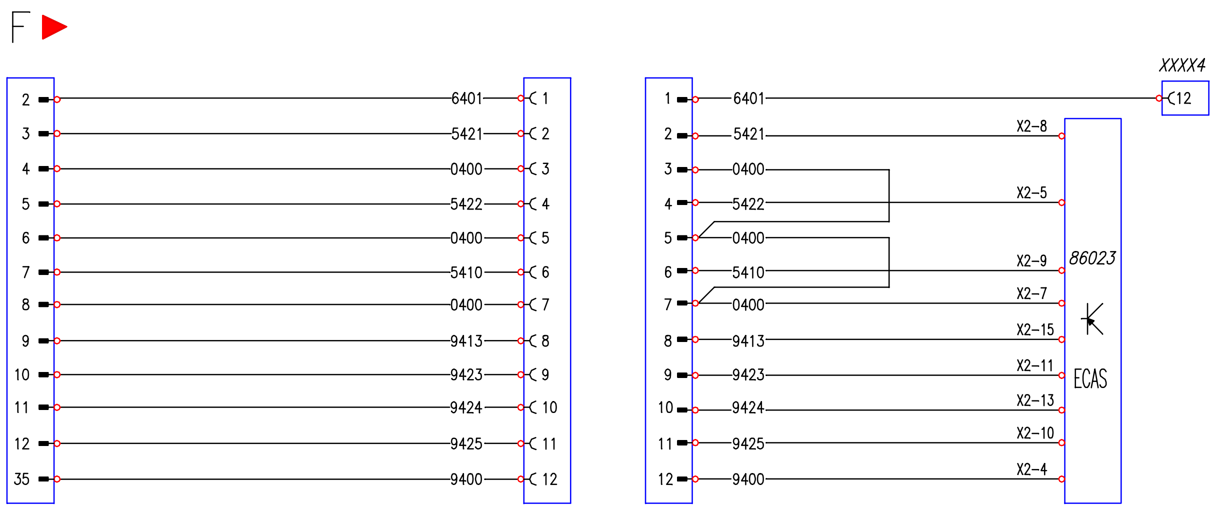
Figure 79



101554

CONNECTOR VIEW (CABLE SIDE)

Figure 80



101555

JUNCTION CONNECTOR ELECTRIC CONNECTIONS

Pin	Function	Cable colour code
1	Pneumatic suspension low air pressure warning light (ECAS)	6401
2	Rear axle right chassis level control sensor signal (ECAS)	5421
3	Chassis level control sensor ground (ECAS)	0400
4	Rear axle left chassis level control sensor signal (ECAS)	5422
5	Chassis level control sensor ground (ECAS)	0400
6	Front axle chassis level control sensor signal (ECAS)	5410
7	Chassis level control sensor ground (ECAS)	0400
8	Front axle solenoid valve power supply (ECAS)	9413
9	Rear axle solenoid valve cluster power supply (ECAS)	9423
10	Rear axle solenoid valve cluster power supply (right valve)	9424
11	Rear axle solenoid valve cluster power supply (left valve)	9425
12	Solenoid valve power supply after the control unit (ECAS)	9400

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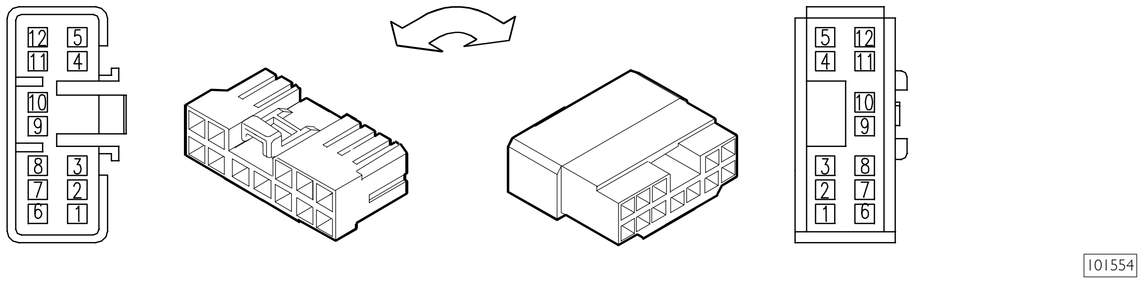
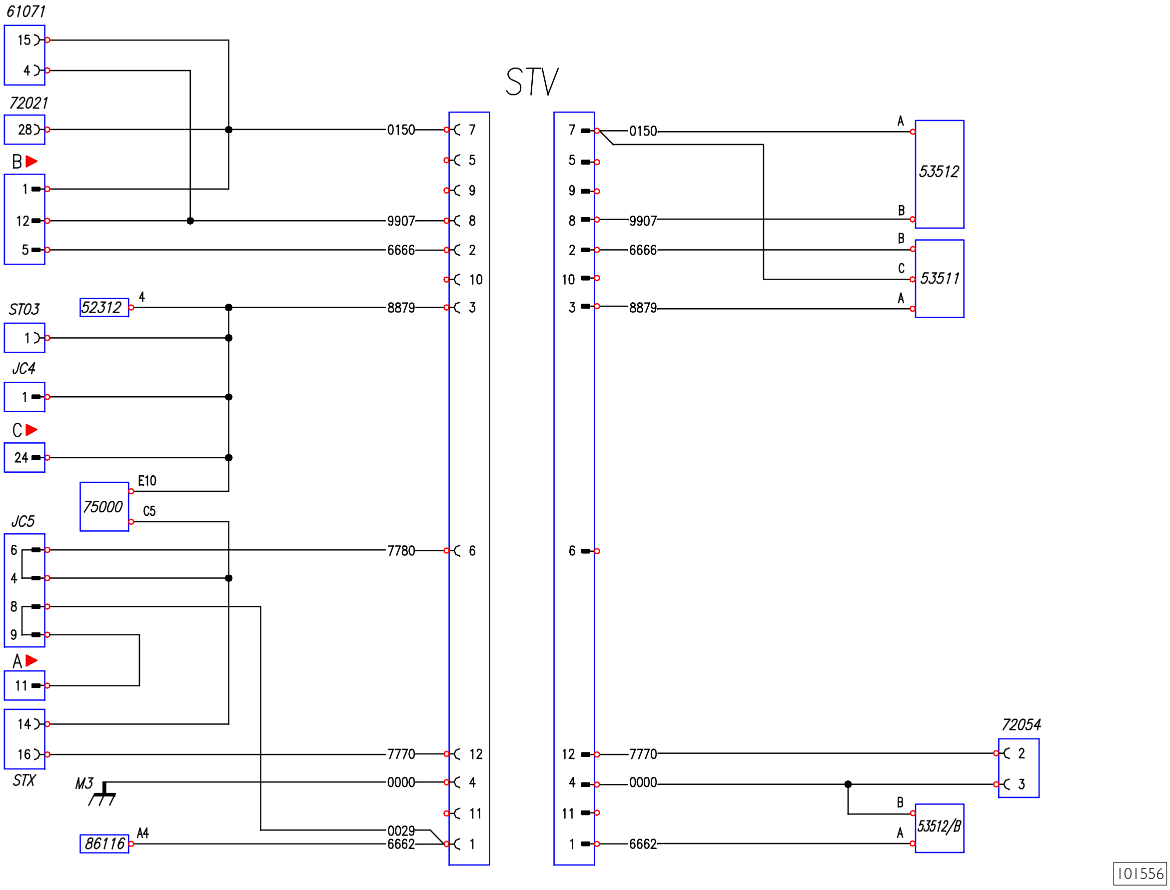
Junction connector STV (blue) – dashboard cable / cab rear

Figure 81



CONNECTOR VIEW (CABLE SIDE)

Figure 82

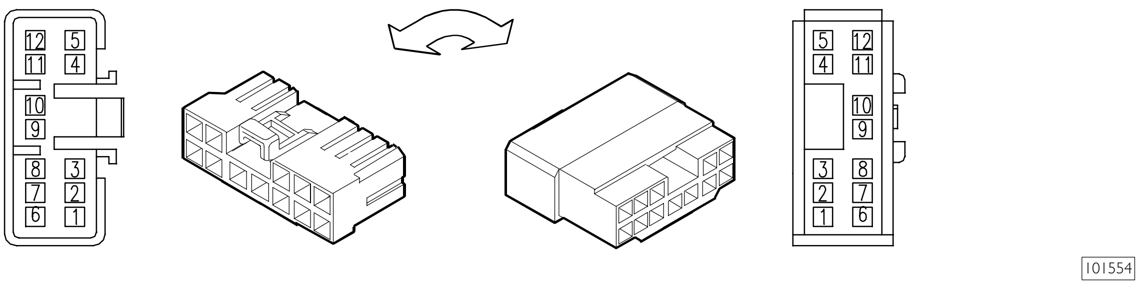


JUNCTION CONNECTOR ELECTRIC CONNECTIONS

Pin	Function	Cable colour code
1	Handbrake ON signalling optical indicator	6662
2	Cab unhooked signalling optical indicator	6666
3	General interlocking power supply after the fuse	8879
4	Ground	0000
5	–	–
6	D+ alternator (downstream the diode)	7780
7	EDC control unit component ground	0150
8	Signal from handbrake ON switch	9907
9 ÷ 11	–	–
12		7770

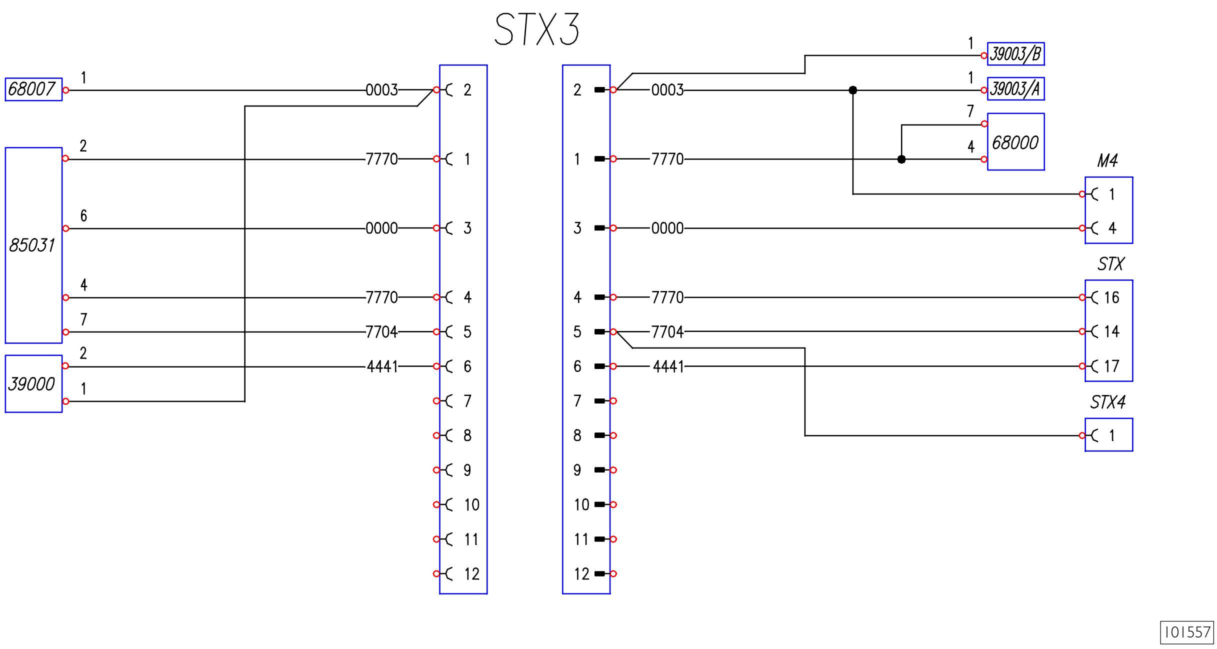
Junction connector STX3 – roof panel cable / ceiling light cable

Figure 83



CONNECTOR VIEW (CABLE SIDE)

Figure 84

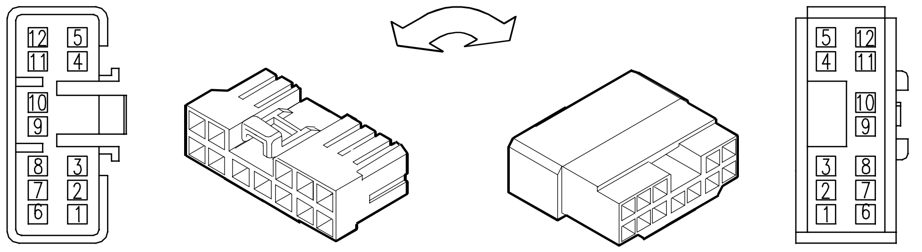


JUNCTION CONNECTOR ELECTRIC CONNECTIONS

Pin	Function	Cable colour code
1	Ceiling light ignition ground (switch on the door)	0003
2	Radio power supply (12v)	7770
3	Ground	0000
4	Radio power supply (12v)	7770
5	Radio amplifier power supply	7704
6	Ceiling light ignition with separate switch (trucks)	4441
7	–	–
8	–	–
9	–	–
10	–	–
11	–	–
12	–	–

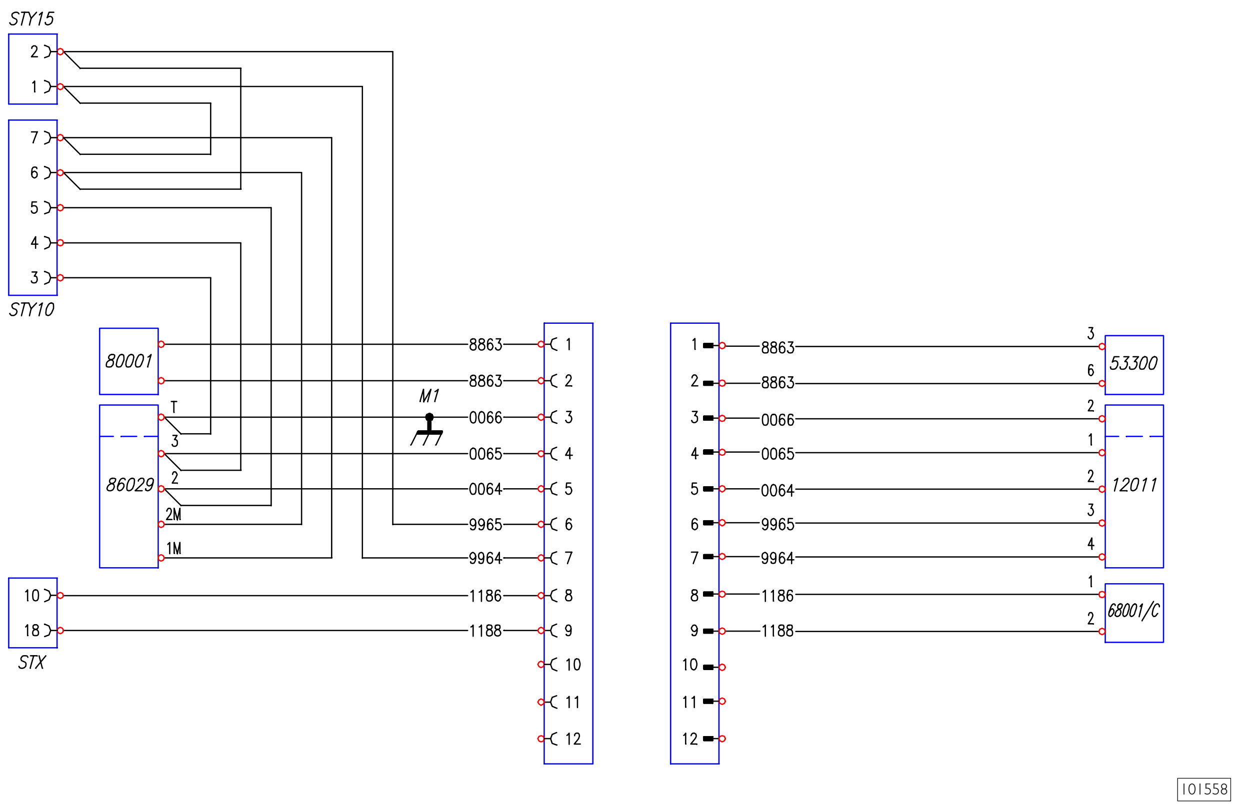
Junction connector STY09 (gray) – driver's side door electric lock and loudspeaker

Figure 85



CONNECTOR VIEW (CABLE SIDE)

Figure 86



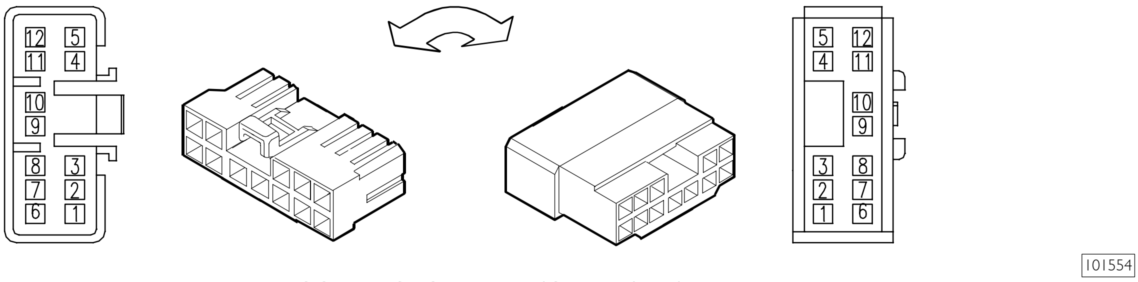
JUNCTION CONNECTOR ELECTRIC CONNECTIONS

Pin	Function	Cable colour code
1	Side window regulator motor power supply	8863
2	Side window regulator motor power supply	8863
3	Tachograph clock ground	0066
4	Central locking control (door closing)	0065
5	Central locking control (door opening)	0064
6	Central locking motor power supply (door closing)	9965
7	Central locking motor power supply (door opening)	9964
8	Left channel loudspeaker (–)	1186
9	Left channel loudspeaker (+)	1188
10	–	–
11	–	–
12	–	–

3

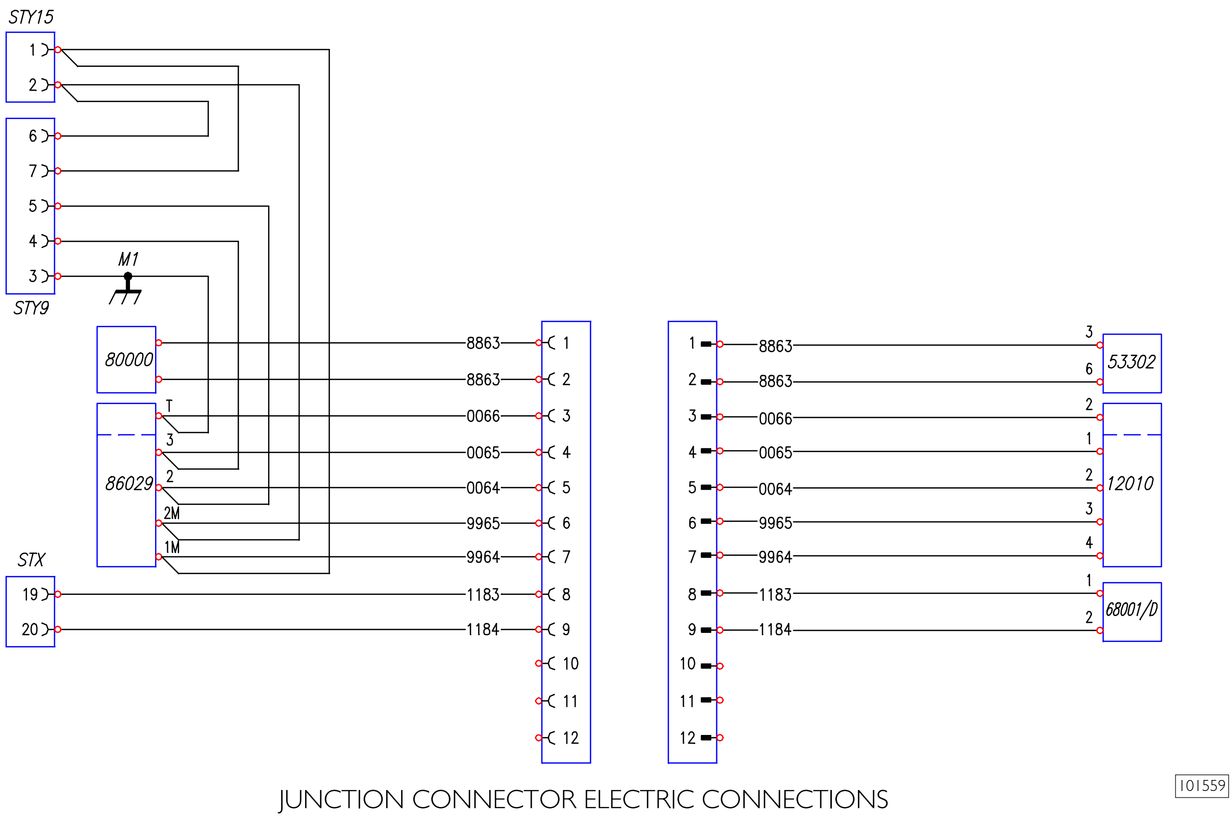
Junction connector STY10 (gray) – passenger's side door electric lock and loudspeaker

Figure 87



CONNECTOR VIEW (CABLE SIDE)

Figure 88



JUNCTION CONNECTOR ELECTRIC CONNECTIONS

Pin	Function	Cable colour code
1	Side window regulator motor power supply	8863
2	Side window regulator motor power supply	8863
3	Tachograph clock ground	0066
4	Central locking control (door closing)	0065
5	Central locking control (door opening)	0064
6	Central locking motor power supply (door closing)	9965
7	Central locking motor power supply (door opening)	9964
8	Right channel loudspeaker (–)	1183
9	Right channel loudspeaker (+)	1184
10	–	–
11	–	–
12	–	–

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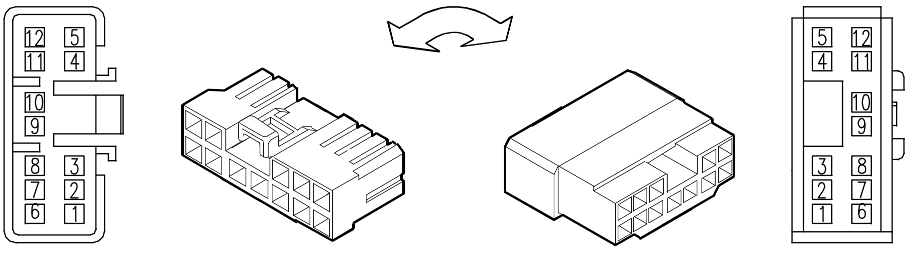
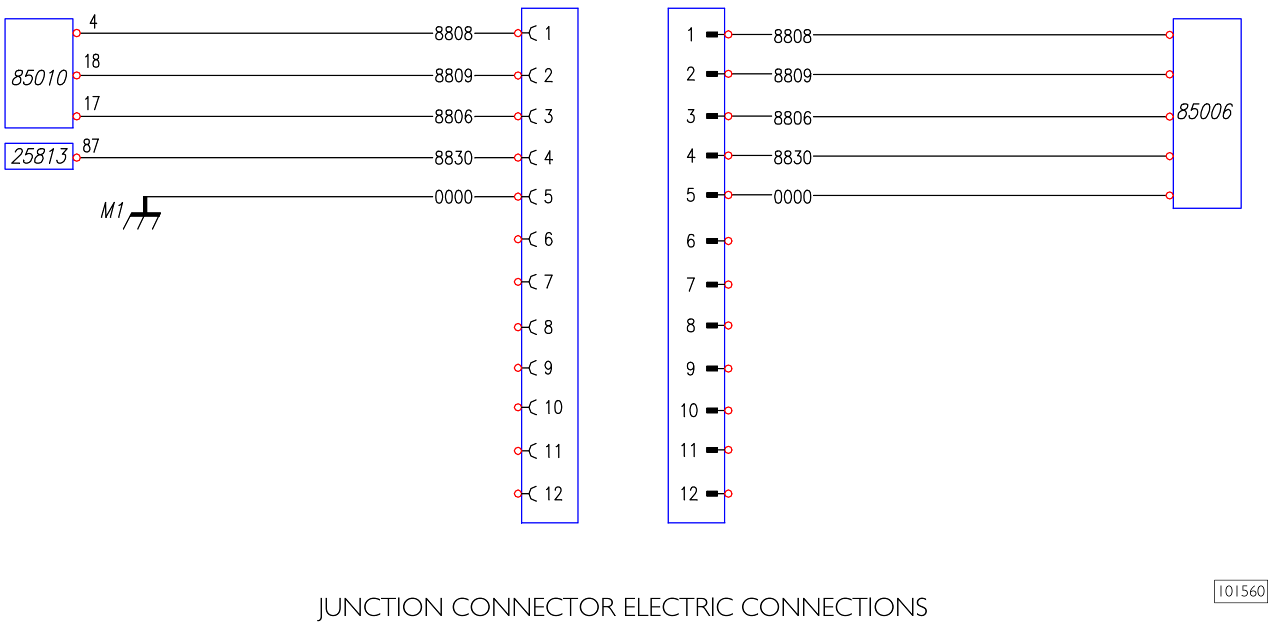
Junction connector STY16 (blue) – driver's side heated mirror control

Figure 89



CONNECTOR VIEW (CABLE SIDE)

Figure 90

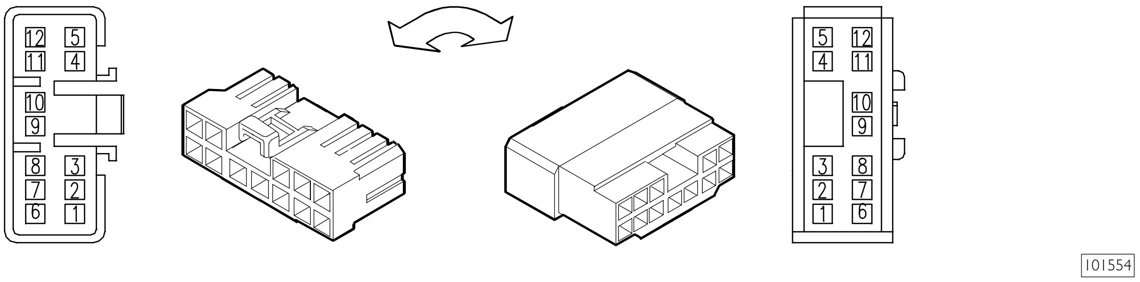


JUNCTION CONNECTOR ELECTRIC CONNECTIONS

Pin	Function	Cable colour code
1	Motor power supply for vertical orientation of main left rear–view mirror	8808
2	Motor power supply for horizontal orientation of main left rear–view mirror	8809
3	Motor power supply for orientation of main left rear–view mirror	8806
4	Heated rear–view mirror resistor power supply	8830
5	Ground	0000
6	–	–
7	–	–
8	–	–
9	–	–
10	–	–
11	–	–
12	–	–

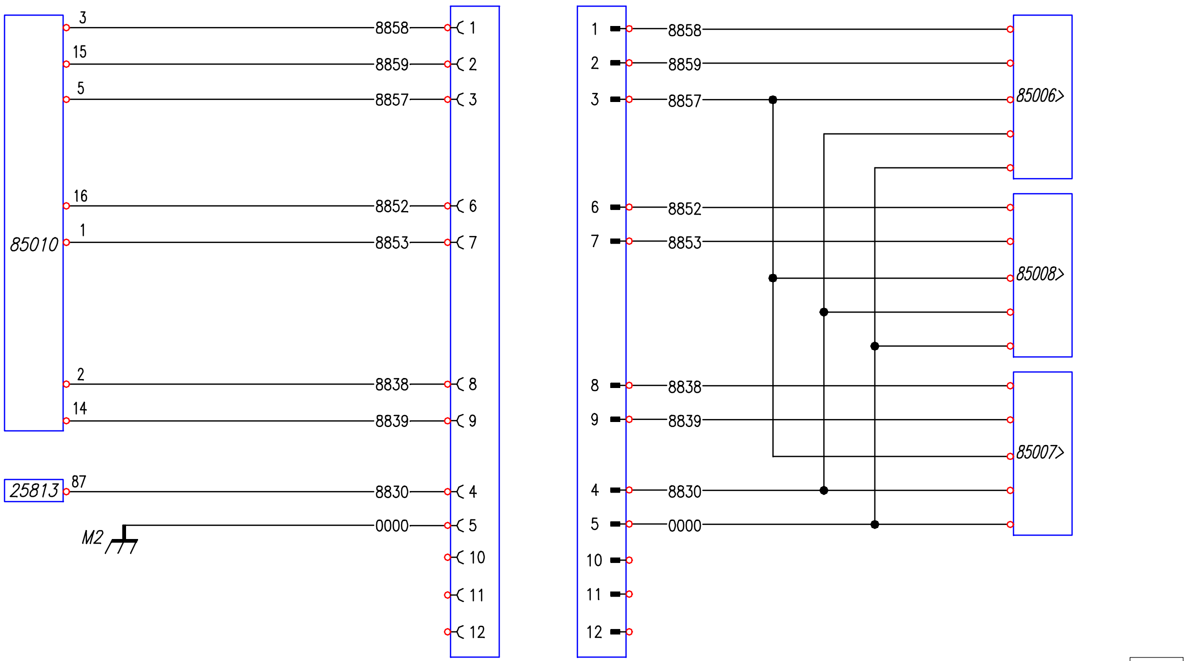
Junction connector STY17 (blue) – passenger's side heated mirror control

Figure 91



CONNECTOR VIEW (CABLE SIDE)

Figure 92

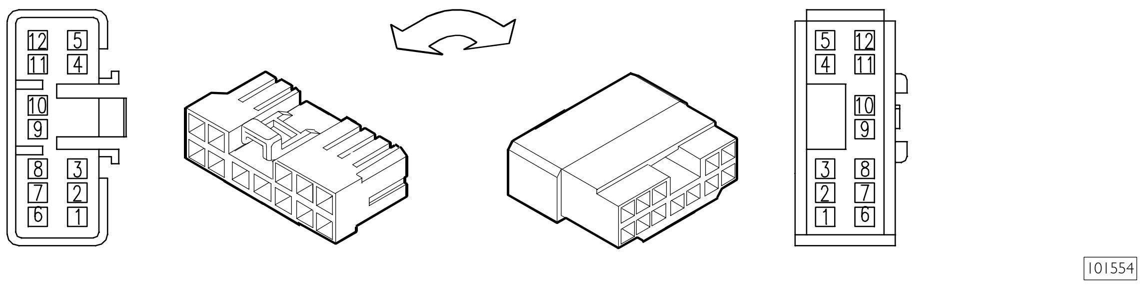


JUNCTION CONNECTOR ELECTRIC CONNECTIONS

Pin	Function	Cable colour code
1	Motor power supply for vertical orientation of main right rear–view mirror	8858
2	Motor power supply for horizontal orientation of main right rear–view mirror	8859
3	Motor power supply for orientation of main right rear–view mirror	8857
4	Heated rear–view mirror resistor power supply	8830
5	Ground	0000
6	Motor power supply for vertical orientation of passenger's side wide–angle rear–view mirror	8852
7	Motor power supply for horizontal orientation of passenger's side wide–angle rear–view mirror	8853
8	Motor power supply for vertical orientation of passenger's side approach rear–view mirror	8838
9	Motor power supply for horizontal orientation of passenger's side approach rear–view mirror	8839
10	–	–
11	–	–
12	–	–

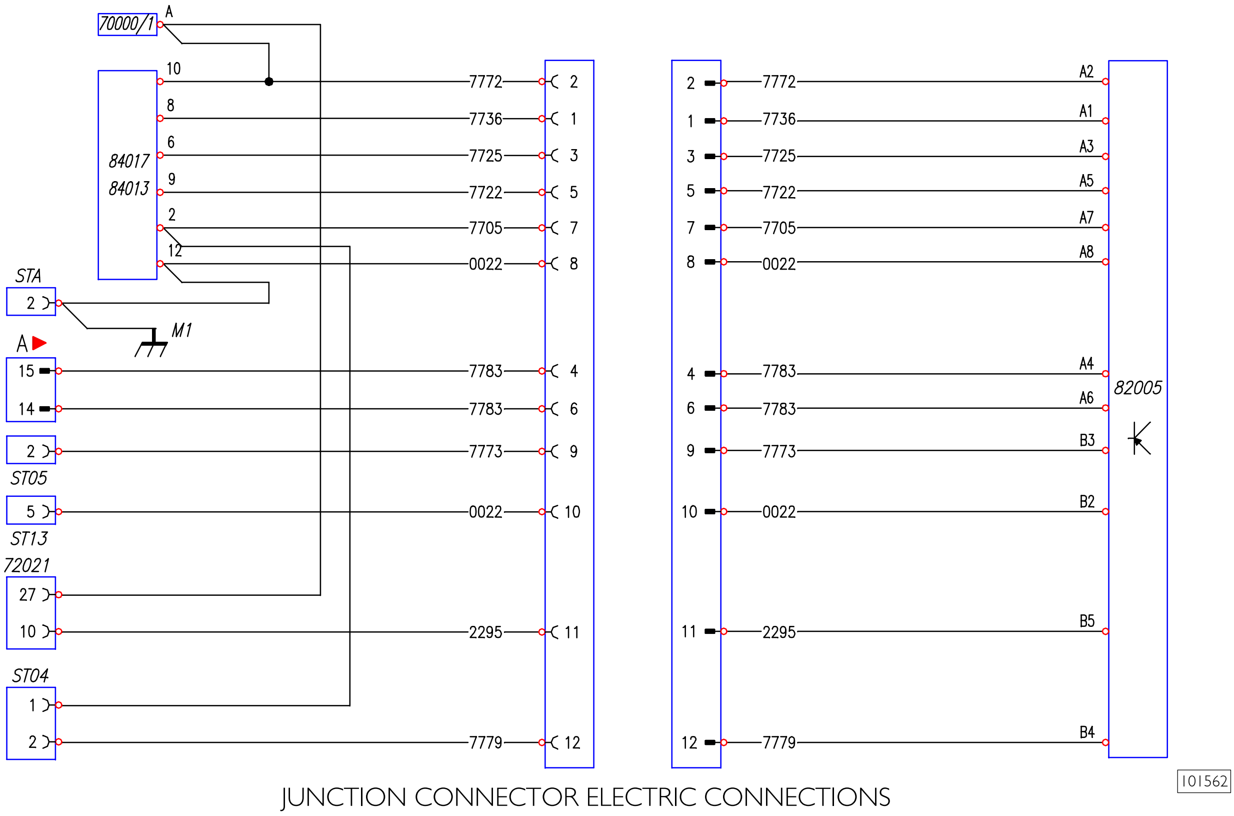
Junction connector STY18 (gray) – cab cable / auxiliary heater control unit cable

Figure 93



CONNECTOR VIEW (CABLE SIDE)

Figure 94

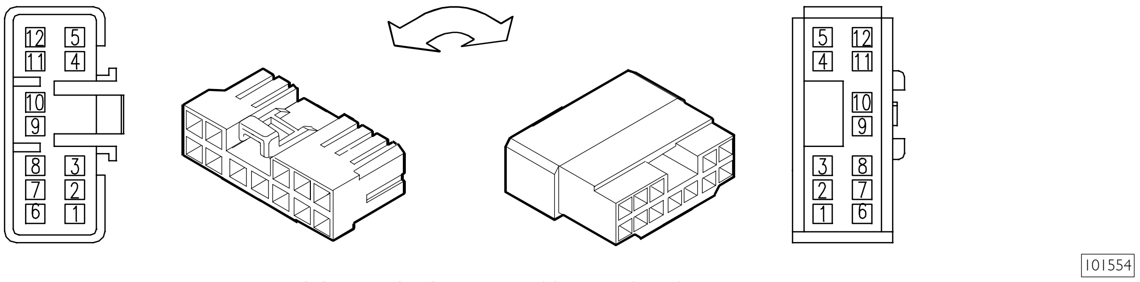


JUNCTION CONNECTOR ELECTRIC CONNECTIONS

Pin	Function	Cable colour code
1	Auxiliary heater air temperature control thermostat power supply	7736
2	Positive after the fuse	7772
3		7725
4	Auxiliary heater fuel intercept solenoid valve and auxiliary fuel pump power supply	7783
5	Auxiliary heater cab heating air motor power supply	7722
6	Auxiliary heater fuel intercept solenoid valve and auxiliary fuel pump power supply	7783
7	Auxiliary heater ignition spark power supply	7705
8	Insulated ground for auxiliary heater	0022
9	Alternator excitation	7773
10	Insulated ground for auxiliary heater	0022
11	Diagnostic "K" line for "Instrument Cluster"	2295
12	Auxiliary heater remote–control switch power supply throughthe safety control unit	7779

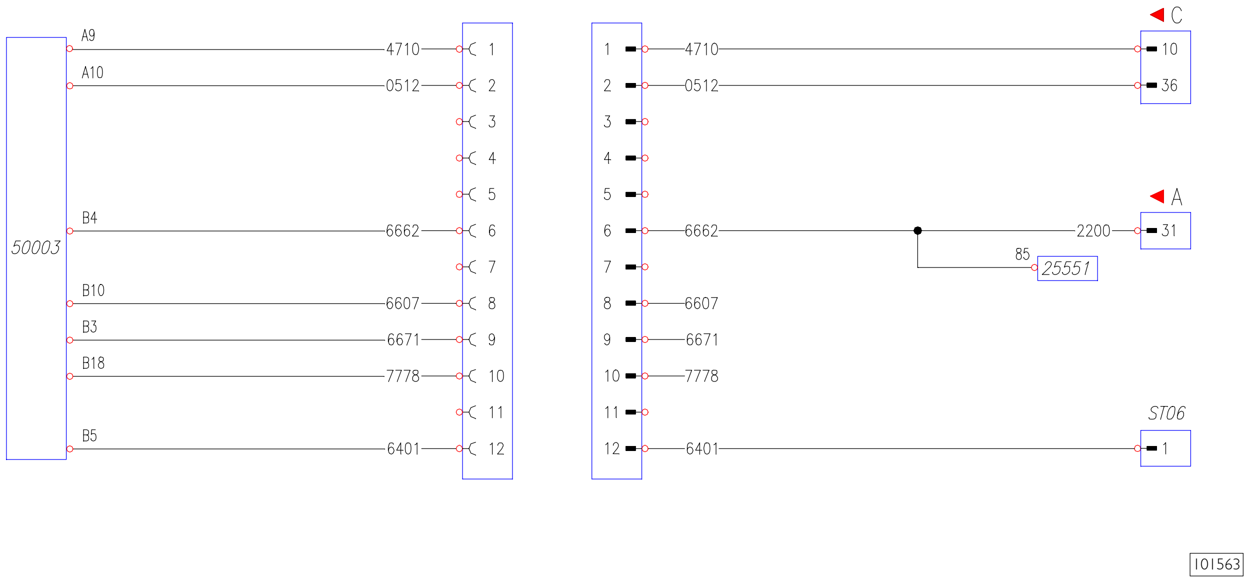
Junction connector XXXX4 (gray) – branching–off from Cluster for optional provision

Figure 95



CONNECTOR VIEW (CABLE SIDE)

Figure 96

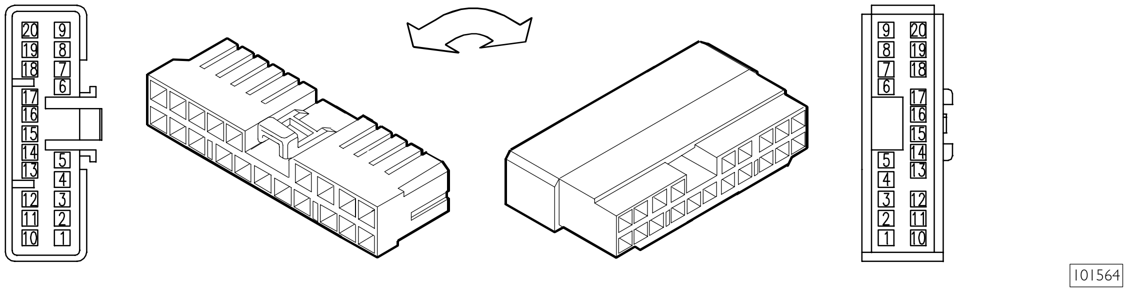


JUNCTION CONNECTOR ELECTRIC CONNECTIONS

Pin	Function	Cable colour code
1	External temperature sensor	4710
2	External temperature sensor	0512
3	–	–
4	–	–
5	–	–
6	Signal for loading side warning light	2200
7	–	–
8	Box tilted warning light signal	6607
9	Trailer ABS failure warning light signal	6671
10	Alternator charge warning light signal	7778
11	–	–
12	Low air pressure warning light signal for ECAS	6401

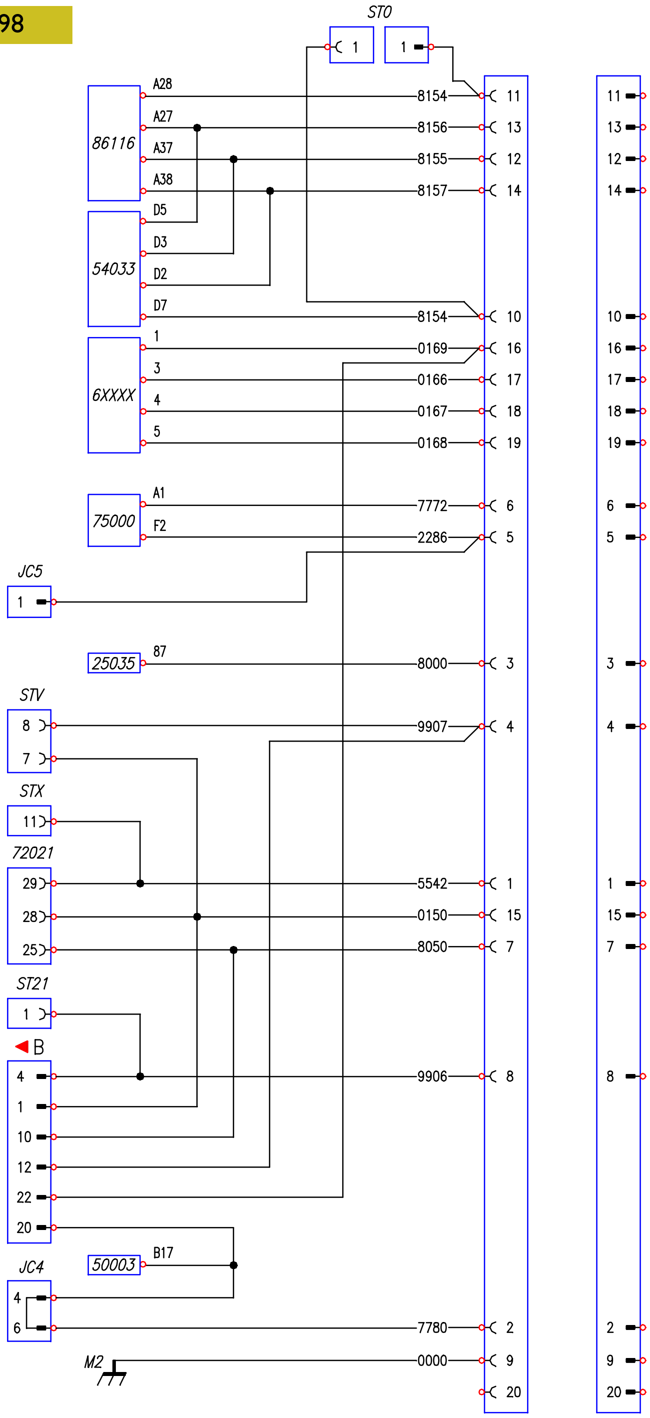
Junction connector 61071 – for body builders (cab)

Figure 97



CONNECTOR VIEW (CABLE SIDE)

Figure 98



JUNCTION CONNECTOR ELECTRIC CONNECTIONS

Pin–out

Pin	Function	Cable colour code
1	Speed signal (to the diagnosis take–off)	5542
2	D+ alternator downstream the diode	7780
3	Optical indicator circuit power supply	8000
4	Starting enable switch	9907
5	Rear fog lamp power supply	2286
6	Positive after the fuse	7772
7	Gearbox idling signalling switch	8050
8	Engine stop signal	9906
9	Ground	0000
10	Signal from switch for Cruise Control cut–off for EDC	8154
11	Signal from switch for Cruise Control cut–off for EDC	8154
12	Signal from Cruise Control recall switch for EDC	8155
13	Signal from Cruise Control speed increase switch for EDC	8156
14	Signal from Cruise Control speed decrease switch for EDC	8157
15	Component return connection to the EDC control unit	0150
16	Eco–Power control, EDC control unit	0169
17	Command from power take–off 1 switch to the EDC control unit	0166
18	Command from power take–off 2 switch to the EDCcontrol unit	0167
19	Command from Eco–Power switch to the EDC control unit	0168
20	–	–

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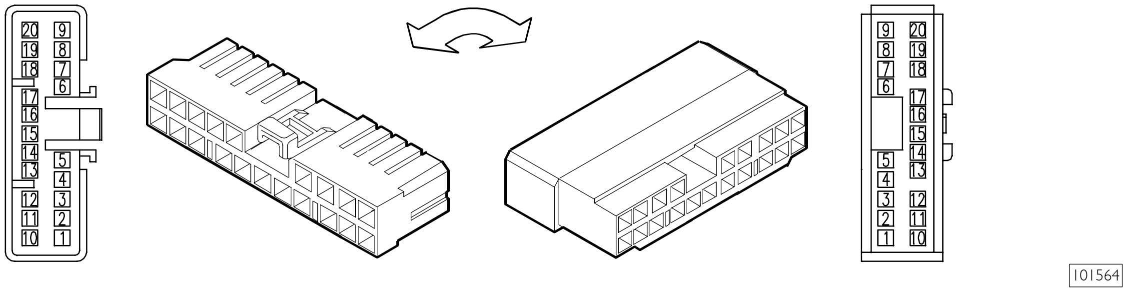
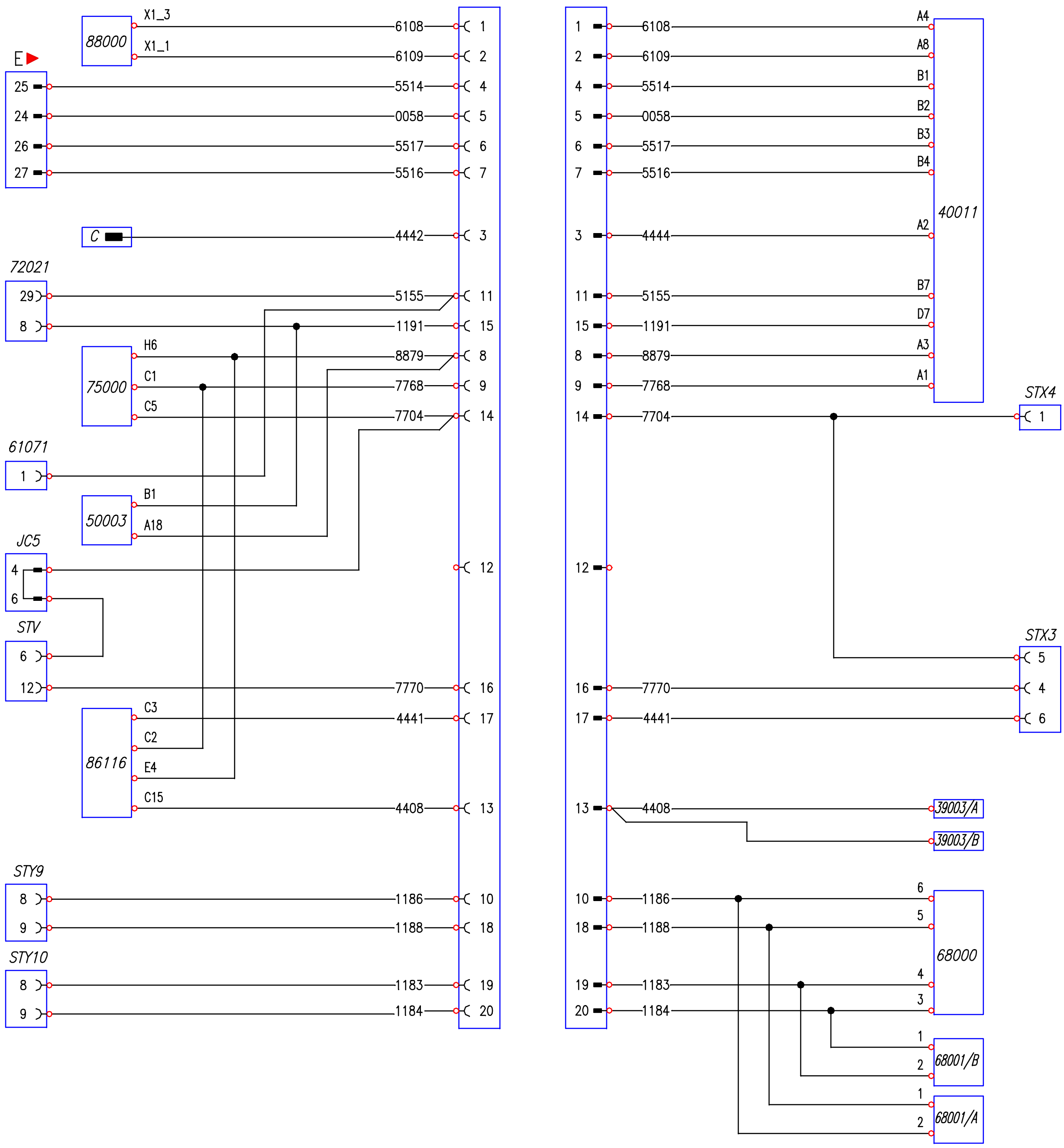
Junction connector STX (gray) – roof panel cable / dashboard cable

Figure 99



CONNECTOR VIEW (CABLE SIDE)

Figure 100



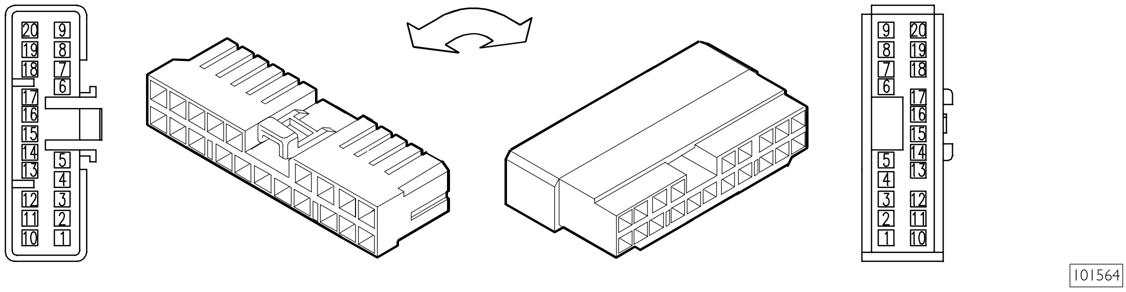
JUNCTION CONNECTOR ELECTRIC CONNECTIONS

Pin–out

Pin	Function	Cable colour code
1	Automatic transmission control unit CAN line ”H”	**6108**
2	Automatic transmission control unit CAN line ”L”	**6109**
3	Dashboard ideograph illumination bulb power supply	**4442**
4	Power supply–electronic tachograph transmitter	**5514**
5	Electronic tachograph transmitter insulated negative	**0058**
6	Speed signal–electronic tachograph transmitter	**5517**
7	Speed signal–electronic tachograph transmitter	**5516**
8	General interlocking power supply after the fuse	**8879**
9	Power supply direct from tachograph battery	**7768**
10	Left channel loudspeaker (–)	**1186**
11	Speed signal for EDC (B7 tachograph)	**5155**
12	–	**–**
13	Front door step lights	**4408**
14	Radio amplifier power supply	**7704**
15	Line ”L” for ADM control unit – electronic differential lock	**1191**
16	Radio power supply (12v)	**7770**
17	Ceiling light illumination with separate switch 1 (trucks)	**4441**
18	Left channel loudspeaker (+)	**1188**
19	Right channel loudspeaker (–)	**1183**
20	Right channel loudspeaker (+)	**1184**

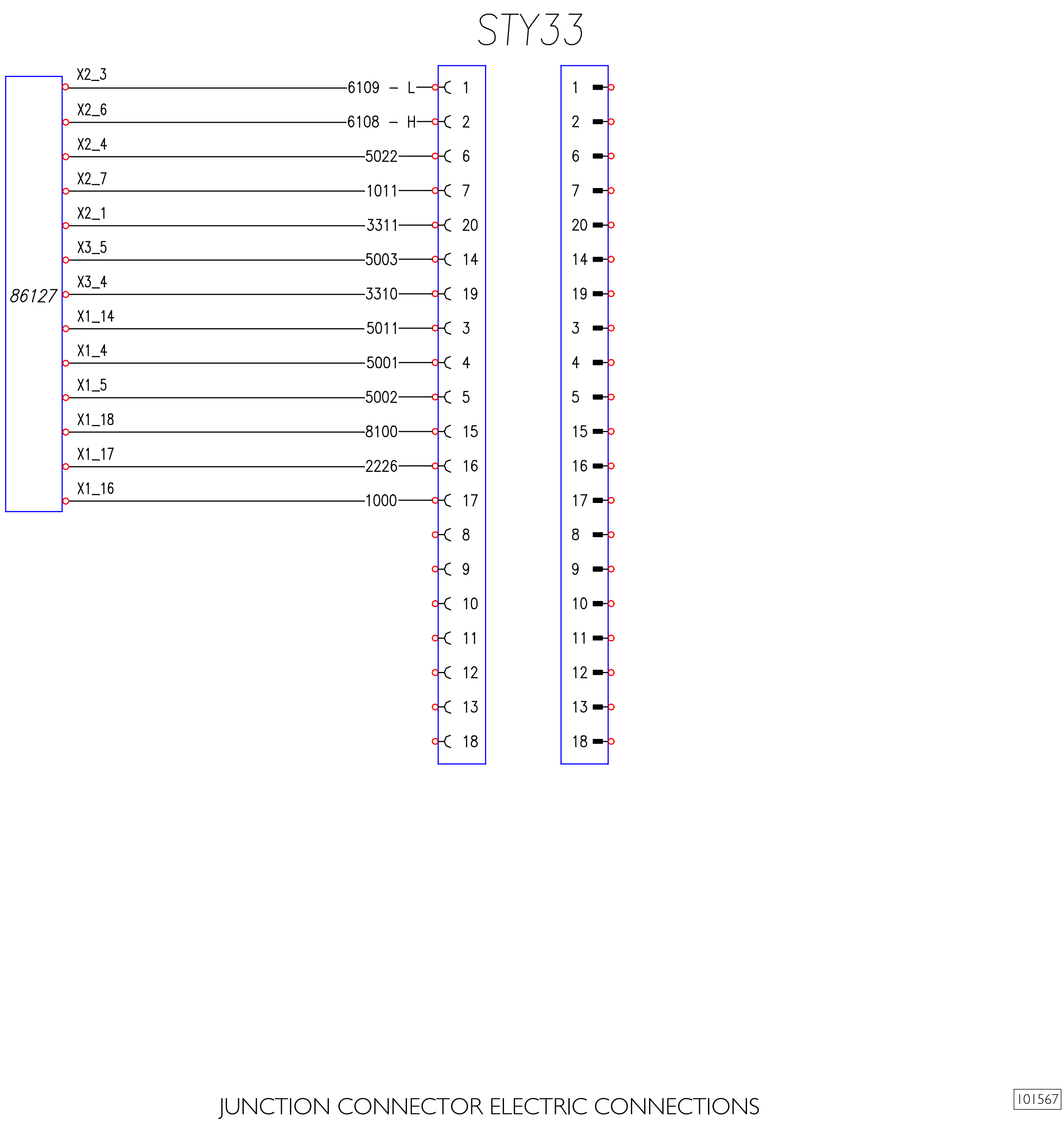
Junction connector STY33 (black) – for body builders (DMI control unit – option 5626)

Figure 101



CONNECTOR VIEW (CABLE SIDE)

Figure 102



JUNCTION CONNECTOR ELECTRIC CONNECTIONS

Pin–out

Pin	Function	Cable colour code
1	CAN line – L	**6109**
2	CAN line – H	**6108**
3	DMI control unit pin X1–14	**5011**
4	DMI control unit pin X1–4	**5001**
5	DMI control unit pin X1–5	**5002**
6	DMI control unit pin X2–4	**5022**
7	DMI control unit pin X2–7	**1011**
8	–	**–**
9	–	**–**
10	–	**–**
11	–	**–**
12	–	**–**
13	–	**–**
14	DMI control unit pin X–5	**5003**
15	DMI control unit pin X–18	**8100**
16	Reversing lamp power supply arrangement	**2226**
17	Gear lever neutral and parking brake ON signal	**1000**
18	–	**–**
19	Brake pedal pressed signal	**3310**
20	Clutch pedal pressed signal	**3311**

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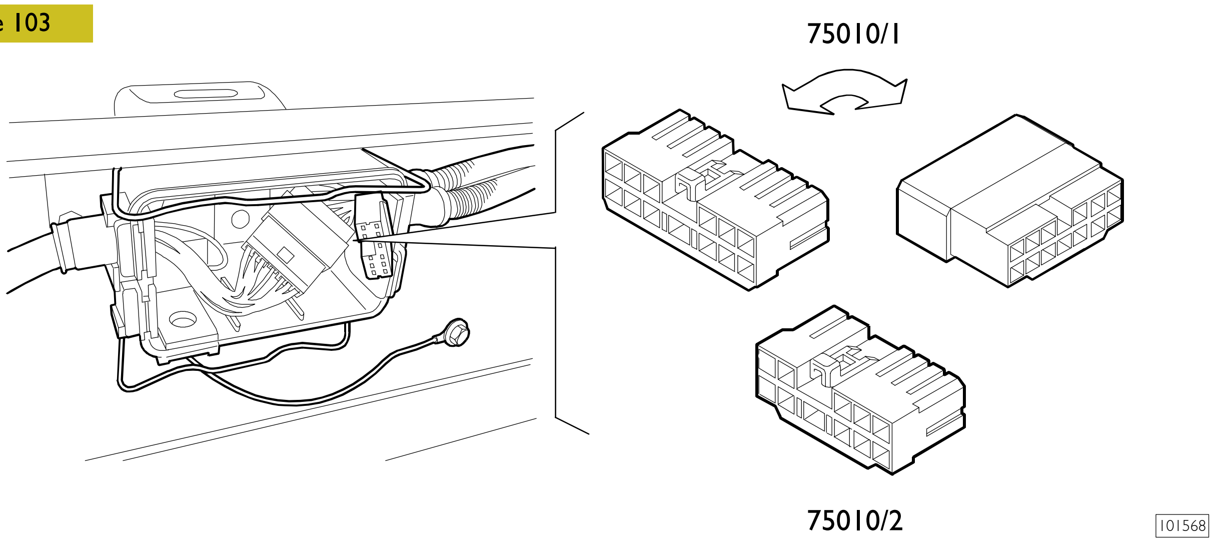
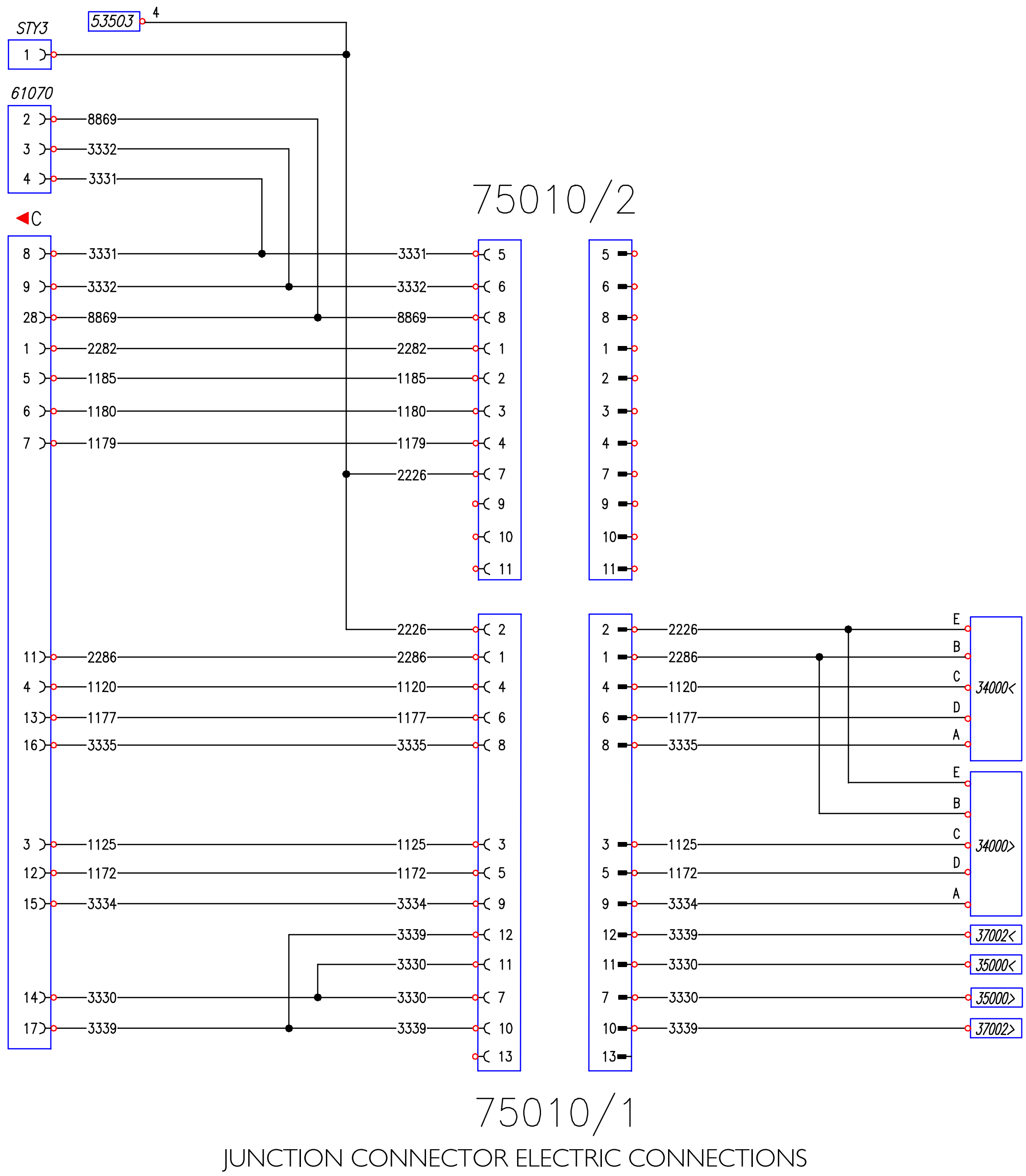
Rear lights junction box – trailer arrangement

Figure 103



CONNECTOR VIEW (CABLE SIDE)

Figure 104



JUNCTION CONNECTOR ELECTRIC CONNECTIONS

75010/1 (13 pin – white) – rear lights

Pin	Function	Cable colour code
1	Tractor rear fog lamp power supply, after IVECO check	2286
2	Reversing lamp power supply	2226
3	Rear right indicator bulb	1125
4	Rear left indicator bulb	1120
5	Right rear stop signalling	1172
6	Left rear stop signalling	1177
7	License plate light	3330
8	Right sidelights	3335
9	Left sidelights	3334
10	Right/left clearance lights	3339
11	License plate light	3330
12	Right/left clearance lights	3339
13	–	–

75010/2 (11 pin – white) – trailer arrangement

Pin	Function	Cable colour code
1	Trailer rear fog lamp power supply	2282
2	Trailer right indicator light	1185
3	Trailer left indicator light	1180
4	Trailer brake lights	1179
5	Right clearance lights	3331
6	Left clearance lights	3332
7	Trailer reversing lamp power supply	2226
8	Key–controlled positive (+15)	8869
9	–	–
10	–	–
11	–	–

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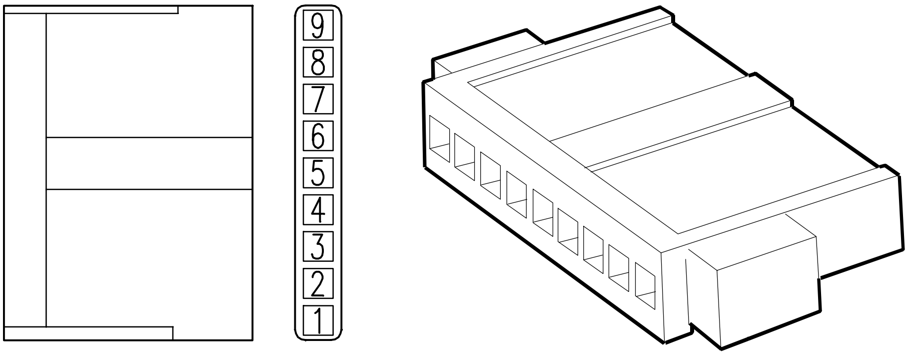
Joint JC1 / JC2 / JC3

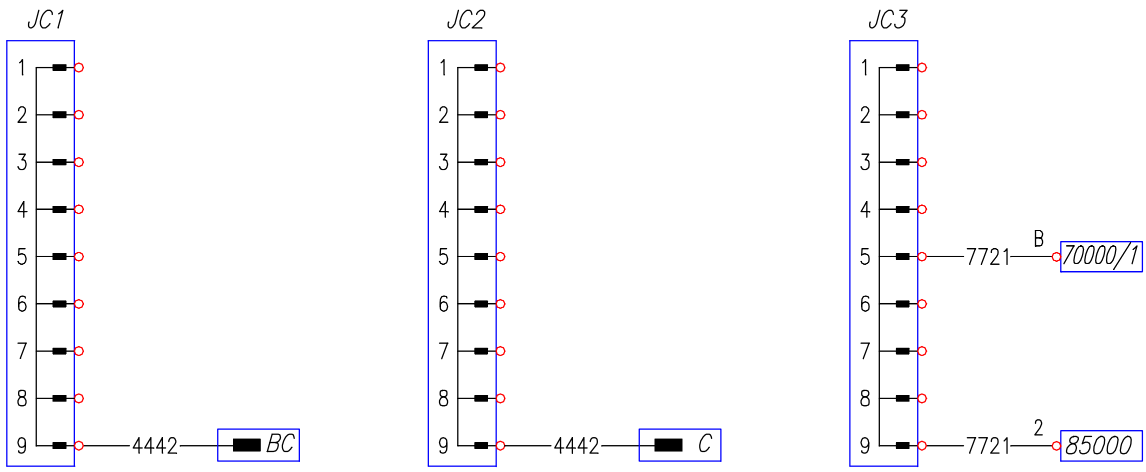
Figure 105



JOINT PERSPECTIVE VIEW

101570

Figure 106



101571

JOINT ELECTRIC CONNECTIONS – JC1 / JC2 / JC3

Joint JC1 (blue)

Pin	Function	Cable colour code
1 ÷ 9	Ideograph power supply positive	4442

Joint JC2 (blue)

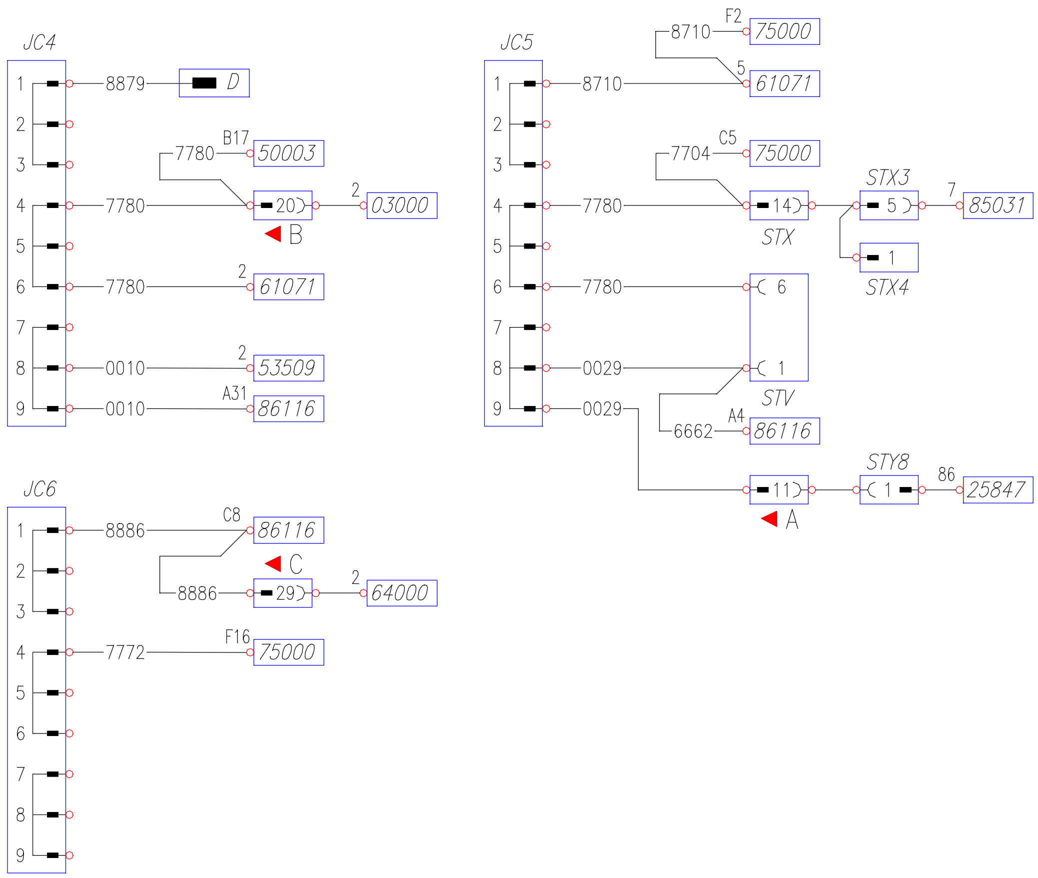
Pin	Function	Cable colour code
1 ÷ 9	Ideograph power supply positive	4442

Joint JC3 (blue)

Pin	Function	Cable colour code
1 ÷ 9	Cigar lighter power supply positive	7721

Joint JC4 / JC5 / JC6

Figure 107



JOINT ELECTRIC CONNECTIONS – JC4 / JC5 / JC6

101572

Joint JC4 (green)

Pin	Function	Cable colour code
1 ÷ 3	Positive +15 for general interlocking power supply after the fuse	8879
4 ÷ 6	D+ alternator	7780
7 ÷ 9	Ground from ceiling light ignition switch	0010

Joint JC5 (green)

Pin	Function	Cable colour code
1 ÷ 3	Positive +15 for power supply provided for external body builders (max. = 10 A)	8710
4 ÷ 6	Battery positive after the radio amplifier power supply fuse	7704
7 ÷ 9	Signal from start lock switch with handbrake OFF	0029

Joint JC6 (green)

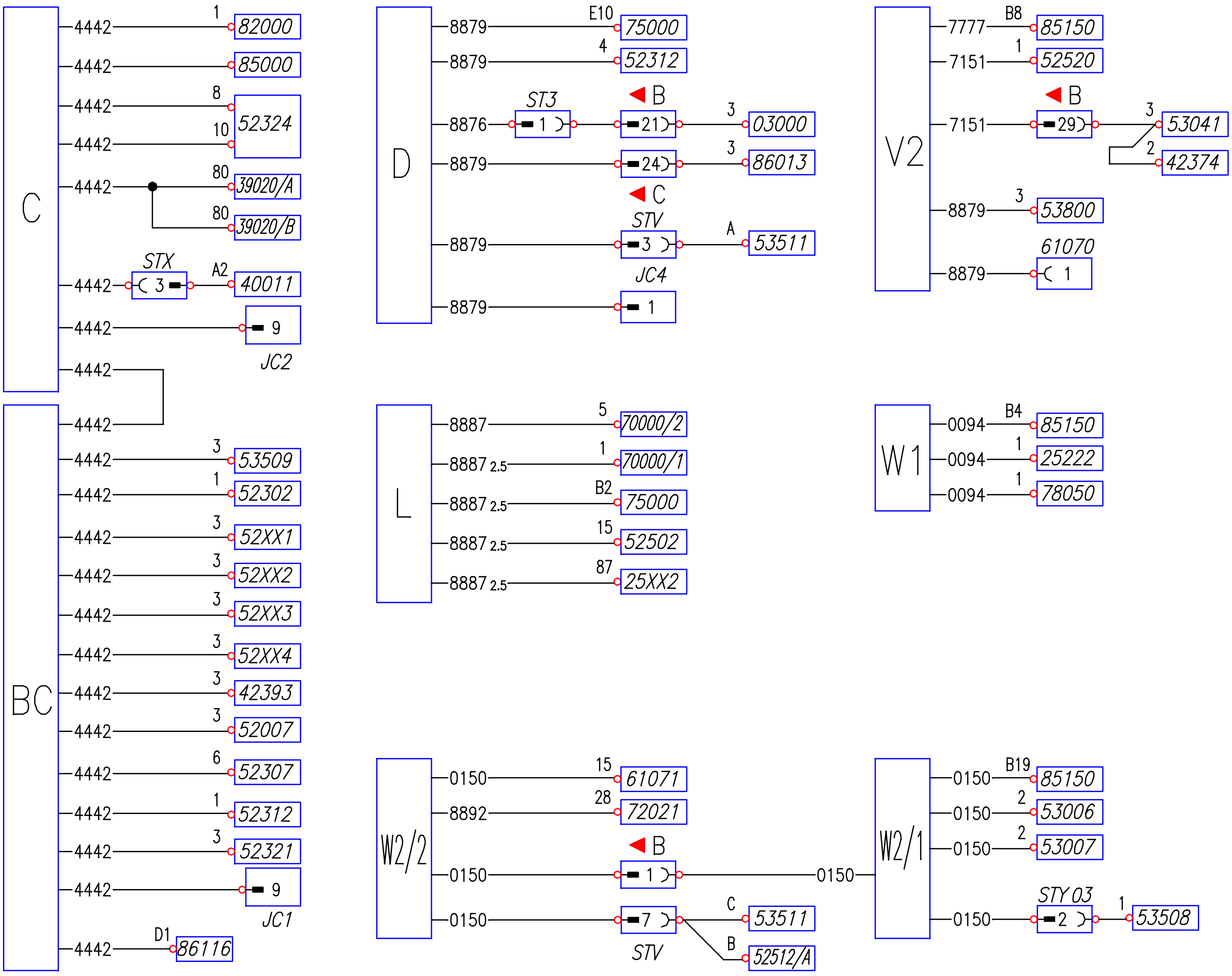
Pin	Function	Cable colour code
1 ÷ 3	Windscreen washer electric pump power supply	8886
4 ÷ 6	Battery positive after the fuse	7772
7 ÷ 9	Free	–

Branch points (ultrasound welds)

Figure 108

ULTRASOUND WELDING WITH INSULATION OBTAINED BY MEANS OF THERMO–SHRINKING SHEATH

Figure 109

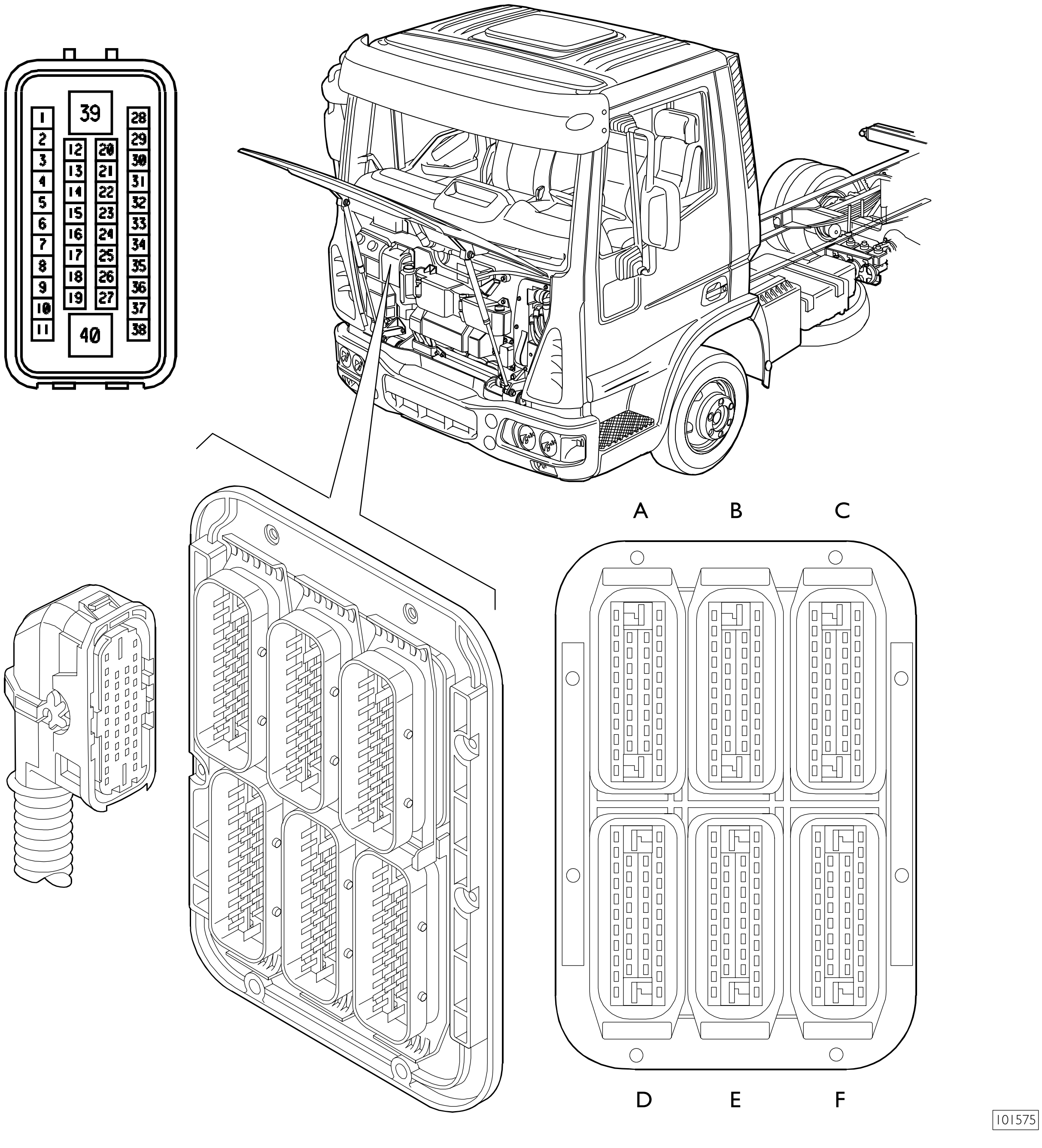


BRANCH POINT ELECTRIC CONNECTIONS – BC / C / D / L / V2 / W1 / W2

Branch point	Function	Cable colour code
BC	Ideograph power supply positive (pin D1 – Body Controller) (Cluster area)	4442
C	Ideograph power supply positive (central area cab section)	4442
D	Positive +15 for general interlocking power supply after the fuse (cab section)	8879
L	Positive +15 for general service power supply before the fuse (cab section)	8887
V2	Positive for EDC system power supply after the fuse (chassis section)	7151
W1	Pre–heating actuation enable relay ground (chassis section)	0094
W2/1	Component return connection to the EDC control unit (chassis section)	0150
W2/2	Component return connection to the EDC control unit (cab section)	0150

BULKHEAD

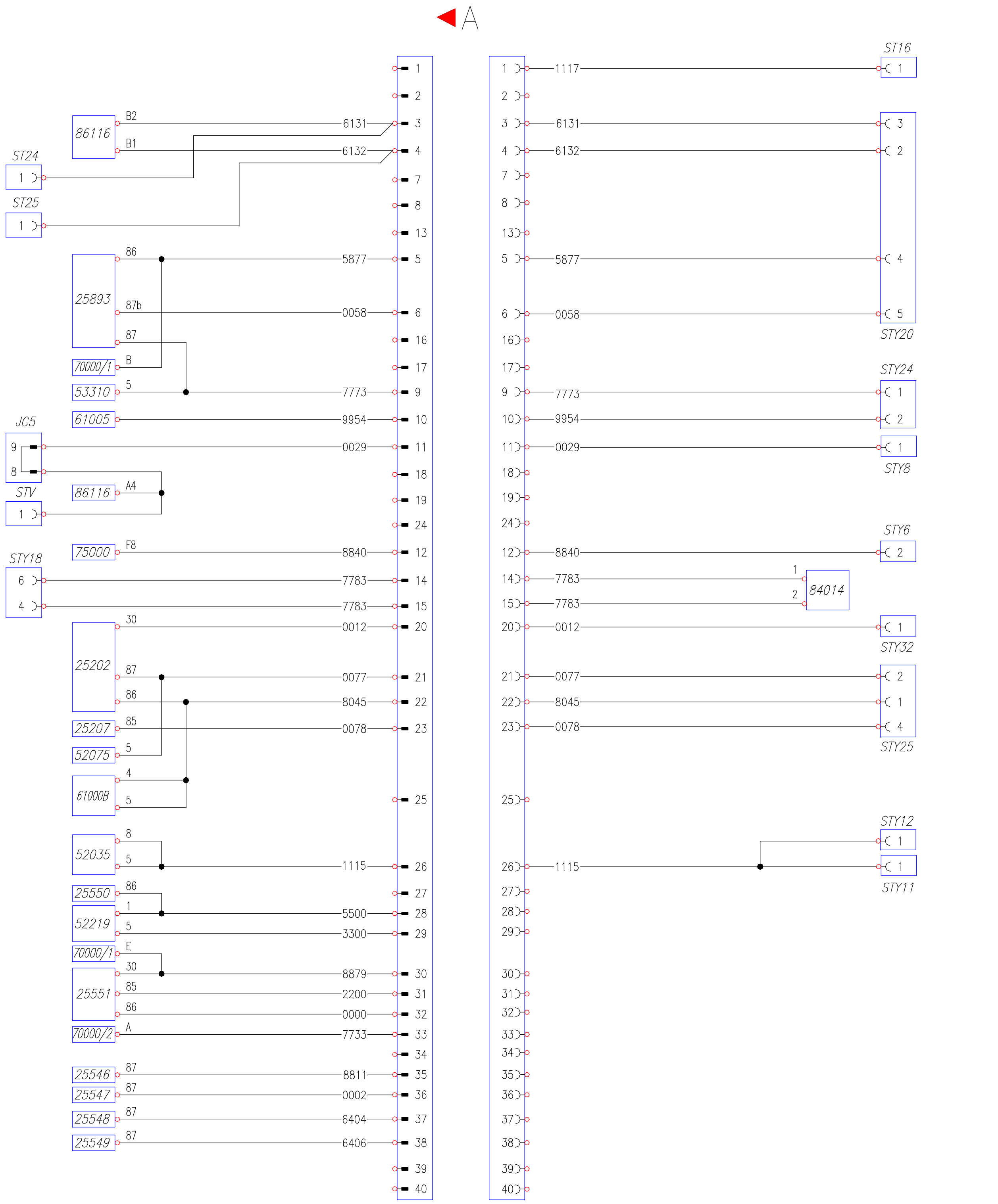
Figure 110



Ref.	Description
A	Option
B	EDC
C	Services / Lights
D	Automatic transmission
E	Services / Lights
F	ABS / ECAS

Connector ”A” (white) – cab cable / chassis cable

Figure 111



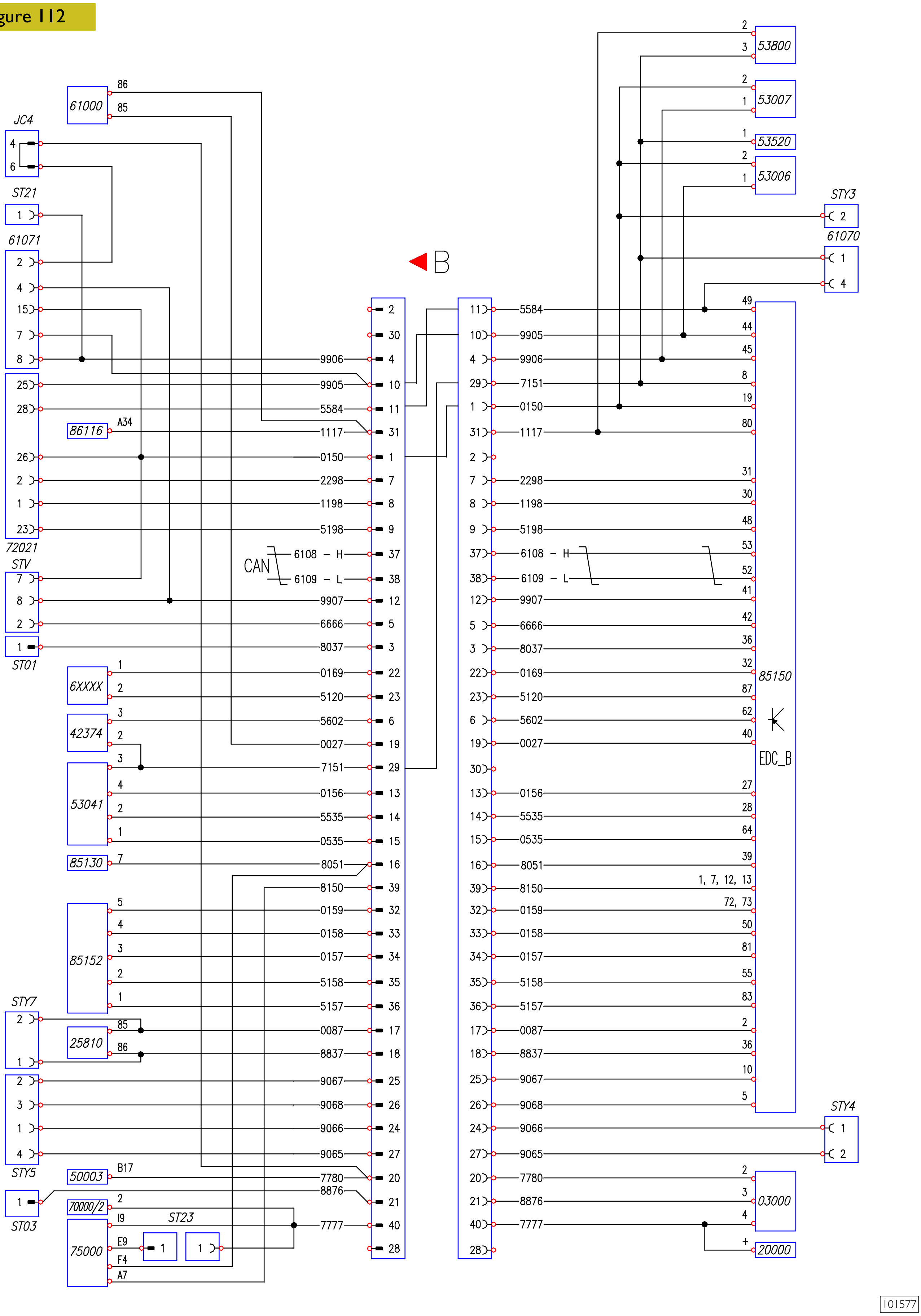
CONNECTOR ”A” ELECTRIC CONNECTIONS

Pin – out connector ”A”

Ref.	Description	Cable
1	Front parking brake ON switch signal	1117
2	–	–
3	PTO1 ON signal	6131
4	PTO2 ON signal	6132
5	PTO actuation solenoid valve power supply	5877
6	PTO actuation solenoid valve ground	0058
7	–	–
8	–	–
9	Signal from PTO actuation enable switch	7773
10	PTO actuation enable switch ground	9954
11	Hydraulic cab tilting relay control ground after grill opening signalling switch	0029
12	Braking system air drier resistor power supply	8840
13	–	–
14	Auxiliary heater fuel intercept solenoid valve and auxiliary fuel pump power supply	7783
15	Auxiliary heater fuel intercept solenoid valve and auxiliary fuel pump power supply	7783
16	–	–
17	–	–
18	–	–
19	–	–
20	TGC ground	0012
21	Brake light signal from brake value transmitter with EBS	0077
22	TGC excitation through key switch	8045
23	Alternator D+ after the power diode	0078
24	–	–
25	–	–
26	Rotary lamp power supply	1115
27	–	–
28	Loading board preset	–
29	Loading board preset	–
30	Loading board preset	–
31	Loading board preset	–
32	Loading board preset	–
33	Loading board preset	–
34	–	–
35	Loading board preset	–
36	Loading board preset	–
37	Loading board preset	–
38	Loading board preset	–
39	Heated diesel fuel pre–filter power supply	7753
40	–	–

Connector "B" (brown) – cab cable / chassis cable

Figure 112



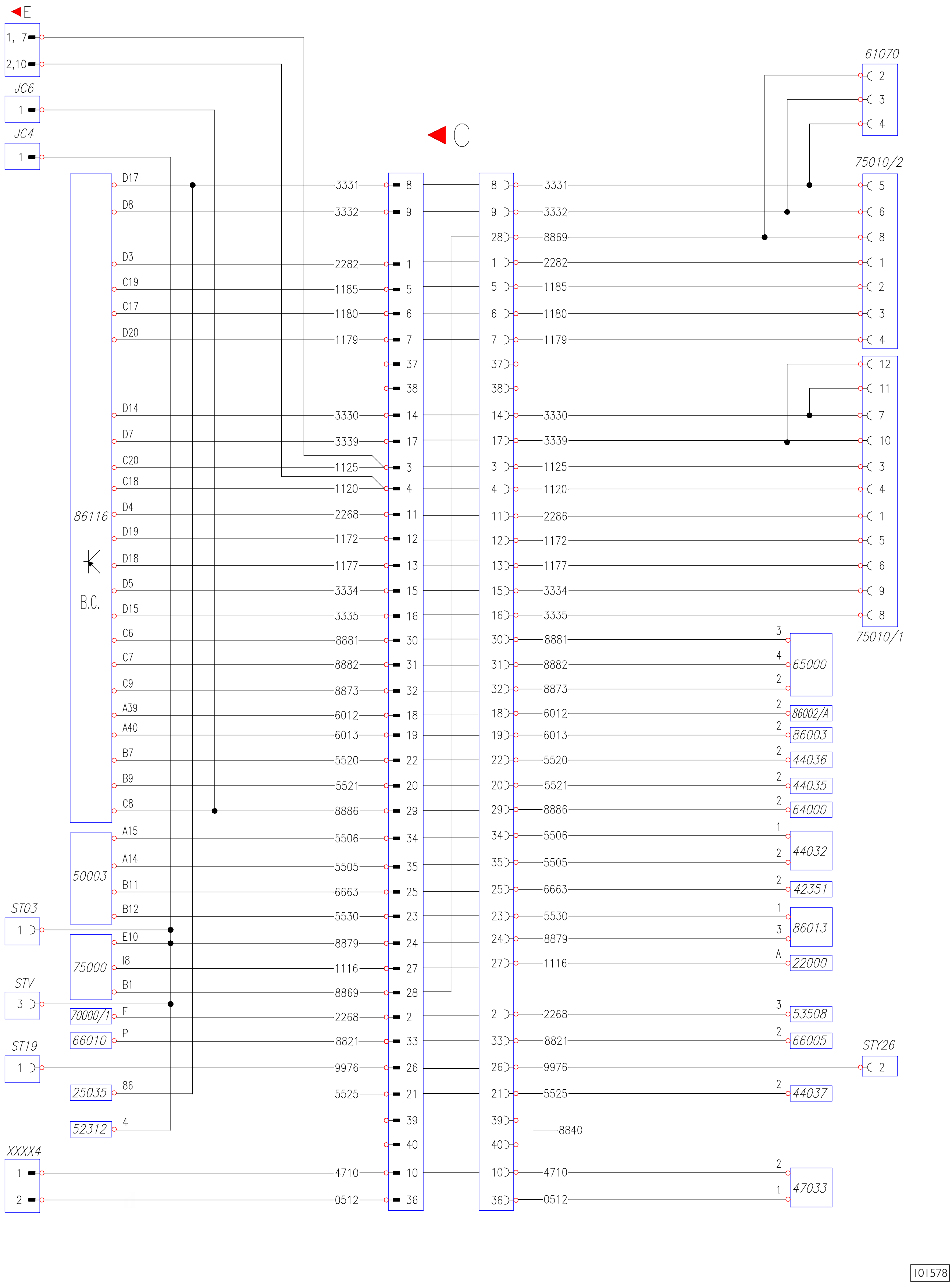
CONNECTOR "B" ELECTRIC CONNECTIONS

Connector ”B” pin–out

Ref.	Description	Cable
1	Negative for starting sensors	0150
2	–	–
3	Signal ”+50”	8037
4	Engine stop signal	9906
5	Cab unhooked signal	6666
6	Clutch release signal	5602
7	EDC diagnosis K line	2298
8	EDC diagnosis L line	1198
9	30–pole diagnosis pin 23 (engine phase)	5198
10	Engine starting signal	9905
11	30–pole diagnosis pin 28 (rate gyroscope)	5584
12	Handbrake ON signal	9907
13	EDC diagnosis request button	0156
14	EDC failure warning light positive	5535
15	EDC failure warning light negative	0535
16	Power supply ”+15”	8051
17	Diesel fuel heating remote–control switch	0087
18	Diesel fuel heating remote–control switch	8837
19	Exhaust brake cut–out with ABS	0027
20	”L” warning light alternator	7780
21	”+15” alternator	8876
22	EDC7 pin 32 (PTO 1, 2, 3)	0169
23	EDC7 pin 87 (PTO 1, 2, 3)	5120
24	Conditioner control	9066
25	Conditioner compressor remote–control switch	9067
26	Conditioner compressor actuation signal	9068
27	Conditioner	9065
28	–	–
29	EDC (clutch ON signalling switch and blink–code power supply)	7151
30	–	–
31	Stop signal from the brake pedal	8153/1117
32	Accelerator pedal pin 5	0159
33	Accelerator pedal pin 4	0158
34	Accelerator pedal pin 3	0157
35	Accelerator pedal pin 2	5158
36	Accelerator pedal pin 1	5157
37	CAN line – H	6108
38	CAN line – L	6109
39	Power supply after the fuse for EDC	8150
40	Battery ”+” for tachograph and radio	7777

Connector "C" (white) – cab cable / chassis cable

Figure 113



CONNECTOR "C" ELECTRIC CONNECTIONS

Connector ”C” pin–out

Ref.	Description	Cable
1	Trailer rear fog light	2282
2	Reversing lights	2268
3	Rear right indicator light	1125
4	Rear left indicator light	1120
5	Trailer right indicator light	1185
6	Trailer left indicator light	1180
7	Trailer right & left brake lights	1179
8	Trailer right sidelights	3331
9	Trailer left sidelights	3332
10	External temperature sensor	4710
11	Tractor right & left rear fog lights	2286
12	Tractor right brake light	1172
13	Tractor left brake light	1177
14	Tractor right & left license plate lights	3330
15	Rear right sidelights	3334
16	Rear left sidelights	3335
17	Rear right & left clearance lights	3339
18	Front wheel brake wear	6012
19	Rear wheel brake wear	6013
20	Windscreen washer tank low water level warning light	5521
21	Cooling water minimum level warning light	5525
22	Power steering fluid low level warning light	5520
23	Signalling the presence of water in the diesel fuel filter	5530
24	Signalling the presence of water in the diesel fuel filter	8879
25	Air filter clogged signalling	6663
26	Geared–down speeds ON warning light	9976
27	Horn	1116
28	”+15” for body builders	8869/8869
29	Windscreen washer water pump	8886
30	Windscreen wiper motor 53/B	8881
31	Windscreen wiper motor 53	8882
32	Windscreen wiper motor 31/B	8873
33	Headlamp wiper power supply	8821
34	Engine oil level	5506
35	Engine oil level	5505
36	External temperature sensor	0512
37	–	–
38	–	–
39	–	–
40	–	–

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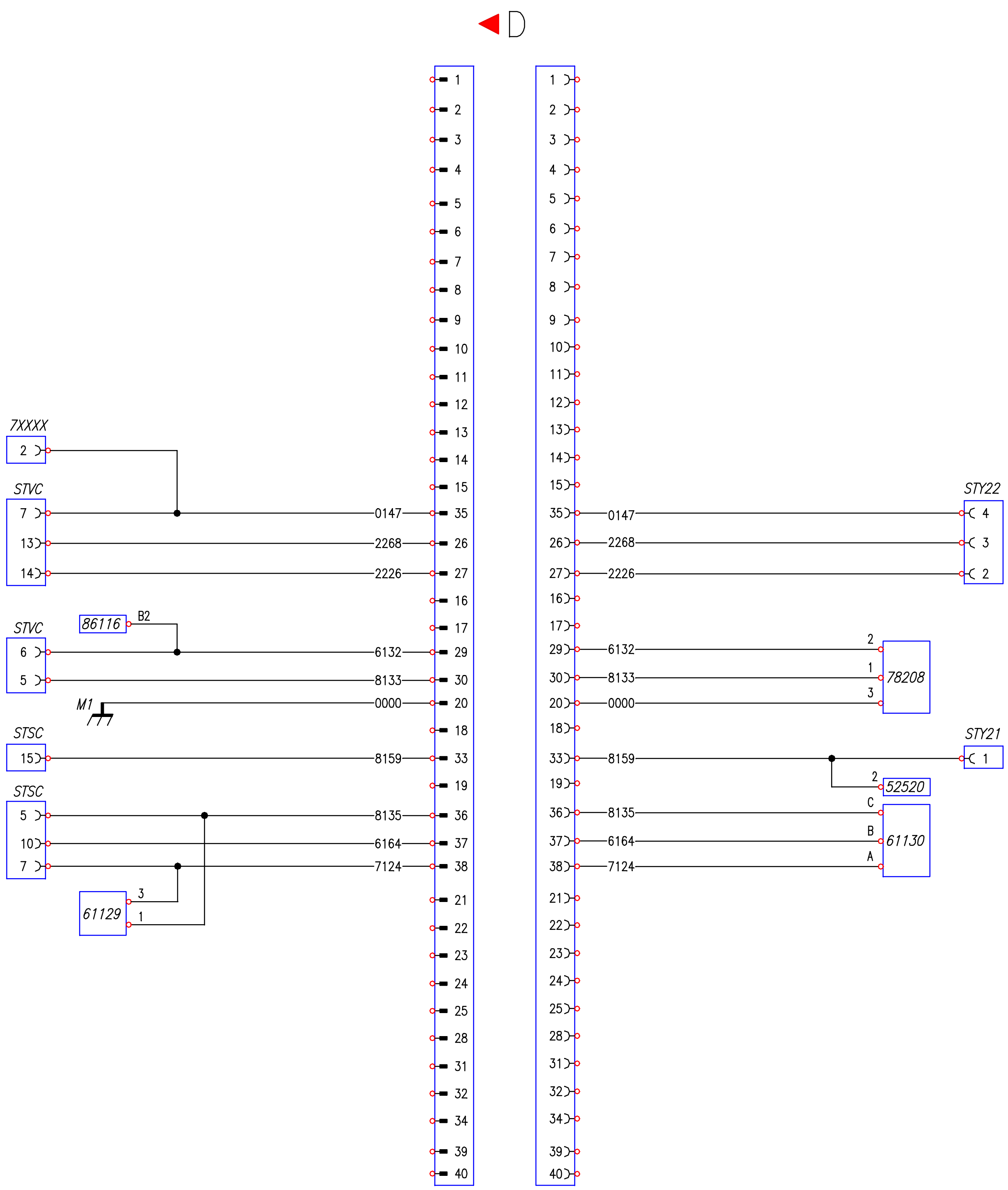
Connector ”D” (white) – cab cable / chassis cable

Figure 114



101579

CONNECTOR ”D” ELECTRIC CONNECTIONS

Connector ”D” pin–out

Ref.	Description	Cable
1	–	–
2	–	–
3	–	–
4	–	–
5	–	–
6	–	–
7	–	–
8	–	–
9	–	–
10	–	–
11	–	–
12	–	–
13	–	–
14	–	–
15	–	–
16	–	–
17	–	–
18	–	–
19	–	–
20	PTO solenoid valve ground (Allison automatic transmission)	0000
21	–	–
22	–	–
23	–	–
24	–	–
25	–	–
26	Reversing lamp switch power supply (Allison automatic transmission)	2268
27	Reversing lamp power supply (Allison automatic transmission)	2226
28	–	–
29	PTO actuation signal (Allison automatic transmission)	6132
30	PTO solenoid valve power supply (Allison automatic transmission)	8133
31	–	–
32	–	–
33	Signal from exhaust brake switch for EDC	8159
34	–	–
35	Automatic neutral position signal for body builders (Allison automatic transmission)	0147
36	Resistor cluster ground for retarder pressure switches (Allison automatic transmission)	8135
37	Retarder request signal from the resistor cluster for retarder pressure switches (Allison automatic transmission)	6164
38	Resistor cluster power supply for retarder pressure switches (Allison automatic transmission)	7124
39	–	–
40	–	–

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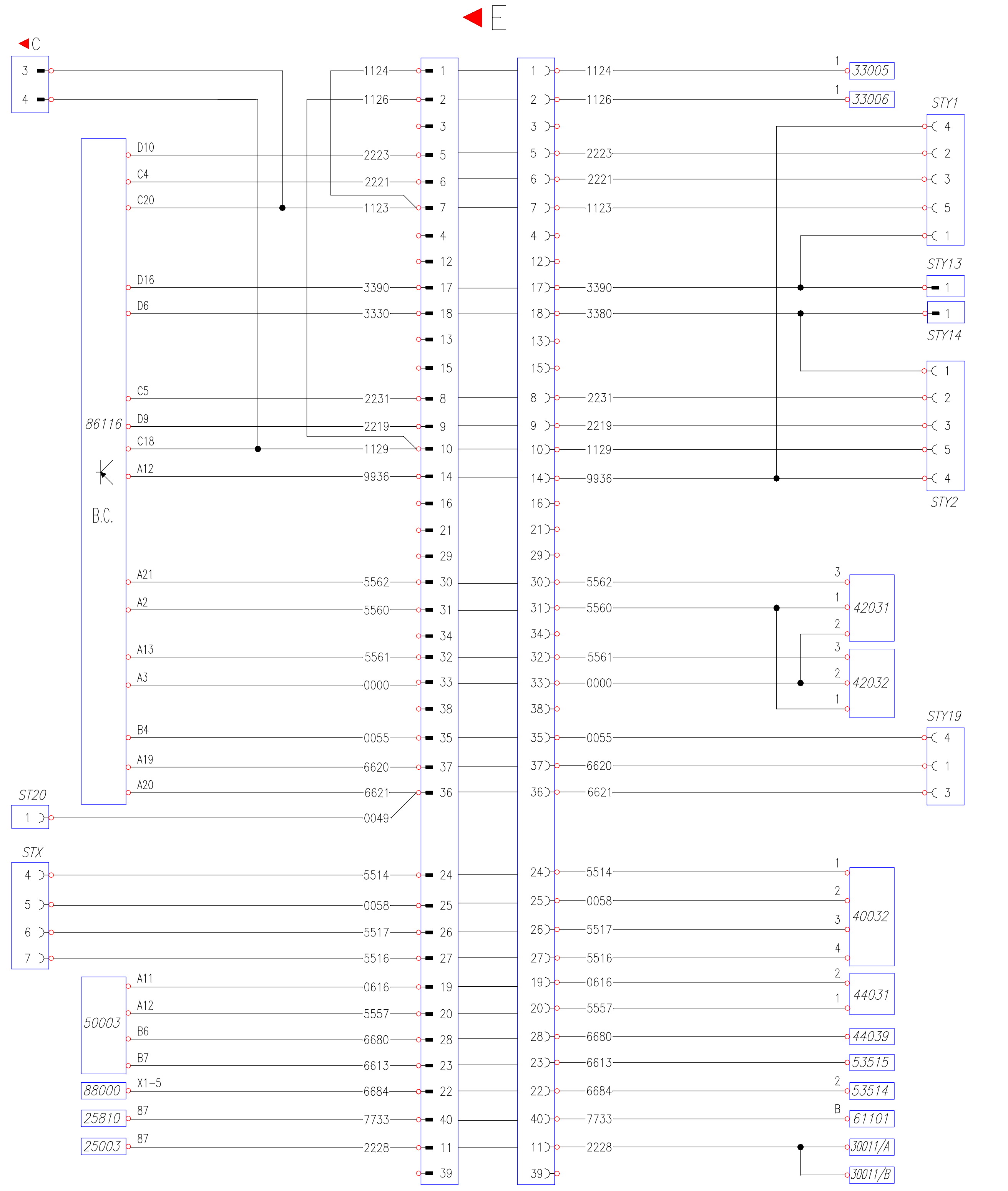
Connector "E" (green) – cab cable / chassis cable

Figure 115



CONNECTOR "E" ELECTRIC CONNECTIONS

Connector ”E” pin–out

Ref.	Description	Cable
1	Right side indicator light	1124
2	Left side indicator light	1126
3	–	–
4	–	–
5	Right low–beam headlamp	2223
6	Right high–beam headlamp	2221
7	Front right indicator light	1123
8	Left low–beam headlamp	2231
9	Left high–beam headlamp	2219
10	Front left indicator light	1129
11	Right & left fog lamps	2228
12	–	–
13	–	–
14	Headlamp trim adjustment	9936
15	–	–
16	–	–
17	Front right sidelights and clearance lights	3390
18	Left front sidelights and clearance lights	3380
19	Fuel level indicator ground	0616
20	Low fuel level indicator	5557
21	–	–
22	Rear brake converter limit switch	6684
23	Rear brake converter limit switch	6613
24	Brake failure	5514
	Tachograph (B1)	
25	Brake failure indicator for ABS	0058
	Tachograph (B2)	
26	”L” alternator (telltale)	5517
	Tachograph (B3)	
27	Alternator 15 terminal	5516
	Tachograph (B4)	
28	”+” battery for tachograph	6680
	Brake fluid level sensors	
29	–	–
30	Front brake air pressure	5562
31	Brake air pressure sensor power supply	5560
32	Rear brake air pressure	5561
33	Brake air sensor ground	0000
34	–	–
35	Front differential longitudinal lock	0055
36	Rear transverse differential ON locking signal (Rockwell)	6621
37	Exhaust brake cut off	6620
	Rear transverse differential ON locking signal (Rockwell)	
38	–	–
39	–	–
40	Fuel heating resistor	7733

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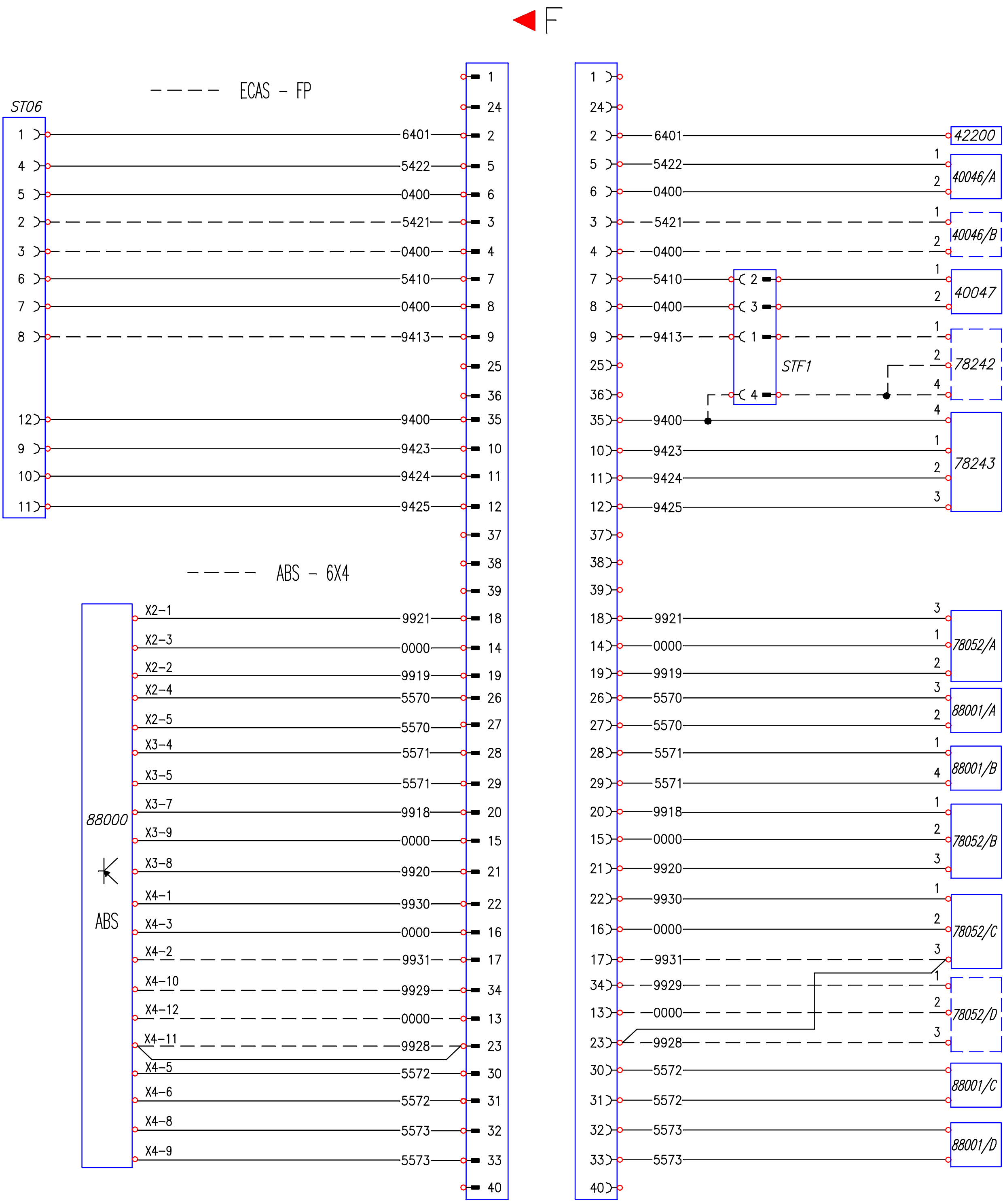
Connector ”F” (black) – cab cable / chassis cable

Figure 116



CONNECTOR ”F” ELECTRIC CONNECTIONS

Connector ”F” pin–out

Ref.	Description	Cable
1	–	–
2	Suspension failure (low pressure)	6401
3	Rear right level sensor	5421
4	Rear right level sensor	0400
5	Rear left level sensor	5422
6	Rear left level sensor	0400
7	Front level sensor	5410
8	Front level sensor	0400
9	Front ECAS solenoid valve	9413
10	Rear ECAS solenoid valve	9423
11	Rear ECAS solenoid valve	9424
12	Rear ECAS solenoid valve	9425
13	Rear right ABS solenoid valve ground (6x4 only)	0000
14	Front left ABS solenoid valve ground	0000
15	Front right ABS solenoid valve ground	0000
16	Rear ABS solenoid valve ground	0000
17	Rear solenoid valve power supply (left, 6x4)	9931
18	Front left ABS solenoid valve power supply	9921
19	Front left ABS solenoid valve power supply	9919
20	Front right ABS solenoid valve power supply	9918
21	Front right ABS solenoid valve power supply	9920
22	Rear ABS solenoid valve power supply (right x 260)	9930
23	Rear left ABS solenoid valve power supply (right, 6x4)	9928
24	–	–
25	–	–
26	Front left ABS sensor	5570
27	Front left ABS sensor	5570
28	Front right ABS sensor	5571
29	Front right ABS sensor	5571
30	Rear left ABS sensor	5572
31	Rear left ABS sensor	5572
32	Rear right ABS sensor	5573
33	Rear right ABS sensor	5573
34	Rear right ABS solenoid valve power supply (6x4 only)	9929
35	ECAS rear / front distributor positive	9400
36	–	–
37	–	–
38	–	–
39	–	–
40	–	–

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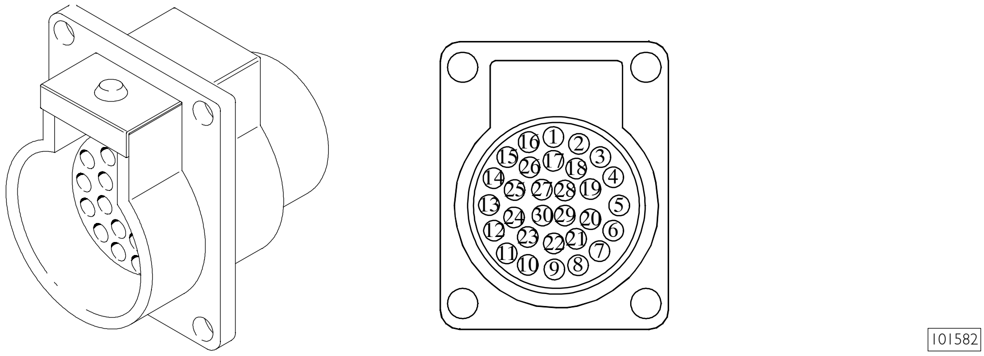
Diagnosis connector – 72021

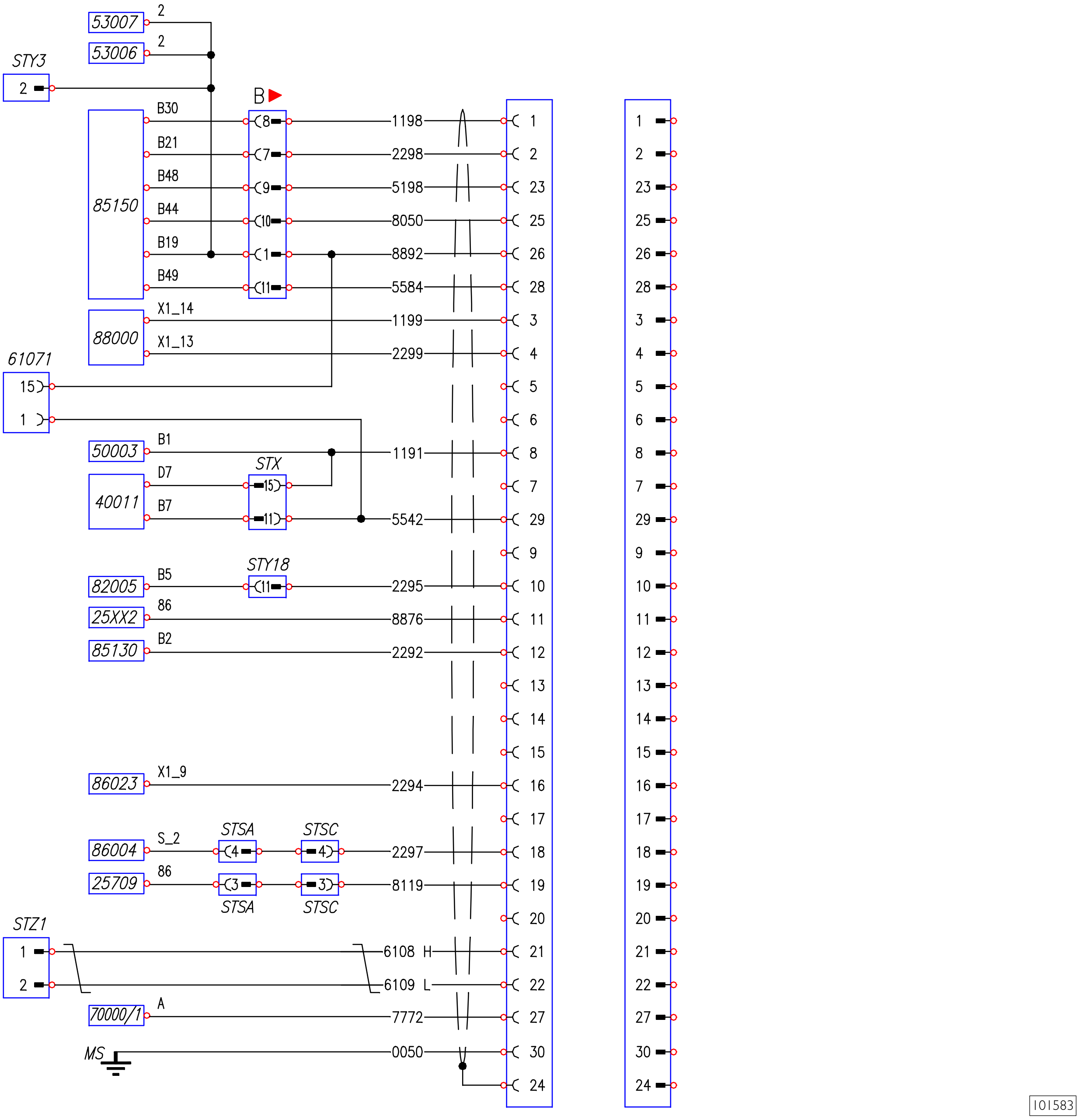
A 30–pin diagnosis connector, used for diagnosis of the electronic systems available on the vehicle, is found in the lower part of the cab, below the central dashboard.

Figure 117



DIAGNOSIS CONNECTOR (FRONT VIEW)

Figure 118



DIAGNOSIS CONNECTOR ELECTRIC CONNECTIONS

Pin–out

Ref.	Function	Function	Cable colour code
1	EDC	L	1198
2		K	2298
3	ABS	L	1199
4		K	2299
5	Retarder arrangement	–	–
6		–	–
7		–	–
8	Cluster / Tachograph	L	1191
9		–	–
10	AIR TOP 2000 heater	K	2295
11	Service actuation – key turned to RUNNING	+15	8876
12	Immobilizer	K	2292
13	Air–conditioning unit arrangement	L	1196
14		K	2296
15		–	–
16	ECAS suspensions	K	2294
17		–	–
18	Allison automatic transmission	K	2297
19	Diagnosis enable with automatic transmission	–	8119
20		–	–
21		H	6108
22		L	6109
23	Engine phase signal	Phase	5198
24	Screen	Braided wire	–
25	Engine starting signal	–	8050
26		–	8892
27	Positive	+30	7772
28	Engine revs	n	5584
29	Vehicle speed	n	5542
30		31	0050

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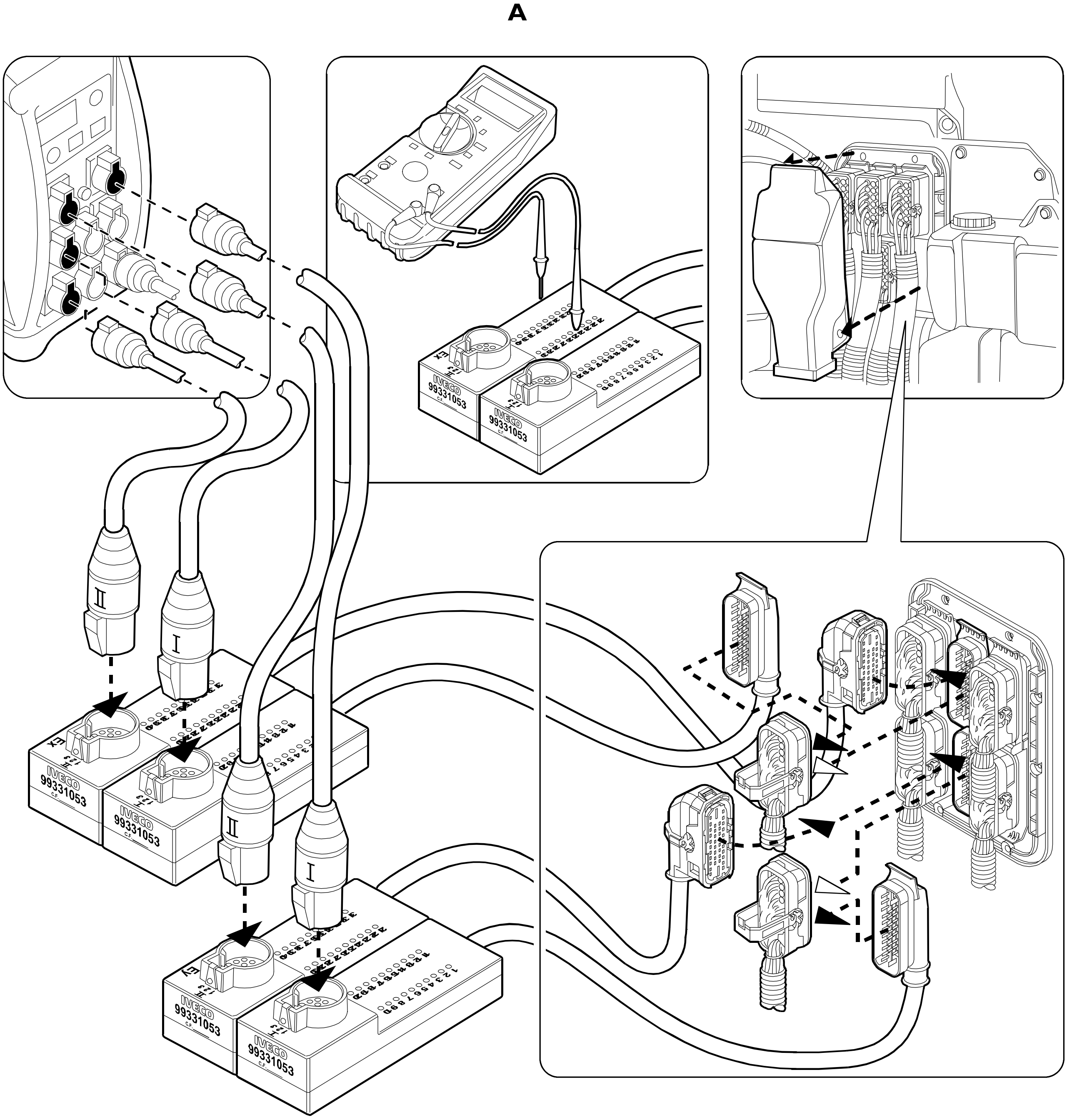
Bulkhead measurement adapter

This adapter makes it possible to carry out the tests by means of E.A.SY. MODUS, IT2000 and IWT, either upstream or downstream the bulkhead, and also act on the individual bulkhead pins to make measurements by means of a multimeter (as shown by detail A in the figure).

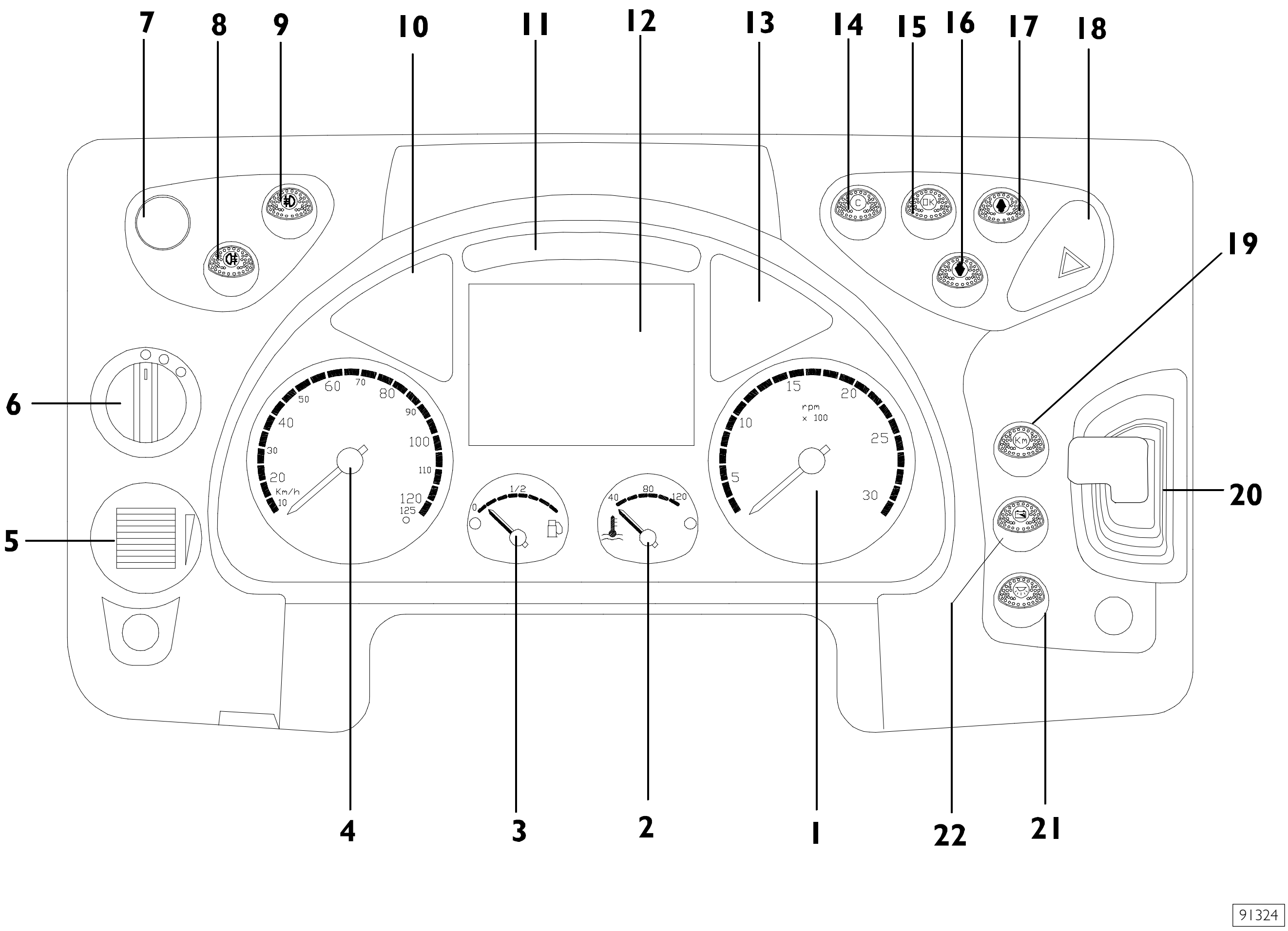
Figure 119



101584

INSTRUMENT PANEL

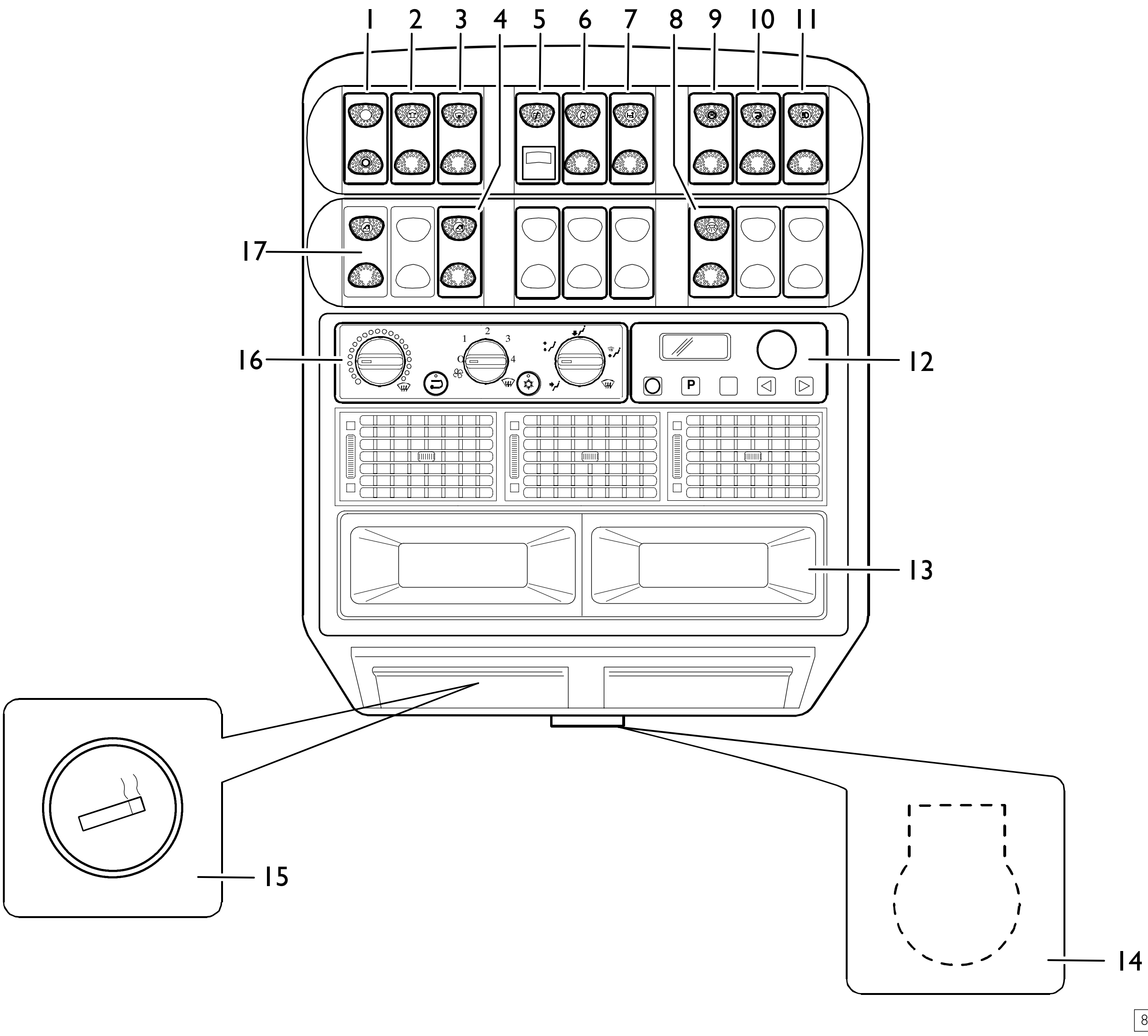
Figure 120



Ref.	Description
1	Rev counter
2	Engine coolant temperature gauge
3	Fuel level gauge
4	Tachograph display
5	Headlamp trim control
6	External light switch
7	Cap
8	Fog light actuation switch
9	Rear fog light actuation switch
10	Optical indicator cluster
11	Optical indicator cluster
12	Display
13	Optical indicator cluster
14	Display menu output switch
15	Display menu actuation switch
16	Menu switch –
17	Menu switch +
18	Emergency light actuation switch
19	Speed limiter switch
20	Internal light switch (located in the central dashboard if the retarder hand lever is available)
21	Internal illumination ceiling light switch (available on long cabs only)
22	TGC actuation (where provided)

CENTRAL DASHBOARD

Figure 121



Ref.	Description
1	Arrangement for exhaust brake
2	Rotating lamp actuation switch
3	Heated windscreen actuation switch
4	Passenger's side window regulator button
5	TGC deactivation in an emergency (ADR)
6	Sunroof control
7	Overall power takeoff control
8	Cab interior light switch (only if the retarder hand lever is available)
9	Retarder cut–out from the brake pedal
10	Loading gate
11	Auxiliary high–beam headlamps
12	WEBASTO heater control
13	Glove compartment
14	30–pole diagnosis takeoff
15	Cigar lighter
16	Cab interior heater controls (conditioner OPTION)
17	Driver's side window regulator button

Central dashboard (models)

Figure 122

4 x 4

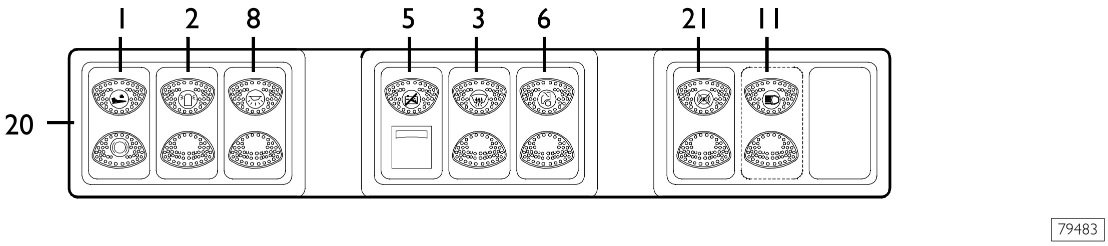


Figure 123

EuroMidi

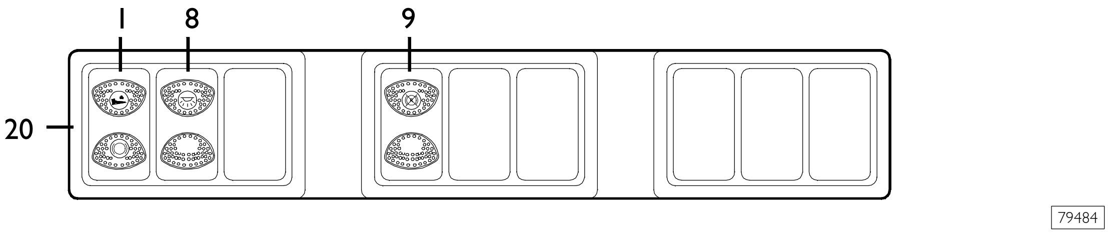
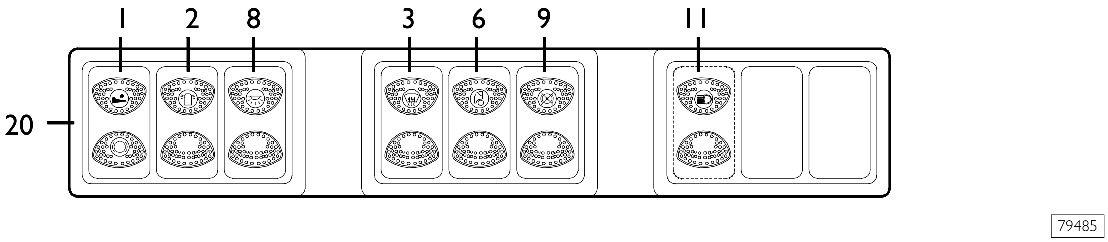


Figure 124

Fire Fighting



Ref.	Description
1	Arrangement for exhaust brake
2	Rotating lamp actuation switch
3	Heated windscreen actuation switch
5	TGC deactivation in an emergency (ADR)
6	Sunroof control
8	Cab interior light switch (only if the retarder hand lever is available)
9	Retarder cut–out from the brake pedal
11	Auxiliary high–beam headlamps
20	Upper part of central dashboard (different according to the models)
21	ABS cut–out (only 4x4)

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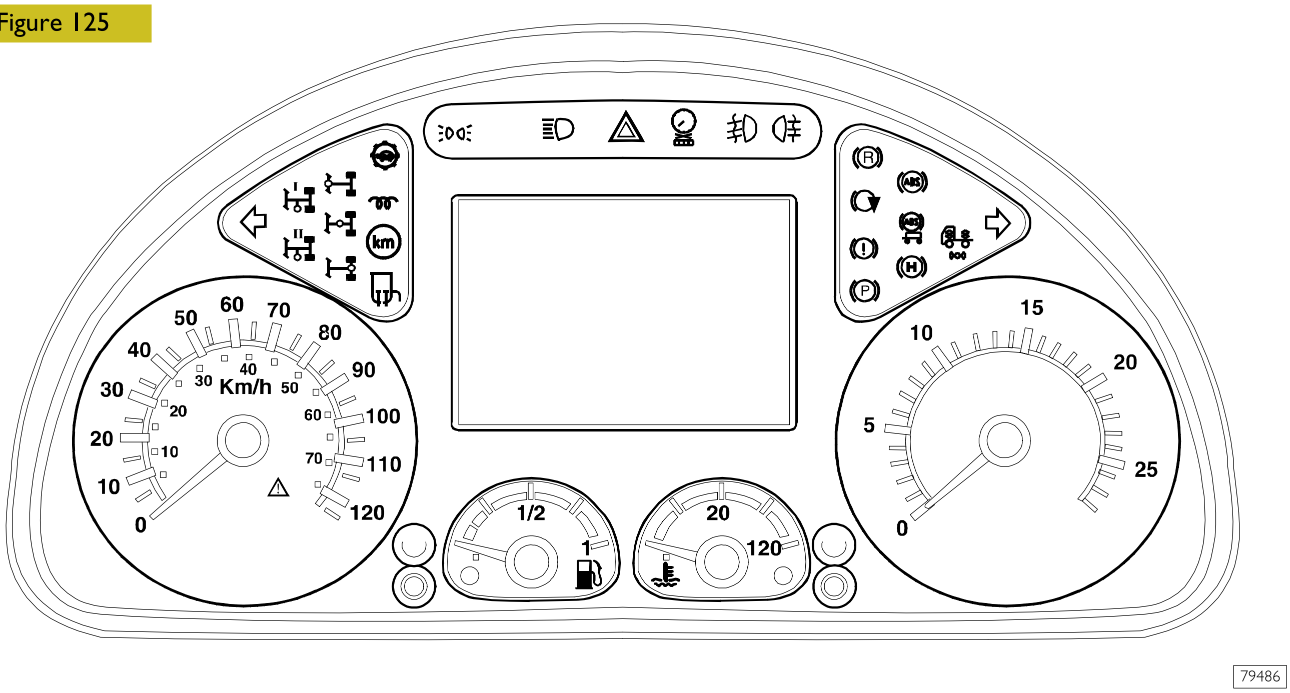
INSTRUMENT CLUSTER

Description

Figure 125



The vehicle's electric system has been modified by introducing a new instrument board called Instrument Cluster, similar to the model available on higher range "STRALIS" vehicles.

This system has the following characteristics and is made up of:

- one instrument indicating the vehicle speed (both in km/h and mph);
- one instrument indicating engine speed
- one fuel level gauge;
- one coolant temperature gauge;
- one display showing faults and user messages;
- three optical indicator clusters;
- four buttons to scroll the various menus (model Highline only);
- one background lighting control button;
- one trip meter reset button (page shift on Baseline).

In addition to being connected to the vehicle's CAN line, the Instrument Cluster receives a set of signals directly from a few sensors or switches available in the vehicle's electric system.

The Instrument Cluster also receives the signals from the four buttons for display menu control. The button operating logic is of the standard type: the arrows allow you to shift the pages; if a page with various lines to be displayed is chosen, the display allows you to view only 3 lines at a time or a page with a submenu. Pressing OK allows you to access the page and the "arrows" can be used. Button C allows you to return to the previous page.

A black–and–white display is available. The lack of a colour display has been made up for by a logic associating a yellow or red warning light to the icon indicating the information to be signalled to the driver. Direct signals are sent out to the Instrument Cluster (no CAN line is provided) from:

- Engine oil level
- Fuel level
- Presence of water in the diesel fuel filter
- Air filter clogged signalling
- Rear converter limit switch signalling
- Rear brake oil level
- Immobilizer optical indicator
- Battery recharge indicator
- Trailer ABS failure indicator.

All the other signals are received, through the CAN line, in order to allow the relevant message to be displayed.

The Cluster does not store failures; it only displays them.

At present, the vehicle systems on which diagnosis can be made are EDC, IMMOBILIZER, ELECTRIC MIRRORS, and BODY CONTROLLER.

With these systems, if the “HIGHLINE” model Cluster is available, a diagnosis screen can be shown on the display, which allows you to refer to the failure codes of the concerned system.

These codes can be referred to by means of the “MENU” buttons provided on the dashboard.

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Models available

Two models of the IC system are available: BASELINE and HIGHLINE.

They differ from each other in that they have (or have not) control buttons, and the screens on the IC display.

Baseline

No menu control button is provided.

Trip meter reset button (this is also used to change IC screen).

Highline

Four menu/IC screen control buttons are available.

Trip meter reset button (this is also used for trip 1 function).

Screens available with vehicle running

Baseline

time/km/partial km

time/km/partial time

time/miles/partial miles (UK customer market)

brake air pressure / engine oil pressure

Highline

time/km/partial km/°C/gear engaged (automatic transmission)

time/km/partial time/°C/gear engaged (automatic transmission)

engine oil pressure / brake air pressure

trip 1

trip 2

time/km/partial km

time/km/partial time

time/miles/partial miles (UK customer market)

engine oil level

brake air pressure / engine oil pressure

Highline

time/km/partial km/°C/gear engaged (automatic transmission)

time/km/partial time/°C/gear engaged (automatic transmission)

engine oil level / brake pad wear percentage (%)

engine oil pressure / brake air pressure

trip 1

trip 2

fuel litre meter index / fuel consumption indicator

engine oil level / brake pad wear percentage (%)

light check

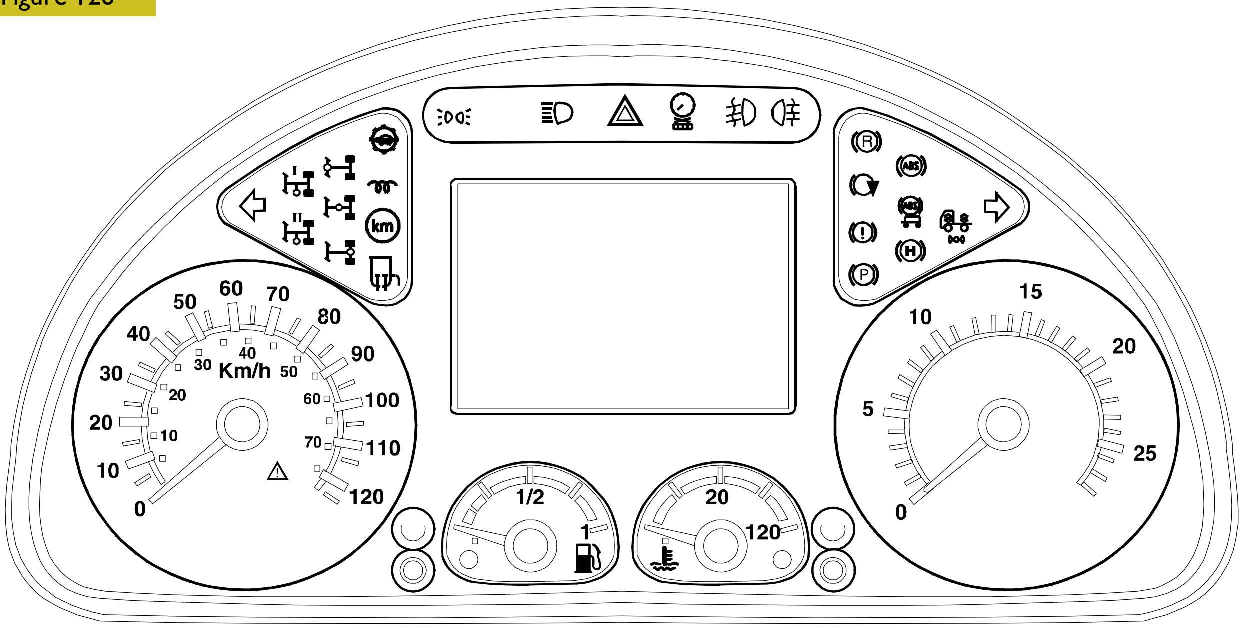
diagnostics

vehicle maintenance

language setting / measurement unit

OPTICAL INDICATORS ON THE CLUSTER

Figure 126



Description	Colour	Ideograph	Description	Colour	Ideograph
External lights	Green		Side power takeoff I ON	Yellow	
High–beam headlamps	Blue		Rear power takeoff 2 and torque distributor both ON	Yellow	
Emergency lights	Red		Tractor left indicator	Green	
Instrument board failure	Red		Decelerator ON	Yellow	(R)
Fog lights	Green		Exhaust brake ON	Yellow	
Rear fog lights	Yellow		Braking system failure	Red	(!)
Slow gears engaged	Yellow		Emergency brake ON	Red	(P)
Engine preheating	Yellow		Tractor ABS failure	Yellow	(ABS)
Programmable speed limiter	Yellow	km	Trailer ABS failure	Yellow	ABS
Heated mirrors	Yellow		Special emergency brake (FF vehicles) ON	Red	(H)
Front transverse differential lock	Yellow		Pneumatic suspension low pressure	Red	
Longitudinal differential lock – Torque distributor (in neutral)	Yellow		Trailer right indicator	Green	
Rear transverse differential lock	Yellow				

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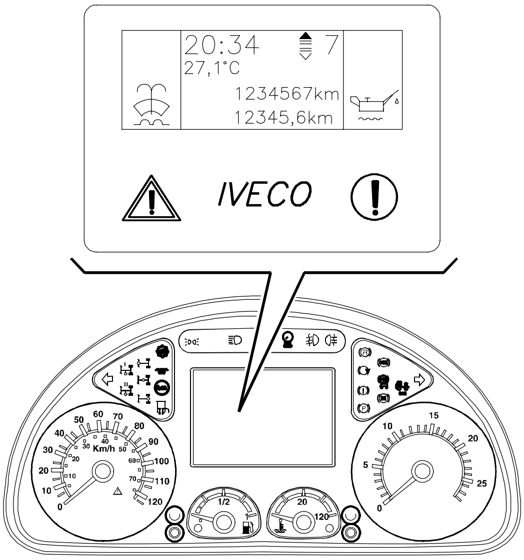
(FAILURE) INDICATORS ON THE DISPLAY

When the functions below are actuated, or when the following anomalies occur, the corresponding symbol will appear in the display section.

The yellow symbols (minor anomalies and failures) will appear on the left side of the display; the red symbols (serious failures) will appear on the right side.

Figure 127



79489

Description	Colour	Ideograph
Minor anomaly and failure warning light	Yellow	
Serious failure warning light (stop)	Red	

Description	Colour	Ideograph	Description	Colour	Ideograph
Rear axle brake air low pressure	Red		Radiator water low level	Red	
Front axle brake pad wear	Red		EDC	Red	EDC
Rear axle brake pad wear	Red		Gearbox failure	Red	
Brake fluid low level	Red		Gearbox oil high temperature	Yellow	
Rear AoH converter limit switch	Red	AoH	Retarder high temperature	Yellow	R
Tractor EBS failure	Red	EBS	Decelerator failure	Yellow	R
Tractor EBS failure	Red	EBS 1	Pneumatic suspension failure	Red	
Engine oil low pressure	Red		IBC failure	Red	IBC
Engine coolant high temperature	Red		Generator charge	Red	
Engine oil low level	Red		Auxiliary generator charge	Red	

Description	Colour	Ideograph	Description	Colour	Ideograph
Power steering fluid low level	Red		External lighting	Yellow	
Cab uncoupled	Red		Box tipped	Yellow	
Loading gate	Red		Air filter clogged	Yellow	
Airbag failure	Red		Presence of water in the diesel fuel prefilter	Yellow	
Doors open	Red		Windscreen washer fluid low level	Yellow	
Vehicle braked by EBS	Yellow		Driving time anomaly	Yellow	T
ASR ON (brake control)	Yellow	ASR	Carry out maintenance	–	
Tractor EBS failure	Yellow	EBS	–	–	km 2
Tractor EBS failure	Yellow	EBS 1	Trailer linked	–	
EDC failure	Yellow	EDC	EDC in power takeoff mode	–	PTO
Immobilizer actuation/failure	Yellow	CODE	Safety belts not fastened	Red	
Immobilizer actuation/failure	Yellow		Instrument board anomaly	Yellow	
Start–up cut out	Yellow		Instrument board failure	Red	
Gearbox failure	Yellow		Low external temperature	–	
Automatic transmission gear engagement restraint	Yellow		–	–	
Pneumatic suspension failure	Yellow		CAN network failure	Yellow	CAN
Pneumatic suspensions not in running conditions	Yellow		CAN network failure	Red	CAN
IBC anomaly	Yellow	IBC			

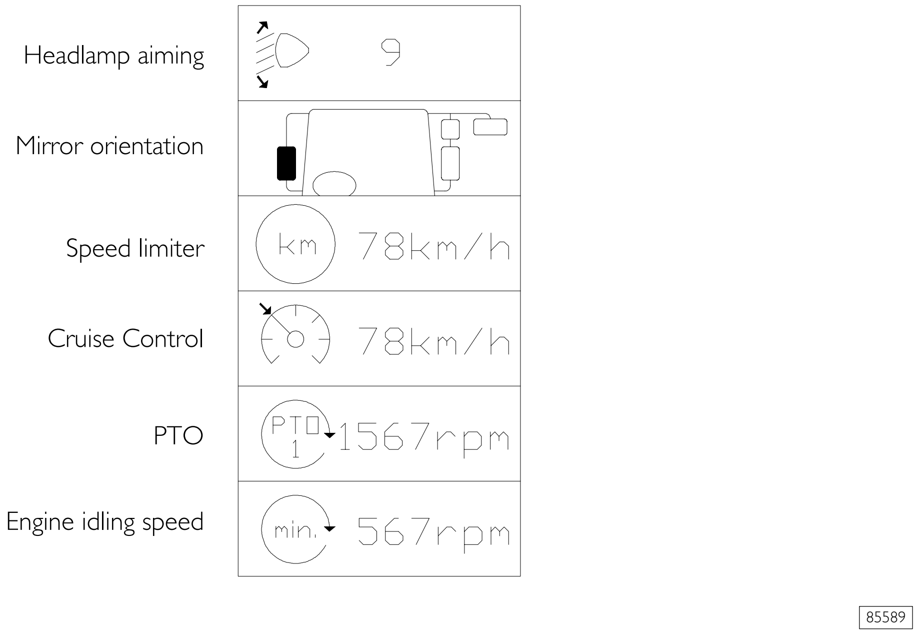
"POP–UP" EVENTS

Both current models allow you to display a few vehicle conditions (called "POP–UP events") in the base page structure, for a pre–established time. After this screen is shown, the display will automatically go back to the latest screen available.
Below is a list of the conditions that can be displayed:

Headlamp setting

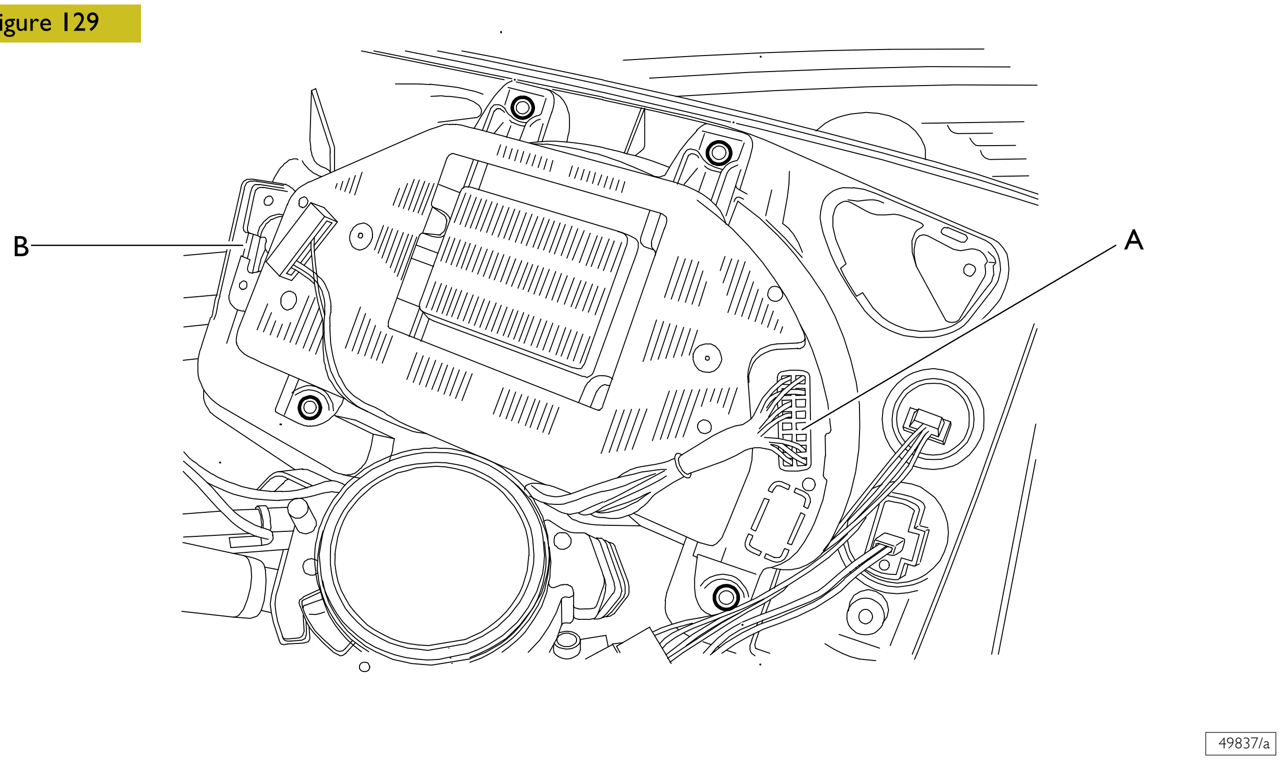
Mirror adjustment
Speed limiter
Cruise control
PTO (revs)
Engine idling speed

Figure 128



CLUSTER (PIN–OUT)

Figure 129



Ref.	A – Black	Cable colour	B – Blue	Cable colour
1	Immobilizer warning light signal	6092	Diagnosis connector pin 8	1191
2	CAN H line	6108	ABS (connector X1–18)	6670
3	CAN L line	6109	Trailer ABS failure warning light signal	6671
4	–	–	Hand brake warning light signal	6662
5	–	–	Air pressure low warning light signal for ECAS	6401
6	–	–	Rear brake oil level	6680
7	–	–	Rear converter limit switch	6613
8	–	–	–	–
9	External temperature sensor	4710	–	–
10	External temperature sensor	0152	Box tilted warning light signal	6607
11	Fuel level gauge earth	5557	Air filter clogged sensor	6663
12	Fuel level gauge	0616	Sensor for presence of water in the diesel fuel filter	5530
13	–	–	Menu “UP” button	5900
14	Engine oil level sensor	5505	–	–
15	Engine oil level sensor	5506	Menu “DOWN” button	5901
16	–	–	Menu “OK” button	5902
17	–	–	Battery recharge failed warning light signal	7780
18	+15	8879	Alternator charge warning light signal	7778
19	Earth	0000	–	–
20	+30	8871	Menu “C” button	5903

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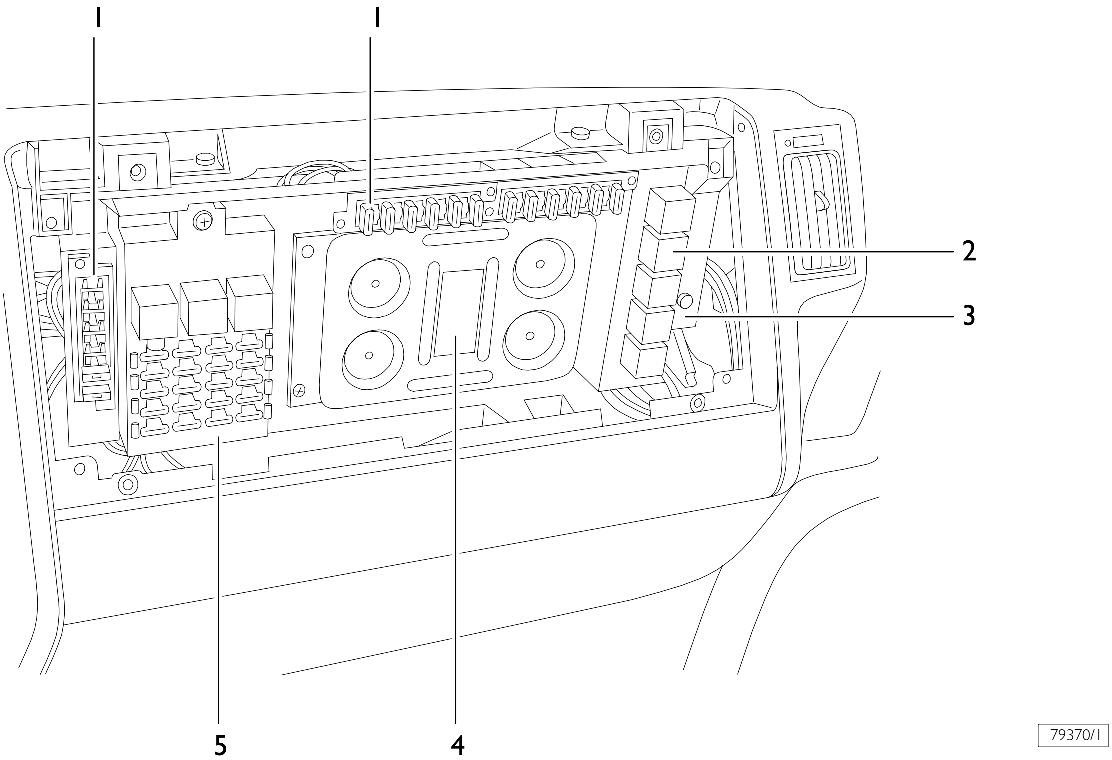
CENTRAL INTERCONNECTING UNIT

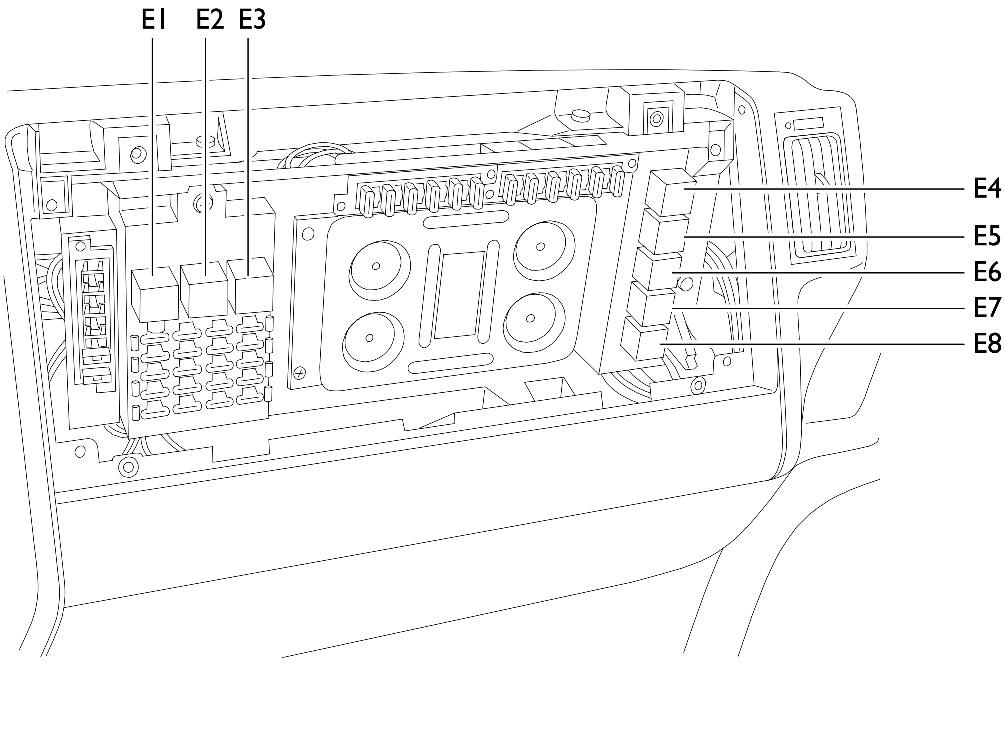
Figure 130



Ref.	Description
1	Fuse holder (70000/3 – /1 – /2)
2	Remote–control switches
3	LED (see Immobilizer)
4	Body Controller
5	Control unit / Remote–control switches

REMOTE–CONTROL SWITCH ASSEMBLY

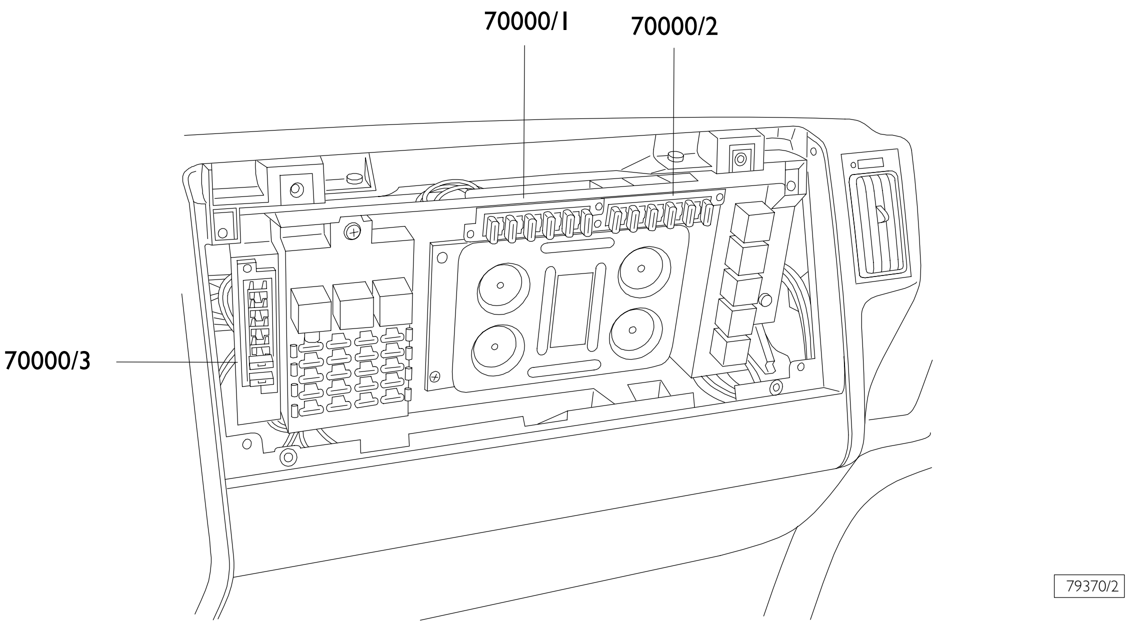
Figure 131

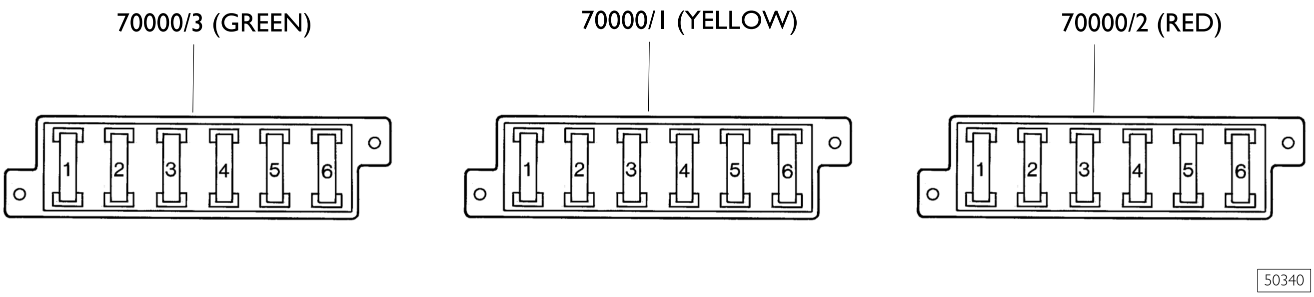


Ref.	Code	Description
E1	25213	Key–controlled power supply remote–control switch
E2	25879	PTO remote–control switch
E3	25805	Horn control remote–control switch
E4	25035	External light (body builders) remote–control switches
E5	25810	Diesel fuel heating remote–control switch
E6	25003	Fog light remote–control switch
E7	25813	Heated rearview mirror remote–control switch
E8	–	Remote–control switch for +15 power supply from diagnosis connector

FUSE ASSEMBLY

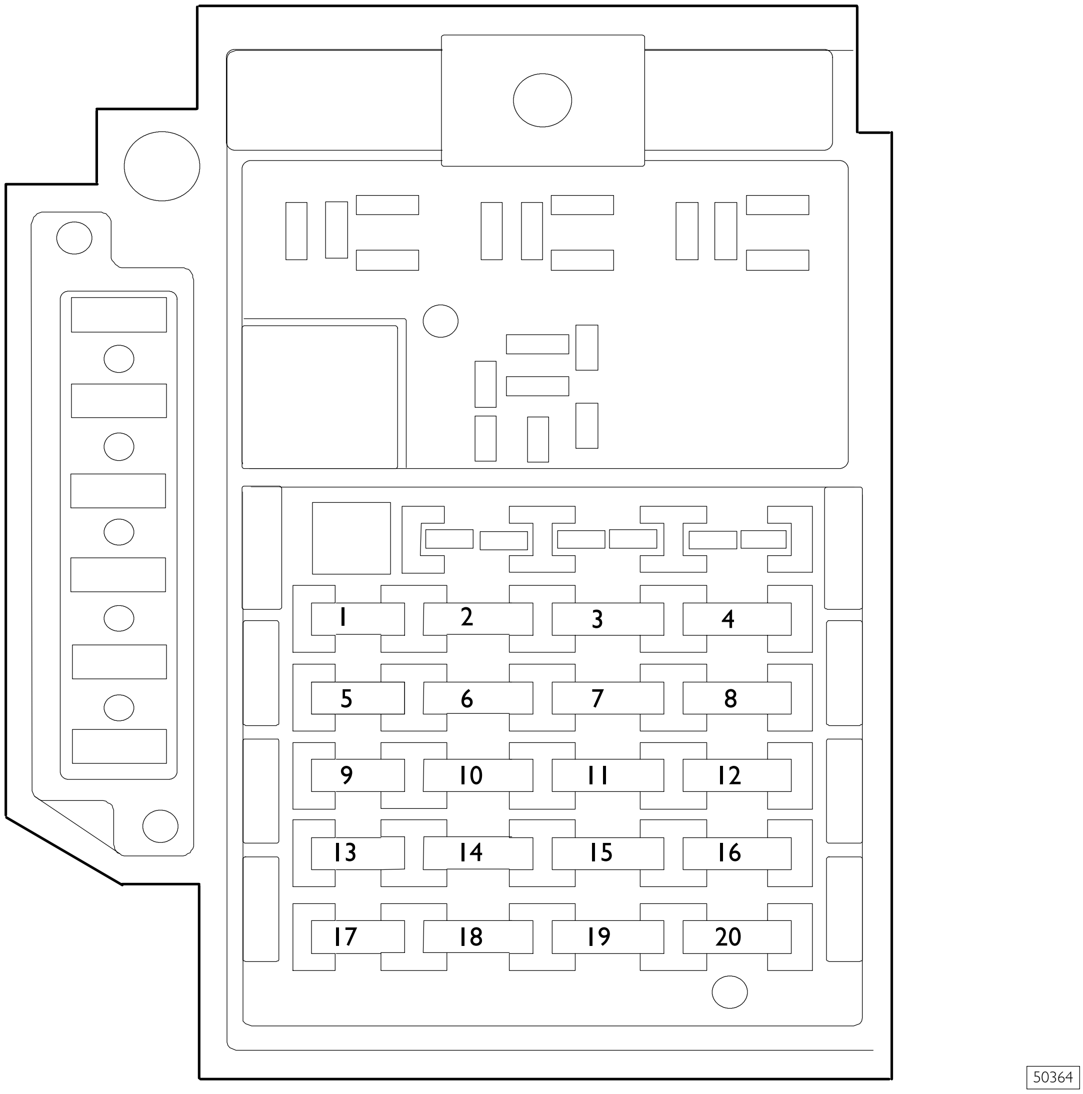
Figure 132





Position		Rating	Function	Power supply
70000/3	1	30A	Heated windscreen	+30
	2	30A	Heated windscreen	+30
	3	–	–	–
	4	–	–	–
	5	–	–	–
	6	–	–	–
70000/1	1	10A	Auxiliary heater	+30
	2	10A	Cigar lighter / Headlamp washer / Ceiling light	+30
	3	10A	Fog light / Rotating lamps	+30
	4	10A	Conditioner / Adjustable heated mirrors	+30
	5	10A	Heated seat	+15/1
	6	10A	Reversing lights	+15/1
70000/2	1	20A	Diesel fuel heating / Loading gate / Diesel fuel prefilter heating / Window regulator	+30
	2	20A	Sunroof	+30
	3	20A	Trailer ABS	+30
	4	20A	ABS	+30
	5	5A	ABS – ECAS	+15/1
	6	5A	ABS	+30

Figure 133



Fuse	Rating	Description
1	5A	Body Control (15) / MICO tachograph / Instruments Cluster
2	5A	Cab uncoupled / Immobilizer / Sensor for presence of water in the diesel fuel filter / Headlamp trim corrector / Bed lights
3	10A	MICO tachograph / Body Control (Left low–beam lamp – Right high–beam lamp)
4	10A	Body builders
5	5A	EDC7
6	5A	Trailer takeoff (+15) / Chassis body builder takeoff (+15)
7	10A	Central locking / Auxiliary heater / Fridge / Radio
8	10A	Body Control (Right low–beam lamp – Left high–beam lamp)
9	5A	Cab body builders (+15)
10	10A	Body Control (left sidelights and stop lights)
11	10A	Body Control (indicators – emergency lights)
12	10A	Horn
13	20A	Window regulators / Heated windscreen
14	20A	Windscreen defrosting electric heater / Conditioner
15	10A	Body Control (windscreen wiper – windscreen washer)
16	5A	Brake air drier / Adjustable heated rearview mirrors / Control unit
17	5A	External light body builders (+58)
18	5A	Instruments Cluster
19	20A	EDC7
20	10A	Body Control (right sidelights and rear fog light)

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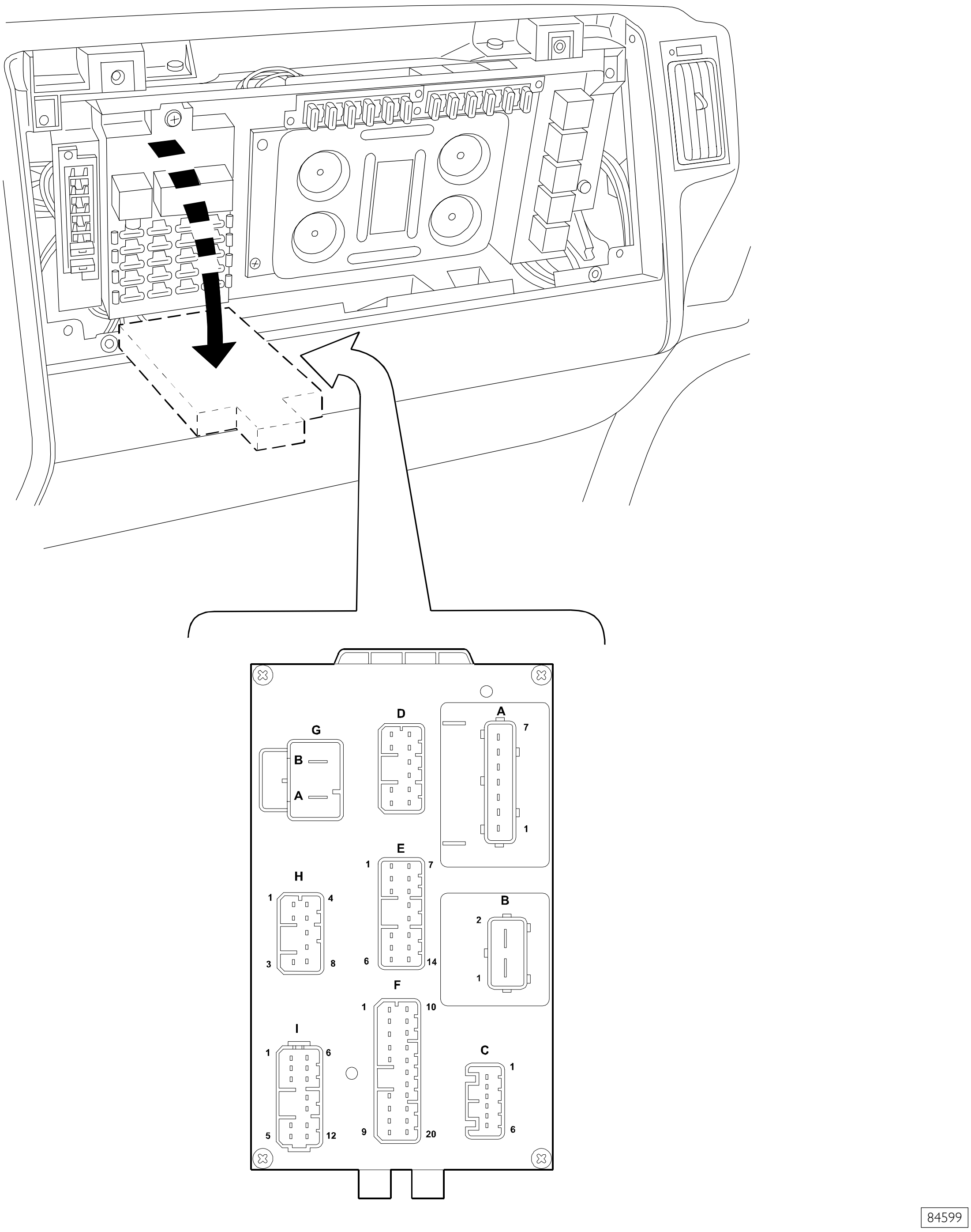
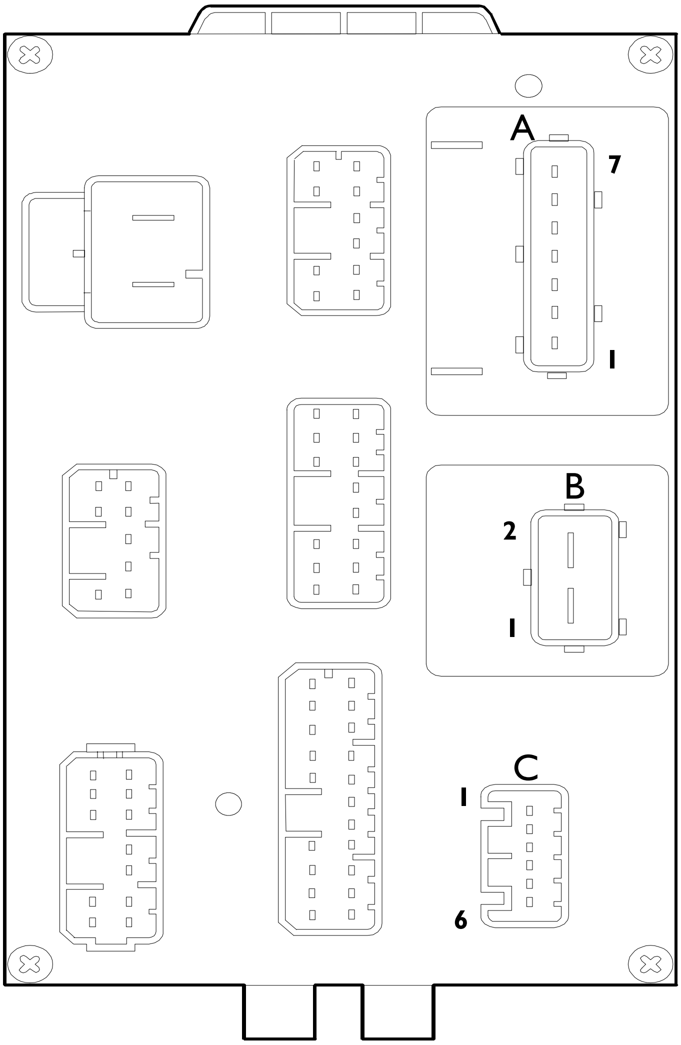
CONNECTOR ASSEMBLY

Figure 134



Connector "A" – "B" – "C"

Figure 135



50365

Ref.		Function	Cable colour code
A	1	Positive after TGC for body builders connector / connector IWT2 (1)	7772
	2	–	–
	3	–	–
	4	Pin C14 positive (Body Controller) / Connector IWT2 (2)	2197
	5	Electric heater positive	8879
	6	Pin C16 positive (Body Controller) / Connector IWT1 (15)	1117
	7	Positive for EDC / Connector IWT1 (12)	8150
B	1	Positive +15 for body builders	8869
	2	Positive +15	8887
C	1	Pin C2 positive (Body Controller) / Roof panel cable junction	7768
	2	–	–
	3	Diagnosis connector IWT2 (10)	0053
	4	Diagnosis connector IWT2 (9)	9954
	5	Positive for roof panel cable junction	7704
	6	Positive for connector IWT1 (6)	8861

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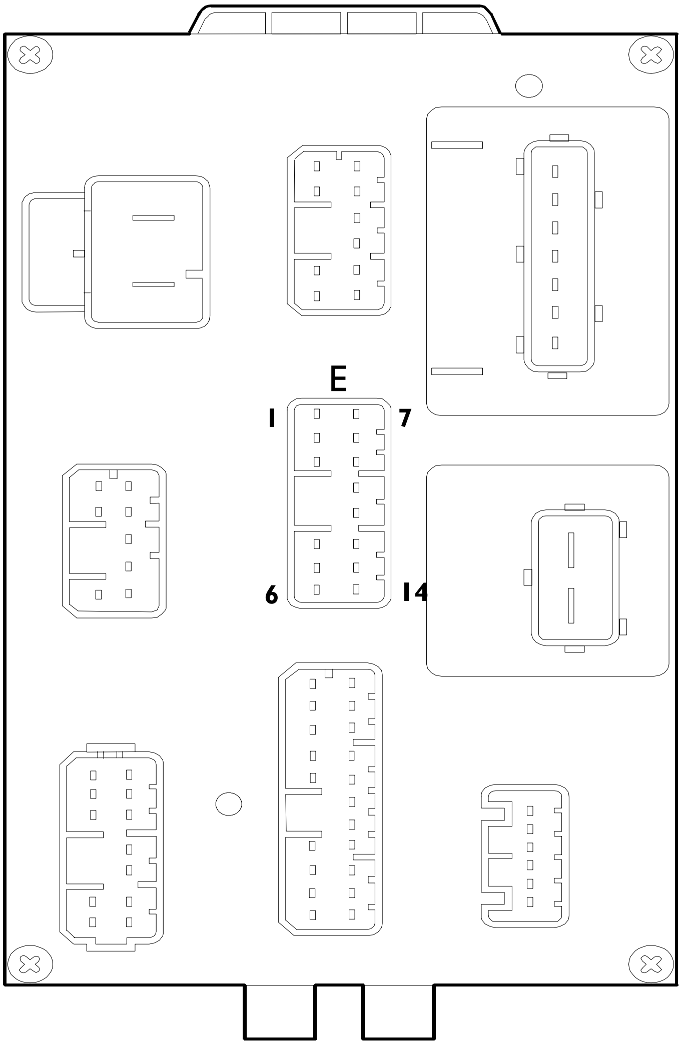
Connector “E”

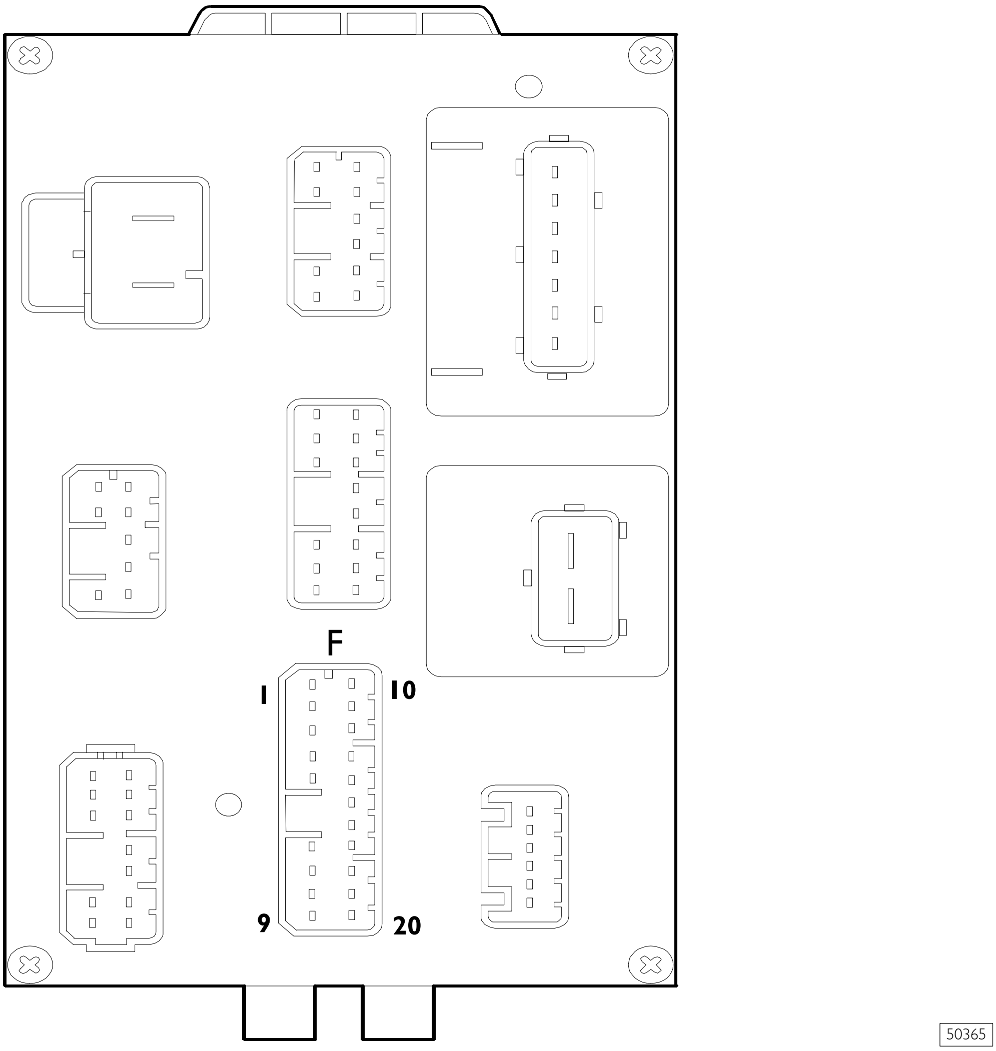
Figure 136



	Ref.	Description	Cable colour code
	1	–	–
	2	–	–
	3	–	–
	4	–	–
	5	–	–
	6 (OPT)	–	–
E	7	–	–
	8	Positive after TGC – Body Controller (D12) / Connector IWT1 (16)	8879
	9	Battery positive +30 – Tachograph / Radio	7777
	10	Positive +15	8879
	11	–	–
	12	–	–
	13	–	–
	14	–	–

Connector "F"

Figure 137



Ref.		Description	Cable colour code
	1	–	–
	2	–	–
	3	Positive	8887
	4	15/1 positive	8051
	5	–	–
	6	–	–
	7	–	–
	8	–	–
	9	–	–
F	10	–	–
	11	Pin A15 positive (Body Controller) for parking lights	8807
	12	–	–
	13	–	–
	14	–	–
	15	Signal ground	0000
	16	Positive	7772
	17	–	–
	18	Positive	8871
	19	–	2283
	20	Positive to turn on horn by means of button	1116

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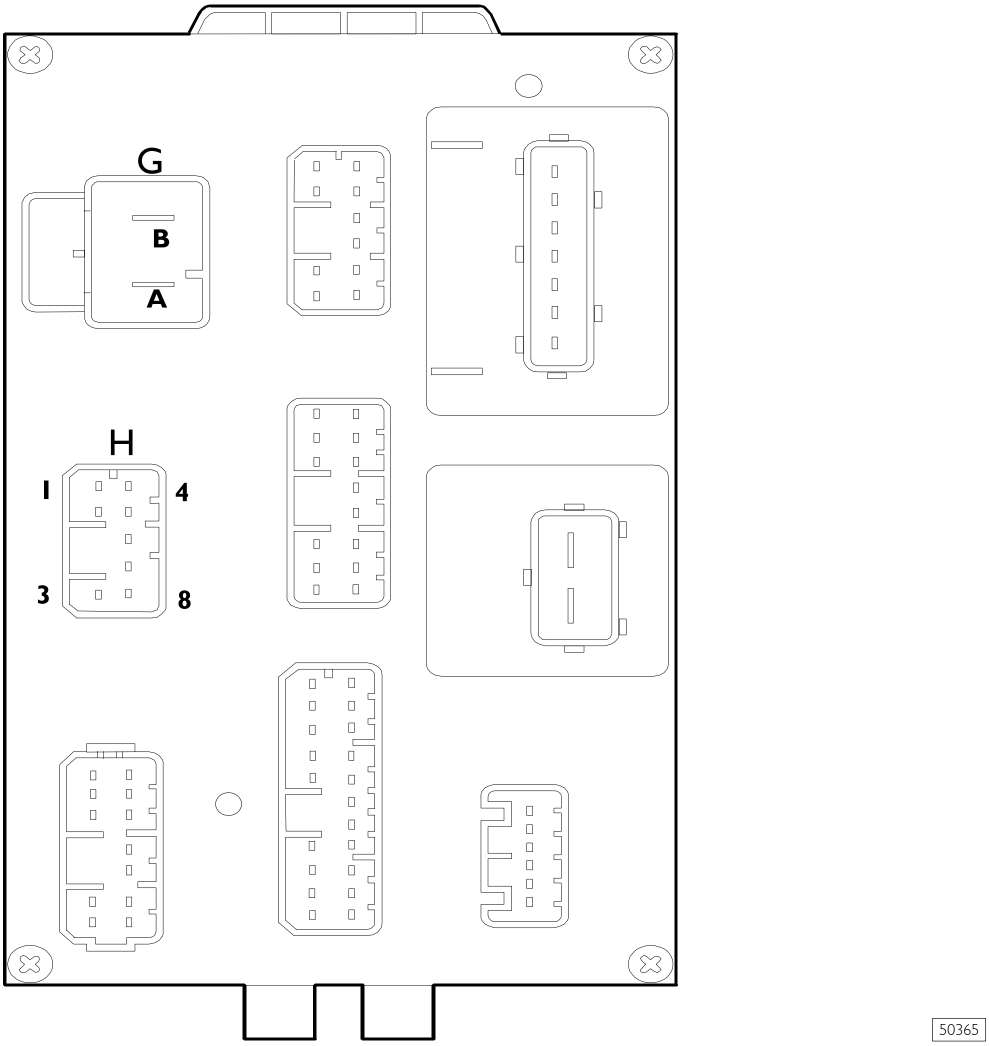
Connector "G" – "H"

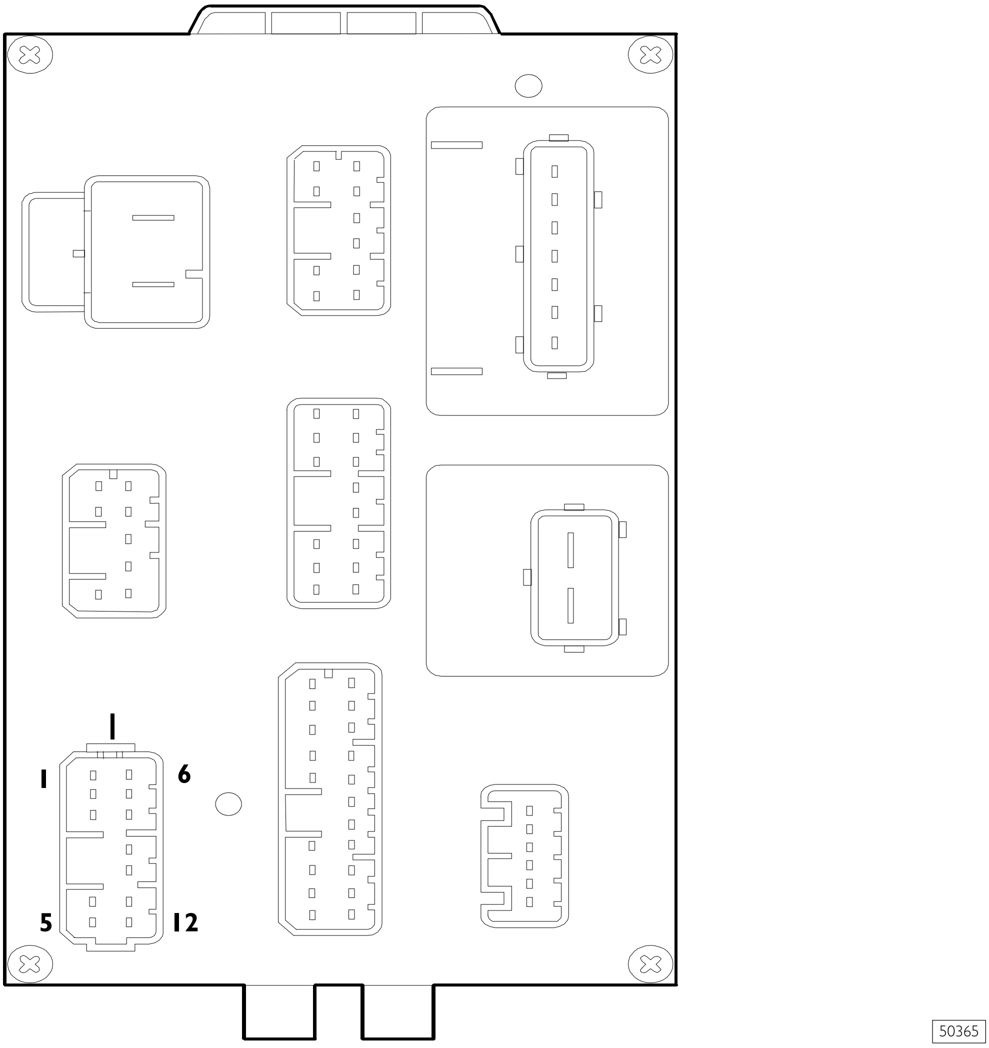
Figure 138



Ref.		Description	Cable colour code
G	A	Battery positive after TGC	7777
	B	Battery positive after TGC	7701
H	1	–	–
	2	–	–
	3	Connector IWT2 (3) / Body builders light remote–control switch (30) positive	8830/7777
	4	–	–
	5	–	–
	6	Positive for Body Controller (E4) / Roof panel cable junction / Cluster (A18) +15	8886/8879
	7	Connector IWT1 (7) +15	8840
	8	Connector IWT1 (6) +30	7772

Connector "I"

Figure 139



Ref.		Description	Cable colour code
I	1	Ground	0000
	2	–	–
	3	–	–
	4	Connector IWT1 (8) positive +15	8880
	5	–	–
	6	–	–
	7	–	–
	8	Positive after horn TGC	1116
	9	Positive (+30) for tachograph / Radio	7777
	10	–	–
	11	–	–
	12	–	–

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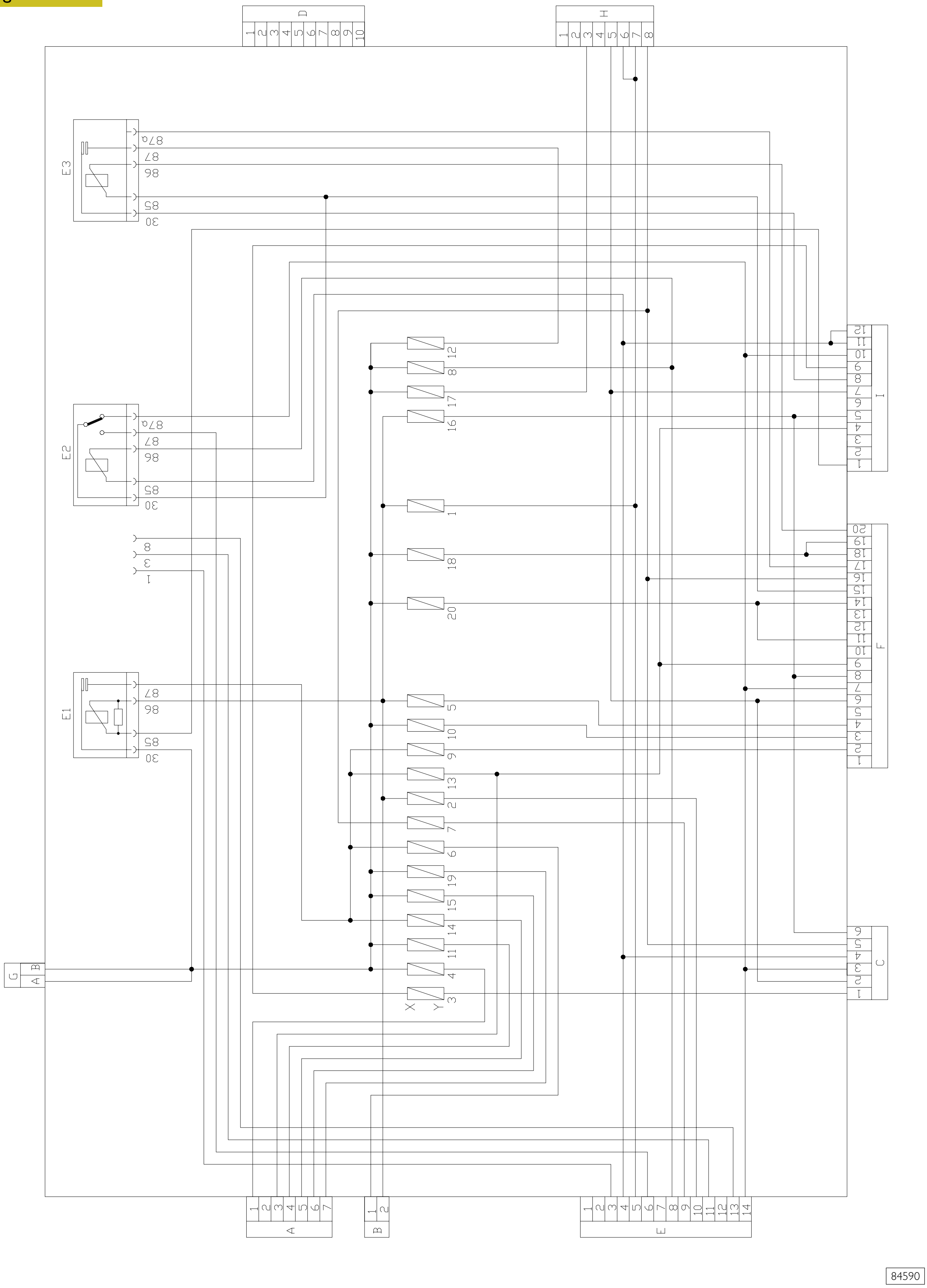
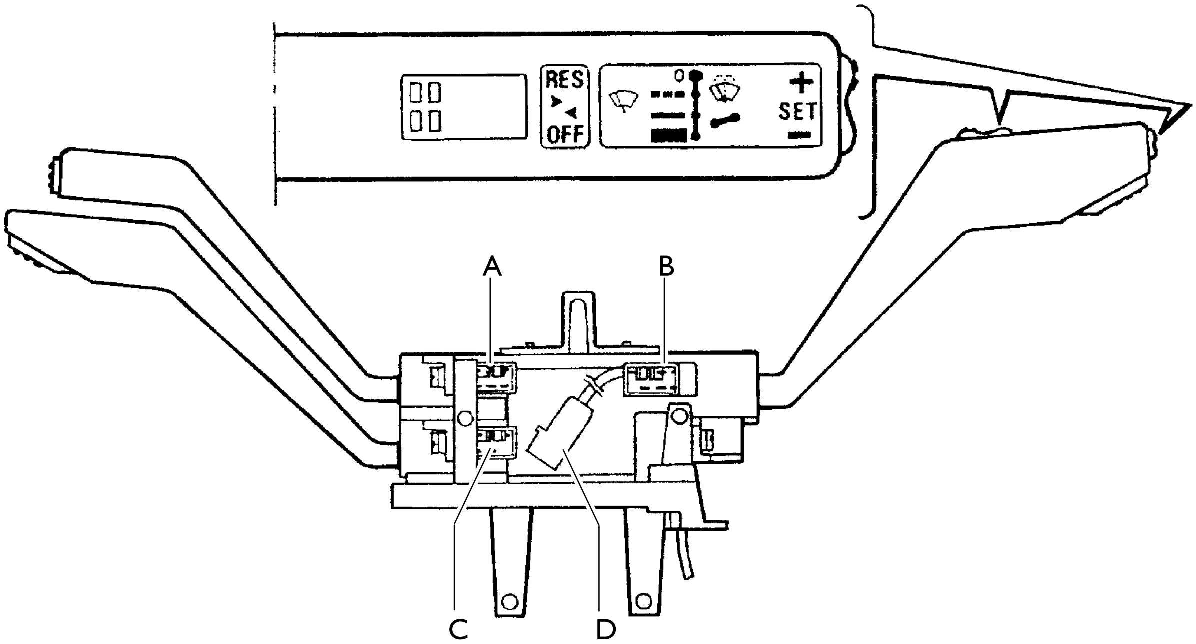
Internal wiring diagram

Figure 140



STEERING COLUMN STALK

Figure 141



TECHNICAL VIEW

Ref.		Cable colour code	Function
A	1	1103	Right indicator
	2	0000	Earth
	3	1109	Left indicator
	4	1116	Horn control
	5	1116	Horn positive (+30)
B	1	–	–
	2	2201	High–beam lamp actuation control
	3	0000	Earth
	4	2204	Headlight flashing device control
	5	0000	Earth
C	1	8881	Windscreen wiper
	2	–	–
	3	8882	Windscreen wiper (reset)
	4	–	–
	5	0000	Earth
	6	8822	Windscreen wiper (intermittent wipe)
	7	8886	Windscreen wiper (electric pump control)
D	1	0000	Earth
	2	8157	To Body Controller terminal A38 (SET+)
	3	8155	To Body Controller terminal A37 (RESUME)
	4	0000	Earth
	5	8156	To Body Controller terminal A27 (SET)
	6	–	–
	7	8154	To Body Controller terminal A28 (RESUME)

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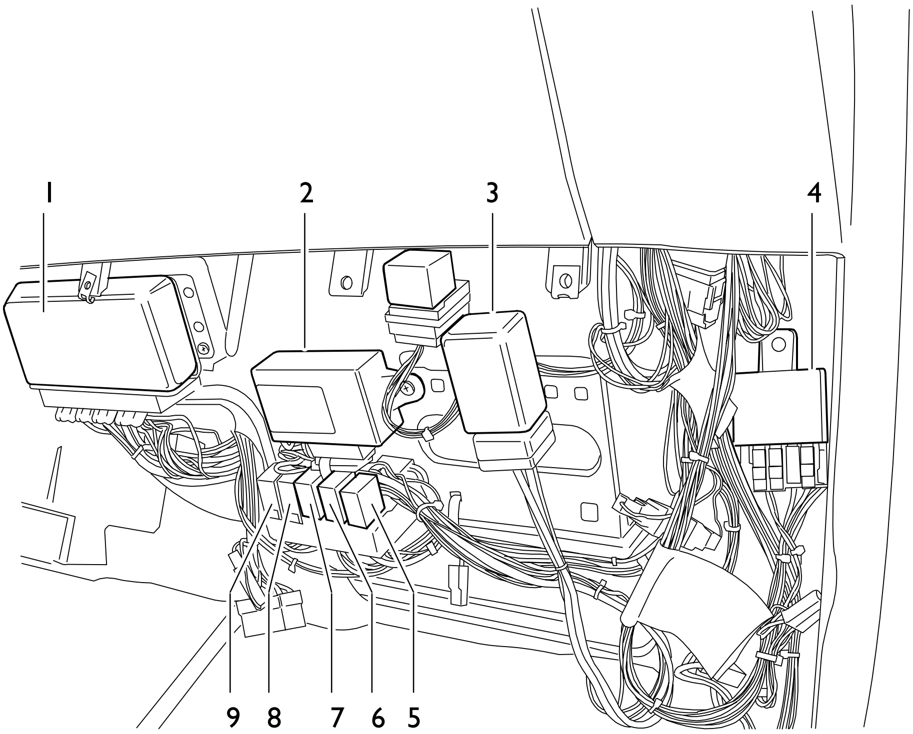
POSITION OF ELECTRONIC CONTROL UNITS

Figure 142

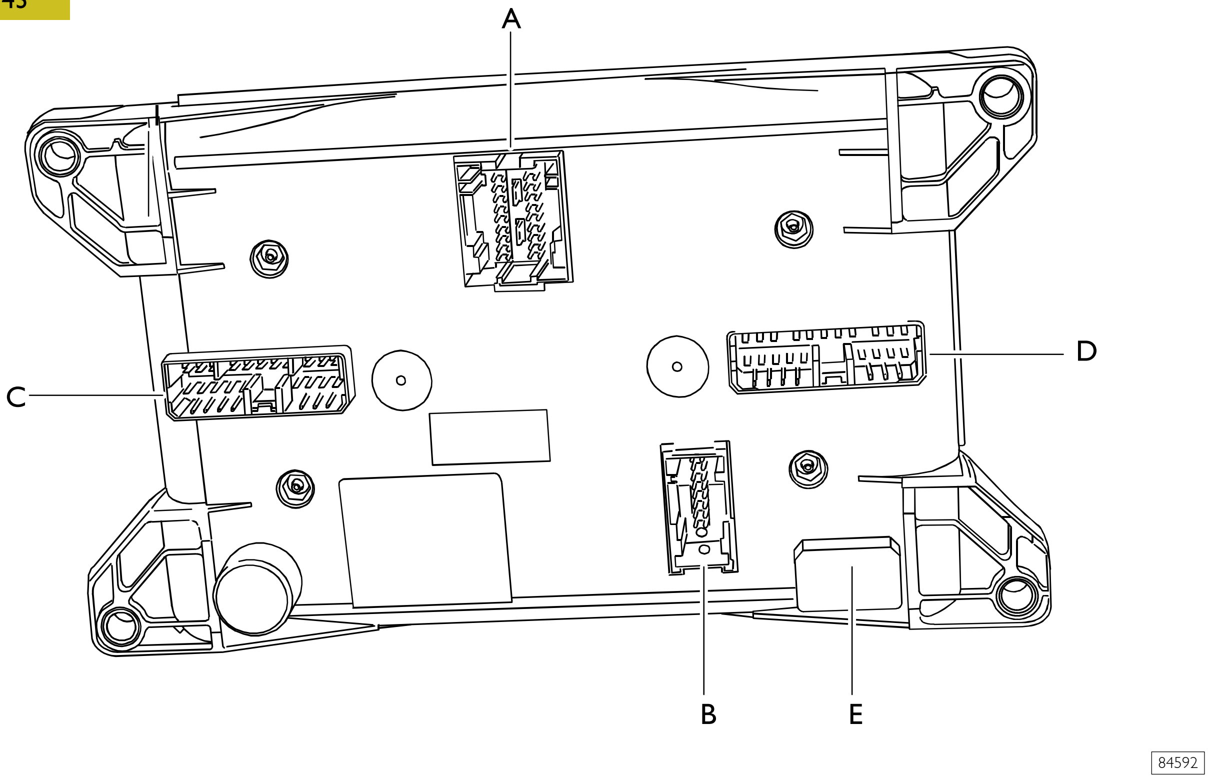


Ref.	Description
1	ABS
2	Rearview mirror control
3	Remote–control switch
4	Central locking control unit
5 ÷ 7	Auxiliary remote–control switches (OPT.)
8	Diode cluster
9	Resistor cluster

BODY CONTROLLER

Linking connectors

Figure 143



Ref.	Description
A	External lights / Rear fog lights / Start–prevent switch with hand brake OFF / High–beam headlamps / Low–beam headlamps / Flashing the lights / Headlamp trim / Emergency lights / Indicators / Braking gasket wear / Speed limiter / Exhaust brake selector / Door lights / Slow gear switch / Front and rear brake air pressure sensors / Stop signal (from brake pedal switch on the duplex) / Windscreen wiper
B	Power takeoff / Levels: radiator water, power steering oil, windscreen washer, TGC
C	Power supply +30 (after TGC) / +30 / CAN line / Windscreen wiper motor / Windscreen washer electric pump / Ceiling light / Step lights / Earth / Indicators / Left low–beam lamp / Right high–beam lamp / Trailer junction (right–left indicators) / CAN line
D	Left high–beam lamp / Right high–beam lamp / rear fog lights, stop lights, sidelights, clearance lights, number–plate lights
E	(High–low) gear engagement solenoid valve control

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Component control connector “A” (black)

Ref.	Cable colour code	Function
1	3302	Positive for fog light remote–control switch
2	5560	Positive for brake air sensors
3	0000	Brake air sensor earth
4	6662	Signal from start–prevent switch with hand brake ON
5	9024	Signal from exhaust brake selector (PIN1)
6	9976	Geared–down speed ON warning light (signal)
7	2237	External light switch (PIN 4)
8	2282	Rear fog light switch (PIN 2)
9	8886	Steering column stalk (windscreen wiper control (PIN 7C))
10	–	IVECO rear axle differential lock signal
11	9934	Signal from headlamp trim corrector (PIN 3)
12	9936	Headlamp adjustment unit control (PIN 2)
13	5561	Rear brake air pressure sensor signal
14	–	–
15	9025	Signal from exhaust brake selector (PIN 7)
16	2205	Signal from slow speed selecting switch
17	9968	Signal from speed limiter switch
18	2228	Signal from fog light switch
19	6620	Signal from Rockwell rear axle transverse differential lock signalling switch
20	6621	Signal from Rockwell / Iveco rear axle transverse differential lock signalling switch
21	5562	Front brake air pressure sensor signal
22	7728	Signal from emergency light actuation switch
23	0003	Signal from left door button
24	8882	Steering column stalk (windscreen wiper control PIN 3C)
25	1103	Steering column stalk (right indicator switch)
26	2204	Steering column stalk (light flash button)
27	8156	Cruise Control steering column stalk (SET–) (PIN D5)
28	8154	Cruise Control steering column stalk (RESUME) (PIN D7)
29	8822	Steering column stalk (windscreen wiper control PIN6C)
30	8881	Steering column stalk (windscreen wiper control PIN 1C)
31	0010	Signal from central ceiling light switch–on button
32	3333	External light switch (PIN 5)
33	0003	Signal from right door button
34	1117	Stop light button (stop signal)
35	1109	Left direction steering column stalk (PINA3)
36	2201	High–beam lamp actuation steering column stalk (PINB2)
37	8155	Cruise Control steering column stalk (ON) (PIND3)
38	8157	Cruise Control resume steering column stalk (SET+) (PIND2)
39	6012	Front wheel shoe wear signalling
40	6013	Rear wheel shoe wear signalling

Connector “B” (white)

Ref.	Cable colour code	Function
1	**6131**	Rear power takeoff ON signal
2	**6132**	Side power takeoff ON signal
3	–	Free
4	**0055**	Longitudinal lock ON signal
5	–	Free
6	**6659**	Front differential lock ON signal
7	**5520**	Radiator water level signal
8	**5525**	Power steering oil level signal
9	**5521**	Windscreen washer fluid level signal
10	–	Free
11	–	Free
12	–	Free
13	–	Free
14	–	Free
15	–	Control from TGC closing button
16	–	Free
17	–	Free
18	–	Positive for TGC closing remote–control switch excitation
19	–	Free
20	–	Free

Connector “C” (black)

Ref.	Cable colour code	Function
1	–	Free
2	7768	Positive +30 (prima TGC)
3	4441	Positive for internal ceiling light
4	2221	Right high–beam headlamp
5	2231	Left low–beam headlamp
6	8861	Windscreen wiper motor (53B)
7	8882	Windscreen wiper motor (53)
8	8886	Positive for windscreen washer electric pump
9	8873	Windscreen wiper motor (31B)
10	0000	Earth
11	6108	CAN “H” line
12	6109	CAN “L” line
13	–	Free
14	2197	Positive after TGC
15	4408	Positive for step light
16	1117	Positive after TGC
17	1180	Positive for trailer left indicators
18	1120	Positive for left indicators
19	1185	Positive for trailer right indicators
20	1125	Positive for right indicators

Connector “D” (blue)

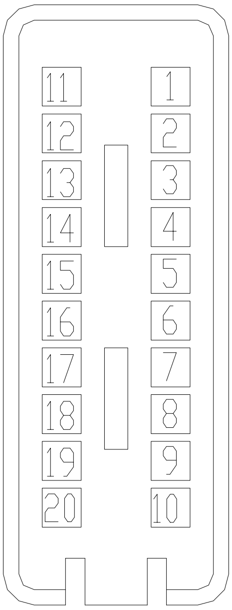
Ref.	Cable colour code	Function
1	4442	Positive for ideograph illumination
2	–	Free
3	2282	Positive for trailer reverse fog light
4	2286	Positive for reverse fog light
5	3334	Positive for rear left sidelights
6	3380	Positive for front left sidelight / Positive for front right clearance light
7	3339	Positive for rear clearance lights
8	3332	Positive for trailer left sidelight
9	8807	Positive after TGC
10	2223	Right low–beam headlamp / Headlamp trim consent
11	2219	Left low–beam headlamp
12	8879	Positive after TGC
13	8887	Positive after TGC
14	3330	Number–plate lights
15	3335	Positive for rear right sidelights
16	3390	Positive for front right sidelights / Positive for front left clearance light
17	3331	Positive for trailer front sidelights / Positive for body builders connector external light remote–control switch
18	1177	Positive for left stop light
19	1172	Positive for right stop light
20	1179	Positive for trailer stop light

Connector “E” (white)

Ref.	Cable colour code	Function
1	–	Free
2	–	Free
3	9973	Positive for high gear engagement solenoid valve control (9–speed gearbox)
4	8886	Positive +15
5	–	Free
6	–	Free
7	9110	Positive for geared–down speed engagement solenoid valve control (9–speed gearbox)
8	–	Free

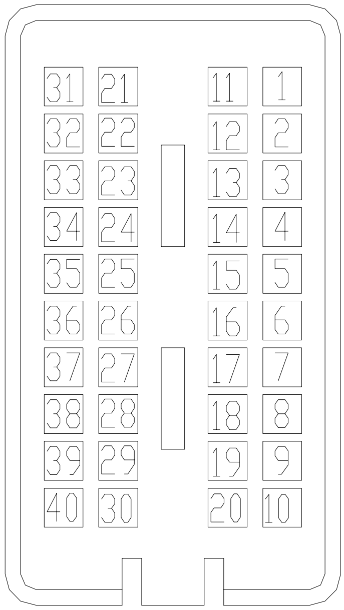
CONNECTOR PIN–OUT

Figure 144



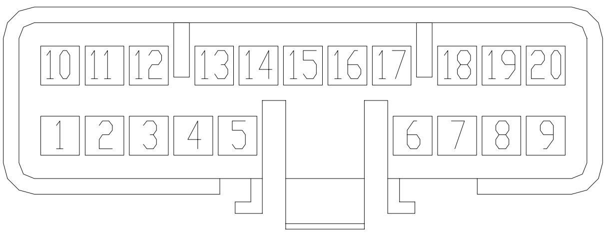
85561

CONNECTOR B



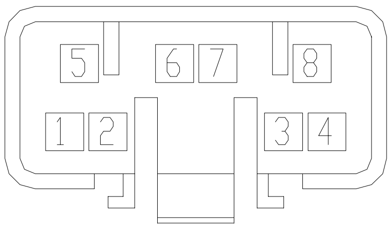
85562

CONNECTOR A



85563

CONNECTOR C/D



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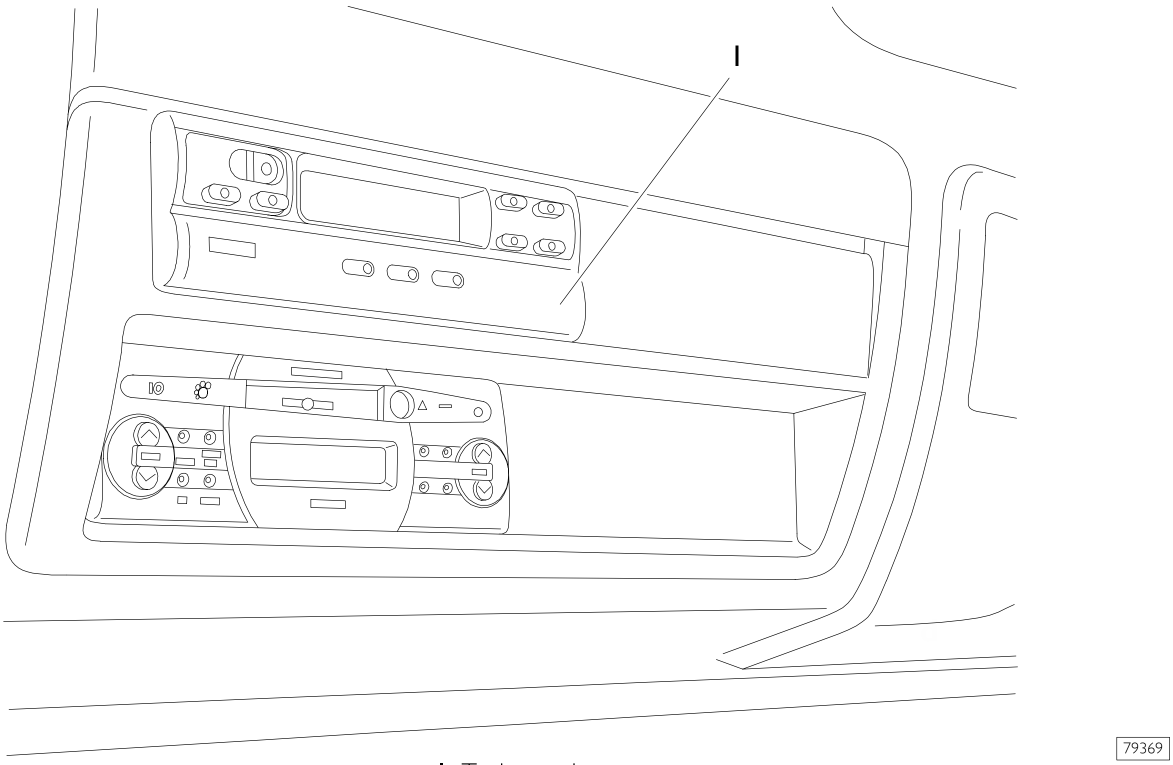
CONNECTOR E

TACHOGRAPH

Figure 145



1. Tachograph

Ref.		Cable colour code	Function
A	1	7768	Positive +30 direct to the battery
	2	4444	Ideograph illumination
	3	8879	Positive +15
	4	6108	CAN “H” line
	5	0066	Earth
	6	0066	Earth
	7	–	–
	8	6108	CAN “L” line
B	1	5514	Sensor (A) signal
	2	0058	Sensor (B) signal
	3	5517	Sensor (C) signal
	4	5516	Sensor (D) signal
	5	–	–
	6	–	–
	7	5515	To diagnosis connector pin 29
	8	–	–
C	1	–	–
	2	–	–
	3	–	–
	4	–	–
	5	–	–
	6	–	–
	7	–	–
	8	–	–
D	1	–	–
	2	–	–
	3	–	–
	4	–	–
	5	–	–
	6	–	–
	7	1191	Signal: Cluster B1 / Diagnosis pin 8
	8	–	–

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DESCRIPTION OF EDC 7 INJECTION SYSTEM

IVECO Code recognition

The EDC7 control unit communicates with the Immobilizer ECU to obtain the engine starting enable signal.

Engine pre–heating resistance control

The pre–post heating function is activated when even a single water, air or fuel temperature sensor indicates a temperature lower than 5 °C.

Timing phase recognition

The cylinder in which to inject the fuel is recognized through the signal from sensor on the camshafts and the sensor on the flywheel.

Injection control

Based on the information coming from the sensors, the control unit manages the pressure regulator, changes the pre–injection and the main injection operating modes. On Tector motors pre–injection is active at any rotation speed rate of the motor.

Closed cycle control of injection pressure

Based on engine loading, as determined by processing the signals from the various sensors, the control unit manages the regulator to have the optimal pressure at all times.

Main pilot injection advance control

Based on the signals from the different sensors, the control unit determines the optimal point according to the internal mapping.

Idling speed control

The control unit processes the signals from the different sensors and adjusts the quantity of fuel injected.
It checks the pressure regulator, varies the electro–injector injection time.
Within certain thresholds, it also takes into account battery voltage.

Maximum speed limitation

At 2700 rpm, the control unit limits fuel flow by reducing the electro–injector opening time.
At a speed of over 3000 rpm, it de–activates the electro–injectors.

Cut Off

Fuel cut off at release stage is managed by the control unit which implements the following logics:

- ❑ cuts off the power to the electro–injectors
- ❑ re–activates the electro–injectors immediately before idling speed is reached
- ❑ controls the fuel pressure regulator.

Exhaust fume control at acceleration stage

At considerable load levels, based on the signals from the air flowmeter and the engine speed sensor, the control unit manages the pressure regulator and varies the electro–injectors actuation time, so as to prevent the emission of exhaust fume.

Fuel temperature control

When the temperature of the fuel exceeds 75 ºC (as measured by the sensor placed on the fuel filter) the control unit reduces the injection pressure.
If the temperature exceeds 90 ºC, the power is reduced to 60%.

After Run

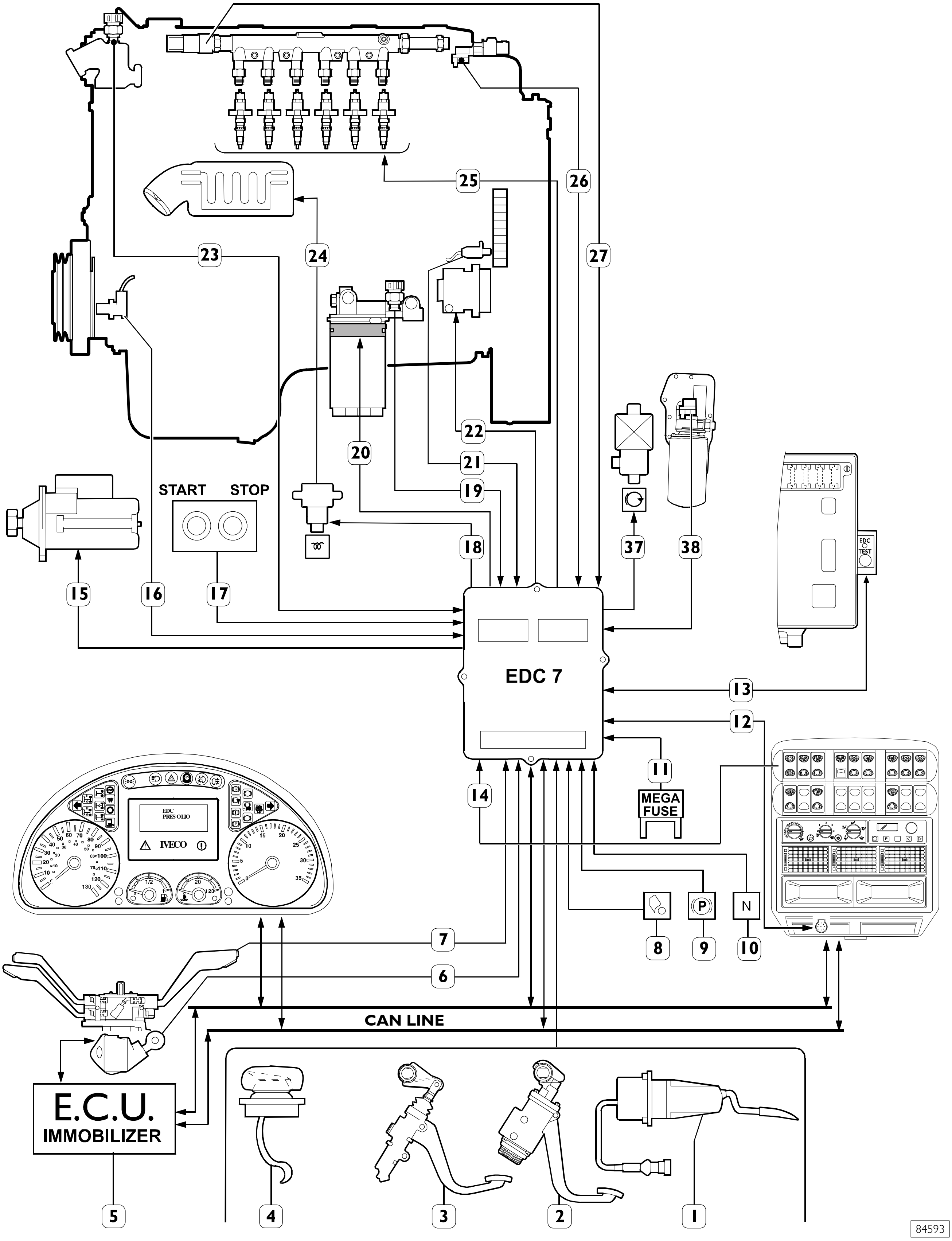
The control unit microprocessor makes it possible to memorize some data in the EEPROM, including the failure memory and the Immobilizer information, so as to make them available for the subsequent starting.

Protection from overheating

If water temperature reaches 110 °C, the central control unit reduces the motor performance.
When the temperature falls below 100 °C, the motor starts to function normally again.

Injection system assembly

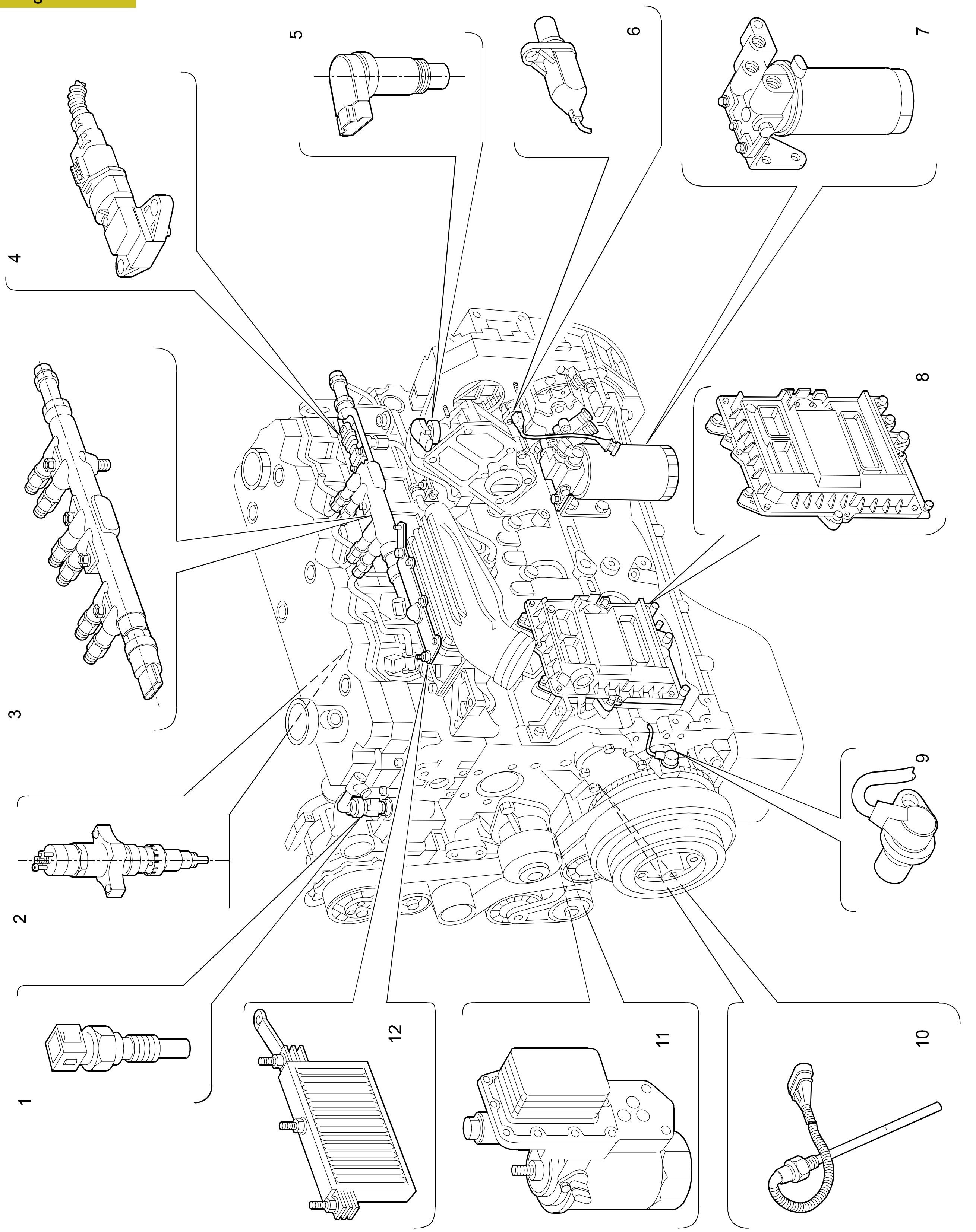
Figure 146



Ref.	Description
1	Position sensor on accelerator pedal
2	Primary and secondary brake switch
3	Sensor on clutch pedal
4	Exhaust brake switch
5	Immobilizer ECU
6	Ignition key
7	Lever mounted switches
8	Cab unhooked switch
9	Handbrake engaged
10	Neutral switch
11	(20 A) protective fuse
12	Tester connector
13	Blink–Code button
14	Exhaust brake selector
15	Starter motor
16	Crankshaft sensor
17	Engine stop/start buttons
18	Preheating remote control switch
19	Fuel temperature sensor
20	Fuel heating resistor
21	Timing system sensor
22	Pressure regulator
23	Coolant temperature sensor
24	Preheating resistor
25	Electro–injectors
26	Air temperature/pressure sensor
27	Fuel temperature/pressure sensor
28	Exhaust brake solenoid valve
29	Oil temperature/pressure sensor

Arrangement of the sensors

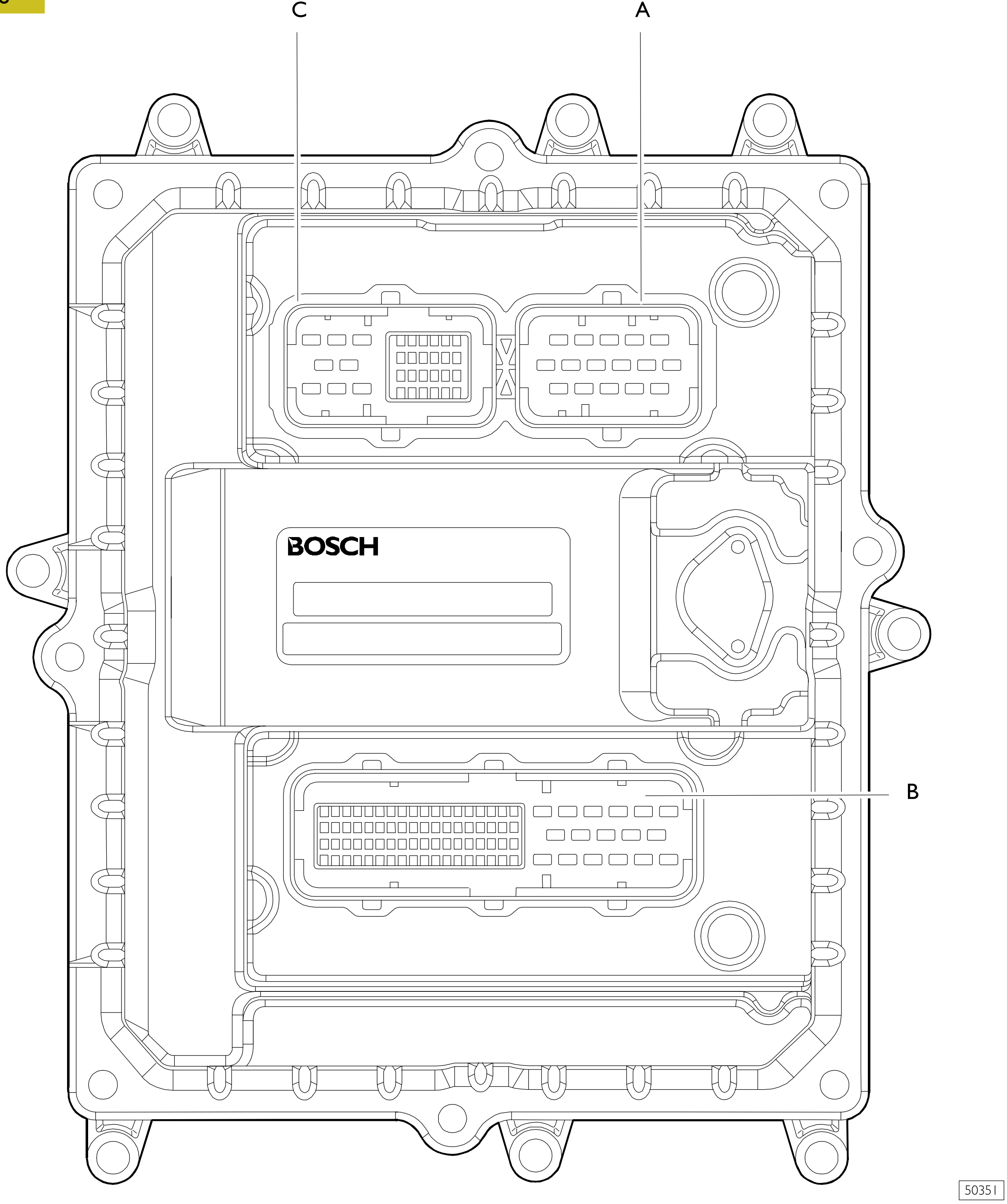
Figure 147



Ref.	Component code	Description
1	85153	Coolant temperature sensor
2	78247	Electro–injector
3	85157	RAIL pressure sensor
4	85156	Air temperature/pressure sensor
5	44037	Power steering level sensor
6	48042	Timing sensor
7	47042	Fuel temperature sensor
8	85150	EDC7 control unit
9	48035	Crankshaft sensor
10	44043	Engine oil level transmitter
11	42030	Engine oil pressure/temperature sensor
12	61121	Pre–post hearing resistance

EDC 7 electronic control unit

Figure 148



A. Injector connector – B. Frame connector – C. Sensor connector

The control unit is fitted onto the engine via a heat exchanger by means of elastic blocks which reduce the vibrations transmitted to the unit by the engine.

It is powered by a fuse (20 A) placed in the UCI (fuse no. 19).

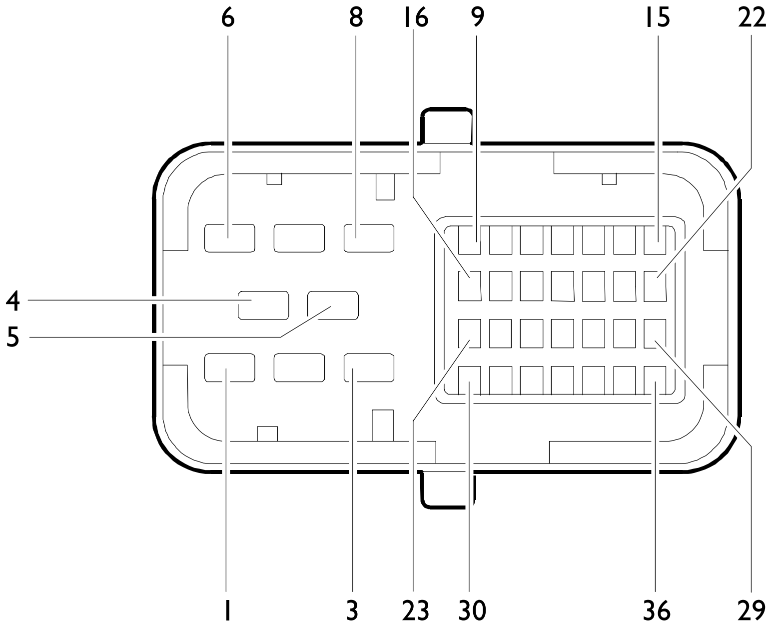
The main relay which is normally used to power the system is located inside the control unit itself.

Sensors connector "C"

Figure 149

Colour legend

B black
R red
U blue
W white
P purple
G green
N brown
Y yellow
O orange

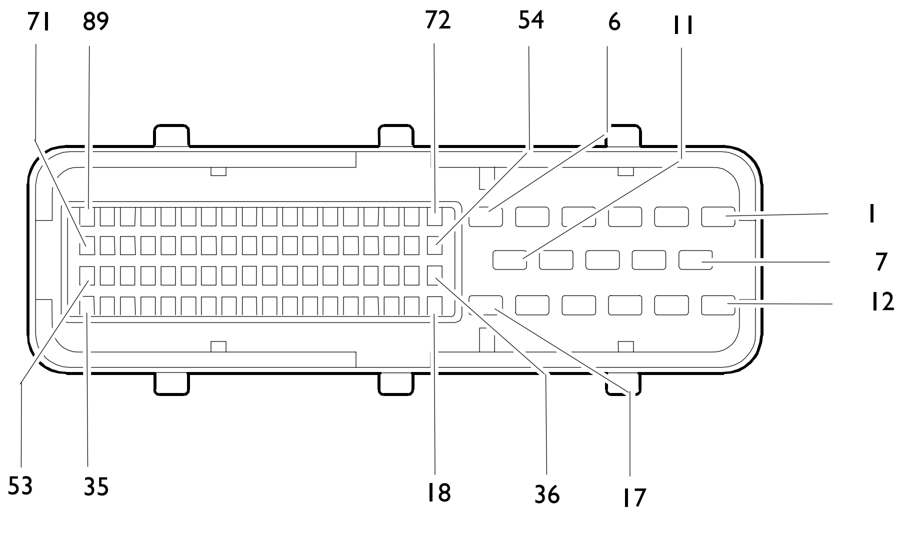


50350

ECU Pin	Cable Colour	Function
1÷4	–	–
5	NW	Ground for pressure regulator
6	–	–
7	NP	Control for pressure regulator
8	–	–
9	PY	Power supply for engine oil temperature pressure sensor
10	NY	Power supply for air pressure temperature sensor
11	–	–
12	GY	Power supply for rail pressure sensor
13÷16	–	–
17	YR	Ground for fuel temperature sensor
18	YN	Ground for coolant temperature sensor
19	PN	Ground for engine oil temperature pressure sensor
20	GN	Power supply for rail pressure sensor
21	N	Power supply for air pressure / temperature sensor
22	–	–
23	U	Timing sensor
24	U	Crankshaft sensor
25	R	Crankshaft sensor
26	–	–
27	GO	Signal from rail pressure sensor
28	NG	Signal from air pressure sensor
29	UO	Signal from air temperature
30	R	Ground for timing sensor
31÷32	–	–
33	PO	Signal from engine oil temperature sensor
34	YU	Signal from diesel oil temperature sensor
35	PG	Signal from engine oil pressure sensor
36	YO	Signal from coolant temperature sensor

"B" frame connector

Figure 150



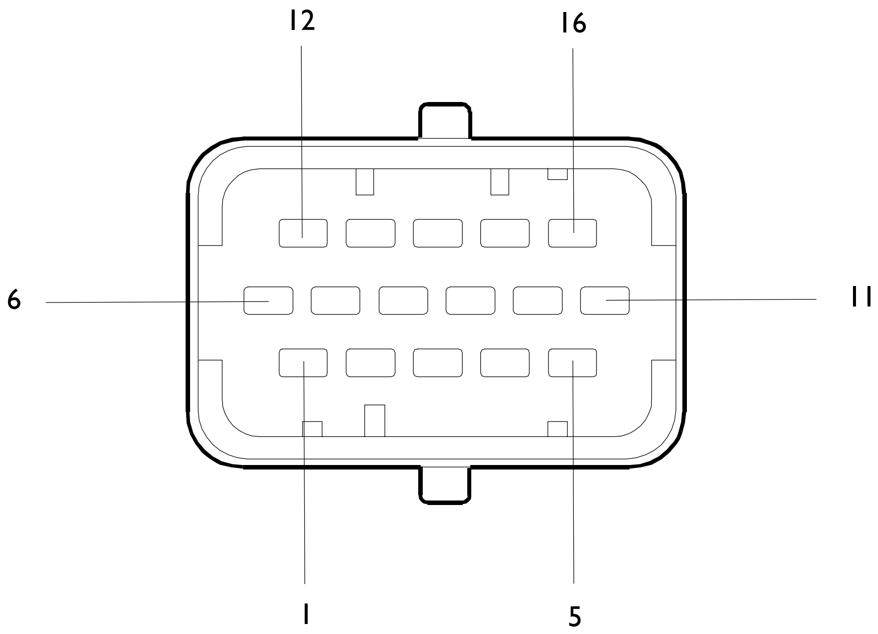
ECU Pin	Cable	Function
1	8150	Direct positive from battery
2	0087	Negative for diesel oil filter heating relay
3	0000	Ground
4	0094	Negative for exhaust brake solenoid valve/control relay/pre–post hearing resistance
5	9068	Air–conditioning system remote–control switch drive signal
6	–	–
7	8150	Direct positive from battery
8	7777	Positive for clutch sensor/Blink Code button/exhaust brake button/brake pedal switch on the duplex
9	0000	Ground
10	9067	Air–conditioning system remote–control switch drive signal
11	9966	Negative for exhaust brake solenoid valve
12	8150	Direct positive from battery
13	8150	Direct positive from battery
14	0000	Ground
15	0000	Ground
16	8885	Positive to turn on thermostarter relay
17–18	–	–
19	0150	Negative for start–up buttons/stop from engine compartment/gearlever in neutral/hand brake ON
20	8037	Positive from key–operated switch at starting stage (+50)
21	8159	Positive from exhaust brake switch
22	–	Control from brake pedal position exhaust brake selector
23–25	–	
26	–	–
27	5162	Positive from blink code button
28	5535	Positive for EDC failure warning light
29	–	–
30	1198	L line for 30 pin tester connector (pin 1)
31	2298	Line K for 30 pin tester connector (pin 2)
32	0169	PTO
33–35	–	–
36	8837	Positive for diesel oil filter heating relay
37	8888	Positive for starter motor
38	–	–

"B" frame connector

ECU Pin	Cable	Function
39	8051	Positive from key–operated switch, +15
40	0027	Cutting off engine brake with ABS in
41	9907	Signal from handbrake engaged switch
42	6666	Signal from cab unhooked switch
43	0115	Gearbox in neutral position (signal)
44	9905	Positive from start button from engine compartment
45	9906	Positive from stop button from engine compartment
46	–	–
47	–	–
48	5198	Engine phase signal for diagnosis connector (pin 23)
49	5584	Signal for electronic rev counter
50	0158	Negative from accelerator pressed switch
51	–	–
52	6109	CAN line (white wire) L
53	6108	CAN line (green wire) H
54	–	–
55	5158	Positive for accelerator pedal position sensor
56	–	–
57–58	–	–
59	–	–
60	–	–
61	–	–
62	5602	Clutch sensor
63	–	–
64	0535	Negative for EDC failure warning light
65	–	–
66	–	–
67–71	–	–
72	0159	Signal from accelerator pressed switch
73	0159	Redundant signal from accelerator pressed switch
74	5155	–
75	–	–
76	8158	Positive from secondary brake pedal switch
77	5502	Signal from second speed limiter switch
78	9071	Air–conditioning system
79	–	–
80	8153	Brake light signal
81	0157	Ground for accelerator pedal position sensor
82	–	–
83	5157	Signal from accelerator pedal position sensor
87	5120	PTO

Electroinjectors connector “A”

Figure 151

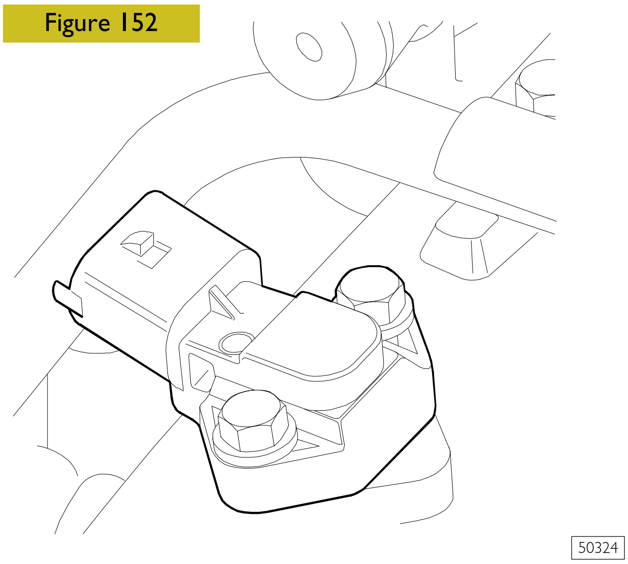


ECU Pin	Cable Colour (4 cylinders)	Function (4 cylinders)
1	–	–
2	–	–
3	–	–
4	WP	Cylinder 4 injector
5	–	–
6	–	–
7	–	–
8	–	–
9	RG	Cylinder 1 injector
10	UN	Cylinder 2 injector
11	UG	Cylinder 3 injector
12	WR	Cylinder 4 injector
13	RY	Cylinder 1 injector
14	–	
15	UO	Cylinder 2 injector
16	UY	Cylinder 3 injector

Colour legend

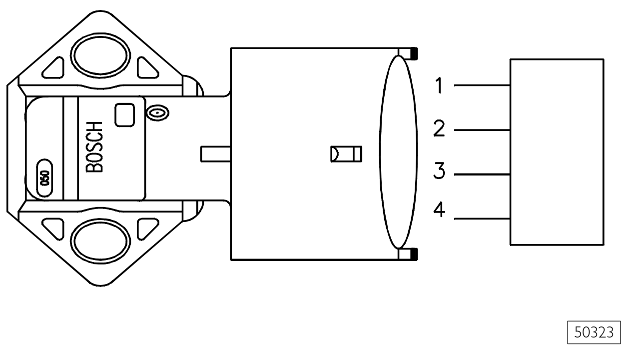
B black
R red
U blue
W white
P purple
G green
N brown
Y yellow
O orange

Figure 152



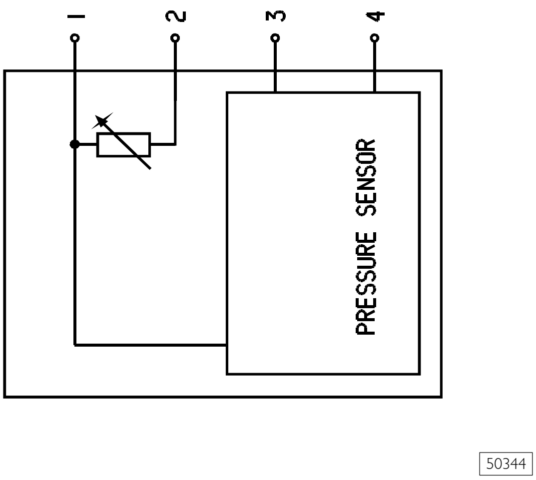
EXTERIOR VIEW OF SENSOR

Figure 153



CONNECTION CONNECTOR

Figure 154



WIRING DIAGRAM

Air temperature/pressure sensor (85156)

This component combines a temperature and a pressure sensor.

It is fitted to the intake manifold so that, by measuring the maximum quantity of air taken in, it makes it possible to determine the exact amount of fuel to be injected at each cycle.

This sensor is connected to the control unit via pins 21/C – 29/C – 10/C – 28/C.

It is powered at 5 V.

The output voltage is proportional to the pressure (or temperature) measured by the sensor.

Pins 21/C – 29/C Temperature

Pins 10/C – 28/C Pressure

Oil pressure/temperature sensor

This component is identical to the air temperature/ pressure sensor

It is mounted horizontally on the engine oil filter.

It measures the engine oil temperature and pressure.

It is connected to the control unit via pins 19C – 33C – 9C – 35C.

The values sent are transmitted to the EDC control unit which, in its turn, controls the indicator on the dash (indicator / low pressure warning light).

Pins 19/C – 35/C Temperature

Pins 9/C – 33/C Pressure

The engine oil temperature is used by the EDC unit only.

Ref.	Description	Control unit Pin	
		Oil	Air
1	Ground	19C	21C
2	Temp. signal	35C	29C
3	+5	9C	10C
4	Press. signal	33C	28C

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Crankshaft sensor (48035)

This inductive type sensor is located in the left front part of the engine. It generates signals obtained from magnetic flux lines which close through the openings of a toothed wheel force fitted to the crankshaft. The same signal is used to manage the electronic rev counter.

It is connected to the control unit via pins 25C – 24C.

The sensor's resistance value is ca 900 Ω.

Supplier BOSCH

Tightening torque 8 ± 2 Nm

Timing system sensor (48042)

This inductive sensor is located in the left front part of the engine. It generates signals obtained from magnetic flux lines which close through the holes situated in gears force fitted to the camshaft. The signal generated by this sensor is used by the ECU as the injection timing signal.

Though it is similar to the crankshaft sensor, it is not interchangeable with the latter since its outer shape is different.

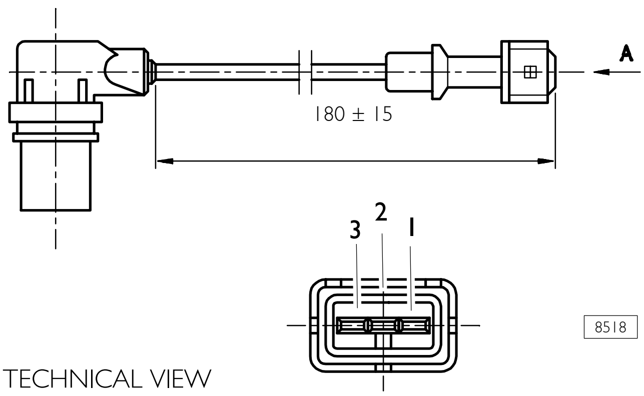
It is connected to the control unit via pins 23C – 30C.

The sensor's resistance value is ca 900 Ω.

Supplier BOSCH

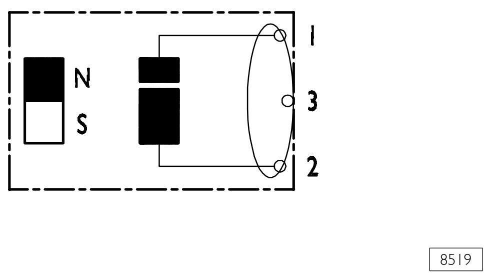
Tightening torque 8 ± 2 Nm

Figure 155



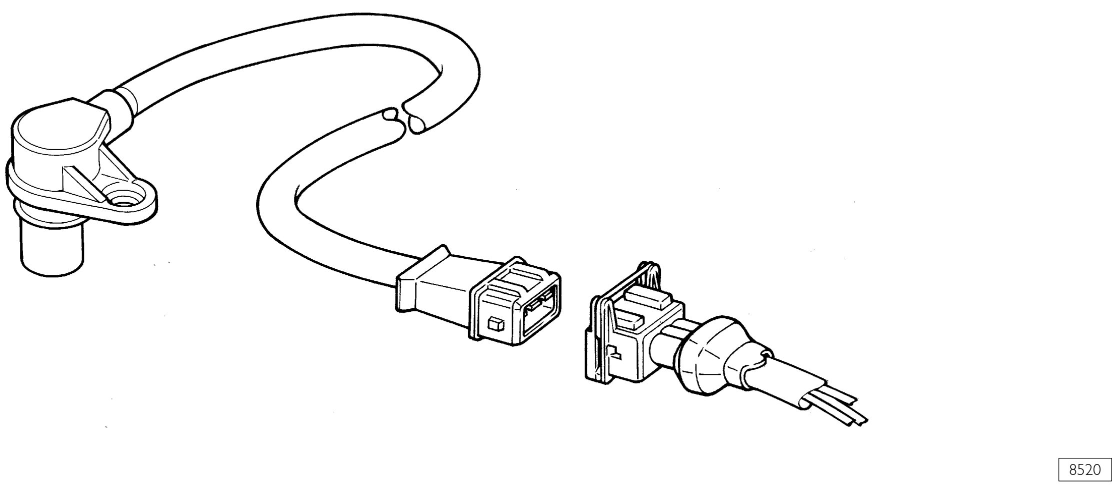
TECHNICAL VIEW

Figure 156



WIRING DIAGRAM

Figure 157



PERSPECTIVE VIEW

Ref.	Description	Control unit Pin	
		48035	48042
1	Signal	25C	23C
2	Signal	24C	30C
3	Shielding		

Fuel pressure sensor (85157)

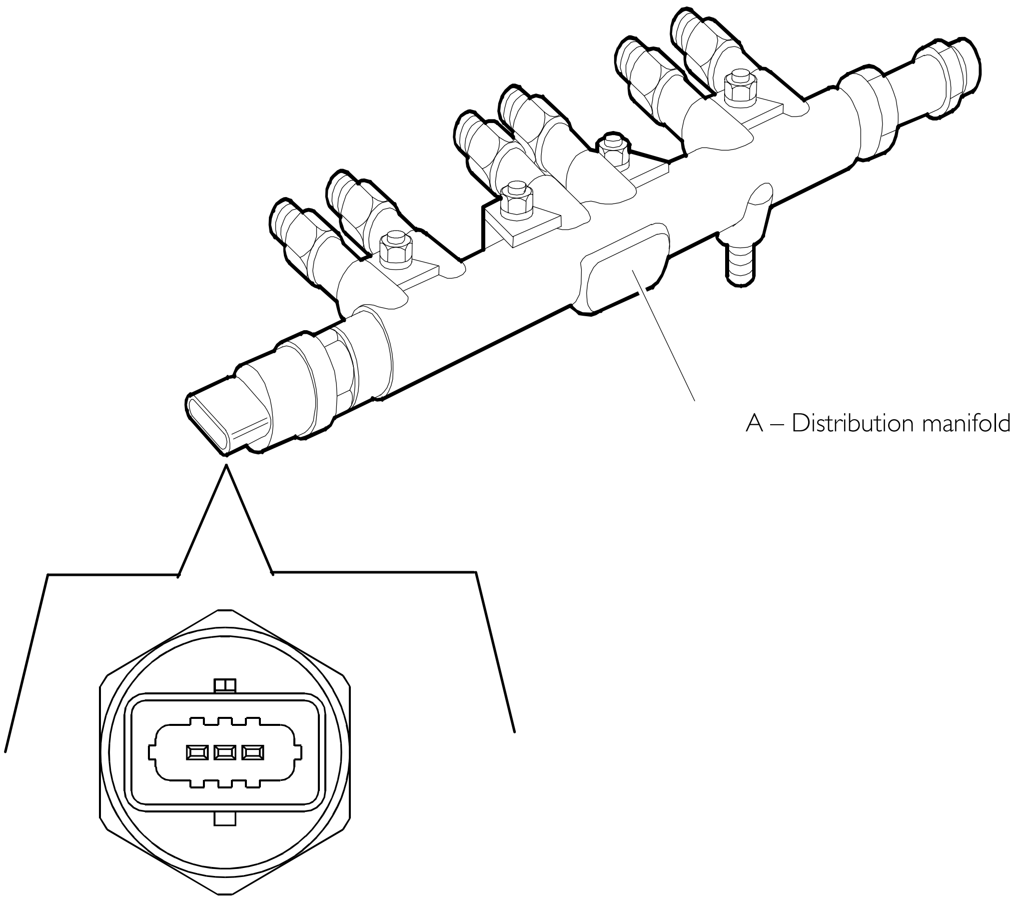
Fitted to one end of the rail, it measures the pressure of the existing fuel in order to determine the injection pressure.

The value of injection pressure is used to keep the pressure level under control and to determine the time duration of the injection electronic command.

It is connected to the control unit on pins 20C – 27C – 12C.

It is powered at 5 V.

Figure 158



Ref.	Description	Control unit pin
1	Ground	20C
2	Signal	27C
3	Power	12C

High pressure pump (pressure regulator)

Pump with 3 radial pistons controlled by the timing gears, requiring no phase adjustment, with rotor type feed pump fitted to the back.

A. Connection between fuel discharge outlet and filter support

B. Connection for fuel inlet from control unit heat exchanger

C. Connection for fuel inlet from fuel filter

D. Connection between fuel outlet from feed pump and filter

E. Connection between fuel outlet and rail

1. High pressure pump
2. Feed pump
3. Pressure regulator (N.O. solenoid valve modulated by the control unit by means of PWM signal).

Pressure regulator

Situated at the inlet of the high pressure pump, on the low pressure system, it adjusts the quantity of fuel reaching the high pressure pump as a function of the commands received from the electronic control unit.

It basically consists of the following parts:

- trapezoidal section shutter;
- valve control pin;
- pre–charging spring;
- coils.

In the absence of the control signal, the pressure regulator is normally open, and hence the high pressure pump is in its maximum delivery conditions.

The control unit modulates a PWM control signal which reduces, to a greater or lesser extent, the section carrying the fuel to the high pressure pump.

This component cannot be replaced individually and hence it cannot be taken down.

The amount of fuel feeding the high pressure pump is metered by a proportional valve situated on the low pressure system – managed by the EDC 7 control unit.

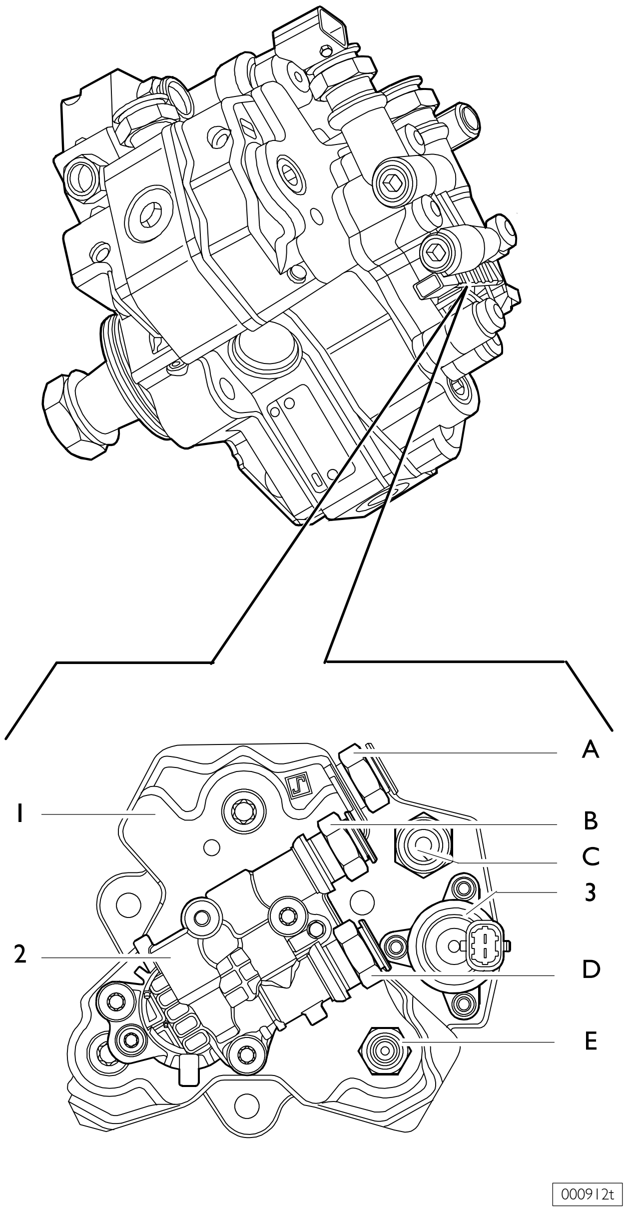
The delivery pressure to the rail is modulated between 250 and 1400 bar by the control unit working on the pressure regulator solenoid valve.

It is a N.O. solenoid valve

Its resistance is ca 3.2 Ω.

It is connected to the control unit via pins C5 – C7.

Figure 159



Electroinjector

The injector features a traditional construction, save for the fact that it has no needle return springs.

The electroinjector essentially consists of two parts:

- actuator – atomiser consisting of a pressure rod **1**, a needle **2** and nozzle **3**;
- control solenoid valve, consisting of a coil **4** and pilot valve **5**.

The solenoid valve controls the rise of the atomiser needle.

Injection starts

Upon being energised, coil **4** moves up the shutter **6**.

The fuel contained in the control volume **9** flows back towards line **12** resulting in a pressure drop in the control volume **9**.

At the same time, the fuel pressure in the pressure chamber **8** moves up the needle **2** resulting into the fuel being injected into the cylinder.

Injection ends

When coil **4** is de–energised, the shutter **6** closes again so as to re–create a balance of forces which moves the needle back into its closed position and stops the injection process.

This is a N.O. solenoid valve.

Individually connected to EDC control unit on connector A.

The resistance of the coil of each individual injector is 0.56 ÷ 0.57 Ω.

Figure 160

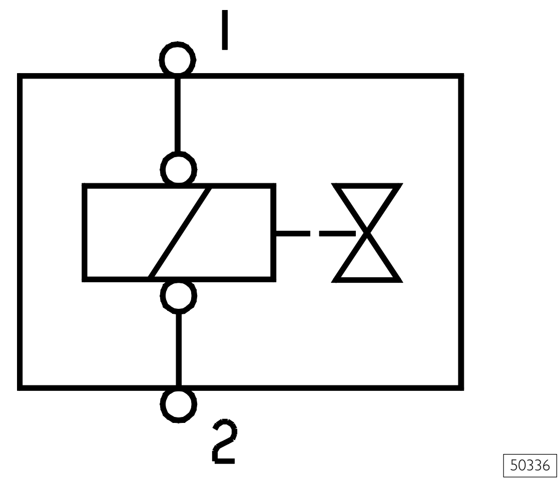
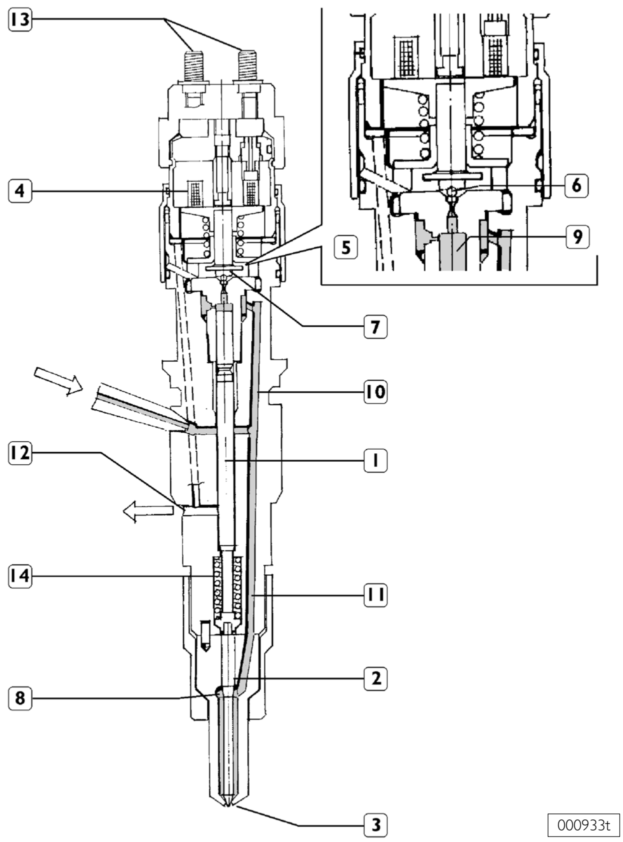


Figure 161



INJECTION IN RESTING POSITION

1. Pressure rod – 2. Needle – 3. Nozzle – 4. Coil – 5. Pilot valve – 6. Ball shutter – 7. Control area – 8. Pressure chamber – 9. Control volume – 10. Control line – 11. Feed line – 12. Control fuel outlet – 13. Electrical connection – 14. Spring – 15. High pressure fuel inlet.

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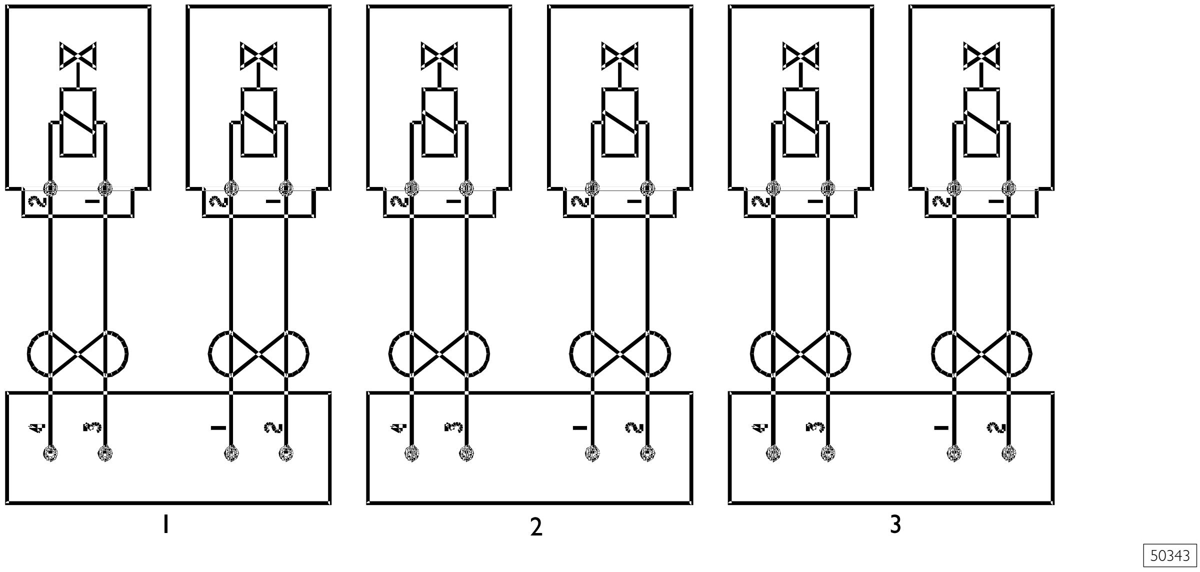
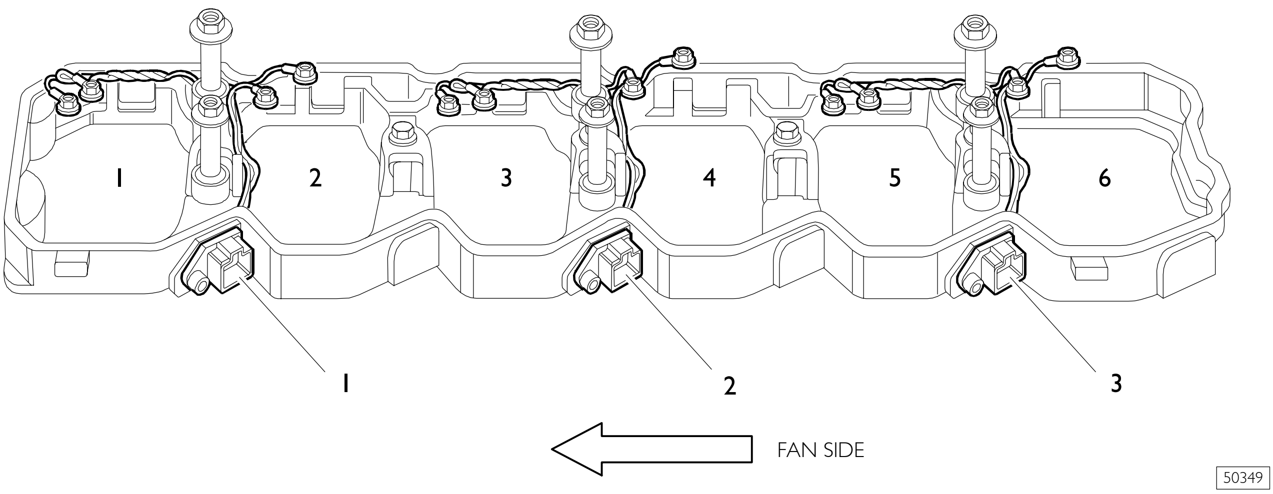
Connecting connectors

Figure 162



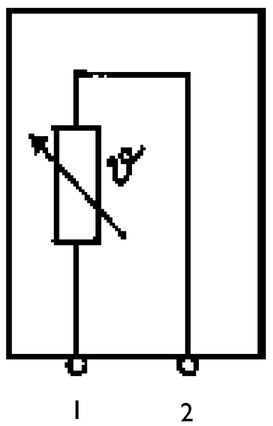
WIRING DIAGRAM OF THE CONNECTIONS

Figure 163



Ref.		Description	Control unit Pin
CONNECTOR **1**	1	Cylinder 2 injector	3 A
	2	Cylinder 2 injector	6 A
	3	Cylinder 1 injector	13 A
	4	Cylinder 1 injector	9 A
CONNECTOR **2**	1	Cylinder 4 injector	5 A
	2	Cylinder 4 injector	14 A
	3	Cylinder 3 injector	12 A
	4	Cylinder 3 injector	4 A
CONNECTOR **3**	1	Cylinder 6 injector	10 A
	2	Cylinder 6 injector	15 A
	3	Cylinder 5 injector	16 A
	4	Cylinder 5 injector	11 A

Figure 164



Coolant temperature sensor (47035)

This is a variable resistance sensor that is able to measure coolant temperature and transmit a signal to the control unit reflecting the thermal conditions of the engine.

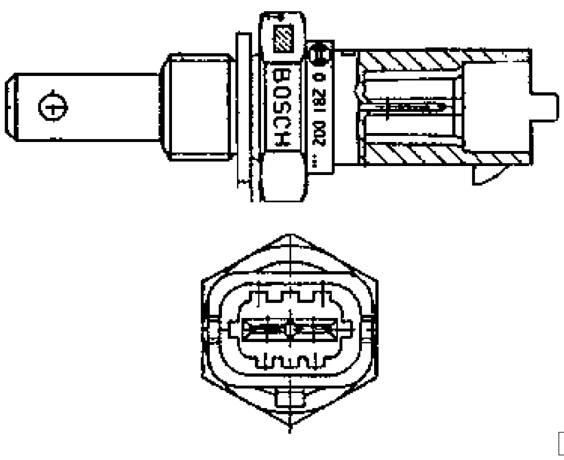
The same signal is used by the control unit to manage the temperature gauge on the dash.

It is connected to the control unit via pins 18C – 36C.

Its resistance at 20 °C = 2.50 KΩ.

It is placed in the upper engine part.

Figure 165



Fuel temperature sensor (47042)

This sensor is identical to the previous one.

It measures the temperature of the fuel and transmits a signal to the control unit reflecting the thermal conditions of the diesel oil.

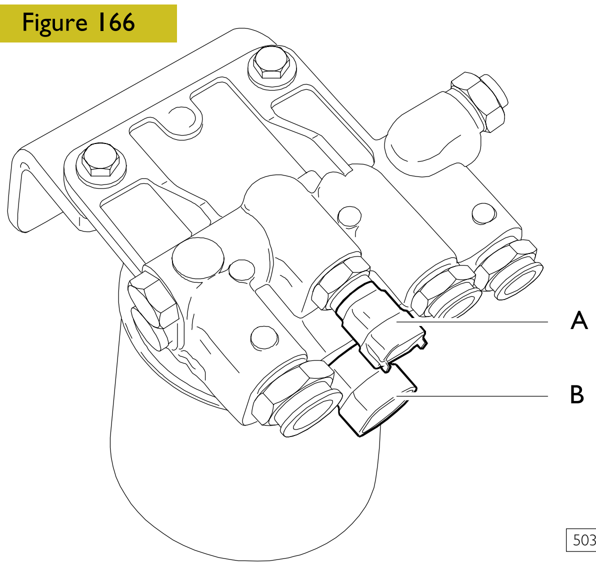
It is connected to the control unit via pins 17C – 34C.

Its resistance at 20 °C = 2.50 KΩ.

The ECU manages the relay for the control of filter heating when the temperature of the fuel drops to ≤ 36 °C.

Ref.	Description	ECU pin	
		47035	47042
1	Ground	18C	17C
2	Signal	36C	34C

Figure 166



A. Fuel temperature sensor B. Filter heating resistance

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Fuel pre–filter

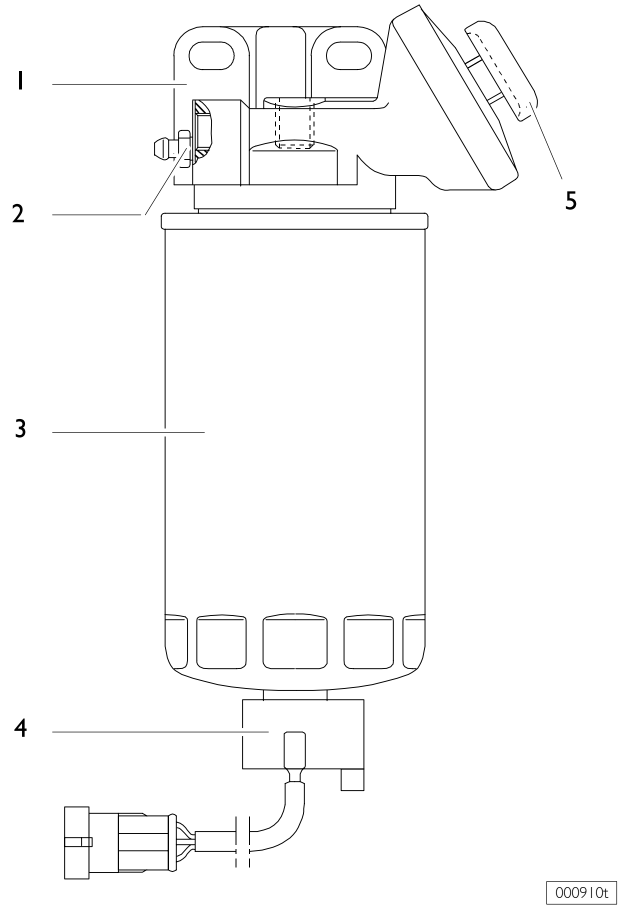
The water separation type fuel filter is mounted on the right hand side of the vehicle frame and has, on the cartridge base **3**, a sensor **4** detecting the presence of water in the fuel.

The filter support houses a manual priming pup **5** and a screw **2** to bleed the air from the system.

The presence of condensate in the filter and the filter clogged condition are revealed by sensor **4** by turning on a single warning light in the dash.

If the warning light lights up, take action immediately to remove the cause, as common rail system components deteriorate quickly if there is water or impurities in the fuel.

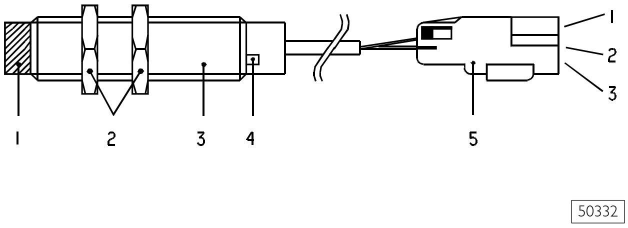
Figure 167



Tightening torque

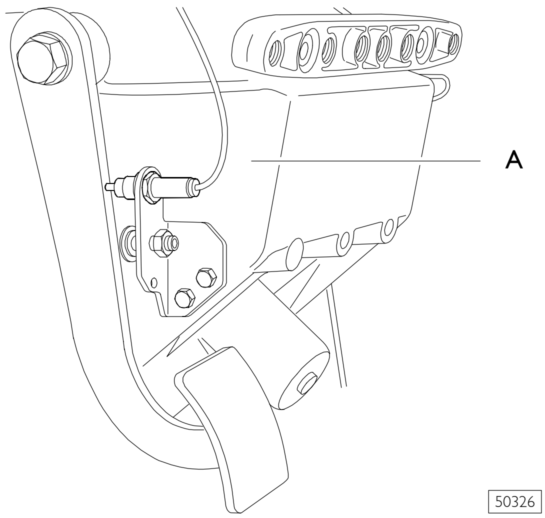
Bleed screw 2	6 to 8 Nm
Filtering cartridge 3	18 ± 0.1 Nm
Sensor 4	0.8 ± 0.1 Nm

Figure 168



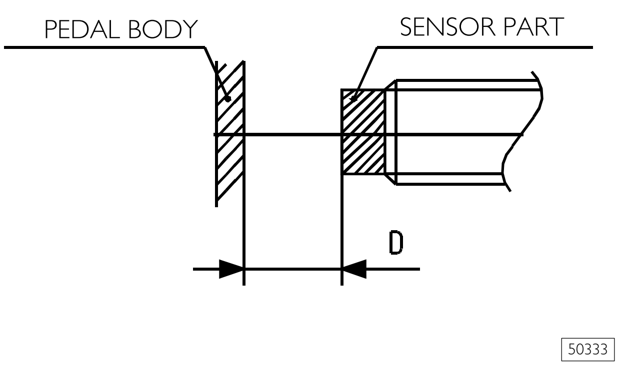
1. Sensitive part of sensor – 2. Tightening screws (torque 10 Nm) – 3. Brass body – 4. Yellow LED – 5. Connector.

Figure 169



A. Clutch sensor

Figure 170



D. Triggering distance

Clutch sensor (42374)

This is an electronic proximity switch

It is fitted to the clutch pedal and determines the engagement of the clutch

It is fitted with a yellow led indicator that lights up when the pedal is released.

It is connected to electronic control unit via pin 62B.

Triggering distance

To prevent the pedal from hitting against the sensor head upon being released abruptly, we recommend the following triggering distance: 1 to 3 mm (D).

Ref.	Cable colour	Description	Control unit pin
1	0000	Ground	–
2	7151	Power supply	8B
3	0160	Signal	62B

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Pre–post heating resistance

This resistance is located on the intake manifold.

It is used to warm up the air in pre–post heating operations. It is powered by a remote control switch situated on the left hand side of the frame.

Its resistance is ~ 0,5 **Ω**.

Resistance control remote control switch

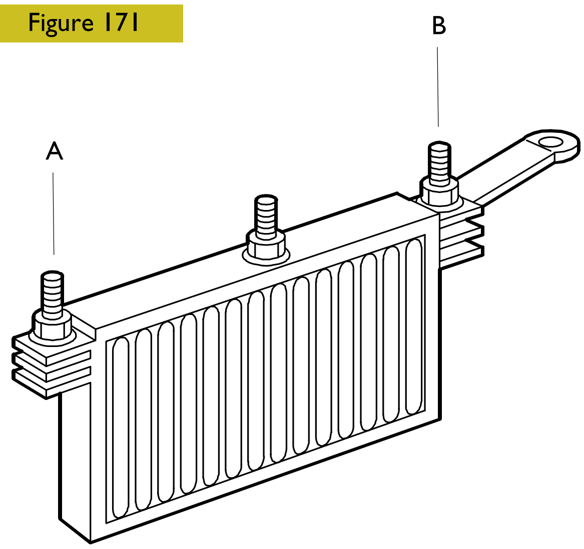
The remote control switch is connected to the EDC control unit via pins 4B – 16B.

It is activated when the temperature of the water or the diesel oil exceeds 5 °C.

It is located in the front part of the vehicle, on the left longitudinal.

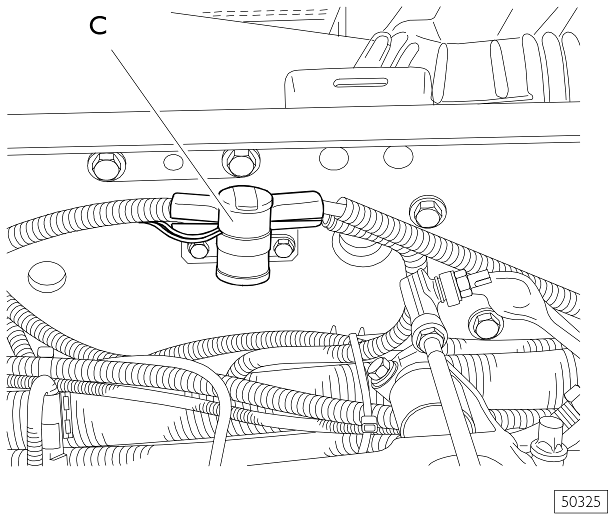
The remote control switch coil resistance is about 15 **Ω**.

Figure 171



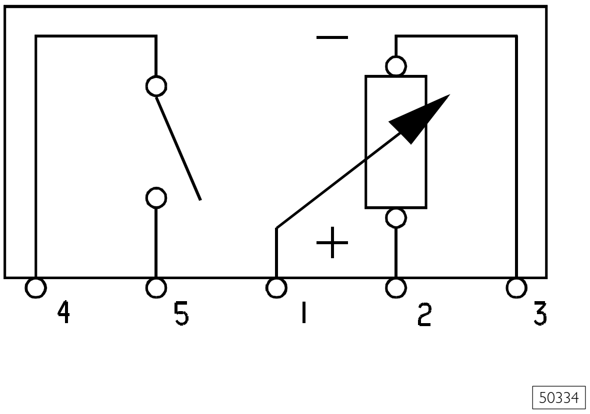
A. – B. Connecting terminals

Figure 172



C. Remote control switch

Figure 173



WIRING DIAGRAM

Figure 174

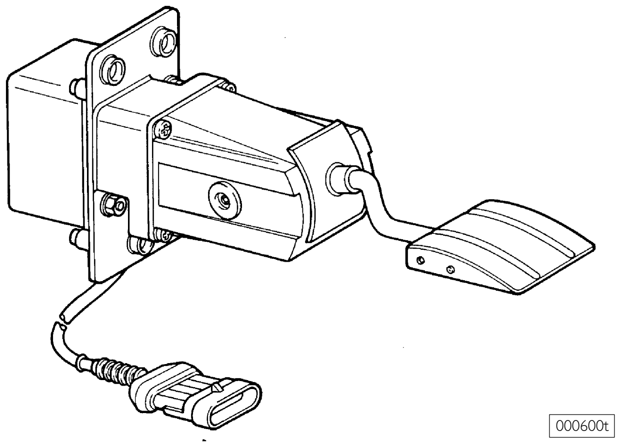
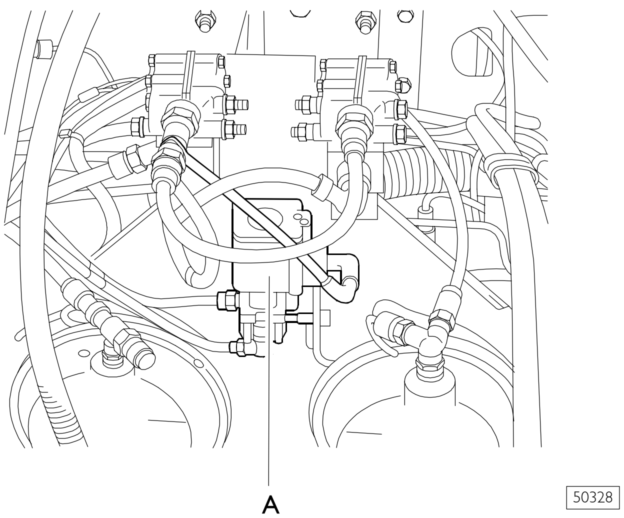


Figure 175



A. Exhaust brake solenoid valve

Load sensor on accelerator for EDC (85152)

The accelerator pedal position sensor is of potentiometric type, with built in N.O. minimum switch.

It supplies to the ECU a value proportional to the activation angle of the pedal itself, so as to determine fuel feed.

It is connected to the control unit via pins 73B – 81B – 83B – 55B – 58B.

The resistance of the potentiometer is ca 1 KΩ.

The power supply voltage is 5 V.

Exhaust brake solenoid valve (78050)

This is a N.C. on–off solenoid valve.

It is positioned on the left hand side of the frame. By controlling this solenoid valve, the ECU opens the passage for the air coming from the aux. unit tank to control the exhaust brake cylinder which, in its turn, closes the throttle valve in the exhaust manifold.

It is connected to the control unit via pins 4B – 11B.

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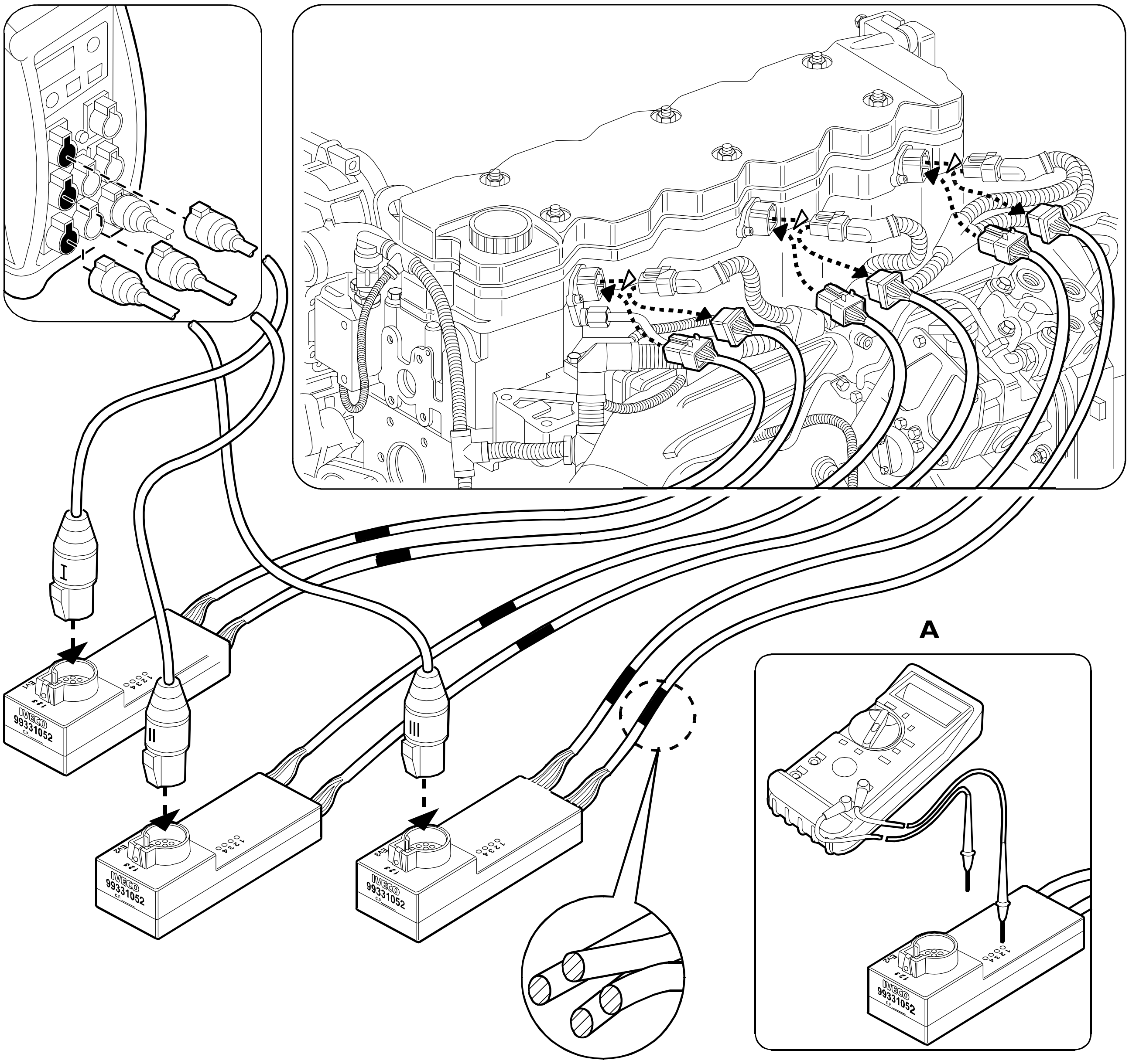
Adapters for diagnostic with MODUS, IT2000 and IWT

Adapter for readings on engine injector

In addition to tests through MODUS, IT2000 and IWT this adapter enables to perform readings with multimeter on individual injectors (as shown in detail A).

Figure 176



001662t

Testing methods

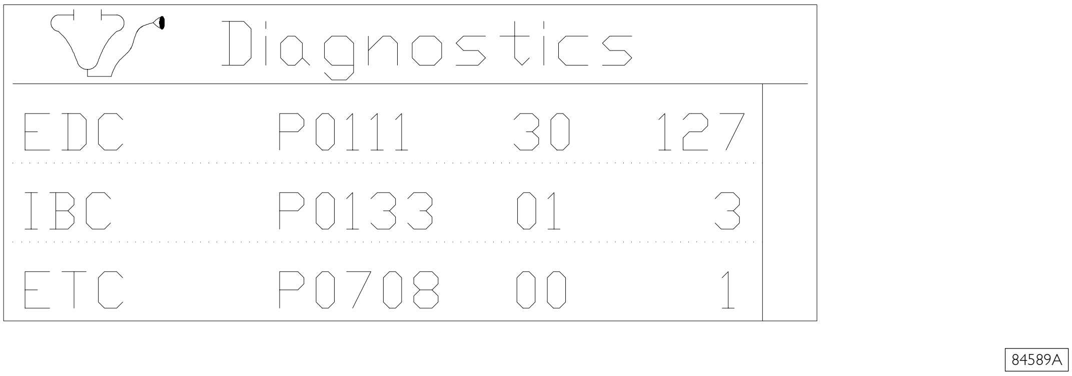
Two warning lights (yellow or red) will be displayed according to the gravity of the failure.

HIGHLINE model clusters will show a "DIAGNOSTIC" screen, in the middle part of the display, which will indicate failure codes.

MODUS – IT 2000 – E.A.S.YI.

These diagnostic instruments allow you to make a full diagnosis of the various systems available on IVECO range vehicles.

Figure 177



SCREEN ON THE DISPLAY (HIGHLINE MODEL)

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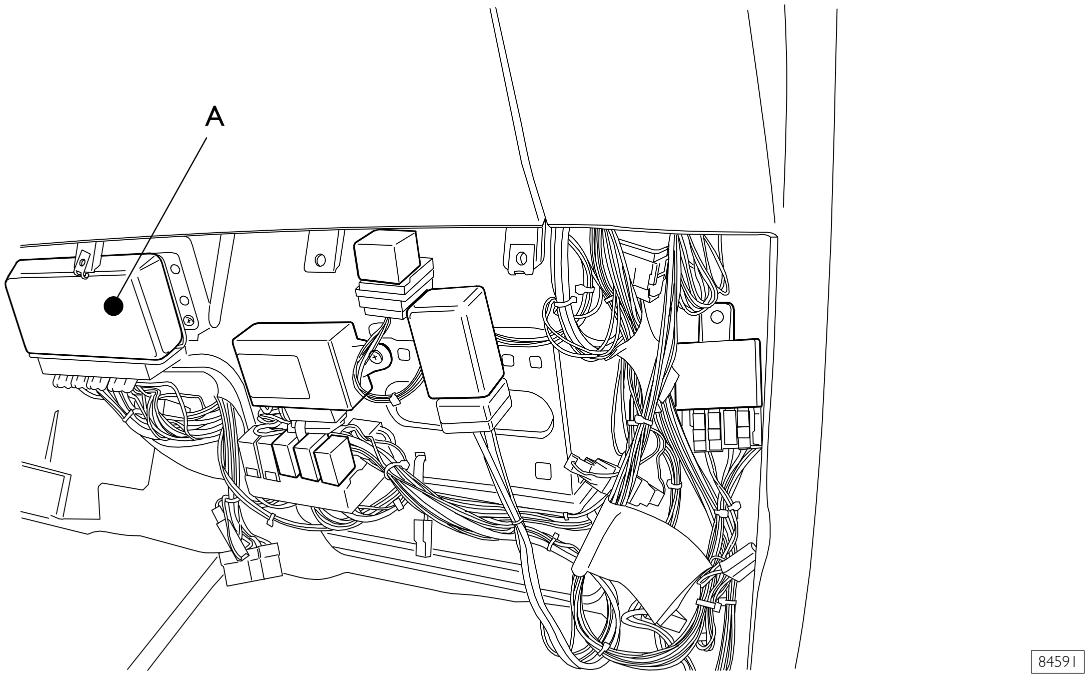
ABS

Electronic control unit location on vehicle

Figure 178



A. Electronic control unit ABS

The system is able to prevent wheel locking, that could occur when braking, under any vehicle load condition and under any wheel–roadbed friction coefficient condition, in order to guarantee better braking performances and a better vehicle stability.

The system is activated upon startup and automatically operates for speeds greater than 5 km/h if, after a braking, one or more wheels tend to lock.

The ABS system is able to control engine brake exclusion and distributor locking (if it exists).

They are disconnected when it is detected that one or more driving wheels tend to lock.

Re–connection is automatic when the ABS system ceases to operate.

On all vehicles of the range, the system has three channels, two on front wheels and one on rear axle, apart from 3–axle vehicles in which the system has four channels.

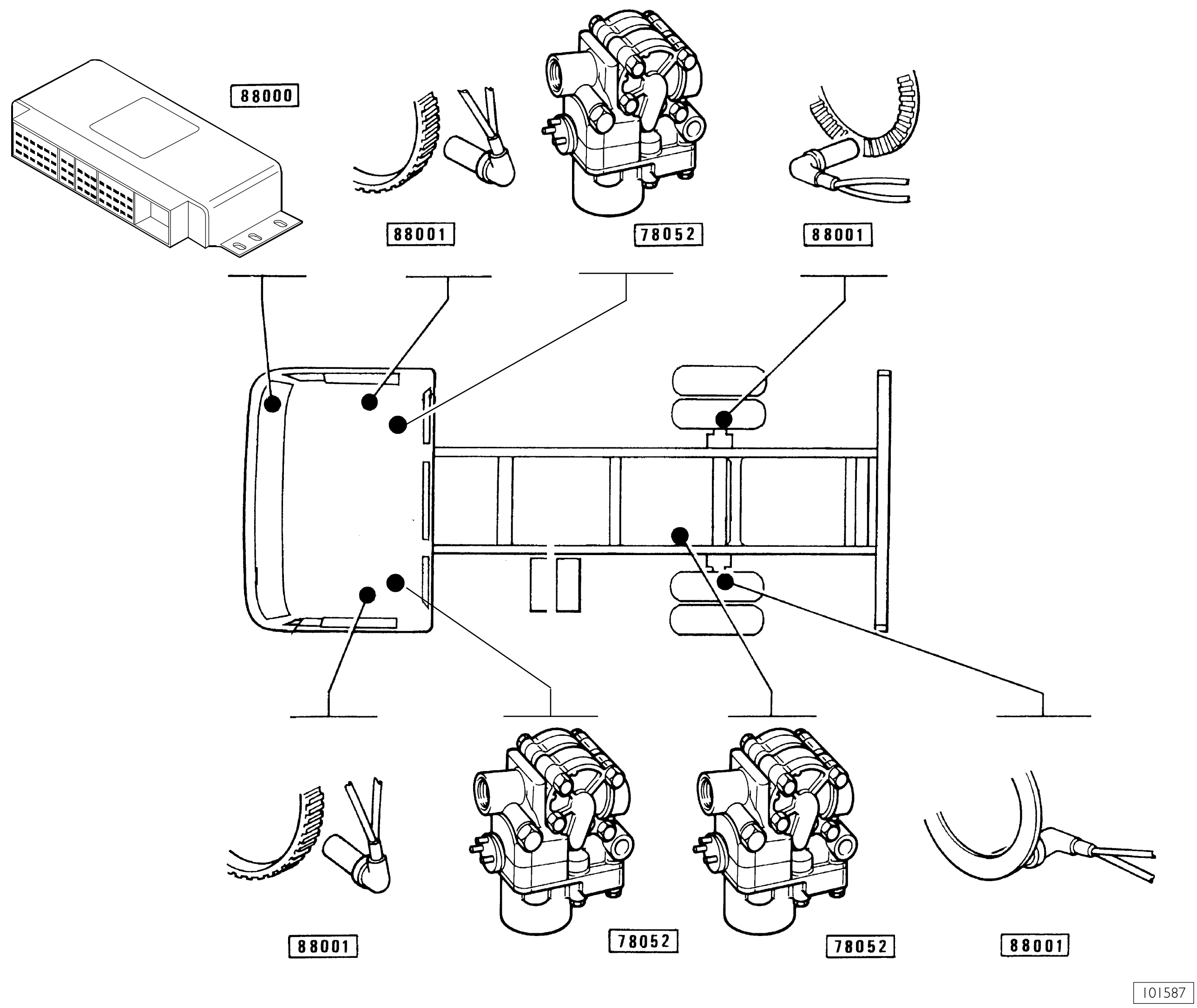
Purpose of the unit is processing signals coming from wheel revolution sensors and suitably driving the system solenoid valves in order to avoid locking the wheels when braking.

Signal processing is carried out by a microprocessor that computes acceleration and deceleration values of the different wheels and carries out the logic combination of the various adjustment signals.

If an anomaly is detected, the unit takes care of automatically excluding the whole ABS system, leaving however the traditional braking system efficient, and of informing the driver by lighting the suitable warning light on the dashboard.

Component location on a vehicle (Electric system)

Figure 179

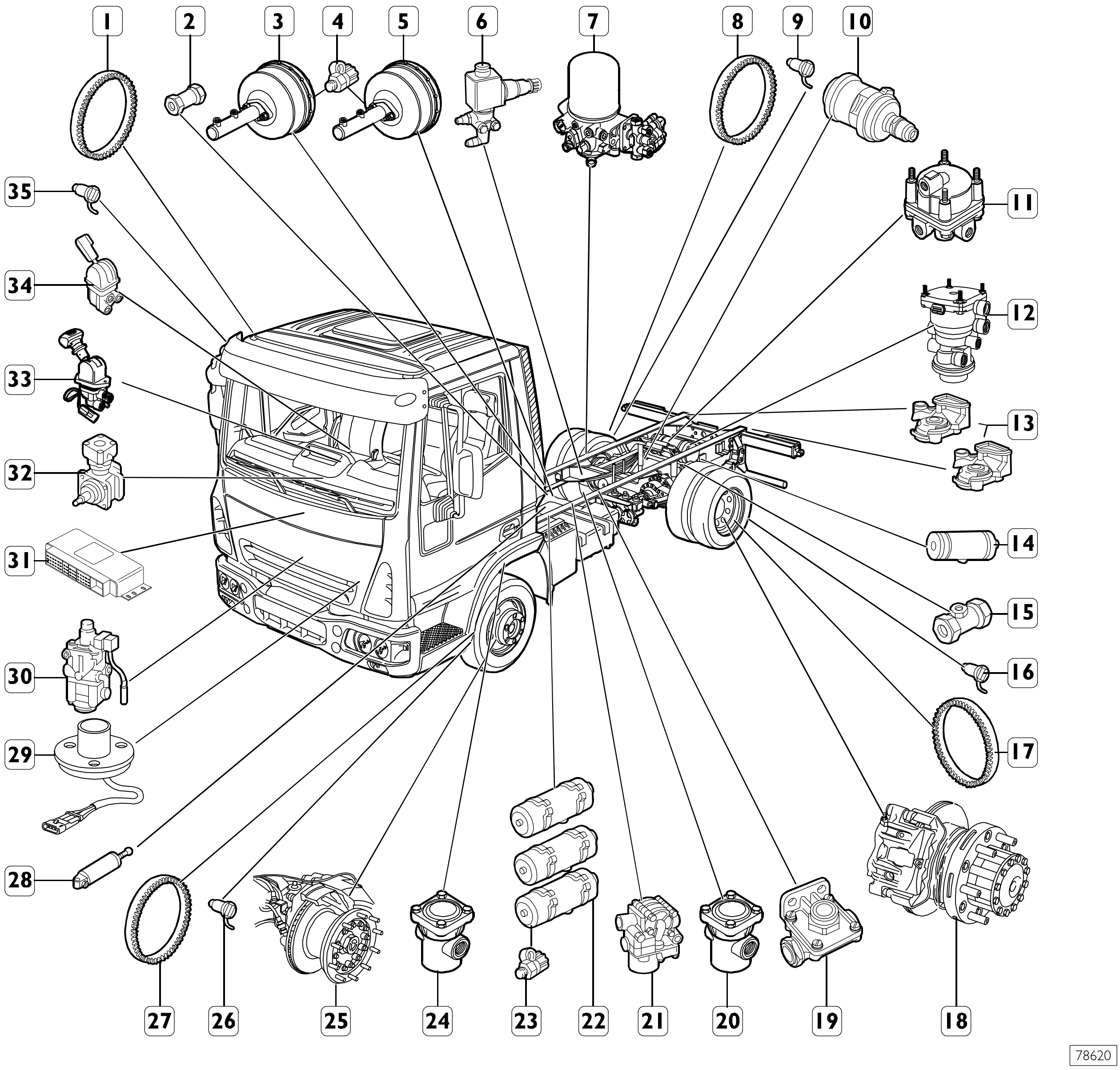


Components code	Description
78052 88000 88001	Solenoid valve for ABS Electronic control unit for ABS system Sensor for ABS system

ABS

Component location on a vehicle (Pneumatic system)

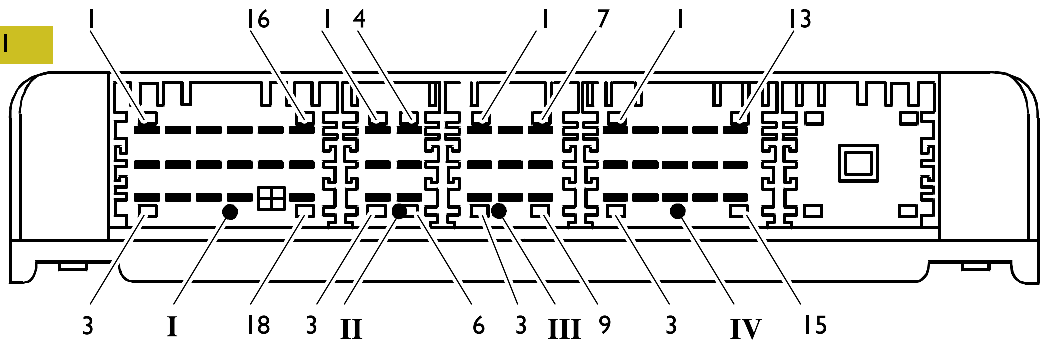
Figure 180



1. Phonic wheel – **2.** Check valve – **3.** Hydropneumatic converter – **4.** Pressure control takeoff – **5.** Hydropneumatic converter – **6.** Exhaust brake solenoid valve – **7.** A.P.U. – **8.** Phonic wheel – **9.** Wheel revs sensor – **10.** Spring–operated cylinder – **1.** Power valve – **12.** Triple–control servodistributor – **13.** Coupling head – **14.** Emergency braking tank + trailer – **15.** Hydraulic pressure control takeoff – **16.** Wheel revs sensor – **17.** Phonic wheel – **18.** Rear disc brake assembly – **19.** Quick–release valve – **20.** Pressure reducer – **21.** Electropneumatic valve – **22.** Air tank – **23.** Pressure control takeoff – **24.** Pressure reducer – **25.** Front disc brake assembly – **26.** Wheel revs sensor – **27.** Phonic wheel – **28.** Exhaust brake cylinder – **29.** Exhaust brake control button – **30.** Duplex distributor – **31.** ABS electronic control unit – **32.** Single–cylinder compressor – **33.** Emergency brake distributor – **34.** Trailer deceleration control distributor (option) – **35.** Wheel revs sensor.

Electronic control unit (Bosch)

Figure 181



Connector	PIN	Cable colour	Description
I	1	–	CAN "L" line
	2	–	–
	3	–	CAN "H" line
	4	–	–
	5	6684	Signal from front br. converter cylinder limit switches(only vehicles 60–100)
	6	–	–
	7	8847	Positive (+15)
	8	7710	
	9	–	–
	10	0050	Ground
	11	–	–
	12	0000	Ground
	13	2299	To tester connector (pin 4) line K
	14	1199	To tester connector (pin 3) Line L
	15	–	–
	16	–	–
	17	–	–
	18	6670	ABS failure warning light control
II	1	9921	Positive for left axle ABS solenoid valves
	2	9919	Positive for left axle ABS solenoid valves
	3	0000	Positive for left axle ABS solenoid valves
	4	5570	Positive for ABS left sensor
	5	5570	Negative for ABS left sensor
	6	–	–
III	1	–	–
	2	–	–
	3	–	–
	4	5571	Negative for ABS right sensor
	5	5571	Positive for ABS right sensor
	6	–	–
	7	9918	Positive for right axle ABS solenoid valves
	8	9920	Positive for right axle ABS solenoid valves
	9	0000	Negative for right axle ABS solenoid valve
IV	1	9930	Positive for right rear axle (Model 260) solenoid valve
	2	–	–
	3	0000	Negative for rear axle ABS (left Mod. 260) solenoid valve
	4	–	–
	5	5572	Positive for ABS left sensor
	6	5572	Negative for ABS left sensor
	7	–	–
	8	5573	Positive for ABS right sensor
	9	5573	Negative for ABS right sensor
	10	–	–
	11	9924	Positive for rear axle ABS (right Mod. 260) solenoid valve
	12	–	
	13	–	–
	14	–	–
	15	–	–

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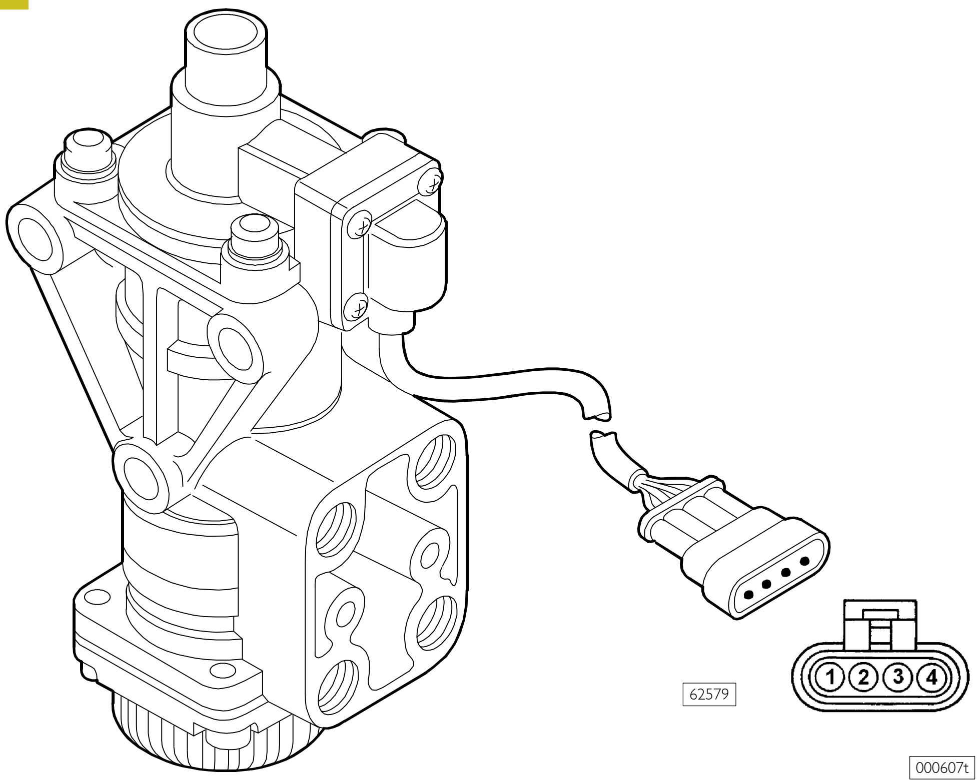
Duplex distributor

Figure 182



Brake switch

This is a microswitch mounted directly on the duplex distributor (SWITCH).

The N.C. contact provides the control unit (pin B76) with a positive signal (with the pedal released) and is used to detect service brake actuation so as to deactivate the Cruise Control function and cut off fuel delivery.

The N.A. contact provides the BODY CONTROLLER control unit (pin A34) with a positive signal, so that the control unit itself can control stop light actuation.

Electric connections

Ref.	Cable colour	Description
1	–	Power supply positive signal
2	1176	Positive signal to turn on the stop lights (Body Controller, pin E11)
3	7151	Power supply positive signal
4	8158	Positive signal with brake released for EDC control unit (pin B76)

Sound wheel and speed sensor 88001

Sensors continuously supply the electronic center with all the data it requires to properly pilot the electro valves.

Signals are obtained from magnetic flow lines that close through the teeth of a teethed wheel facing the sensor and rotating together with the wheel.

Passage from full to empty due to the presence or absence of the tooth causes sufficient magnetic flow variation to create induced electromagnetic force at sensor terminals and thus an alternating electrical signal that is sent to the electronic center.

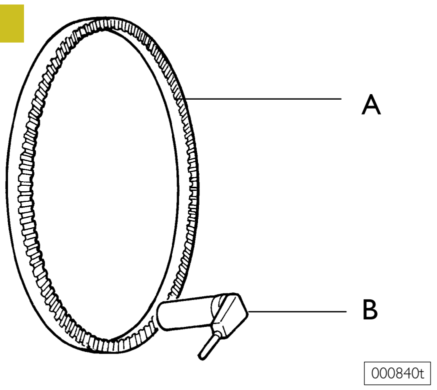
The clearance between the sensor and wheel, called air gap, must obviously be at a pre–set value of 0.8 ÷ 1.6 mm for proper signals to be sent. Resistance of each sensor at connection terminals is between 1 and 2 kW.

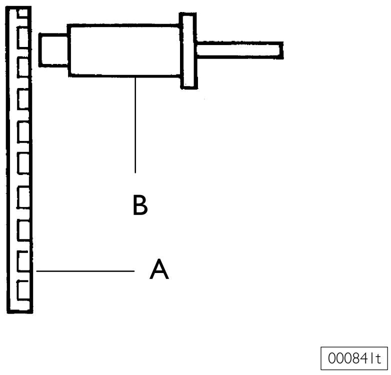
The toothed wheel is called sound wheel because the signal it generates has the same frequency as a sound wave.

The frequency of this signal serves to define wheel rotation speed.

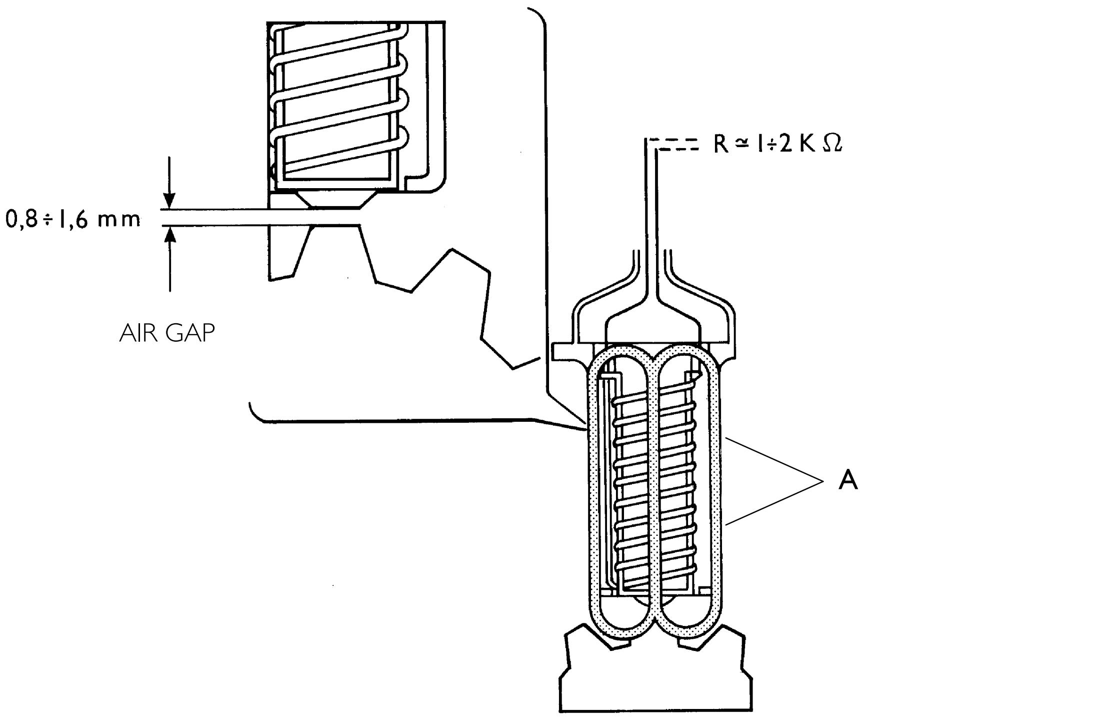
Frequency variations, or the speed at which signals follow one another, define acceleration and deceleration rates.

Figure 183





SOUND WHEEL (A) AND SENSOR B) PERSPECTIVE VIEWS



A. Magnetic flow lines

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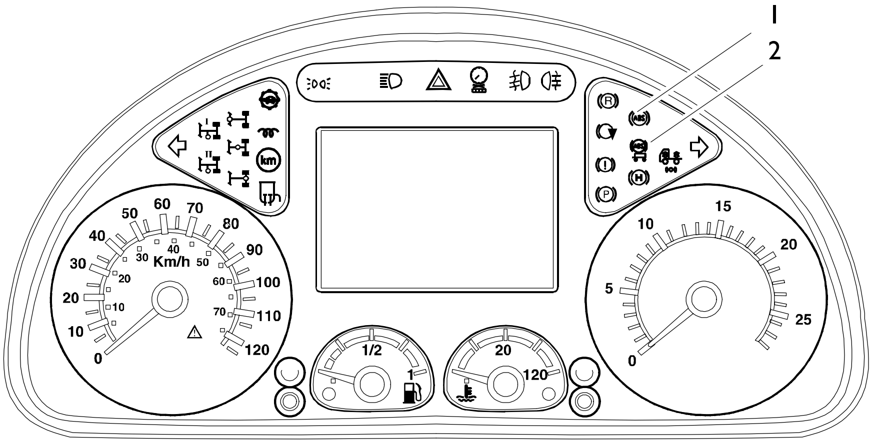
Diagnostics

Warning lights operation

Figure 184



79486

ABS system anomalies signalling

By inserting the key–switch, the electronic unit will carry out a system test by lighting the signalling lights placed on the dashboard for ~2 seconds. If no failures are detected, the lights will be turned off. Otherwise, depending on the anomaly severity, the following warning lights will remain on:

Red ABS light (1)

This warning light signals the presence of anomalies in the trailer ABS system (for towed vehicles).

This warning light signals the presence of a serious anomaly in the system, which impairs the braking system operation. In this case, contact your IVECO Dealership immediately, since braking will, under such conditions, occur in the normal mode.

Trailer ABS red warning light (2)

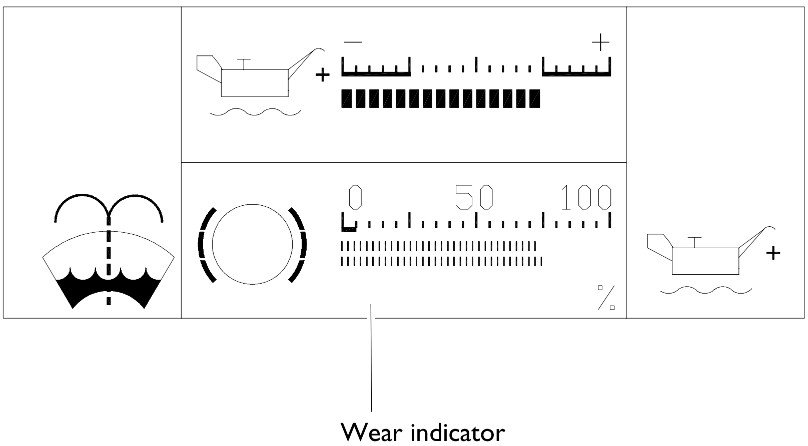
It signals the presence of anomalies in the ABS system on the trailer (for vehicles suitable for towing).

Braking gasket wear signalling (HIGHLINE models)

Braking gasket wear is signalled by means of the display available on the CLUSTER, and the degree of wear is shown as a percentage value (%).

Failure codes are not currently shown in the display.

Figure 185



84598

ECAS

General

The air suspension features great flexibility, vibration damping capacity and above all, thanks to the system's self–adjusting functions, it maintains the "frame–road surface" distance constant, regardless of vehicle load. By means of a special button, the air suspension makes it possible, among other things, to vary the "frame–road surface" distance and hence the height of the vehicle's loading floor.

In addition to the well known advantages of air suspension, the ECAS suspension offers:

- an appreciable reduction in air consumption;
- prompt action of the different adjustment processes;
- simple system construction;
- full safety;
- the possibility of total system diagnosis.

The **ECAS (Electronically Controlled Air Suspension)** system automatically controls the nominal level of the vehicle's air suspension, with the possibility, for the vehicles that adopt it, of lifting the rear added axle, when required by the vehicle's operating conditions, and transferring the load onto the drive axle at take–off, if adherence conditions are poor (aid at take–off).

However, all the foregoing operations can take place only in specific operating conditions under the surveillance of the safety devices equipping the systems connected to the units involved.

The ECAS automatically controls the height of the frame (the distance between the frame and the road surface) based on the actual values sent in by the sensors, by comparing these actual values with the nominal ones stores in its memory.

If the actual level changes or departs from the nominal value or the value set previously by the driver, the control unit corrects it by means of the electropneumatic devices.

The system is equipped with a remote control for frame lifting/lowering and levelling operations, which can be operated with the vehicle standing or moving.

In addition to the lifting, lowering and self–levelling operations, the remote control makes it possible to save other frame levels, which can be recalled as necessary.

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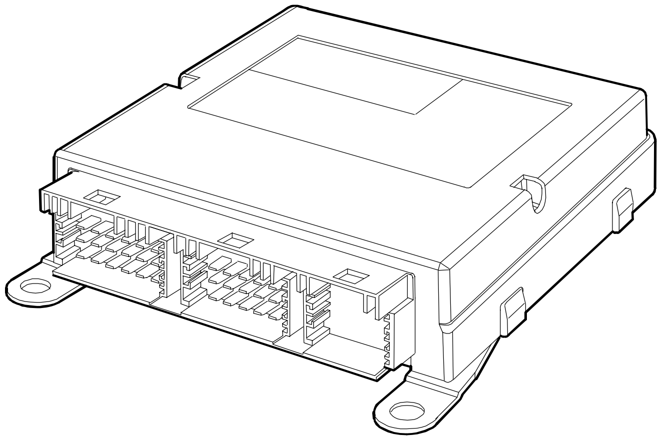
Electronic control unit (86023)

Figure 186



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A. ECAS electronic control unit

Supplier	WABCO
Power supply voltage	18 to 32V
Thermal working range	–40° to +70°

The electronic control unit makes it possible to manage the different positions of the frame as a function of the commands imparted by the driver by means of the remote control unit. When you turn on the key–operated switch, the electronic control unit performs a system test by powering for ca 2 sec. the yellow and red telltales located on the dash.

If a fault is detected, the red warning light will either stay permanently lit or blink, depending on its severity, while the yellow light can stay lit only if the vehicle level is not normal or a plausibility error is detected.

Since it has to keep the running level requested by the driver constant and, at the same time, it has to reduce the consumption of air, the control unit checks cyclically the signals coming from the level sensors and steps in ONLY if it detects a deviation for more than five counts.

The correction is applied with a time lag, as follows:

~1 sec. if the vehicle is standing

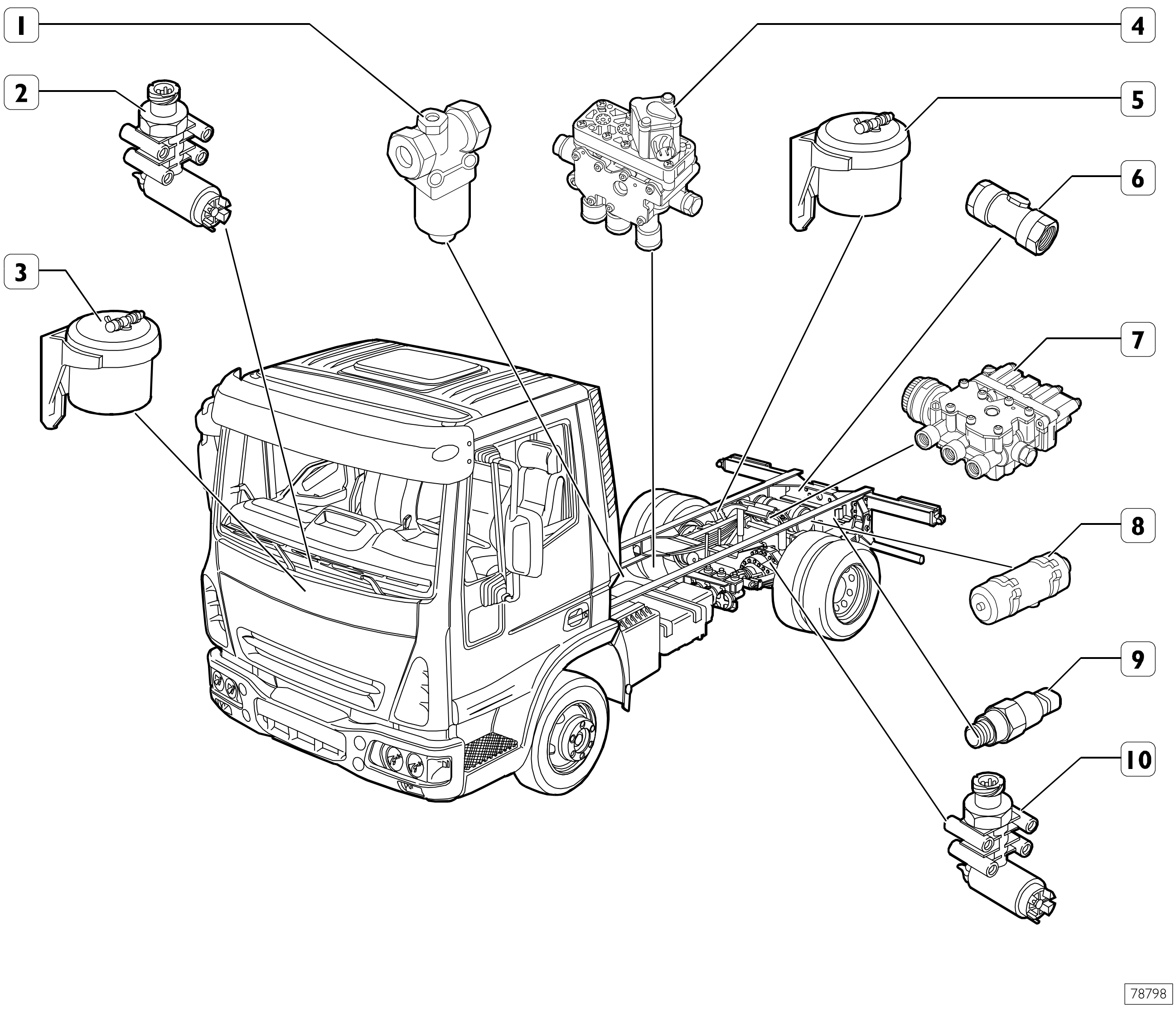
~ 60 sec. if the vehicle is moving

If the level is not reset within a max. time interval of 30 sec. of the start of the correction, the control unit will memorise a plausibility error.

At the braking stage, upon receiving a signal from the stop light switch, the electronic control unit stops all automatic level adjustment operations. Though it has a Blink Code, displayed through the red warning light, for a preliminary diagnosis, the control unit has a highly advance self–testing system that can recognise and memorise, as a function of environmental conditions, any failure, including those of intermittent types, which may occur during system operation, so as to ensure effective and reliable repair interventions. All tests and failure memory programming/deletion interventions, etc. can be performed by means of the computerised testing station "MODUS". All system components, save for the steering system, are connected to the electronic control unit via a comb type connector. The number of the pins, and hence the type of ECU, vary depending on the version.

Location of the components on the vehicle

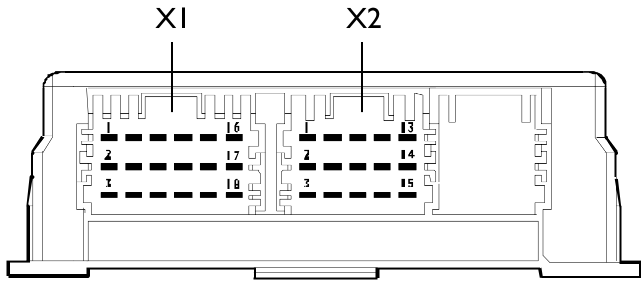
Figure 187



1. Controlled–pressure valve – **2.** Front axle level sensor – **3.** Front air–operated spring – **4.** Front axle electropneumatic distributor – **5.** Rear air–operated spring – **6.** Check valve – **7.** Rear axle electropneumatic distributor – **8.** Tank – **9.** Pressure control takeoff – **10.** Rear axle level sensor.

Electronic control unit pin–out

Figure 188



001717t

Connector X1

Pin	Cable	Function
1	GN/VE	CAN "L" line
2	——	——
3	WS/BI	CAN "H" line
4	——	——
5	8445	Positive from manual leveling push button (Optional)
6	——	——
7	7440	Positive for power supply direct from the battery
8	6402	Communication line with remote control (pin 3)
9	2294	Line K for diagnosis connector (pin 4)
10	8810	Positive for key–controlled power supply
11	6403	Communication line with remote control (pin 4)
12	0000	Earth
13	8810	Positive for remote control power supply (pin 1)
14	——	——
15	0402	Negative for remote control (pin 2)
16	——	——
17	——	——
18	——	——

Connector X2

Pin	Cable	Function
1	——	——
2	——	——
3	——	——
4	9400	Negative for front axle (pin 2) and rear axle (pin 4) solenoid valve (front / rear distributor)
5	5422	Positive for left rear axle level sensor (pin 1)
6	——	——
7	0400	Negative for rear axle level sensors (pin 2)
8	5421	Positive for right rear axle level sensor (pin 1)
9	5410	Positive for front axle level sensor (pin 1)
10	9425	Negative for rear left chassis control solenoid valve (pin 3) (rear distributor)
11	9423	Negative for power supply solenoid valve (pin 1) (rear distributor)
12	——	——
13	9424	Negative for rear right chassis control solenoid valve (pin 2) (rear distributor)
14	——	——
15	——	Negative for front chassis control solenoid valve (pin 1) (front distributor)

Level sensor

Technical data

Power supply voltage	Pulse 5 to 15V
Measuring principle	Inductive
Current drained	Max 100mA
Lever working range	Max 100°

The level sensor is made up of a coil fastened to the frame and a small piston.
By means of a cam and a lever connected to the axle, with each variation in height the piston is moved inside the coil and changes the inductance.

The electronic control unit uses these variations to intervene during the different working stages of the system.
The connecting lever of the sensor **has a fixed, non adjustable measure.**

Figure 189

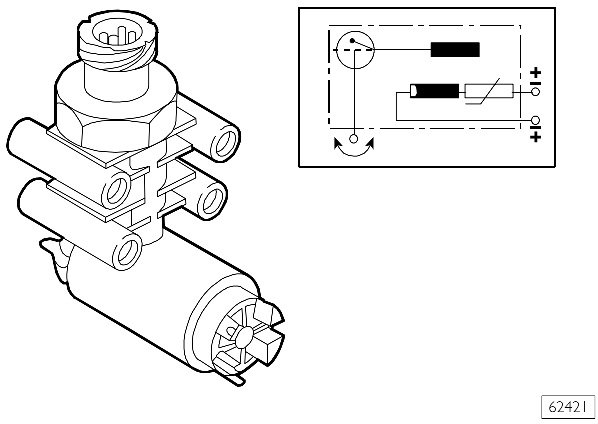


Figure 190

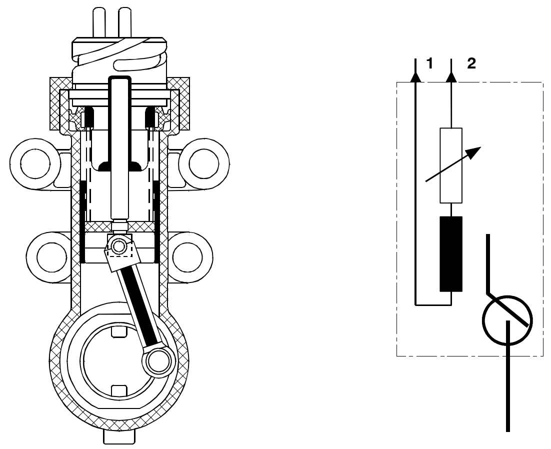
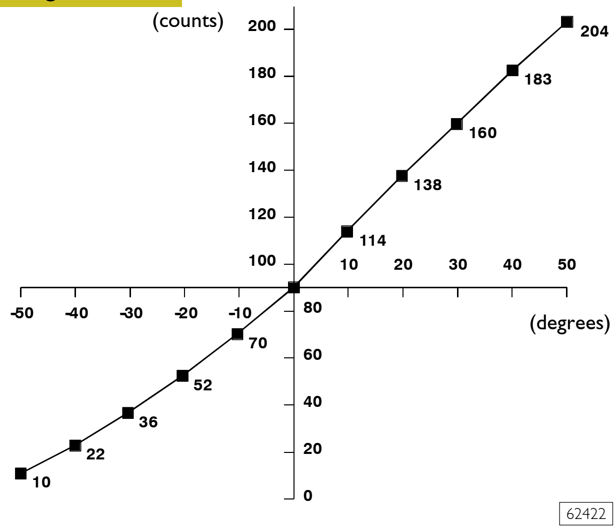


Figure 191



WORKING CURVE

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Axle electropneumatic distributor (78242)

This unit consists of a control solenoid valve and two pneumatic distributors for the management of both sides of the axle.

To prevent pressure transfers between the air springs and hence to stabilise the axle on, the internal connection between the outlets is fitted with a calibrated hole.

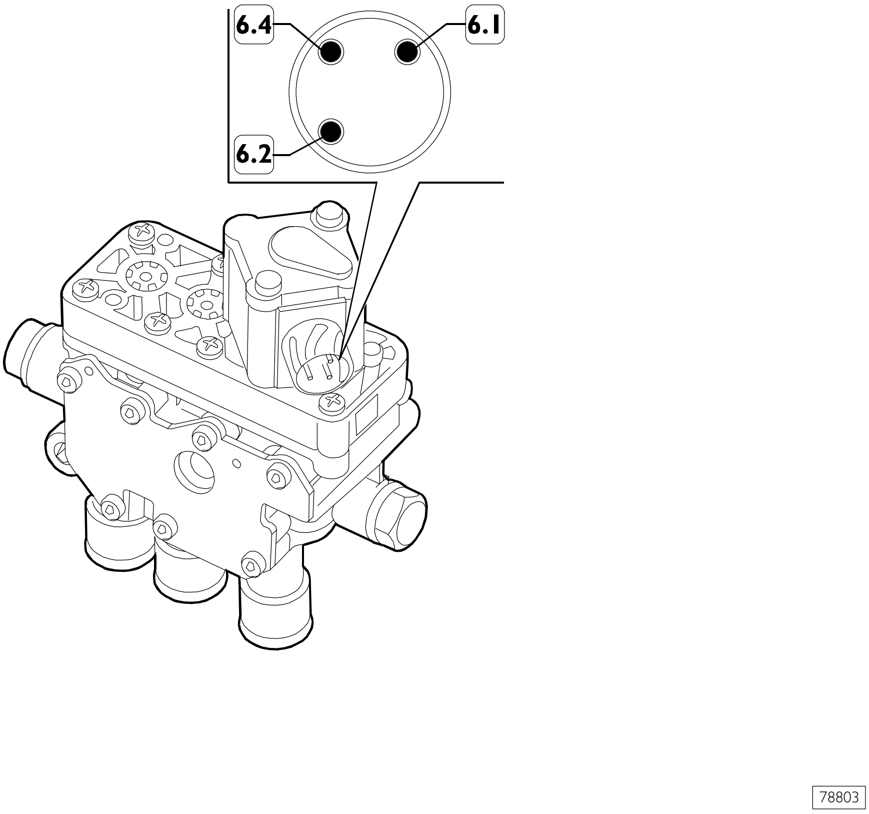
The electropneumatic distributor is connected to the system via a 3–pin connector.

Pin 1 Positive for solenoid valve power supply “A”

Pin 2 Negative

Pin 4 –

Figure 192



Rear axle electropneumatic distributor (78243)

This unit consists of three solenoid valves, "A", "B" and "C", and as many pneumatic distributors.

Solenoid valve "A" is responsible for the management of the supply/discharge distributor.

Solenoid valve "B" manages the right hand side frame levelling distributor.

Solenoid valve "C" manages the left hand side frame levelling distributor.

The electropneumatic distributor is connected to the system via a 4–pin connector.

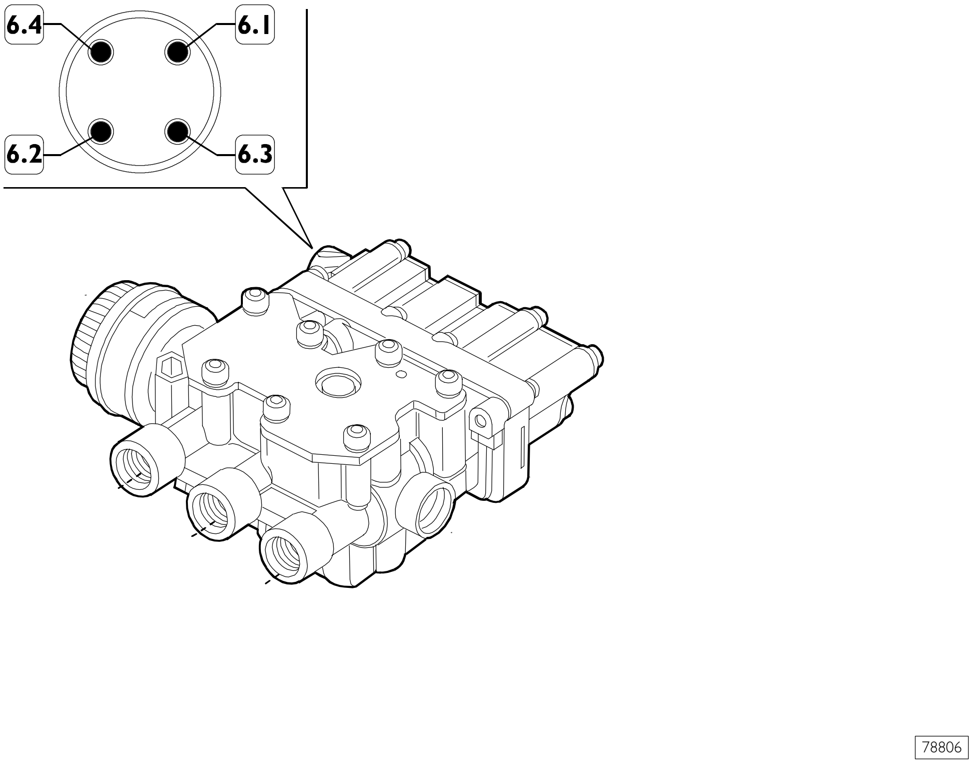
Pin 1 Solenoid valve "A" power supply positive

Pin 2 Solenoid valve "B" power supply positive

Pin 3 Solenoid valve "C" power supply positive

Pin 4 Common negative

Figure 193



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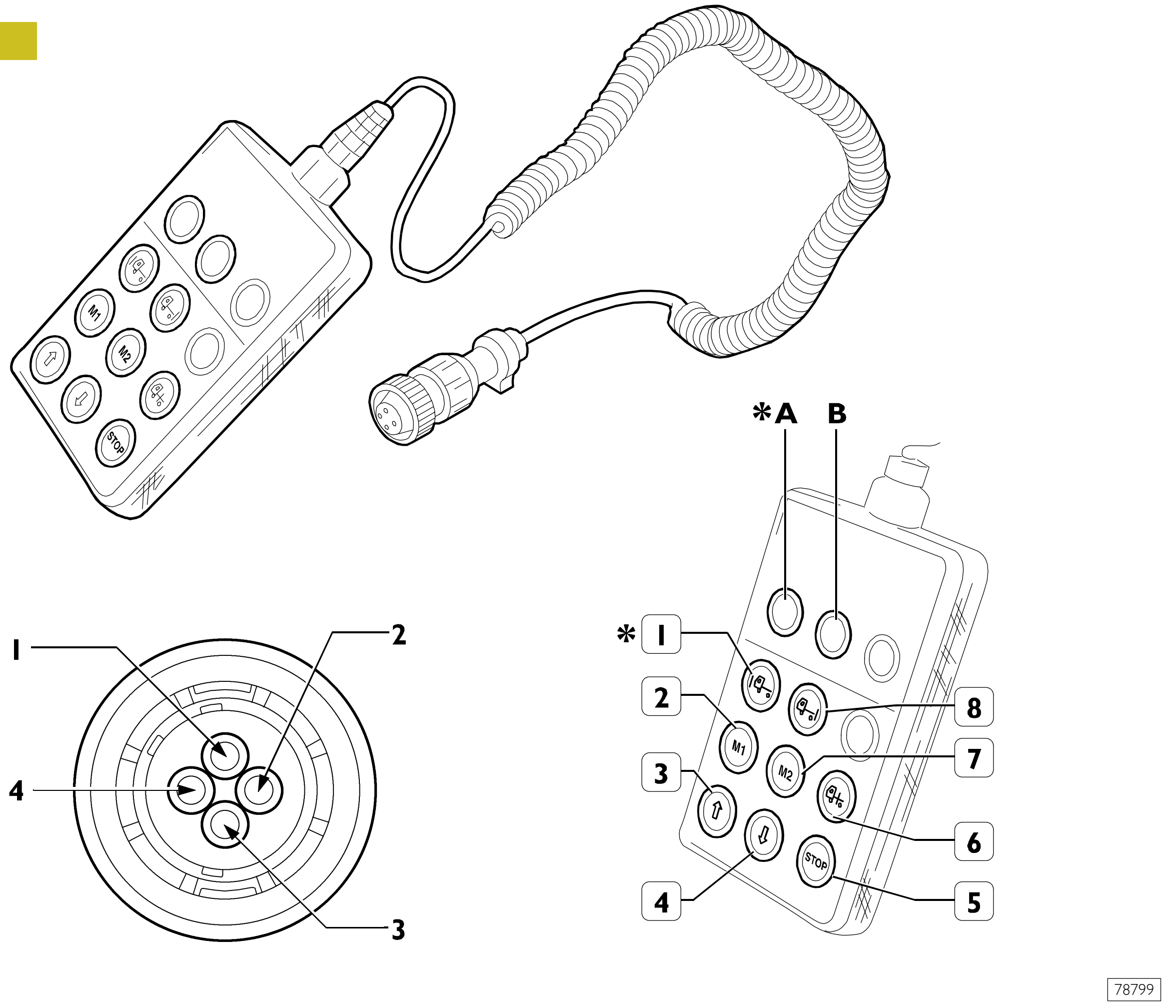
Remote control “85065“

Figure 194



The traditional controls in the cab have been replaced by a remote control unit which is located on the left.

This device is used to manage the different frame levelling functions.

Its pull–out construction makes it possible to make all the selections both from inside the cab and from the ground.

It consists of a series of selection buttons and two telltales:

A) Green light for the selection of the front axle *
B) Green light for the selection of the rear axle

1) Front axle selection*
2) Rear axle selection
3) Level "1" memory
4) Level "2" memory
5) Frame levelling
6) Frame lifting
7) Frame lowering
8) STOP

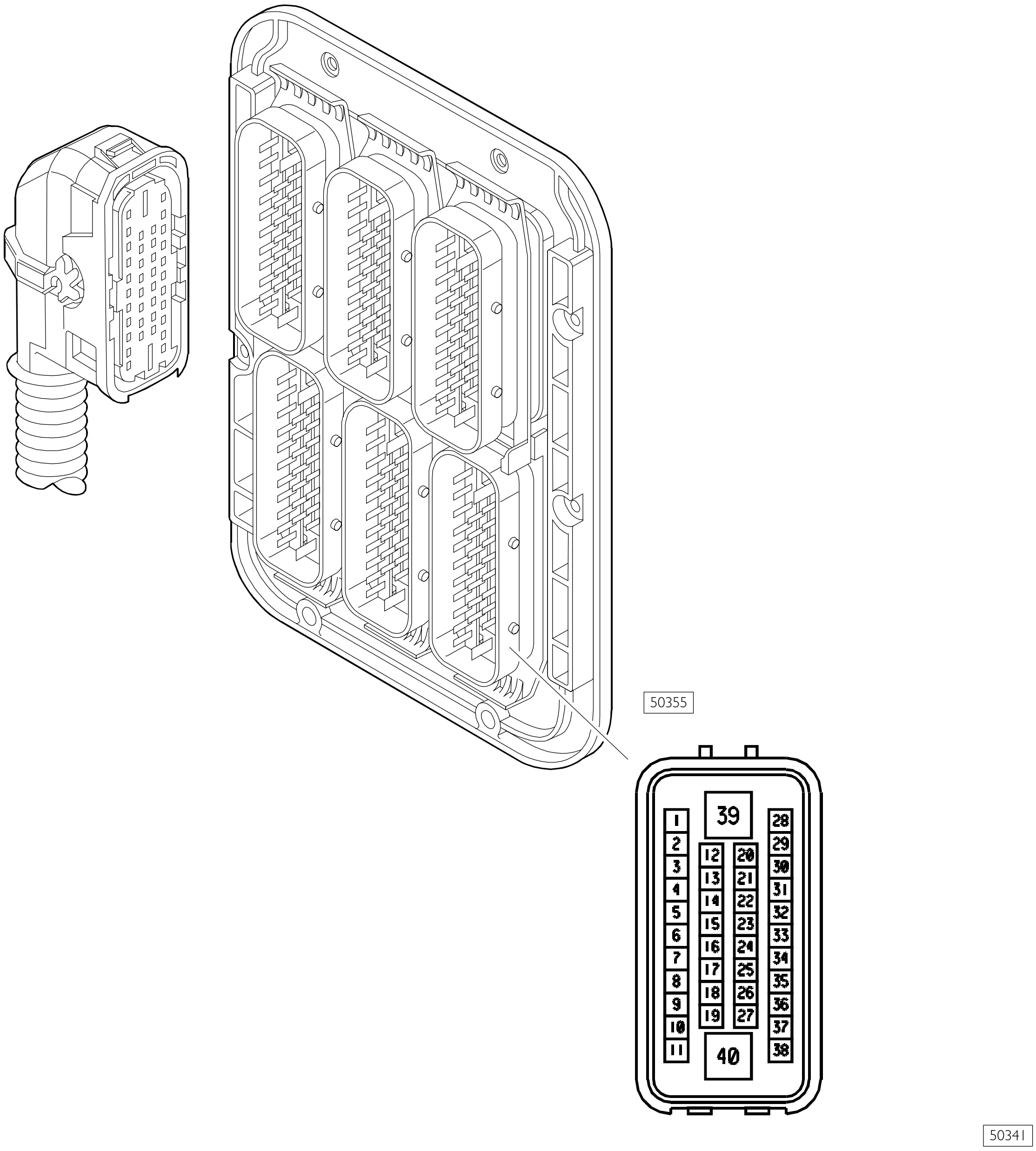
The remote control is connected t the system via a 4–pin connector

Pin 1 Power supply positive
Pin 2 Negative
Pin 3 Control unit communication line
Pin 4 Control unit communication line

For the use of the remote control see the "Operation" section.
* For full air vehicles only.

”F” Through–wall joint

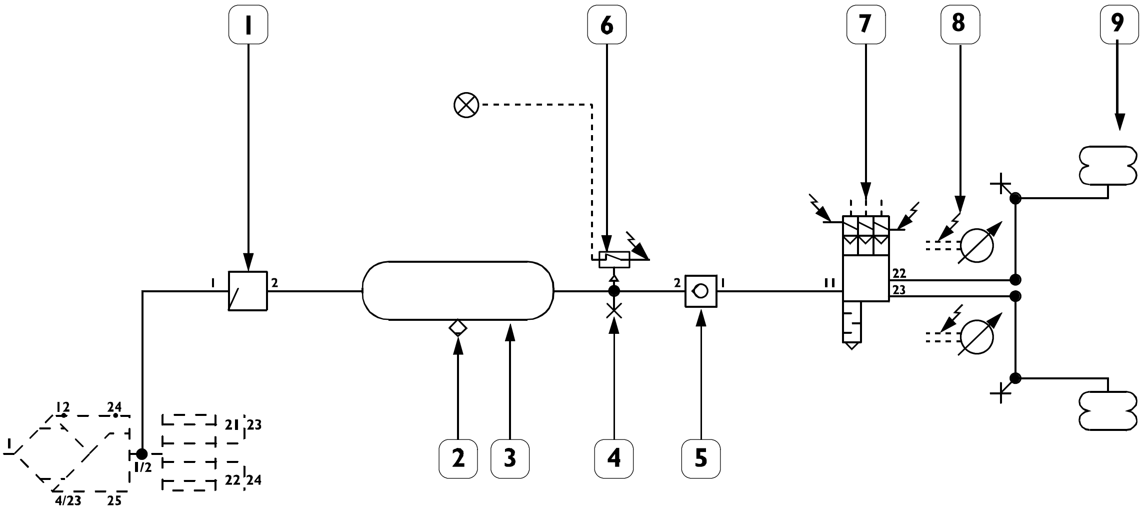
Figure 195



Pin	Function	Cable colour code
1	–	–
2	Air/ECAS suspension	6401
3	Right rear ECAS sensor	5421
4	Right rear ECAS sensor	0400
5	Left rear ECAS sensor	5422
6	Left rear ECAS sensor	0400
7	Front ECAS sensor	5410
8	Front ECAS sensor	0400
9	Front ECAS solenoid valve	9413
10	Rear ECAS solenoid valve	9423
11	Rear ECAS solenoid valve	9424
12	Rear ECAS solenoid valve	9425

Rear air suspension operating principle diagram

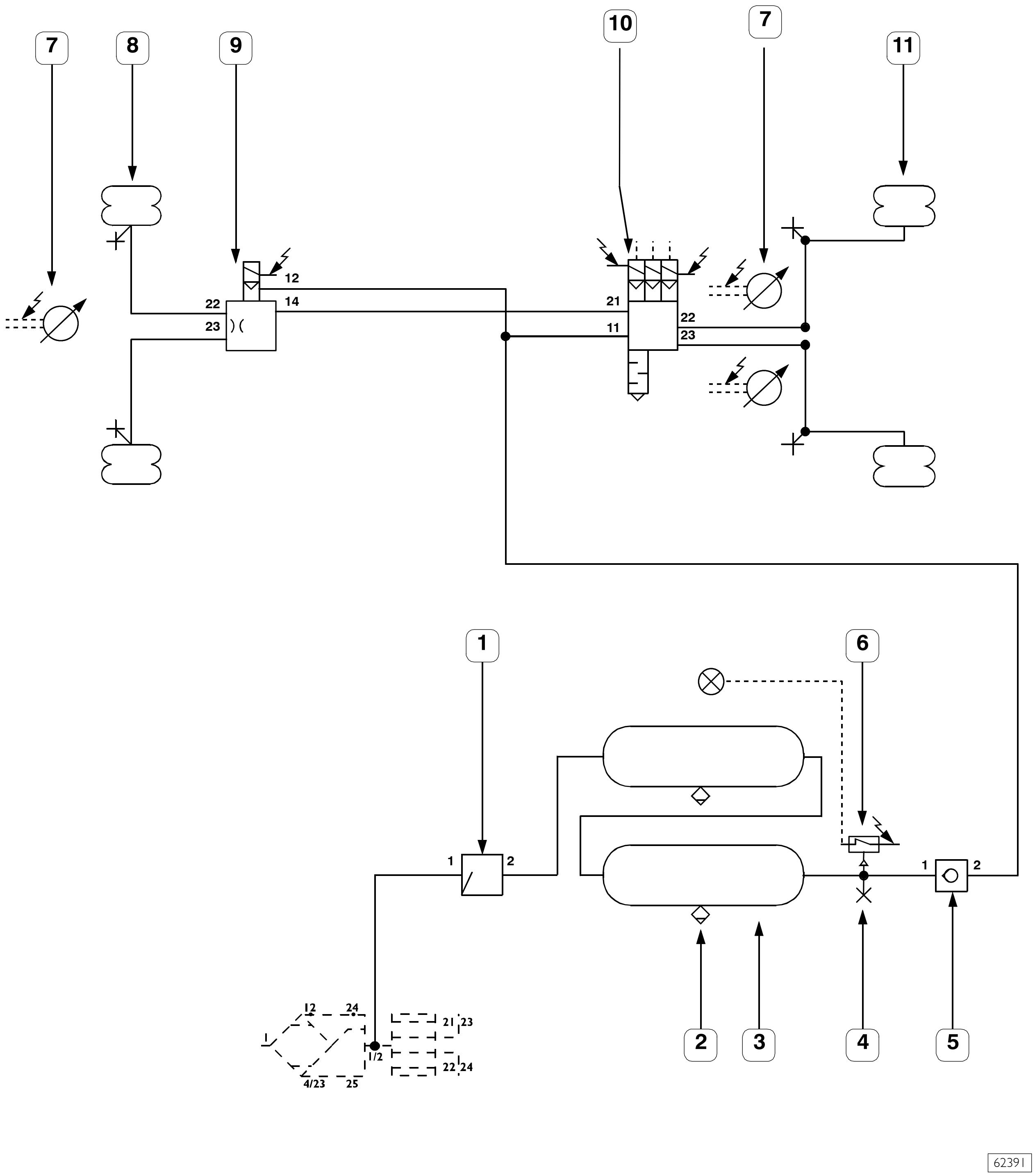
Figure 196



1. Air intake valve with limited return – 2. Manual condensate bleed valve – 3. Air tank – 4. Pressure testing tap – 5. Check valve – 6. Low pressure indicator – 7. Electropneumatic distributor – 8. Electronic levelling valve – 9. Rear axle air spring

FULL air suspension operating principle diagram

Figure 197



1. Air intake valve with limited return – 2. Manual condensate bleed valve – 3. Air tank – 4. Pressure testing tap – 5. Check valve – 6. Low pressure indicator – 7. Electronic levelling valve – 8. Axle air spring – 9. Axle electropneumatic distributor – 10. Rear axle electropneumatic distributor – 11. Rear axle air spring.

Diagnosis

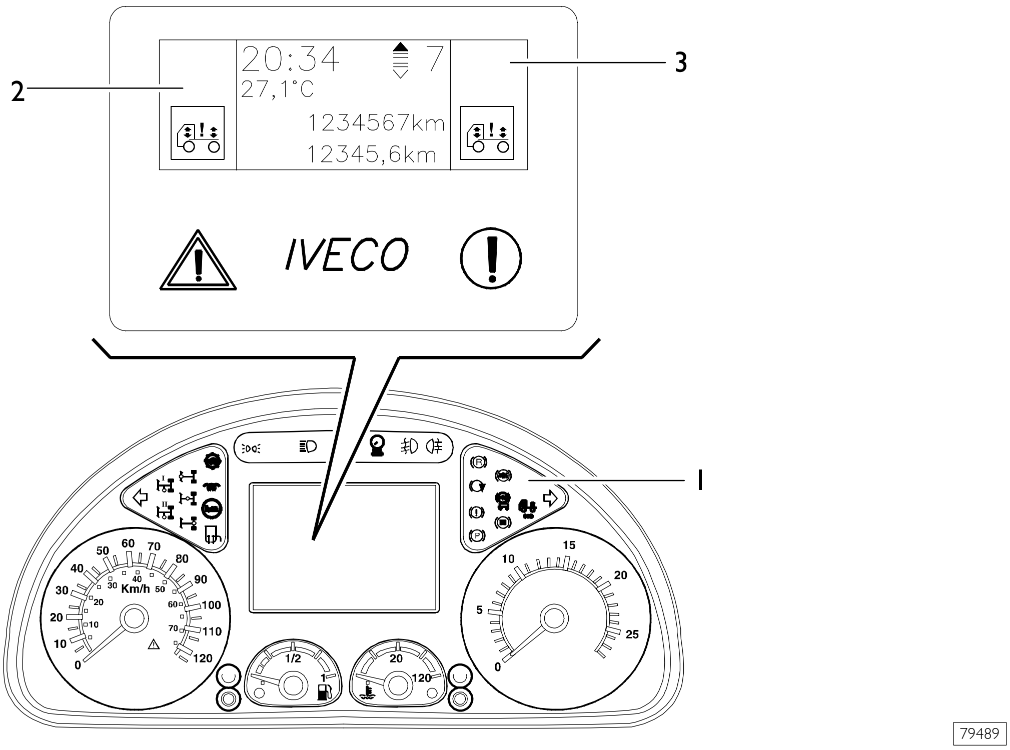
If an anomaly is found, the CLUSTER display will show an error message which can be yellow (minor anomaly) or red (serious anomaly).

If yellow symbol 2 (minor anomaly) appears, it will be shown on the left side of the display. If red symbol 3 (serious anomaly) appears, it will be shown on the right side of the display.

The engine must not be stopped if warning light 1 comes on.

If warning light 3 comes on when the vehicle is running, stop the vehicle and turn the ignition key to "STOP". Turn the key to "MAR" again after approximately 7 seconds: if warning light 3 does not go out after approximately 2 seconds, contact your Dealership immediately.

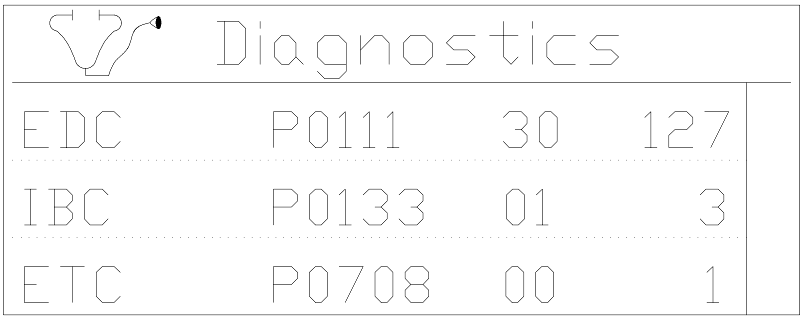
Figure 198



1. Low pressure warning light – 2. System failure (YELLOW) – 3. System failure (RED)

As far as electronic systems are concerned, the respective failure messages can be shown in the display (if the CLUSTER is available in HIGHLINE models).

Figure 199



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The "diagnostic" screen is divided into four columns:

Column 1: Indicates the concerned system

Column 2: Control unit data

Column 3: Type of failure

Column 4: Frequency of failure

To access this screen, the menu control buttons available on the dashboard are used.

ENGINE BRAKE

Simplified system operation

The "engine brake" system is controlled by the EDC control unit.

There are three engine brake control modes which can be selected using the special switch on the centre dashboard, to be used in the different types of situations/routes.

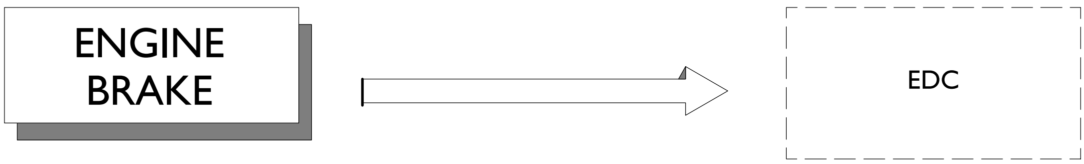
With the selector in the rest position, the button on the cab floor is always operational, (for intermittent use on hills and on snow or ice).

With the selector in position 1 the engine brake is combined with the accelerator pedal, coming into action when the pedal is released (to be used on long downhill roads with steady gradient).

With the selector in position 2 the engine brake is combined with the service brake, functioning starting from the first section of pedal stroke and maintaining the position (essentially to be used to reduce service brake wear for routes where much use of it is needed).

Every time the engine brake is engaged a warning lamp on the cluster turns on.

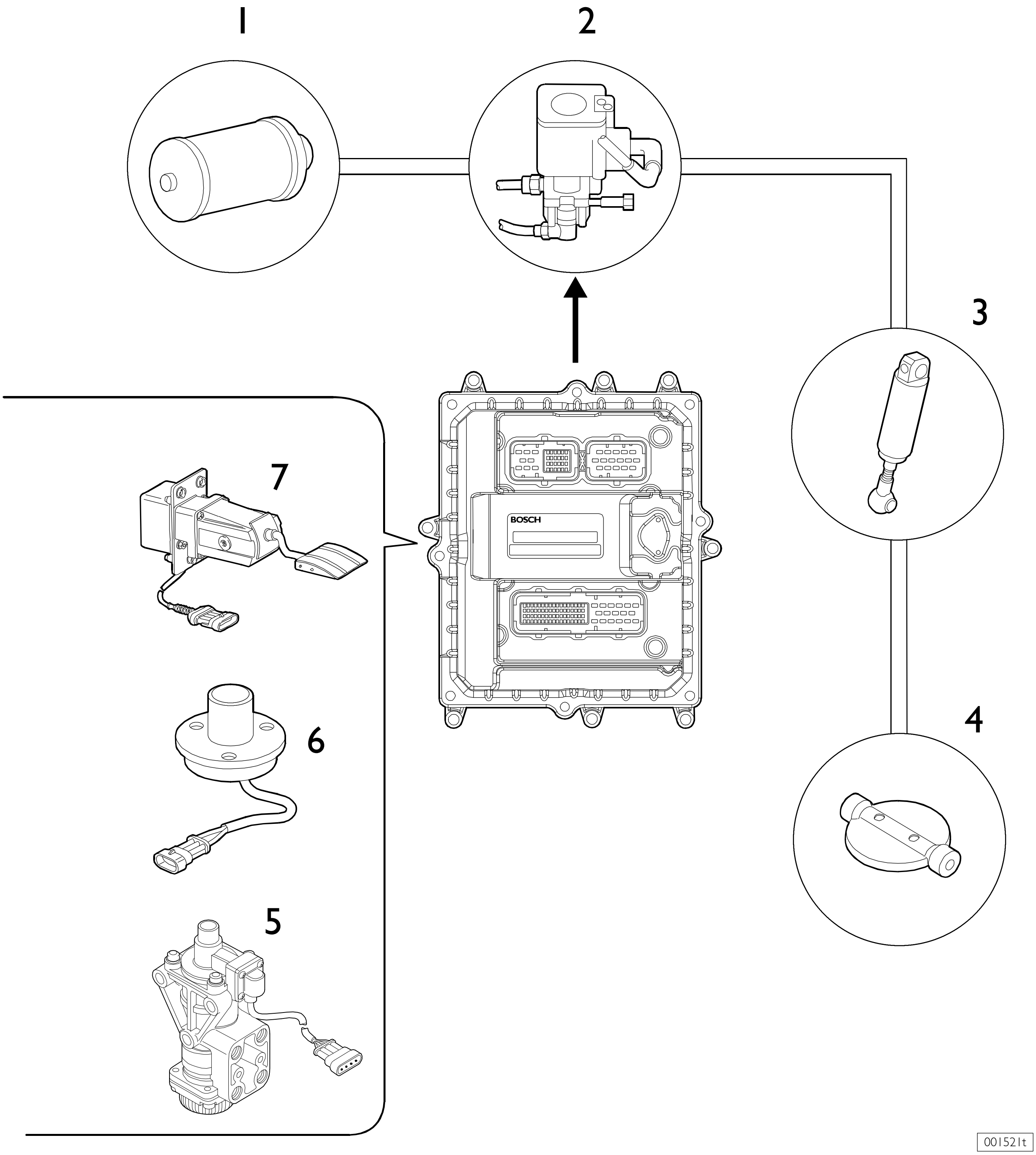
Engagement of the engine brake in combination with the accelerator pedal disables all the adjustment operations connected with the Cruise Control.



The lighting of the respective warning light (located on the CLUSTER) occurs through the "CAN" line.

System components

Figure 200



ENGINE BRAKE SYSTEM

1. Services air tank – 2. Solenoid valve – 3. Small cylinder – 4. Throttle valve on exhaust manifold – 5. Duplex distributor (primary / secondary brake switch) – 6. Engine brake switch – 7. Accelerator pedal with position sensor

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IMMOBILIZER

Description and operation

For better protection against theft, the vehicles have been equipped with an engine blocking system called **”Immobilizer”** which is automatically activated when the ignition key is removed. The key, in fact, contains an electronic device, known as **”Transponder”**, which transmits a coded signal to a special control unit **”ICU”** that enables the engine to be started only if it recognises the code.

General characteristics

System composition

The main components of the system can be summarised as follows:

- Immobilizer control unit (ICU)
- Anti–theft device + No. 2 keys with electronic Transponder (non separable)
- Aerial (on ignition switch)
- EDC type fuel flow actuator (ACT)
- Code_card (specific card with PIN electronic code and mechanical code)

Installation

For its correct operation, the system requires an installation process consisting of the following stages:

- Key training
- Actuator training

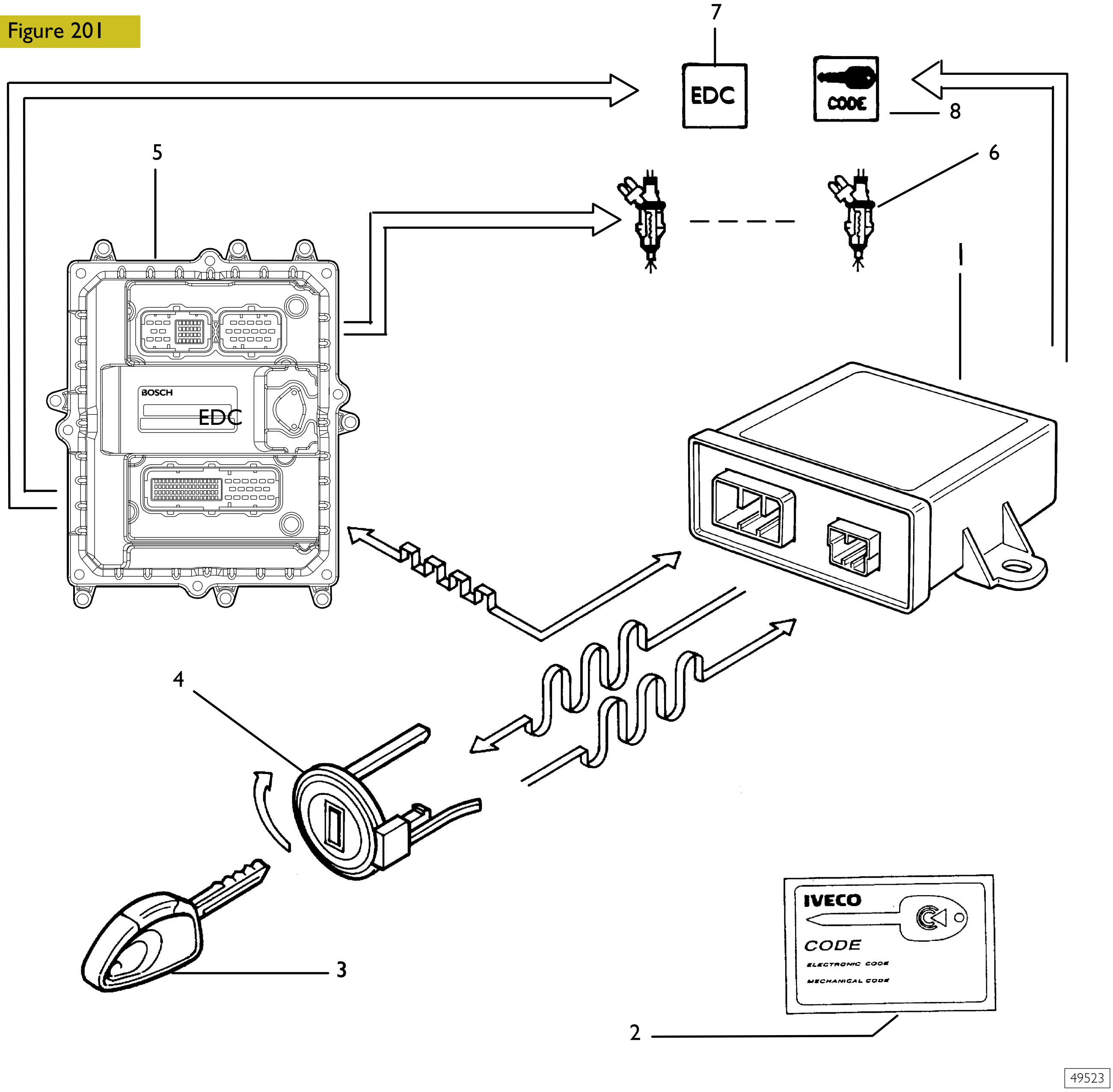
At the end of the process, the Immobiliser control unit is able to detect tampering attempts by recognising the components connected to it in a univocal manner (non separable)

Operating principle

With the key set on ”ON”, the Transponder contained in the key generates a code which is received by the Immobiliser control unit through the aerial.
The control unit transmits to the actuator a request for a validation process by communicating the code received.
The actuator deciphers the code and compares it with the data saved during the installation process.
If the comparison is successful the actuator transmits to the control unit a request to enable fuel flow.
The control unit processes the request and, if everything is correct, sends out the fuel release command to the actuator.
The vehicle can be started.

Components

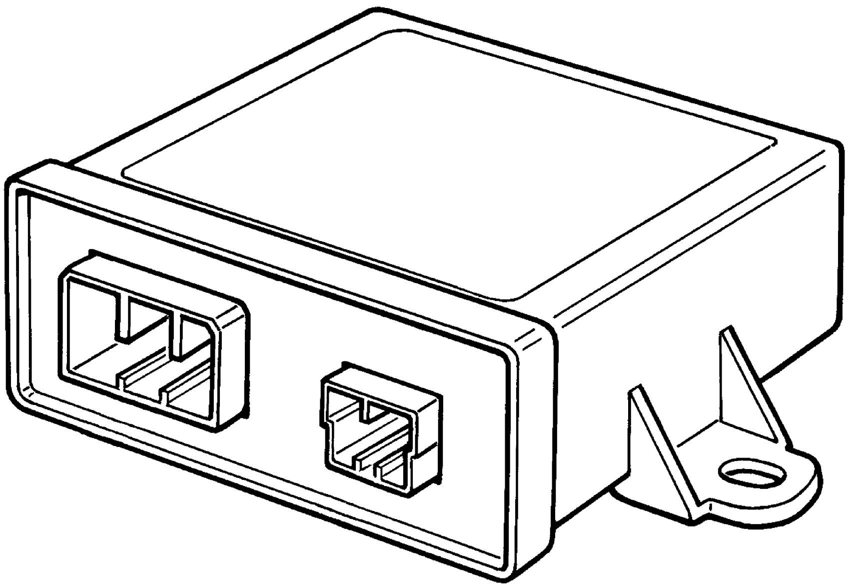
Figure 201



Ref.	Description
1	Immobilizer control unit
2	Codecard
3	Electronic key
4	Antenna
5	Electronic fuel injection control unit (EDC)
6	Electro–injectors
7	EDC failure signalling warning light on CLUSTER (display)
8	IMMOBILIZER failure signalling warning light on CLUSTER (display)

"Immobilizer" control unit

Figure 202



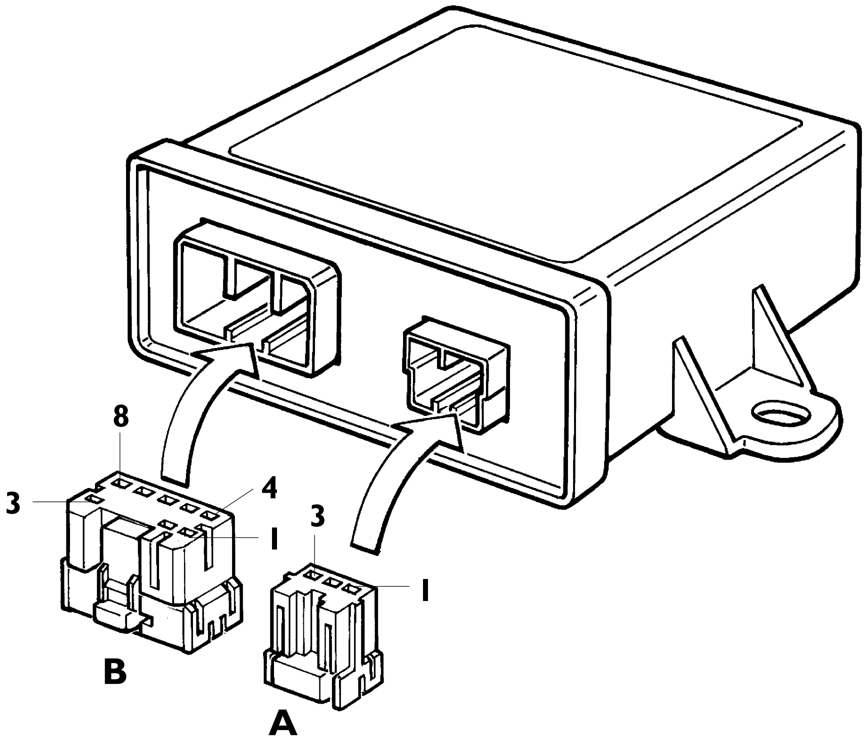
The main function of the control unit is:

- to recognize the introduction and rotation of the key in the switch;
- to activate and read the secret code emitted by the "Transponder";
- to manage and control the processing of the codes;
- to communicate with the "EDC" control unit;
- to memorize any failures;
- To diagnose the system.

The control unit is located in the front left part of the cab, behind the steering wheel.

Immobilizer control unit

Figure 203



Ref.		Description	Cable colour
A	1	Aerial	–
	2	Aerial	–
	3	–	–
B	1	CAN_L line for EDC control unit (Pin 52)	**6109**
	2	K line for 30–pin test connector (Pin 12)	**2292**
	3	Positive signal for Immobiliser failure warning light	**6092**
	4	CAN_H line for EDC control unit (Pin 53)	**0108**
	5	–	–
	6	Ground	**0050**
	7	Key–operated power supply positive (+15)	**8092**
	8	–	–

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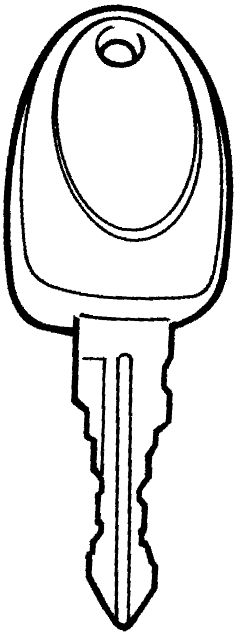
Electronic keys (No. 2)

Figure 204



The handle of the key contains an electronic device called a **"Transponder"** that is **NOT** powered by any battery, this device contains and transmits the secret code.

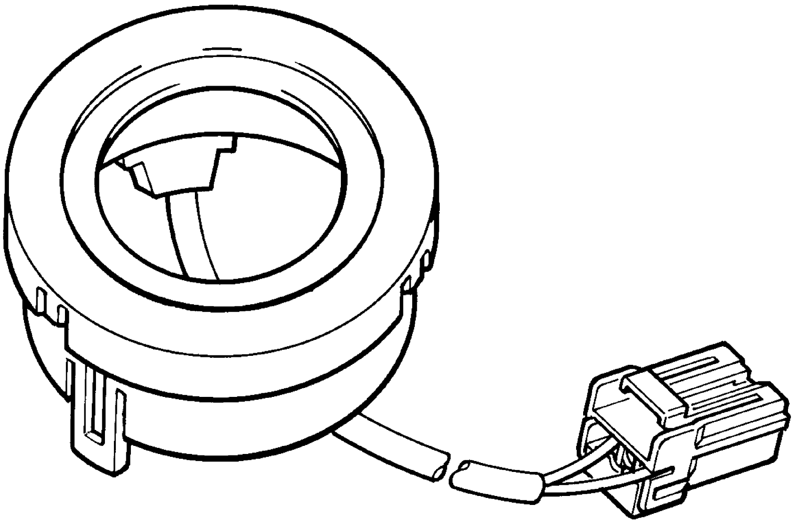
By inserting the key, the **"Transponder"** is activated and therefore energized by the radio waves emitted by the antenna (assembled on the lock of the key switch) and automatically replies by emitting the secret code. If the two codes match, the control unit enables the vehicle to be started, if they don't match it blocks the flow of fuel and therefore the vehicle cannot be started.

- ❑ Two keys are supplied.
- ❑ Each key contains a "Transponder" with the relative secret code.
- ❑ **IT IS VERY IMPORTANT** to follow the correct procedure for key learning.

The "Transponders" in the keys cannot be removed.
There is no master key.

Aerial

Figure 205



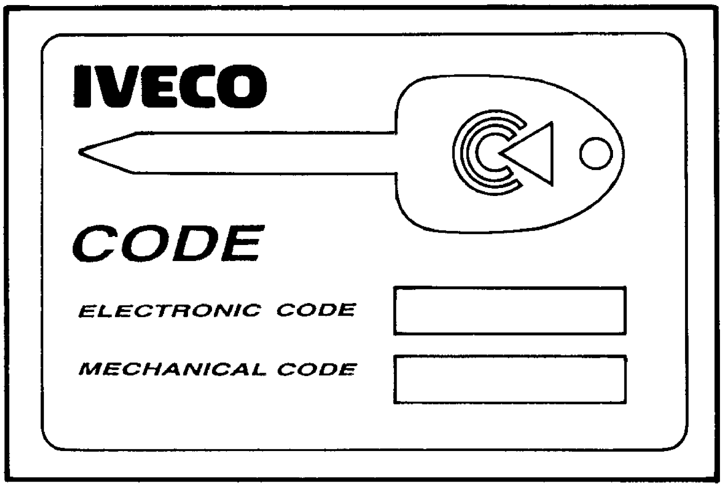
The antenna is assembled coaxially to the key switch.
Its function is to:

- Provide energy to the "Transponder" of the key to send the secret code
- Receive the signal from the "Transponder" and send it to the control unit

The antenna is connected to the control unit at PINS A1 – A2

Code Card

Figure 206



A card that shows two types of code:

- Electronic code
- Mechanical code

Electronic code

This code is essential to start the engine in an emergency situation (key is not recognized, or control unit is not functioning).

The code can be inserted by depressing the accelerator pedal.

Mechanical code

This code is necessary in the event of a request for a duplicate key (mechanical part).

Keep the Code Card in a safe place within reach.

Emergency procedure (starting)

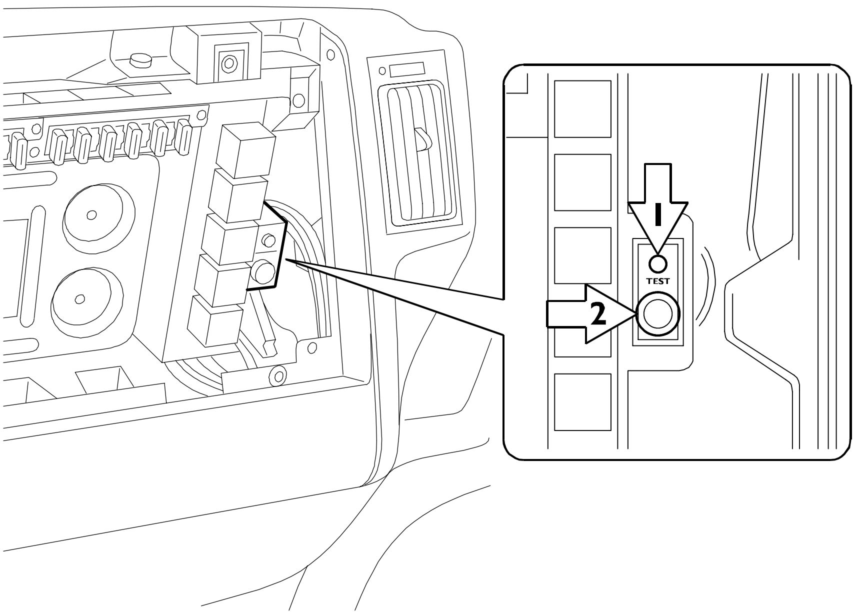
If the vehicle will not start because the key is not recognised, the Immobiliser control unit is defective, etc., it is necessary to perform a **specific** starting procedure.

It is indispensable to enter the **”Electronic code”**, given in the **”Card Code”, ONLY by working on the accelerator** pedal as described below:

1. Turn the key to ON
2. After about 2 seconds, the EDC telltale starts blinking fast.
3. Press the accelerator pedal and keep it pressed for about 5 to 12 seconds.
4. The EDC telltale begins blinking slowly, as soon as the accelerator pedal is released
5. When the number of blinks corresponds to the first digit of the **”Electronic code”**, press the accelerator pedal all the way and then release it.
   (While the pedal is pressed, the EDC telltale stays off).
6. Continue the reading process and the relative pressure on the accelerator pedal for the other four digits of the **”Electronic code”**.
7. At the end of the sequence, if the code introduced is correct and there are no system faults, the EDC telltale stops blinking. The operation has been concluded correctly.
8. Start the vehicle.

To perform the emergency procedure in case the CAN line is affected by a SERIOUS FAULT, it will be necessary to refer to the lighting messages of LED (1) available in the U.C.I. in front of the passenger’s seat. Under normal conditions, displaying will occur by means of the EDC warning light available on the Cluster display.

Figure 207



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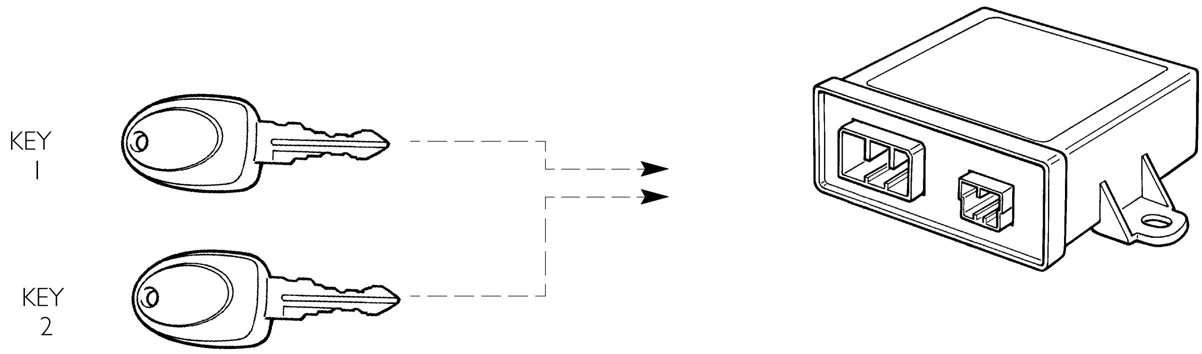
Key memorisation process

Figure 208



In the event that the key is lost or for its replacement, a specific procedure must be followed using **only the specific diagnostic devices.**

This procedure can only be carried out with the assistance of the Modus, IWT

The key memorization procedure can be carried out even if the EDC control unit is not connected.

The keys have already undergone a learning procedure, and therefore belong to that ICU.

It is possible to "teach" new and old keys.

In each case the keys used (enabled on ignition) can never be more than three in number and can only be those used during the last learning process.

A key that has been previously memorized but not inserted in the last learning process will not be able to start the vehicle.

The memorization procedure can only be carried out after having correctly inserted the **Electronic Code** shown on the Code Card supplied.

There are two different procedures, depending on the following situations:

- ❑ Replacement or addition of one or more keys.
- ❑ Installation of a new Immobilizer control unit.

For further clarifications on this matter see manual no. 603.43.613.

Problems during memorization of keys

In the event that the procedure fails, the indicator does not go out.

1) The same key has been inserted twice non–consecutively.
2) The key has not been turned to the stop position quickly enough.
3) More than three keys have been attempted to be memorized.
4) Learning process carried out with keys that are not part of the same KIT (only in installation procedure).
5) Learning procedure carried out with keys that have already been used in other ICU.
6) Problems with learning procedure not being carried out correctly.

System self–testing

After the initial test, the behaviour of the ”code” light informs the operator about system faults, such as:

Light ”always blinking” at a frequency of ”0.3 sec. ON” and ”3 sec OFF” reveals that an error is present or that the starting procedure in an emergency has not been performed correctly.

Light ”always blinking” at a frequency of ”0.3 sec. ON” and ”3 sec OFF” reveals that no key training process has been performed.

Light ”permanently lit” means that the key training procedure has not been performed correctly.

o As a preliminary step you can display the faults, if any, on the telltale module of the on–board panel by activating the Blink code.

For a more exhaustive diagnosis, however, it is indispensable to use the tools, such as MODUS, available to the service network.

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⚠ If after accurate diagnosis it is necessary to replace one or more components, proceed as described below

ALL ENGINES		
PART TO BE REPLACED	PARTS TO BE ORDERED	OPERATIONS AND NOTES
One or two keys (with one still available) Addition of a key	• Parts Keys	⇒ Cut the keys according to the mechanical code. ⇒ Perform "Key memorising" in Immobilizer diagnostics (*). **NB.** In this procedure also enter the remaining working keys otherwise the will NO LONGER be enabled for starting.
Steering lock and/or ratchets ALL the keys	• KEYS KIT with: 2 cut Parts keysSteering lock + Ratchets	⇒ Change the steering lock and ratchets. ⇒ Perform "Key memorising" in Immobilizer diagnostics (*). ⇒ State the **new** mechanical code on the Code Card.
Ratchets (excluding steering lock)	• KIT with: 2 traditional keys + ratchets	⇒ Change the ratchets. **NB.** Traditional keys means keys without Transponder.
Code card (due to loss)	• Code Card	⇒ Complete the "Code Card Duplicate Request Form" printing it from MODUS and send it as mentioned in the ORDER MANAGEMENT form of the IVECO SPARES warehouse concerned.
Aerial	• Aerial	⇒ Replace.
ECU Immobilizer	• KIT ECU Including: Immobilizer ECU – 2 keys to be cut New Code Card	⇒ Complete the "New Immobilizer Installation Form" printing it from MODUS and send it as mentioned in the ORDER MANAGEMENT form of the IVECO SPARES warehouse concerned. ⇒ Cut the keys according to the mechanical code. ⇒ Perform "Key memorising" in Immobilizer diagnostics (*). **NB.** At the end of this operation, check that the electronic code shown on the screen corresponds to the one printed on the Code Card, if it is different, put the one on the screen on the Code Card. ⇒ In EDC diagnostics perform "new key recognition". ⇒ Put the old mechanical code on the new Code Card. ⇒ Scrap the old keys as it will be NO LONGER possible to use them.
EDC control unit	• EDC control unit	⇒ The system recognises the new actuator automatically the first time the ignition key is moved to Drive. **NB.** To order the EDC Control Unit complete the specific form printing it from Modus and sending it to the Market Technical help Desk.

⚠ (*) With MODUS 2.0 (Windows), 1.6C (DOS) or IWT 1.4 release before performing "New key memorising", it is absolutely necessary to disconnect the EDC . Once the operation has been completed, clear the fault memory to prevent the error from staying memorised on the actuator.

⇒ For subsequent releases keep to any new instructions given on the screen.

ELECTRONIC CENTRAL UNIT DMI (DATA MANAGEMENT INTERFACE) (OPT. 5626)

Central unit DMI is an electronic central unit placed in the central units opening in the cab (at passenger side), and is connected to other central units via CAN line. Output signals can be captured via the I/O connector to pin – 20. Information availability depends on vehicle configuration and optional items present. In addition, the DMI can be connected to a board computer to capture and process data in real time directly via CAN line, according to FMS standard.

The DMI can be used by:

1– Preparators via the I/O connector to pin – 20 (positioned in the central units opening), where following signals are present:

pin – 10 (I/O) – gearbox in neutral position and parking brake in

pin – 17 (I/O) – engine running

pin – 19 (I/O) – brake pedal pressed

pin – 20 (I/O) – clutch pedal pressed

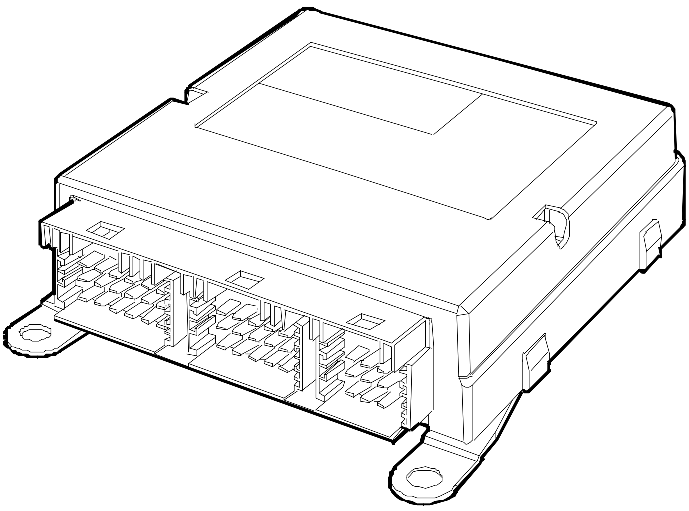
2– Vehicles management system through data transmitted via CAN line. Data can be captured in real time by a board computer.

Through data processing it is possible to:

- ❑ obtain information on vehicle operation conditions (times, distances, fuel consumption, 0)
- ❑ analyse engine operation conditions and braking system use
- ❑ analyse run distances distribution, speeds, stop and start frequencies

3– Interface to PDA (Personal Digital Assistant) which provides vehicle information to be displayed on a palmar computer.

Figure 209



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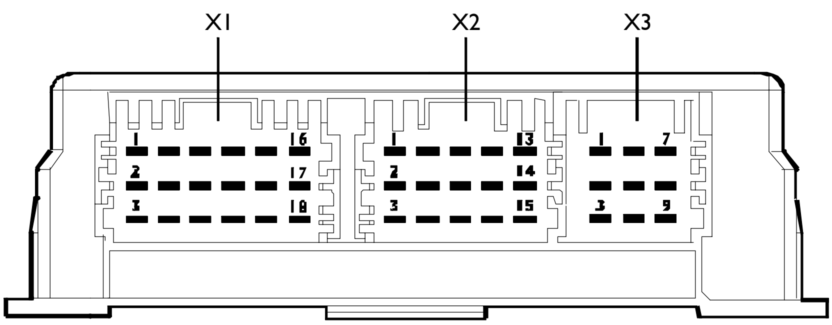

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Connector	Pin	Cable colour	Description
X1	1	7777	Battery positive +30
	2	8887	Positive locked +15
	3	0000	Earth
	4	5001	
	5	5002	
	6	-	Available for future use
	7	-	Available for future use
	8	-	Available for future use
	9	6108	CAN line – H
	10	2290	K line – PDA connector (Palmar connection)
	11	-	Available for future use
	12	6109	CAN line – L
	13	-	Available for future use
	14	5511	
	15	-	Available for future use
	16	1000	Gearbox in neutral position and parking brake in signal
	17	2226	Reverse gear headlight power supply prearrangement
	18	8100	
X2	1	3311	Clutch pedal pressed signal
	2	1012	
	3	6108	CAN line – H (preparators connector (STY33)
	4	5522	
	5	1012	
	6	6109	CAN line – L (preparators connector (STY33)
	7	1011	
	8	-	Available for future use
	9	-	Available for future use
	10	-	Available for future use
	11	-	Available for future use
	12	-	Available for future use
	13	-	Available for future use
	14	-	Available for future use
	15	-	Available for future use
X3	1	-	Available for future use
	2	-	Available for future use
	3	-	Available for future use
	4	3310	Brake pedal pressed signal
	5	5003	
	6	5004	
	7	9906	Engine running signal
	8	9907	Start up confirmation signal
	9	-	Available for future use

AUXILIARY HEATER WEBASTO

Introduction

Driving a vehicle implies a remarkable physical and mental effort especially in the case of long journeys.

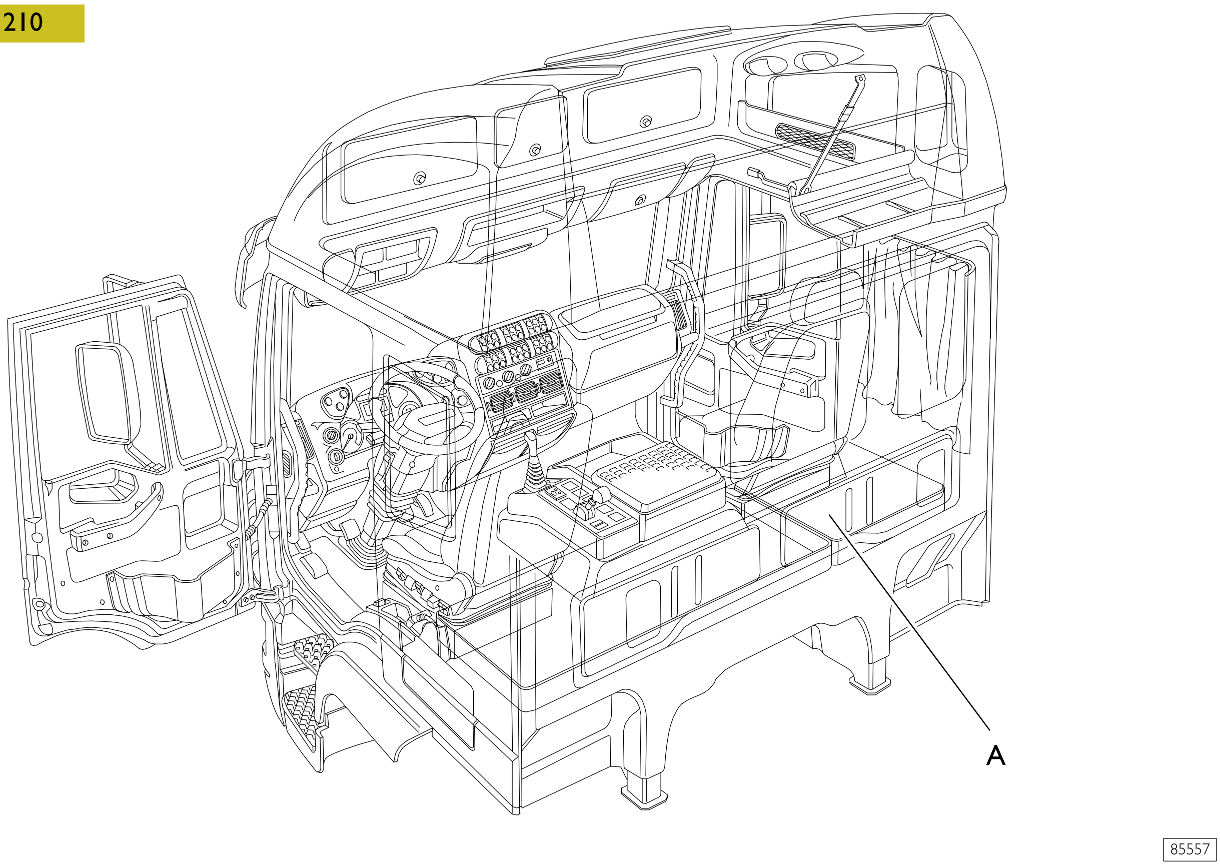
A comfortable environment is essential to safe driving and a prerequisite against possible and unexpected accidents.

For this purpose the vehicle can be equipped with special air–conditioning systems.
This section deals with the AIR TOP 2000 auxiliary heater

Turn off the heater to avoid risks of explosions in proximity of fuel depots, filling stations, store–rooms where dusts or fumes could be set on fire (coal depots, wood dust or cereals store–rooms etc.).

To avoid the risk of intoxication do not start the heater in a closed or poorly aerated environment even by means of a time preselector.

Figure 210



A. Auxiliary heater

GENERAL DESCRIPTION

The air–operated AIR TOP 2000 auxiliary heater, whose working principle is based on the evaporator, is thoroughly separated from that of vehicle's engine.

The heater consists essentially of the following components:

- comburent air fan
- heated air fan
- heat exchanger
- burner union and combustion pipe

The heater is controlled and monitored by means of the following units:

- electronic control unit
- flame test
- bulb
- heat lmiting device
- heat sensor

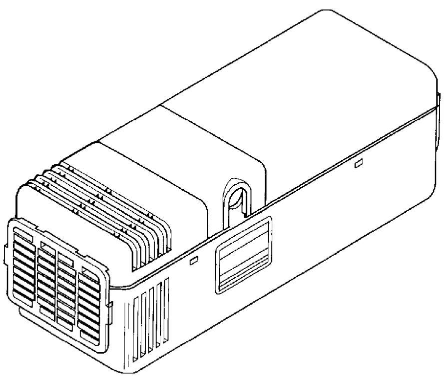
The vehicle's fuel tank supplies the heater with fuel through a metering pump.

The AIR TOP 2000 heater is started and set in operation by a control unit and a timer device. The latter can be of different types depending on the vehicle model on which it is assembled.

Specifications and data

Control voltage		24V
Heat power output	max	2Kw
	regulation	0.9 to 1.8Kw
Fuel consumption	max	0,240L/h
	regulation	0.12 to 0.22L/h
Electric power output	max	22W
	regulation	10 to 18W
Output temperature	max	+40°C
	regulation	+10°C to +35°C
Air delivery	max	70m^3/h
Weight		2,6Kg

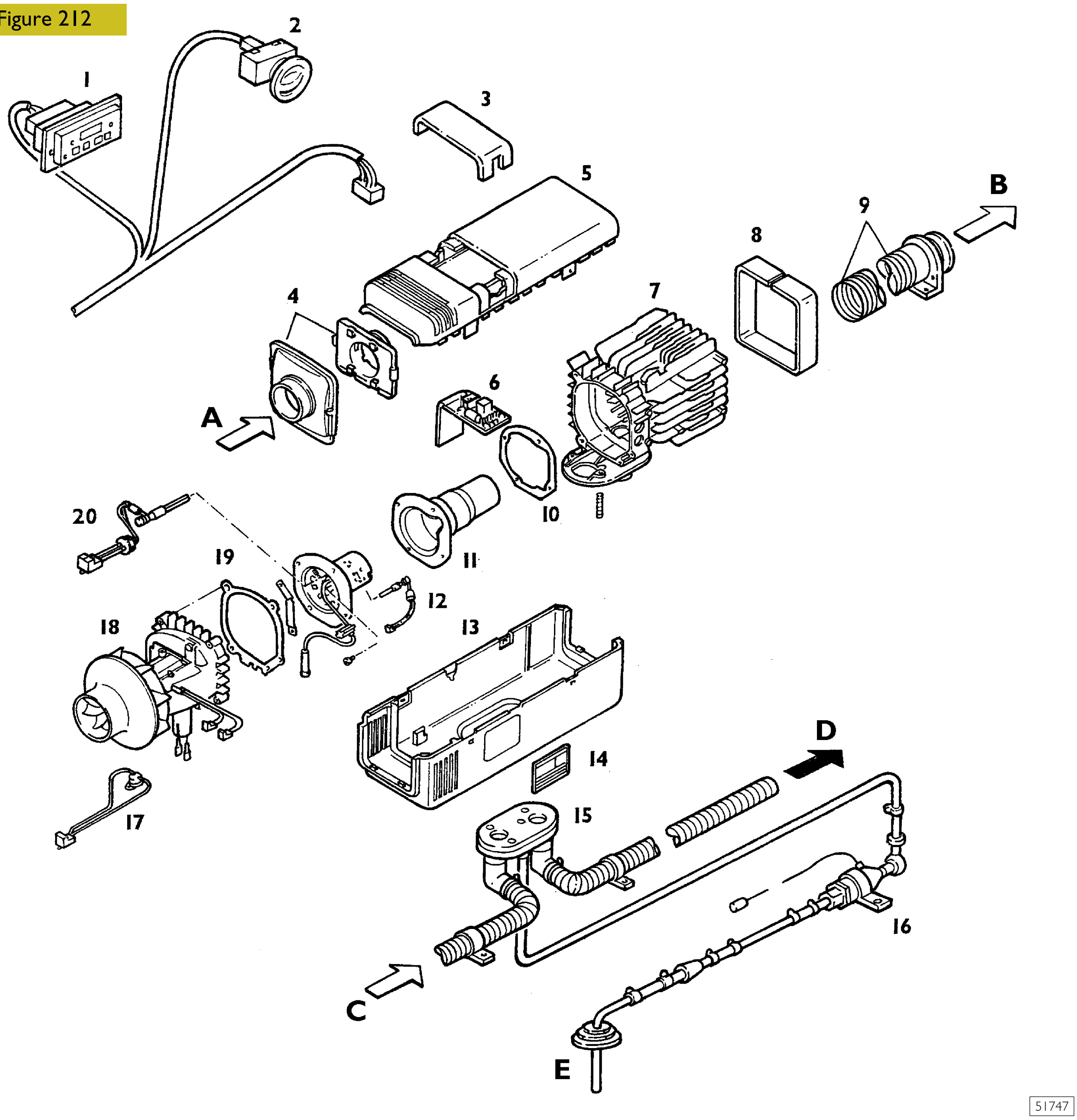
Figure 211



AIR–OPERATED AIR TOP 2000 HEATER

Exploded view

Figure 212



SYSTEM COMPONENT PARTS

1. Timer – **2.** Thermostat – **3.** Electronic control unit guard – **4.** Air inlet flange – **5.** Top case
6. Electronic control unit with temperature sensor – **7.** Heat exchanger – **8.** Felt packing – **9.** Hot air output duct – **10.** Seal –
11. Combustion chamber – **12.** Incandescence plug – **13.** Bottom case – **14.** Identification plate –
15. Engine fuel system connecting unit – **16.** Fuel pump – **17.** Safety switch – **18.** Motor – **19.** Seal –
20. Photoresistance

Circuit connection system

a. Heater air input port
b. Hot air output port
c. Comburent air input line
d. Exhaust gas output line
e. Fuel feed line

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Adjusting the CO_2 content

The auxiliary heater system meets all safety installation standards.

The comburent air is taken from the vehicle exterior.

The exhaust lines are designed to ensure complete discharge of all gases to the vehicle exterior.

All pipes distributing the hot air inside the cab are made of materials guaranteed to resist to very high temperatures (over 130°C).

The CO_2 content in the exhaust gases is adjusted by means of a potentiometer installed in the electronic control unit or control board. The heater is precalibrated by the Manufacturer depending on the type of hot air and comburent air fan included in the system (refer to Figure 213).

Regulation of the heater unit is by means of the potentiometer (use a suitable screwdriver).

Turn the pointer to the right to increase the fan rpm and decrease the CO_2 content. Turn the pointer to the left to reduce fan rpm and increase the CO_2 content.

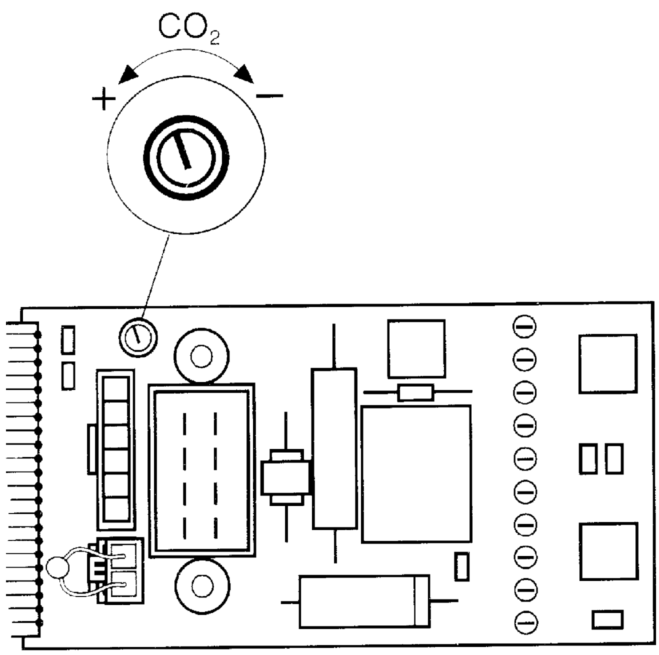
If the regulation field is found to be inadequate, for example if the heating and comburent air fan was replaced, proceed to a new preliminary regulation of the heater unit.

Preliminary heater regulation

NOTE The following procedure deletes all presetting regulation data set by the Manufacturer.

1. Remove the top case.
2. Switch the heater on.
3. Within 5 seconds from switching the unit on, quickly turn the potentiometer twice around the regulation field.
4. Adjust to the desired amount of CO_2 content.
5. Switch the heater off.
6. Fit the top case and fasten it securely.

Figure 213



Adjusting the CO_2 content from the control board.

OPERATION

Beginning of the combustion phase

Once the desired temperature (ranging between 10° and 45°C) is preset, the heater can be switched on by means of the hand/automatic device. The pilot lamp illuminates and the bulb is activated via a pulse regulation system.

The heating and comburent air motor starts to turn at high speed for about 1 sec and then gradually reduces its speed to 30% of its potential.

If the temperature of the air entering the system is higher than the desired temperature only the heating and comburent air motor is activated.

On the contrary, if the temperature of the air entering the system is lower than the desired temperature the combustion process is set in operation.

After 20 seconds approximately the fuel metering pump is started by the electronic control unit or control board.

25 seconds later the fan speed is increased and kept steady for about 20 seconds, i.e. until the beginning of the combustion phase.

From the moment the flame is turned on (indicated by the flame sensor) the combustion process remains steady for the next 20 seconds, that is to say the fan speed is subjected to continuous increasing adjustments until it reaches its maximum figure (this phase lasts 20 seconds approximately).

Should the flame go out during this phase, the starting procedure is automatically repeated.

If combustion is irregular, after two minutes the fan increases its speed for about 30 seconds with the bulb activated and the fuel metering pump closed; the starting procedure is then repeated.

If a second attempt at starting the combustion process also proves unsuccessful, the heater is probably defective. It will go off on its own after 80 seconds approximately.

The heating and comburent air fan is brought to peak speed for about two minutes.

The overall combustion phase lasts for about three minutes.

The control device is fitted with a green led which illuminates and remains on (fixed light) throughout normal operation of the system. A flashing light by the same led indicates overheating.

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Cab heating

While the heater is in operation exhaust gases flow to the heat exchanger. The heat developed by the combustion process is passed on to the heat exchanger faces, absorbed by the air fed by the fan and then spread into the cab.

The temperature of the air entering the system is measured by a sensor fitted to the heater inlet side.

If the temperature of the outgoing air is lower than the preset value, the heater increases its heating power until it reaches the specified figure.

When the system is required to work for a long time without stopping, the delivery of the metering pump is reduced every 15 minutes for 20 seconds in order to increase its heating output to 1.1 Kw.

The pump delivery is instead reduced every 30 minutes for 4 seconds if the desired heating output is less than 1.1 Kw.

Once the preset temperature is attained, the system will reduce the speed of the heating and comburent air fan and the delivery of the fuel metering pump.

- If the temperature of the air entering the heater is higher than the figure selected beforehand, the system will function at idling speed for about 5 seconds and then switch off the metering pump and terminate the combustion process. The fan speed will remain steady for about 35 seconds after which it will increase (for at least 120 seconds) to 60% of its maximum power thus allowing the heater to cool down.
- If the temperature of the air entering the heater is lower than the figure selected beforehand, the fan will function at 30% of its maximum power.

The heater will remain on even in case a signal from the temperature sensor informs the control unit that the running temperature is lower than the preselected figure.

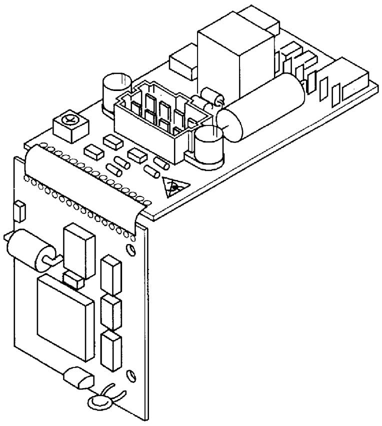
Switching the system off

The led goes off as soon as the cutoff device is actuated.

If the combustion phase has not yet started (heater just switched on) or the system is running at idling speed (owing to a higher temperature of the intake air compared to the preselected value), the heater is immediately turned off.

On the other hand, if combustion is already under way switching off of the heater involves immediate cutoff of the combustion process. In this case the fan speed will remain steady for five seconds and then be reduced to 60% of its maximum power within 30 seconds. As soon as the control unit receives information from the temperature sensor that the flame has gone off, the fan will rev up for about one minute and then return to 60% of its power for two more minutes. The system will then be deactivated.

Figure 214



Main system components

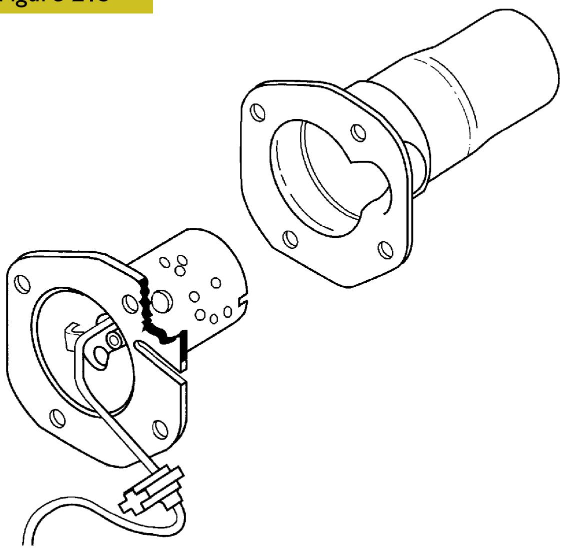
Electronic control unit or control board

The electronic control unit is integrated into the heater. It is designed to ensure correct functioning of the system and keep the combustion process constantly under control.

The purpose of the heat sensor (inside the control unit) is to regulate the temperature while a potentiometer (also in the control unit) is meant to adjust the speed of the heating and comburent air fan.

The system thus ensures that the desired temperature is quickly reached inside the cab and then kept steady according to the preselected figure.

Figure 215

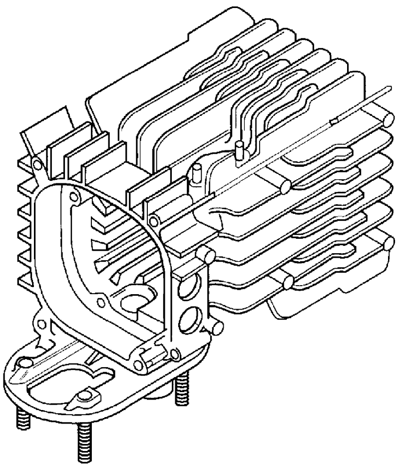


Burner union and combustion pipe

The fuel flowing inside the burner union is distributed into the combustion pipe through the burner section.

Heating of the heat exchanger results from the combustion of the fuel and air mix inside the pipe.

Figure 216



Heat exchanger

The heat developed by the combustion process inside the heat exchanger is sent to the heating and comburent air fan.

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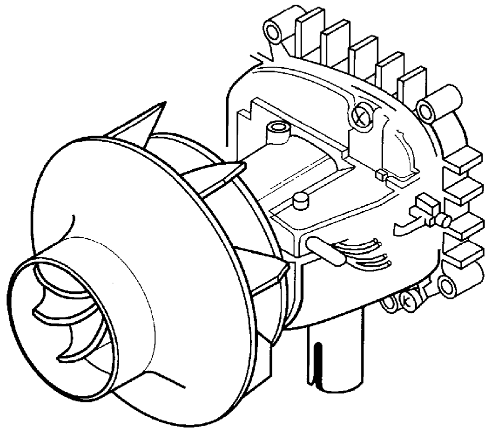
Comburent and heating air fan

The comburent and heating air fan conveys the desired amount of air to be combusted into the burner union through the comburent air input port.

The heating air is delivered to the heater output port by means of a fan.

Figure 217



Flame test

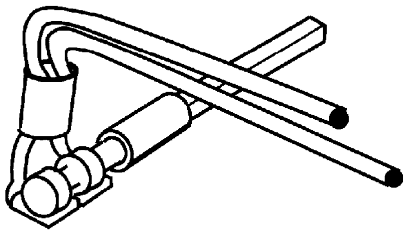
The flame test is performed by a PTC type low value resistor which adjusts its resistance depending on flame and heating degree.

During the heating phase the condition of the flame is therefore kept constantly under control.

TEST VALUES

❑ Cold 25°C resistance	 2.6 to 3.4 ohm 5 mA min
❑ Warm 800°C resistance test current	 12 to 15 ohm 5 mA min

Figure 218



Bulb

The bulb enables ignition of the air and fuel mix during the heater starting phase.

The bulb functions as an electric resistor. It is assembled into the burner union on the flame's opposite side.

TEST VALUES

❑ 25°C resistance test current	1.3 to 1.44 ohm 5 mA min

Figure 219

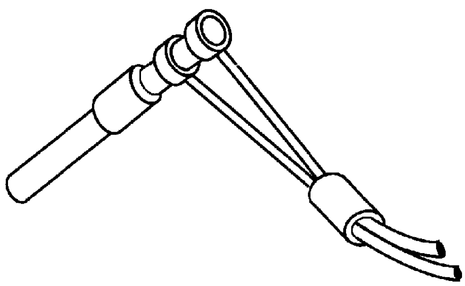


Figure 220

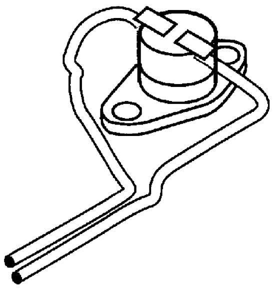
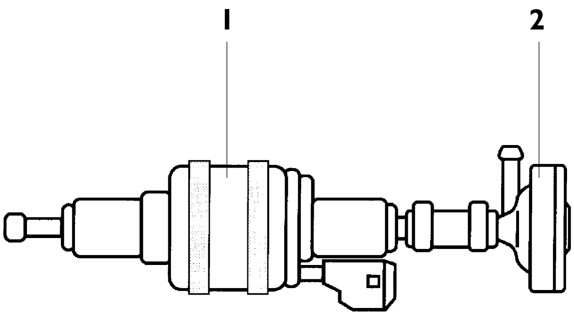


Figure 221



Fuel metering pump
1. Pump – **2.** Filter

Heat limiting device

The purpose of this device is to protect the heater from excessive operating temperatures.

Overheating protection occurs at a temperature of 150°C.

Intervention of the heat limiting device stops the supply of electric power to the fuel metering electric pump and cuts off the heater which cools down and then closes electrically.

Should operation of the burner be required after a failure due to overheating, wait for the heat limiting device to cool down first; then delete the failure from the control unit's memory by turning the heater off and on again.

The limiting device is also activated in case of compressed air leaks (over 1 mBar) between the air intake side and the heating air line.

Fuel metering pump

This pump is made up of fuel feed, metering and cutoff components.

Fuel supply to the heater is from the vehicle's fuel reservoir.

Assembly of the pump should be carried out according to specified installation standards.

The metering pump should be secured by means of a shock absorber suspension system.

When assembling the pump, follow strictly the fitting position shown in the figure to ensure that all air bubbles are thoroughly expelled.

The fuel pump is fixed on chassis longitudinal member.

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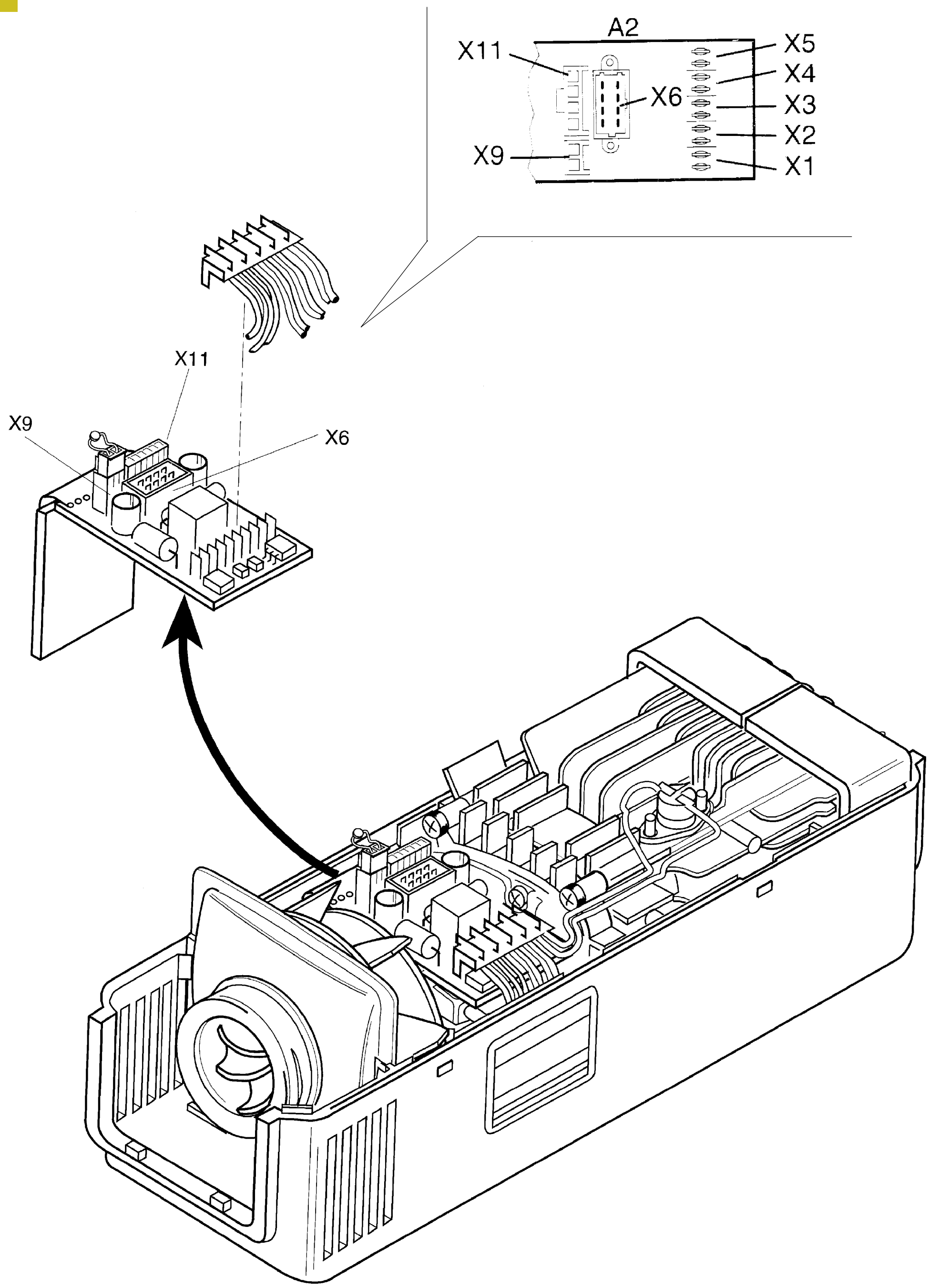
Assembly drawing

HEATER CONNECTION SYSTEM

Figure 222

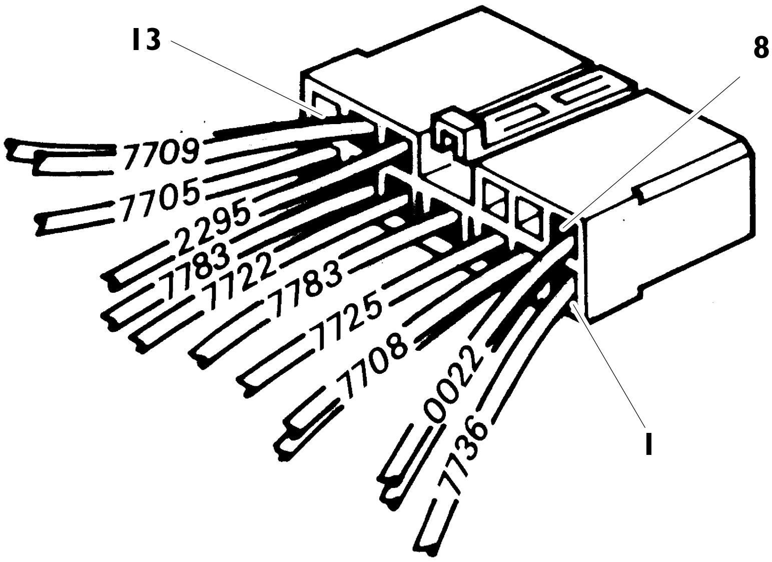


HEATER INTERNAL CONNECTION SYSTEM

X1. Air fan – **X2.** Fuel metering pump – **X3.** Flame sensor – **X4.** Bulb – **X5.** Heat limiting device – **X6.** Main connector – **X9.** Temperature sensor – **X11.** Fault diagnosis K line

ST X1 connection connector

Figure 223



Ref.	Description	Cable colour
1	Air temperature adjustment thermostat supply	7736
2	Supplementary heater supply	7708
3	Timer supply	7725
4	Supplementary pump supply	7783
5	Supplementary heater blower engine supply	7722
6	Supplementary pump supply	7783
7	Supplementary heater turning–on spark plug supply	7705
8	Supplementary heater ground	0022
9	–	–
10	–	–
11	Diagnostic K Line	2295
12	Remote control switch supply (control) for TGC	–

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Fault diagnosis

Fault symptoms – general

Fault	Possible cause	Remedy
The heater goes off	No combustion after starting or after starting procedure is repeated	Turn the heater off briefly and then turn it on again
	The flame goes off during heater operation	Turn the heater off briefly and then turn it on again
	Heater overheating and pilot lamp blinking	Ensure the heating air is free to flow inside the pipe Turn the heater off briefly and then turn it on again
	Feed voltage low	Charge batteries. Turn the heater off briefly and then turn it on again
The heater emits black smoke	Comburent and/or exhaust air pipes restricted	Ensure comburent/exhaust air is free to flow inside the pipe

Fault symptoms – heater running

Fault	Fault occurs after ...	Remedy
The heater does not start, all leds off on control board	immediately	Faulty wiring, fuse cut off
The heater does not start, led on	immediately	Faulty fan/control unit, fan locked
Speed extremely low, no starting	immediately	Faulty command or defective installation of control instrument
The fan motor starts briefly but the fan does not turn	1 second	Bulb short circuit or cut off, flame test cut off or control unit faulty
Motor off, no washing	5 seconds	Fan motor locked
Washing occurs after	1 second	Faulty flame
Washing occurs after	20 seconds	Electronic control unit voltage low
Washing occurs after 2 mins; no pulses from metering pump	120 seconds	Pump wiring faulty or pump failure
Washing occurs after	40 to 120 sec.	Metering pump or overheating protection device cut off
Washing occurs after	230 seconds	Incorrect fuel quantity, fan slow/faulty, burner scaled, comburent and exhaust air lines restricted, heat exchanger scaled, fuel metering pump locked
Washing performed	while heater is running	Faulty component: flame test, bulb, sensor, overheating, metering pump.
Motor off, no washing	while heater is running	Fan motor either faulty or locked
Metering pump cycle discontinued; 30 seconds max speed after starting procedure is repeated	while heater is running	Flame goes off owing either to gas bubbles in combustion lines or upwind at the exhaust gas output port

Repair operations

Repair and maintenance operations should be carried out only by skilled personnel.

Isolate system batteries before carrying out any repair operation on the auxiliary heater.

Especially before the cold season operate the heater at regular intervals for at least ten minutes approximately every four weeks to prevent mechanical parts from locking with time. Overhaul the entire system before the winter season.

Carry out the following operations to obtain maximum performance from your heater:

- Ensure the heating air input and output ports are not restricted by dirt or foreign bodies; this could result in heater overheating and consequent release of the heat limiting device.
- Clean the auxiliary heater from the outside.
- Check efficiency of electrical connections.
- Check the condition of exhaust gas and comburent air lines. Ensure they are not damaged or restricted.
- Check fuel line for tightness and filter efficiency. Replace the latter, if necessary.

Error code display

The following error codes are shown on the digital timer display in the event of a system failure.

Error code	Description
F 01	No starting (after performing the starting procedure twice)
F 02	Flame cutoff
F 03	Low voltage or overvoltage
F 04	Immediate flame recognition failure
F 05	Flame test cutoff or short–circuit
F 06	Temperature sensor cutoff or short–circuit
F 07	Fuel metering pump cutoff or short–circuit
F 08	Fan motor cutoff or short–circuit or defective fan motor running speed
F 09	Bulb cutoff or short–circuit
F 10	Overheating

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DIAGNOSTIC INSTRUMENTS

Electronic system troubleshooting can be performed either by means of the Cluster of the Modus, IT 2000, and E.A.S.Y. diagnostic instruments.

Diagnosis by means of the Cluster allows you to evaluate in advance the situation of the faults found in the system, whereas the diagnostic instruments are essential to carry out thorough diagnosis and take appropriate measures with regard to the individual faults.

Every single instrument displays a guide to diagnosis and repair work, and is connected to the diagnosis connector available on the vehicle (30 pole).

Diagnosis instruments

MODUS (Maintenance and diagnostic system)

Computerized diagnosis station used to diagnose braking systems, pneumatic suspensions, engine and electronically–controlled systems.

The station is equipped with auxiliary functions such as electronic control unit programming, spare part catalog referencing, time schedules, etc.

The vehicle is equipped with a 30–pole diagnosis take–off for interfacing with the instrument.

IT 2000 (IVECO Electronic Tester)

It makes it possible to immediately act on the vehicle, by recognizing the latter by means of the chassis number.

It stores the results of the diagnosis work carried out.

It can also be used as a portable PC and is set for remote diagnosis.

By using the MODUS as a mother station, you can update and configure the IT 2000.

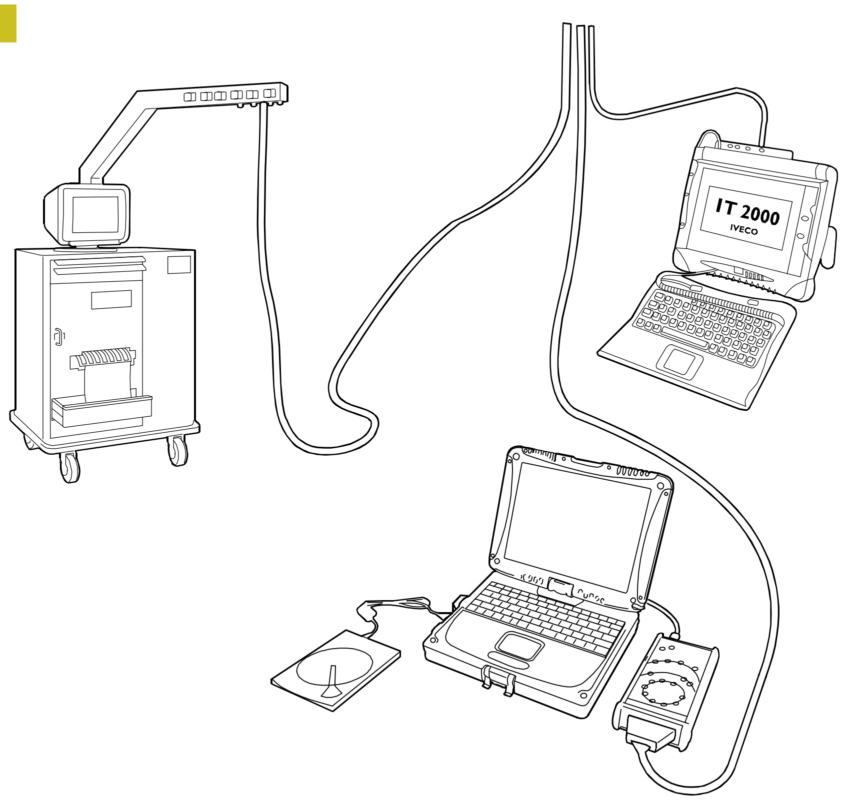
IT 2000 is interfaced with the vehicle through a 30–pole diagnosis take–off.

E.A.SY.

The E.A.SY. system allows you to easily diagnose and program the various electronic control units available on the vehicle. The system is made up of the ECI module for communication with the electronic control units, and a PC made by Panasonic.

The ECI module makes it possible, by taking advantage of the Panasonic PC, to take the proper actions on the vehicle "on the road". In particular, diagnosis may, thanks to the Panasonic PC wireless technology (e.g. GPRS), be assisted by an expert remote center.

Figure 224



101586

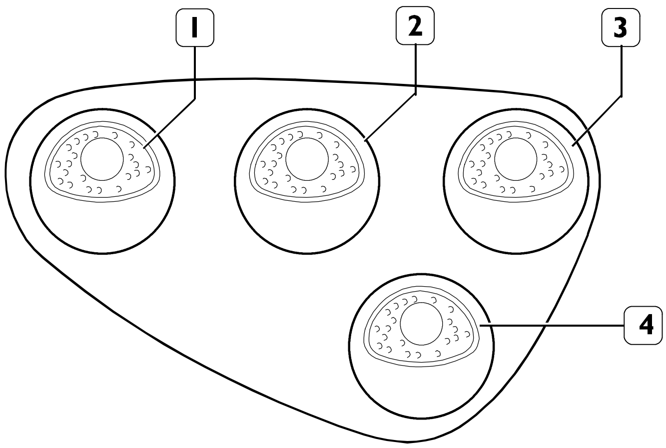
System initialization screen

By turning the key to MAR, the system carries out a general check of the vehicle's conditions.
The figure below illustrates the screen shown by the display when the system is being initialized.

Figure 225

If an anomaly is found, the display shows the symbol of the electronic system involved.
For Highline versions, the error code can be displayed by entering menu DIAGNOSTIC by means of the dedicated controls available on the dashboard right–hand frame (see figure below).

Figure 226

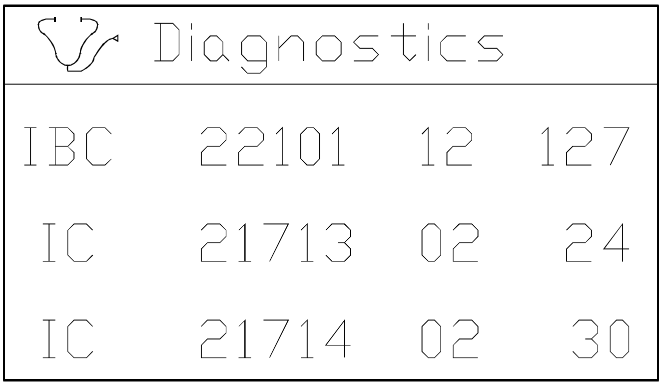


1. Previous page (ESCAPE) – 2. Submenu display/display actuation (OK) – 3. Upper line displaying button – 4. Lower line displaying button

DIAGNOSTIC screen (oly for Highline versions)

To display the DIAGNOSTIC screen, turn the key to MAR with the engine stopped, wait for the initialization screen to be displayed, then press button “OK” to actuate the display. Use buttons ∧ or ∨ to move along until the DIAGNOSTIC screen is found.

Figure 227



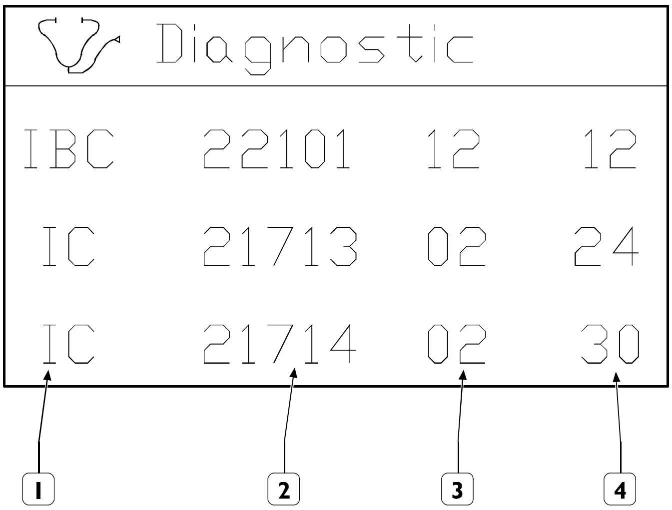
85158

These screens show the faults found in the various electronic systems (EDC, ABS, ECAS, etc.).

Meanings of anomaly codes

When a anomaly has occurred on the display, the DIAGNOSTIC menu shows the following data:

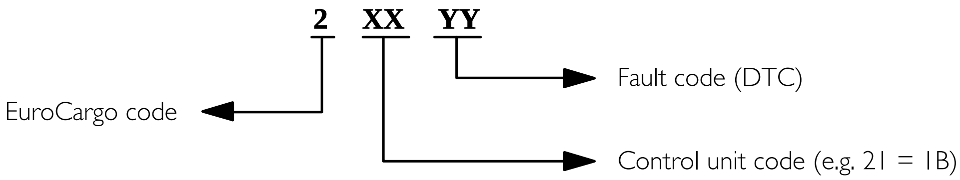
Figure 228



86159

1. Symbol of the system affected by the fault
2. Control unit data
3. Type of fault
4. Anomaly occurrences

Description of fault codes (SPN)



TROUBLESHOOTING
Instrument Body Controller (IBC)

Text on Cluster	Component failure	DTC	FMI	Visible anomaly	Possible cause	Controls to be carried out	Measuring conditions	Values to be found	Notes
	EEPROM	22101	12		Internal EEPROM error to IBC unit (EEPROM CHECKSUM), the error CAN occur in case the battery voltage is too low (ex. 9V), or in case the EEPROM is defective or faulty.	Verify vehicle battery supply. If there is an error in diagnosis instrument, carry out a failure deletion, if the error remains replace the IBC unit.			
		22102	12	It is impossible to activate loads, lights, unavailable windscreen wiper activation. Functionalities managed by IBC ECU are not guaranteed.	Unit output driver temperature greater than maximum value (Tmax= 150°). Probable short–circuit to ground of one of the Body Controller unit outputs (under this condition the IBC ECU enters in protection mode).	Check wiring on all IBC outputs verifying that they are not shortcircuited to ground.			
IBC		22103	0	On left Cluster part, IBC words remain turned on.	Supply voltage on line 1 included between 32 and 36 Volts. The affected voltage value is greater than the threshold. The error could be denounced and not monitored when starting the engine.	1) Check voltage between Iveco Body Controller unit pin C2 (supply line 1 input) and chassis ground. 2) Verify battery voltage, or presence of battery chargers connected during startup. Verify voltage regulator and alternator status.			
IBC		22103	1	On left Cluster part, IBC words remain turned on.	Supply voltage on line 1 included between 8 and 18 Volts. The affected voltage value is lower or greater than the threshold. The error could be denounced and not monitored when starting the engine.	1) Check voltage between Iveco Body Controller unit pin C2 (supply line 1 input) and chassis mass. 2) Verify battery voltage and its status. Verify voltage regulator and alternator status.			
IBC		22103	3	On left Cluster part, IBC words remain turned on.	Supply voltage on line 1 greater than 36 Volts. The affected voltage value is greater than the threshold. The error could be denounced and not monitored when starting the engine.	1) Check voltage between Iveco Body Controller unit pin C2 (supply line 1 input) and chassis ground. 2) Verify battery voltage and its status, check presence of battery chargers connected during startup. Verify voltage regulator and alternator status.			

Text on Cluster	Component failure	DTC	FMI	Visible anomaly	Possible cause	Controls to be carried out	Measuring conditions	Values to be found	Notes
IBC		22103	4	On left Cluster part, IBC words remain turned on.	Supply voltage on line 1 lower than 8 Volts. The affected voltage value is lower than the threshold. The error could be denounced and not monitored when starting the engine.	1) Check voltage between Iveco Body Controller unit pin C2 (supply line 1 input) and chassis ground. 2) Verify battery voltage and its status. Check voltage regulator and alternator status.			
IBC		22104	0	On left Cluster part, IBC words remain turned on.	Supply voltage k30 on line 2 included between 32 and 36 Volts. The affected voltage value is greater than the threshold. The error could be denounced and not monitored when starting the engine.	1) Check voltage between Iveco Body Controller unit pin D12 (supply line 2 k30 input) and chassis ground. 2) Verify battery voltage, or presence of connected battery chargers during startup. Verify voltage regulator and alternator status.			
IBC		22104	1	On left Cluster part, IBC words remain turned on.	Supply voltage k30 on line 1 included between 8 and 18 Volts. The affected voltage value is lower or greater than the threshold. The error could be denounced and not monitored when starting the engine.	1) Check voltage between Iveco Body Controller unit pin D12 (supply line 2 input) and chassis ground. 2) Verify battery voltage and its status. 3) Check TGC status. 4) Verify voltage regulator and alternator status. 5) Verify (10A) fuse 8–10–11–20 integrity.			
IBC		22104	3	On left Cluster part, IBC words remain turned on.	Supply voltage k30 on line 2 greater than 36 Volts. The affected voltage value is greater than the threshold. The error could be denounced and not monitored when starting the engine.	1) Check voltage between Iveco Body Controller unit pin D12 (supply line 1 input) and chassis ground. 2) Verify battery voltage and its status, check presence of connected battery chargers during startup. Check voltage regulator and alternator status.			

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Text on Cluster	Component failure	DTC	FMI	Visible anomaly	Possible cause	Controls to be carried out	Measuring conditions	Values to be found	Notes
IBC		22104	4	On left Cluster part, IBC words remain turned on.	Supply voltage K30 on line 2 lower than 8 Volts. The affected voltage value is lower than the threshold. The error could be denounced and not monitored when starting the engine.	1) Check voltage between pin D12 of Iveco Body Controller unit (supply line 2 input) and chassis ground. 2) Verify battery voltage and its status. Check TGC, voltage regulator and alternator status. Verify integrity of (10A) fuses 8–10–11–20.			
IBC		22105	0	On left Cluster part, IBC words remain turned on.	Supply voltage K30 on line 3 included between 32 and 36 Volts. The affected voltage value is greater than the threshold. The error could be denounced and not monitored when starting the engine.	1) Check voltage between pin D9 of Iveco Body Controller unit (supply line 3 input k30) and chassis ground. 2) Verify battery voltage, or presence of battery chargers connected during startup. Verify voltage regulator and alternator status.			
IBC		22105	1	On left Cluster part, IBC words remain turned on.	Supply voltage K30 on line 3 included between 8 and 18 Volts. The affected voltage value is lower than the threshold. The error could be denounced and not monitored when starting the engine.	1) Check voltage between pin D9 of Iveco Body Controller unit (supply line 3 input) and chassis ground. 2) Verify battery voltage and its status. 3) Check TGC status. 4) Verify voltage regulator and alternator status. 5) Verify integrity of (10A) fuses 8–10–11–20.			
IBC		22105	3	On left Cluster part, IBC words remain turned on.	Supply voltage K30 on line 3 greater than 36 Volts. The affected voltage value is greater than the threshold. The error could be denounced and not monitored when starting the engine.	1) Check voltage between pin D9 of Iveco Body Controller unit (supply line 3 input) and chassis ground. 2) Verify battery voltage and its status, check presence of battery chargers connected during startup. Check voltage regulator and alternator status.			

Text on Cluster	Component failure	DTC	FMI	Visible anomaly	Possible cause	Controls to be carried out	Measuring conditions	Values to be found	Notes
IBC		22105	4	On left Cluster part, IBC words remain turned on.	Supply voltage K30 on line 3 lower than 8 Volts. The affected voltage value is lower than the threshold. The error could be denounced and not monitored when starting the engine.	1) Check voltage between pin D9 of Iveco Body Controller unit (supply line 3 input) and chassis ground. 2) Verify battery voltage and its status. Check TGC, voltage regulator and alternator status. Verify integrity of (10A) fuse 20 (line 3 supply).			
IBC		22106	0	On left Cluster part, IBC words remain turned on.	Supply voltage K30 on line 4 included between 32 and 36 Volts. The affected voltage value is greater than the threshold. The error could be denounced and not monitored when starting the engine.	1) Check voltage between pin D13 of Iveco Body Controller unit (supply line 4 input k30) and chassis ground. 2) Verify battery voltage, or presence of battery chargers connected during startup. Verify voltage regulator and alternator status.			
IBC		22106	1	On left Cluster part, IBC words remain turned on.	Supply voltage K30 on line 4 included between 8 and 18 Volts. The affected voltage value is lower than the threshold. The error could be denounced and not monitored when starting the engine (EEC1 message – Engine Starter Mode = 0001 or 0010).	1) Check voltage between pin D13 of Iveco Body Controller unit (supply line 4 input) and chassis ground. 2) Verify battery voltage and its status. 3) Check TGC status. 4) Verify voltage regulator and alternator status. 5) Verify integrity of (10A) fuses 8–10–11.			
IBC		22106	3	On left Cluster part, IBC words remain turned on.	Supply voltage K30 on line 4 greater than 36 Volts. The affected voltage value is greater than the threshold. The error could be denounced and not monitored when starting the engine.	1) Check voltage between pin D13 of Iveco Body Controller unit (supply line 4 input) and chassis ground. 2) Verify battery voltage and its status, check presence of battery chargers connected during startup. Verify voltage regulator and alternator status.			

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Text on Cluster	Component failure	DTC	FMI	Visible anomaly	Possible cause	Controls to be carried out	Measuring conditions	Values to be found	Notes
IBC		22106	4	On left Cluster part, IBC words remain turned on.	Supply voltage K30 on line 4 lower than 8 Volts. The affected voltage value is lower than the threshold. The error could be denounced and not monitored when starting the engine (EEC1 message – Engine Starter Mode = 0001 or 0010).	1) Check voltage between pin D13 of Iveco Body Controller unit (supply line 4 input) and chassis ground. 2) Verify battery voltage and its status. 3) Check TGC, voltage regulator and alternator status. 4) Verify integrity of (10A) fuses 8–10–11.			
IBC		22107	0	On left Cluster part, IBC words remain turned on.	Supply voltage K30 on line 5 included between 32 and 36 Volts. The affected voltage value is greater than the threshold. The error could be denounced and not monitored when starting the engine.	1) Check voltage between pin C14 of Iveco Body Controller unit (supply line 5 input k30) and chassis ground. 2) Verify battery voltage, or presence of battery chargers connected during startup. Verify voltage regulator and alternator status.			
IBC		22107	1	On left Cluster part, IBC words remain turned on.	Supply voltage K30 on line 5 included between 8 and 18 Volts. The affected voltage value is lower than the threshold. The error could be denounced and not monitored when starting the engine (EEC1 message – Engine Starter Mode = 0001 or 0010).	1) Check voltage between pin C14 of Iveco Body Controller unit (supply line 5 input) and chassis ground. 2) Verify battery voltage and its status. 3) Check TGC status. 4) Verify voltage regulator and alternator status. 5) Verify integrity of (10A) fuses 8–10–11.			

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Text on Cluster	Component failure	DTC	FMI	Visible anomaly	Possible cause	Controls to be carried out	Measuring conditions	Values to be found	Notes
IBC		22107	3	On left Cluster part, IBC words remain turned on.	Supply voltage K30 on line 5 greater than 36 Volts. The affected voltage value is greater than the threshold. The error could be denounced and not monitored when starting the engine.	1) Check voltage between pin C14 of Iveco Body Controller unit (supply line 5 input) and chassis ground. 2) Verify battery voltage and its status, check presence of battery chargers connected during startup. Verify voltage regulator and alternator status.			
IBC		22107	4	On left Cluster part, IBC words remain turned on.	Supply voltage K30 on line 5 lower than 8 Volts. The affected voltage value is lower than the threshold. The error could be denounced and not monitored when starting the engine.	1) Check voltage between pin C14 of Iveco Body Controller unit (supply line 5 input) and chassis ground. 2) Verify battery voltage and its status. Check TGC, voltage regulator and alternator status. 3) Verify integrity of (10A) fuses 8–10–11.			
	Right direction lights	22108	5	On the left Cluster part a lamp is displayed; a right indicator light is not turned on.	The current value acquired from the unit is below the current threshold (I< Is) – (Is=2.7A). One of the 3 lamps (21W) is burnt. The error is detected only when the supply voltage is included between 18V and 24V.	Verify integrity of the 3 lamps, check electric continuity on wiring between IBC output (pin C20) and ground. Check with indicator operation whether between pin C20 and ground there is a 24V voltage. Verify with amperometric pliers the current value absorbed on IBC pin C20. If the absorbed current is < 2.7A, open circuit.			

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Text on Cluster	Component failure	DTC	FMI	Visible anomaly	Possible cause	Controls to be carried out	Measuring conditions	Values to be found	Notes
	Right trailer direction lights	22109	5	In the left Cluster part a lamp and a plug are displayed. No right trailer direction light is turned on.	The error is detected only when all lamps are open circuited and the related supply is included between 18V and 32V. Outputs C18 or C17 short–circuited to ground. If one of the IBC outputs, for actuating arrows on left side, is short–circuited to ground, the system detects an error (open circuit on right trailer side).	Verify status of the two lamps on right trailer side. If the two lamps are ok, by operating the left direction indicator, check output voltage between pin C19 IBC and chassis ground (it must be included between 18V and 32V). Check wiring integrity between pin C19 and lamps.			
	Right vehicle/trailer direction lights	2210A	6	On the left Cluster part a lamp is displayed. By actuating the right direction indicator, vehicle or trailer right direction lights are not turned on.	Internal IBC unit driver short–circuited to ground or overloaded or with overtemperature. Body Controller outputs C20 or C19 short–circuited to ground or current overload. The error is detected only when voltage is included between 18V and 32V.	Verify lamp status on right side (vehicle/trailer). Verify by actuating the right direction indicator between pin C20 and ground and between pins C19 and ground an output voltage equal to 24V. Check wiring integrity between IBC outputs and lamps.			
	Left direction lights	2210B	5	On the left Cluster part a lamp is displayed; a left trailer indicator light is not turned on.	The current value acquired from the unit is below the current threshold (I< Is) – (Is=2.7A). One of the 3 lamps (21W) is burnt. The error is detected only when the supply voltage is included between 18V and 24V.	Verify integrity of the three lamps on tractor left side. If the three lamps are ok, by actuating the left direction indicator, check output voltage between IBC pin C18 and chassis ground (it must be included between 18V and 32V). Check wiring integrity between pin C18 and lamps.			
	Left trailer direction lights	2210C	5	In the left Cluster part a lamp and a plug are displayed. Left trailer direction lights turned off.	The error is detected only when all lamps are open circuited and the related supply is included between 18V and 32V. Outputs C19 or C20 short–circuited to ground. If one of the IBC outputs, for actuating arrows on right side, is short–circuited to ground, the system detects an error (open circuit on left trailer side).	Verify integrity of the two lamps on tractor left side. If the two lamps are ok, by actuating the right direction indicator, check output voltage between IBC pin C17 and chassis ground (it must be included between 18V and 32V). Check wiring integrity between pin C17 and lamps.			

Text on Cluster	Component failure	DTC	FMI	Visible anomaly	Possible cause	Controls to be carried out	Measuring conditions	Values to be found	Notes
	Left vehicle/trailer direction lights	2210D	6	By actuating left direction indicator, vehicle/trailer left direction lights are not turned on.	Internal IBC unit driver short–circuited to ground or overloaded or with overtemperature. Body Controller outputs C18 or C17 short–circuited to ground or current overload. The error is detected only when voltage is included between 18V and 32V.	Verify lamps status on left side (vehicle/trailer). Verify by actuating the left direction indicator between pin C18 and ground and between pin C17 and ground an output voltage equal to 24V. Check wiring integrity between IBC outputs and lamps.			
	Front right parking and clearance lights	2210E	5	On the left Cluster part a lamp is displayed.	The current value acquired from the unit is below the current threshold (I< Is) – (Is=2.7A). One of the 2 lamps (5W) is burnt. The error is detected only when the supply voltage is included between 18V and 24V.	Verify lamp status, wiring integrity between output pin D16 and lamps. Check with connected running lights the output voltage between pin D16 and chassis ground.			
	Rear left parking lights	2210F	5	On the left Cluster part a lamp is displayed.	The current value acquired from the unit is below the current threshold (I< Is) – (Is=2.7A). One of the 2 lamps (5W) is burnt. The error is detected only when the supply voltage is included between 18V and 32V.	Verify lamp status, wiring integrity between output pin D15 and lamps. Check with connected running lights the output voltage between pin D15 and chassis ground.			
	Right and left number plate lights	22110	5	On the left Cluster part a lamp is displayed. Right/left number plate lights do not turn on or remain on even with key on stop.	The current value acquired from the unit is below the current threshold (I< Is) – (Is=2.7A). One of the 2 lamps (5W) is burnt. The error is detected only when the supply voltage is included between 18V and 32V.	Verify lamp status and correct sizing, wiring integrity between output pin D14 and lamps. Check with connected running lights the output voltage between pin D14 and chassis ground.			

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Text on Cluster	Component failure	DTC	FMI	Visible anomaly	Possible cause	Controls to be carried out	Measuring conditions	Values to be found	Notes
	Front right parking and clearance lights or Rear left parking light or Right/left number plate lights or Right trailer parking and clearance lights	22111	6	On the left Cluster part a lamp is displayed. One of the following lights does not turn on or remains always on: front right parking and clearance lights or rear left parking light or right/left number plate lights or right trailer parking and clearance lights.	Internal IBC unit driver short–circuited to ground or overloaded or with overtemperature. One of the Body Controller outputs (pin D16 or D15 or D14 or D17) short–circuited to ground or current overloaded. The error is detected only when the voltage is included between 18V and 32V.	Verify lamp status (vehicle/trailer). Verify with connected running lights between the following pins D17, D16, D15, D14 and ground an output voltage equal to 24V. Check wiring integrity between IBC outputs (D17, D16, D15, D14) and lamps.			
	Front left parking and clearance lights	22112	5	On the left Cluster part a lamp is displayed, parking and/or clearance lights turned off.	The current value acquired from the unit is below the current threshold (I< Is) – (Is=2.7A). One of the 2 lamps (5W) is burnt. The error is detected only when the supply voltage is included between 18V and 32V.	Verify lamp status. Wiring integrity between output pin D6 and lamps. Check with connected running lights the output voltage between pin D6 and chassis ground.			
	Rear right parking lights	22113	5	On the left Cluster part a lamp is displayed, rear left parking light does not turn on.	Open–circuited IBC output D5. The current value acquired from the unit is below the current threshold (I< Is) – (Is=1.8A). One of the 2 lamps (5W) is burnt. The error is detected only when the supply voltage is included between 18V and 32V.	Verify lamp status. Wiring integrity between output pin D5 and lamps. Check with connected running lights the output voltage between pin D5 and chassis ground.			
	Rear right and left clearance lights	22114	5	On the left Cluster part a lamp is displayed, rear right and left clearance lights do not turn on.	Open–circuited IBC output D7. The current value acquired from the unit is below the current threshold (I< Is) – (Is=1.8A). One of the 2 lamps (5W) is burnt. The error is detected only when the supply voltage is included between 18V and 32V.	Verify lamp status and correct sizing, wiring integrity between IBC output pin D7 and lamps. Check with connected running lights the output voltage between pin D7 and chassis ground: it must be equal to 24V.			

Text on Cluster	Component failure	DTC	FMI	Visible anomaly	Possible cause	Controls to be carried out	Measuring conditions	Values to be found	Notes
IBC	Front left parking and clarance lights or Rear right parking light or Right/left clearance lights or Left trailer parking and clearance lights	22115	6	On the left Cluster part IBC words are displayed. One of the following lights does not turn on or remains always on. Front left parking and clearance lights or rear right parking light or right/left clearance lights or left trailer parking and clearance lights.	Internal IBC unit driver short–circuited to ground or overloaded or with overtemperature. One of the Body Controller outputs (pin D6 or D5 or D7 or D8) short–circuited to ground or current overloaded. The error is detected only when the voltage is included between 18V and 32V.	Verify lamp status (vehicle/trailer). Verify with connected running lights between the following pins D6, D5, D7, D8 and ground an output voltage equal to 24V. Check wiring integrity between IBC outputs (D6, D5, D7, D8) and lamps.			
	Right and left fog lights	22116	5	On left Cluster part, a lamp is displayed. Right/left fog lights are not turned on.	Open–circuited IBC output pin D4. The current value acquired by the unit is below the current threshold (I < Is) – (Is=1.8A). One of the 2 lamps (5W) is burnt. The error is detected only if supply voltage is included between 18V and 32V.	Verify lamp status and correct sizing, wiring integrity between IBC output pin D4 and lamps. Check with connected low beams the output voltage between pin D4 and chassis ground: it must be equal to about 24V.			
IBC	Right/left vehicle fog lights or right/left trailer fog lights	22117	6	On the left Cluster part, the IBC words are displayed, right/left vehicle fog lights or right/left trailer fog lights are not turned on.	Short–circuited IBC outputs pins D4 and/or D3. The current value acquired by the unit on pin D4 or D3 is above the current threshold (I > Is) – (Is=1.8A). The error is detected only if supply voltage is included between 18V and 32V.	Verify lamp status and correct sizing, wiring integrity between IBC outputs pins D4, D3 and lamps. Check with connected low beams the output voltage between pin D4 and chassis ground: the measured voltage must be equal to about 24V.			

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Text on Cluster	Component failure	DTC	FMI	Visible anomaly	Possible cause	Controls to be carried out	Measuring conditions	Values to be found	Notes
	Left stop light	22118	5	On left Cluster part, a lamp is displayed. Left stop light is not turned on, or is always on.	Open–circuited or positive short–circuited IBC output pin D18. The current value acquired by the unit is below the current threshold (I < Is) – (Is=0.9A). The lamp (5W) is burnt. The error is detected only if supply voltage is included between 18V and 32V.	Verify lamp status and correct sizing, wiring integrity between IBC output pin D18 and lamp. Check by pressing the brake pedal the output voltage between pin D18 and chassis ground: the measured voltage must be equal to about 24V.			
	Right stop light	22119	5	On left Cluster part, a lamp is displayed. Right stop light is not turned on, or is always on.	Open–circuited or positive short–circuited IBC output pin D19. The current value acquired by the unit is below the current threshold (I < Is) – (Is=0.9A). The lamp (5W) is burnt. The error is detected only if supply voltage is included between 18V and 32V.	Verify lamp status and correct sizing, wiring integrity between IBC output pin D19 and lamp. Check by pressing the brake pedal the output voltage between pin D19 and chassis ground: the measured voltage must be equal to about 24V.			
IBC	Left stop light or right stop light or right/left trailer lights	2211A	6	On left Cluster part, IBC words are displayed. Right and/or left stop lights, or right/left trailer lights are not turned on.	Ground short–circuited IBC outputs pins D18 and/or D19 and/or D20. The current value acquired by the unit on pin D18 or D19 is above the current threshold (I > Is) – (Is=0.9A) – or the current value acquired by IBC on pin D10 is > 1.8A. The error is detected only if supply voltage is included between 18V and 32V.	Verify lamp status and correct sizing, wiring integrity between IBC outputs pins D18, D19, D20 and lamps. Check by pressing the brake pedal the output voltage between pin D18 and chassis ground, between pin D19 and chassis ground, and between D20 and chassis ground: the measured voltage must be equal to about 24V.			
IBC	Right/left arrow control switch (shunt).	2211B	2	On left Cluster part the IBC words are displayed. Right and left direction lights simultaneously blink..	IBC inputs pin A35 and pin A25 both ground short–circuited.	1) Verify wiring integrity between pin A34 and shunt, and between pin A25 and shunt. 2) Check shunt status and verify presence of a short circuit between pins A35 and A25.			

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Text on Cluster	Component failure	DTC	FMI	Visible anomaly	Possible cause	Controls to be carried out	Measuring conditions	Values to be found	Notes
IBC	Windscreen wiper switches	2211C	2	On the left Cluster part, the IBC words are displayed. The windscreen wiper does not work, it is impossible to activate intermittence, low/high speed and windscreen washer.	Interrupted supply line 6. If simultaneously active switches, a short circuit is possible between pin A24 (low speed), A29 (intermittence), A30 (high speed) and A9 (windscreen washer) for IBC.	Verify integrity of 10A fuse 15 (Supply line 6). Check wiring integrity between pins A24, A29, A30, A9 and control switch for windscreen wiper actuation speed selection.			
IBC	Engine brake mode selector	2211D	2	On the left Cluster part the IBC words are displayed, engine brake intervenes both upon accelerator pedal release and by pressing brake pedal.	Simultaneously active IBC inputs pins A15 and A5. Possible short circuit between them.	Verify wiring integrity between pin A15 and selector and between pin A5 and selector. Under static conditions between pin A15 and ground, and between pin A5 and ground a short circuit must be detected.			
	Rear transverse differential locking selector	2211E	2	Blocked rear differentials.	Simultaneously active IBC inputs pins A19 and A20. Possible short circuit to ground between them.	Verify wiring integrity between pin A19 and selector and between pin A20 and selector. Verify selector functionality.			
IBC	Front brake air pressure sensor	2211F	0	On the left Cluster part the IBC words are displayed, the front brake air pressure value is not displayed on Cluster.	Front air brake pressure included between 12 and 22 bars. The acquired input voltage on pin A21(Vout) divided by the supply voltage value (Vc) for front air pressure sensor is included between 0.6V and 1V.	1) Verify with key on stop, between IBC pin A2 and A3 (wiring side, or directly on sensor) a resistance equal to 4KOhm. 2) Check correct sensor supply (5V) provided by IBC unit between pins A2 and A3. 3) Verify wiring integrity between pin A21 and sensor.			
	Front brake air pressure sensor	2211F	1	On the left Cluster part the IBC words are displayed, the front brake air pressure value is not displayed on Cluster.	Front air brake pressure included between 0.5 and 6.5 bars. The acquired input voltage on pin A21(Vout) divided by the supply voltage value (Vc) for front air pressure sensor is included between 0.14V and 0.38V.	1) Verify with key on stop, between IBC pin A2 and A3 (wiring side, or directly on sensor) a resistance equal to 4KOhm. 2) Check correct sensor supply (5V) provided by IBC unit between pins A2 and A3. 3) Verify wiring integrity between pin A21 and sensor.			

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Text on Cluster	Component failure	DTC	FMI	Visible anomaly	Possible cause	Controls to be carried out	Measuring conditions	Values to be found	Notes
	Front brake air pressure sensor	2211F	3	On the left Cluster part the IBC words are displayed, the front brake air pressure value is not displayed on Cluster.	Front air brake pressure greater than 22 bars. The acquired input voltage on pin A21(Vout) divided by the supply voltage value (Vc) for front air pressure sensor is greater than 1 Volt. Short circuit between pins A21 and A2.	1) Verify with key on stop, between IBC pin A2 and A3 (wiring side, or directly on sensor) a resistance equal to 4KOhm. 2) Check correct sensor supply (5V) provided by IBC unit between pins A2 and A3. 3) Verify wiring integrity between pin A21 and sensor.			
	Front brake air pressure sensor	2211F	4	On the left Cluster part the IBC words are displayed, the front brake air pressure value is not displayed on Cluster.	Front air brake pressure lower than 0.5 bars. The acquired input voltage on pin A21 (Vout) divided by the supply voltage value (Vc) for front air pressure sensor is lower than 0.14 Volt. Short circuit to ground between pins A21 and A3.	1) Verify with key on stop, between IBC pin A2 and A3 (wiring side, or directly on sensor) a resistance equal to 4KOhm. 2) Check correct sensor supply (5V) provided by IBC unit between pins A2 and A3. 3) Verify wiring integrity between pin A21 and sensor.			
	Rear brake air pressure sensor	22120	0	On the left Cluster part the IBC words are displayed, the rear brake air pressure value is not displayed on Cluster.	Front air brake pressure included between 12 and 22 bars. The acquired input voltage on pin A13 (Vout) divided by the supply voltage value (Vc) for front air pressure sensor is included between 0.6 Volt and 1 Volt.	1) Verify with key on stop, between IBC pin A2 and A3 (wiring side, or directly on sensor) a resistance equal to 4KOhm. 2) Check correct sensor supply (5V) provided by IBC unit between pins A2 and A3. 3) Verify wiring integrity between pin A13 and sensor.			
	Rear brake air pressure sensor	22120	1	On the left Cluster part the IBC words are displayed, the rear brake air pressure value is not displayed on Cluster.	Front air brake pressure included between 0.5 and 6.5 bars. The acquired input voltage on pin A13 (Vout) divided by the supply voltage value (Vc) for front air pressure sensor is included between 0.14 Volt and 0.38 Volt.	1) Verify with key on stop, between IBC pin A2 and A3 (wiring side, or directly on sensor) a resistance equal to 4KOhm. 2) Check correct sensor supply (5V) provided by IBC unit between pins A2 and A3. 3) Verify wiring integrity between pin A13 and sensor.			

Text on Cluster	Component failure	DTC	FMI	Visible anomaly	Possible cause	Controls to be carried out	Measuring conditions	Values to be found	Notes
	Rear brake air pressure sensor	22120	3	On the left Cluster part the IBC words are displayed, the rear brake air pressure value is not displayed on Cluster.	Front air brake pressure greater than 22 bars. The acquired input voltage on pin A13 (Vout) divided by the supply voltage value (Vc) for front air pressure sensor is greater than 1 Volt. Short circuit between pins A13 and A2.	1) Verify with key on stop, between IBC pin A2 and A3 (wiring side, or directly on sensor) a resistance equal to 4KOhm. 2) Check correct sensor supply (5V) provided by IBC unit between pins A2 and A3. 3) Verify wiring integrity between pin A13 and sensor.			
	Rear brake air pressure sensor	22120	4	On the left Cluster part the IBC words are displayed, the rear brake air pressure value is not displayed on Cluster.	Front air brake pressure lower than 0.5 bars. The acquired input voltage on pin A13 (Vout) divided by the supply voltage value (Vc) for front air pressure sensor is greater than 0.14 Volt. Short circuit to ground between pins A13 and A3.	1) Verify with key on stop, between IBC pin A2 and A3 (wiring side, or directly on sensor) a resistance equal to 4KOhm. 2) Check correct sensor supply (5V) provided by IBC unit between pins A2 and A3. 3) Verify wiring integrity between pin A13 and sensor.			
IBC	Brake air pressure sensor supply	2212B	0	On the left Cluster part the IBC words are displayed, the front brake air pressure value is not displayed on Cluster.	The brake air pressure sensor supply voltage (Vc) output on IBC pin A2 is included between 6V and 8V. The error is detected only when the maximum voltage is included between 18V and 24V, and key on running (K15 ON).	Verify voltage between IBC pins A2 and A3. The measured value must be equal to 5V.			
IBC	Brake air pressure sensor supply	2212B	1	On the left Cluster part the IBC words are displayed, the front brake air pressure value is not displayed on Cluster.	The brake air pressure sensor supply voltage (Vc) output on IBC pin A2 is included between 2V and 4V. The error is detected only when the maximum voltage is included between 18V and 24V, and key on running (K15 ON).	Verify voltage between IBC pins A2 and A3. The measured value must be equal to 5V. Check wiring status between pin A2 and pressure sensor.			

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Text on Cluster	Component failure	DTC	FMI	Visible anomaly	Possible cause	Controls to be carried out	Measuring conditions	Values to be found	Notes
IBC	Brake air pressure sensor supply	2212B	3	On the left Cluster part the IBC words are displayed, the front brake air pressure value is not displayed on Cluster.	The brake air pressure sensor supply voltage (Vc) output on IBC pin A2 is greater than 8V. Possible short circuit to positive between pin A2 and +Vbatt. The error is detected only when the maximum voltage is included between 18V and 24V, and key on running (K15 ON).	Verify voltage between IBC pins A2 and A3. The measured value must be equal to 5V. Verify that no short circuits occur between pin A2 and +Vbatt.			
IBC	Brake air pressure sensor supply	2212B	4	On the left Cluster part the IBC words are displayed, the front brake air pressure value is not displayed on Cluster.	The brake air pressure sensor supply voltage (Vc) output on IBC pin A2 is lower than 2V. Possible short circuit to ground between IBC outputs pins A2 and A3. The error is detected only when the maximum voltage is included between 18V and 24V, and key on running (K15 ON).	1) Verify voltage between IBC pins A2 and A3. The measured value must be equal to 5V. Check that pins A2 and A3 are not mutually in short circuit.			
CAN	VDB CAN Line	2212C	2	The CAN text si displayed on Cluster.	On VDB CAN line no messages are transmitted, probable Vehicle Data Bus in OFF status. Open–circuited VDB CAN line both on tachograph and on EDC sides. The error CAN be diagnosed with Modus/IT2000 tool only after having carried out a VDB CAN line reset.	Verify VDB CAN line status, measuring between pins 21 (CANH) and 22 (CANL) with key on stop, a resistance value must be detected equal to 60 Ohm ±3%.			
		2212D	31		Not programmed IBC unit. After IBC ECU replacement, no programming has been carried out with Modus on new unit.	Verify with diagnostic tool (Modus/IT2000) upon unit data reading the presence of programming–pertaining data.			

Instrument Cluster (IC)

Text on Cluster	Component failure	DTC	FMI	Visible anomaly	Possible cause	Controls to be carried out	Measuring conditions	Values to be found	Notes
	Stepper motor	21704	12	Blocked speed and level indicator pointers on Cluster.	Failure or anomaly of stepper motor adjusting the pointers movement.	Try carrying out an after run by disconnecting Cluster 5A supply fuses (18 and 1) for 10 seconds. If pointers are still blocked, replace the Cluster.			
IC	Fuel level sensor	21705	3	The Cluster displays an ideogram for level indicator. The fuel level indicating pointer on Cluster is always fixed on reserve or maximum.	Open circuit or short circuit on fuel level sensor, the error is detected only if it is active for more than 4 seconds.	Verify wiring between Instrument Cluster and fuel level sensor. Verify continuity between pin 11 (fuel level indicator signal) and sensor, and between pin 12 (fuel level indicator ground) and sensor ground. Measuring directly only on sensor, a 210 Ohm resistance must be detected.			
	Oil level sensor	21706	0	Wrong oil level measure.	Voltage delta acquired as input to Cluster (pin A14) of oil level sensor, between first and second measures, is above the established range.	Verify sensor resistance: at the temperature of 20°C, the resistance must be equal to 13 Ohm. Check wiring integrity between sensor and Instrument Cluster (pins A14, A15).			
	Oil level sensor	21706	1	Wrong oil level measure.	Voltage delta acquired as input to Cluster (pin A14) of oil level sensor, between first and second measures, is above the established range.	Verify sensor resistance: at the temperature of 20°C, the resistance must be equal to 13 Ohm. Check wiring integrity between sensor and Instrument Cluster (pins A14, A15).			
	Oil level sensor	21706	3	Wrong oil level measure.	Voltage provided as output from Cluster (pin A15) to oil level sensor is above the established range. Cluster output pin A15 short–circuited to positive or open–circuited.	Verify sensor resistance: at the temperature of 20°C, the resistance must be equal to 13 Ohm. Check wiring integrity between sensor and Instrument Cluster (pins A14, A15).			
	Oil level sensor	21706	4	Wrong oil level measure.	Voltage provided as output from Cluster (pin A15) to oil level sensor is below the established range. Cluster output pin A15 short–circuited to ground.	Verify sensor resistance: at the temperature of 20°C, the resistance must be equal to 13 Ohm. Check wiring integrity between sensor and Instrument Cluster (pins A14, A15).			

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Text on Cluster	Component failure	DTC	FMI	Visible anomaly	Possible cause	Controls to be carried out	Measuring conditions	Values to be found	Notes
	Ambient temperature sensor	21707	3	The Cluster displays –40 as external temperature value, namely the minimum default value.	Cluster pin A10 input open–circuited or short–circuited to positive.	Verify sensor resistance: measuring between Cluster pins A10 and A9 (wiring side) a resistance must be detected that changes from 0.5 to 50 KOhm according to the temperature (NTC 0.5–50 KOhm, ±5% at the temperature of 25°C).			
	Ambient temperature sensor	21707	4	The Cluster displays an icon showing an analogue instrument. The external temperature value being read with the diagnostic instrument is equal to 80° (max. value).	Cluster pin A10 input short–circuited to signal/chassis ground.	Verify sensor resistance: measuring between Cluster pins A10 and A9 (wiring side) a resistance must be detected that changes from 0.5 to 50 KOhm according to the temperature (NTC 0.5–50 KOhm, ±5% at the temperature of 25°C).			
CAN	CAN line	2170C	2	On Cluster the CAN text remain on.	No message on CAN line Vehicle Data Bus, or Bus off. VDB CAN line H short–circuited to ground, or CAN H and CAN L lines mutually short–circuited.	Verify VDB CAN line status, measuring between pins 21 (CAN H) and 22 (CAN L) with key on stop, a resistance value must be detected equal to 60 Ohm ±3%. Check that 30–pole (diagnostic connector) pin 21 (CAN H) and ground are not mutually short–circuited.			
CAN		2170D	2	On Cluster the CAN text remains on.	The Cluster does not receive the CAN message from Iveco Body Controller 2 ECU (IBC), possible problem on VDB CAN line, information on IBC unit are not transmitted to Cluster.	Verify VDB CAN 1 line: 1) Measuring with key on stop, directly on IBC unit (connector C) between pin C11 (CAN L) and pin C12 (CAN H), a resistance value must be detected that is equal to 20 KOhm. 2) Measuring with key on stop, wiring side, between pin C11 (CAN L) and C12 (CAN H) of connector C, a resistance value must occur that is equal to 60 Ohm ±3%. 3) Verify that between 30–pole pins 21 (CAN H) and 22 (CAN L) there is an impedance value equal to 60 Ohm ± 3%, (measuring with key on stop and connected units).			

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Text on Cluster	Component failure	DTC	FMI	Visible anomaly	Possible cause	Controls to be carried out	Measuring conditions	Values to be found	Notes
CAN		2170E	2	It is impossible to start the engine (active dragging), on Cluster Immobilizer icon and CAN text remain on.	The Cluster does not receive the CAN message (EEC1) from EDC unit, dealing with engine information. Problem on VDB CAN line. Possible communication problem between EDC and IMMOBILIZER.	Verify VDB CAN 1 line: 1) Measuring with key on stop, directly on IBC unit (connector B) between pin 52 (CAN L) and pin 53 (CAN H), a resistance value must be detected that is equal to 120 Ohm. 2) Measuring with key on stop, wiring side, between pin 52 (CAN L) and 53 (CAN H) of connector B, a resistance value must occur that is equal to 120 Ohm (corresponding to internal tachograph resistance). 3) Verify that between 30–pole pins 21 (CAN H) and 22 (CAN L) there is an impedance value equal to 60 Ohm ± 3%, (measuring with key on stop and connected units).			
CAN		2170F	2	The tachograph remains off.	The Cluster does not receive the CAN message from tachograph (TCO). Possible problem on VDB CAN line, information about tachograph are not transmitted to Cluster.	Verify VDB CAN1 line: 1) Measuring with key on stop, directly on tachograph (white connector "A") between pin 8 (CAN L) and pin 4 (CAN H), a resistance value must be detected that is equal to 120 Ohm (internal tachograph resistance). 2) Measuring with key on stop, wiring side, between pins 8 (CAN L) and 4 (CAN H) of connector A, a resistance value must occur that is equal to 120 Ohm (corresponding to internal EDC resistance). 3) Verify that between 30–pole pins 21 (CAN H) and 22 (CAN L) there is an impedance value equal to 60 Ohm ± 3%, (measuring with key on stop and connected units). 4) Check integrity of 5A fuse 1, and 10A fuse 3.			

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Text on Cluster	Component failure	DTC	FMI	Visible anomaly	Possible cause	Controls to be carried out	Measuring conditions	Values to be found	Notes
CAN	ETC (Allison Gearbox)	21710	2		The Cluster does not receive the CAN message from electronic gearbox unit (ETC). Possible problem on VDB CAN line, information about gearbox are not transmitted to Cluster.	Verify VDB CAN1 line: 1) Verify that between 30–pole pins 21 (CAN H) and 22 (CAN L) there is an impedance value equal to 60 Ohm ± 3%, (measuring with key on stop and connected units).			
CAN	EBC (Braking System) ABS/EBS	21711	2		The Cluster does not receive the CAN message from electronic braking system unit (EBC). Possible problem on VDB CAN line, information about EBC ECU are not transmitted to Cluster.	Verify VDB CAN1 line: 1) Verify that between 30–pole pins 21 (CAN H) and 22 (CAN L) there is an impedance value equal to 60 Ohm ± 3%, (measuring with key on stop and connected units).			
CAN	ECAS	21712	2	On Cluster the CAN text remains on. Impossible suspension handling/leveling through cabin remote control.	The Cluster does not receive the CAN message from ECAS unit. VDB CAN line connector X1 pins 1 (CAN L) and 3 (CAN H) are open–circuited, information pertaining suspension unit (ECAS) are not transmitted to Cluster.	Check fuse 5 of assembly 70000/2 that supplies ECAS unit. Verify VDB CAN line by measuring between connector X1 pin 1 (CAN L) and pin 3 (CAN H) a resistance value that is equal to 60 Ohm ±3%. Verify that between 30–pole pins 21(CAN H) and 22(CAN L) there is an impedance value equal to 60 Ohm ± 3%, (measuring with key on stop and connected units).			
	DRIVELINE RETARDER	21713	2		The Cluster does not receive the CAN message from intarder unit. Possible problem on VDB CAN line, information about intarder ECU are not transmitted to Cluster.	Verify VDB CAN1 line: 1) Verify that between 30–pole pins 21 (CAN H) and 22 (CAN L) there is an impedance value equal to 60 Ohm ± 3%, (measuring with key on stop and connected units).			

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Text on Cluster	Component failure	DTC	FMI	Visible anomaly	Possible cause	Controls to be carried out	Measuring conditions	Values to be found	Notes
CAN	MIRROR CONTROLLER	21714	2	On the left Cluster part the CAN text remains on; it is impossible to activate heating and mirror handling.	The Cluster does not receive the CAN message from the MIRROR CONTROLLER unit, possible problem on VDB CAN line, lack of communication with mirror control unit.	Verify VDB CAN1 line (green sheath): 1) Measuring with key on stop, wiring side, between YELLOW connector pins 19 (CAN L) and 20 (CAN H) there must be a resistance value equal to 60 Ohm ±3%. 2) Verify that between 30–pole pins 21 (CAN H) and 22 (CAN L) there is an impedance value equal to 60 Ohm ± 3%, (measuring with key on stop and connected units). 3) Check integrity of 5A fuse 16.			
	EEPROM	21701	12		Faulty physical memory for Instrument Cluster unit. A CHECKSUM error is detected. Internal EEPROM error to IBC unit (EEPROM CHECKSUM), the error CAN occur in case the battery voltage is too low (ex. 9V), or in case the EEPROM is defective or faulty.	Verify vehicle battery supply. If there is an error in diagnosis instrument, carry out a failure deletion, if the error remains replace the IBC unit.			

“EDC 7” injection system

Component failure	DTC	FMI	Error type	Visible anomaly	Possible cause	Recommended repairs	Notes
	00	00			Insufficient fuel level in the tank.	Check the fuel level	The possible grade of smoke is due to the fact that, in case of insufficient fuel, the gearcase tries to compensate by extending the excitation time of the injectors; when the fuel arrives too much of it is used.
	00	00			Fuel suction pipe in the tank partially clogged due to impurities or distortion caused by overheating.	Check whether the priming pump on the prefilter works properly. If the pump knob remains sucked downwards because of the suction pressure, disassemble and check the tank suction pipe. If the suction pipe is all right, replace the prefilter.	In case some shavings have been sucked (due to works carried out by the producer on the fuel tank) perform an accurate cleaning of the tank. As a matter of fact the problem might occur again because of other shavings remained inside the tank.
	00	00			Air intake upstream of the fuel gear pump.	Check the O–Rings and the proper connection of the pipe unions between the tank and the fuel pump (fasteners must be out and unions well hooked).	
	00	00			Fuel leaks from the unions or low– pressure pipes downstream of the fuel pump.	Check the O–Rings and the proper connection of the pipe unions downstream of the fuel pump (fasteners must be out and unions well hooked). Check visually that the low–pressure pipes are not damaged.	Unless the leak is significant, no performance anomalies are detected To check that the O–Rings are all right, extract the fuel return piping from the tank, plug its end hermetically and operate the priming pump by pressurizing the low pressure circuit.

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Component failure	DTC	FMI	Error type	Visible anomaly	Possible cause	Recommended repairs	Notes
	00	00			Excessive fuel blow–by from rail overpressure valve.	Disconnect the fuel return piping and check visually if there is significant blow–by from the overpressure valve.	
	00	00			Signal from key to gearcase EDC cuts off.	Check the wiring.	
	00	00			Fuel filter clogged.	Replace the fuel filter.	Remove the cause of the filter clogging (empty and clean the tank and the part of hydraulic circuit upstream of the filter, perform a replenishment with clean fuel).
	00	00			Inefficient high–pressure pump.	Engine test with diagnostic instrument.	Replace the high–pressure pump after having excluded all the other possible causes.
	00	00			Injector with shutter or solenoid core (mechanical part) locked in open position.	Engine test with Modus–IWT–IT2000. In case of lack of diagnostic instruments, the injector not working is easily detectable feeling by hand the absence of pulsations in the relevant high pressure pipe.	
	00	00			Injector locks in open position (now and then).	In case of lack of diagnostic instruments, the injector not working is detectable feeling by hand the absence of pulsations in the relevant high pressure pipe.	

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Component failure	DTC	FMI	Error type	Visible anomaly	Possible cause	Recommended repairs	Notes
	00	00			Injector locked in open position (irreversibly).	In case of lack of diagnostic instruments, the injector not working is detectable feeling by hand the absence of pulsations in the relevant high pressure pipe.	Generally, in presence of these symptoms, it is instinctive to give up starting the engine. By keeping on trying, however, it is possible to start the vehicle in order to reach an Iveco workshop. By insisting the engine starts with one cylinder missing and little by little the grade of smoke decreases and it disappears.
	00	00			Injector locked in closed position.	In case of lack of diagnostic instruments, the injector not working is detectable feeling by hand the absence of pulsations in the relevant high pressure pipe.	
	00	00			Clutch switch: signal missing.	Operate the clutch by fully pressing the pedal and reading the status parameters by means of the diagnostic instrument on Modus. If the switch is all right and well adjusted, check wiring, connections and correct assembly of the switch.	If there is no pressed clutch signal, the gearcase doesn't detect it because it regards this condition as normal. By pressing the clutch pedal with Cruise Control/Power takeoff engaged, the engine reaches the peak rpm because it tries to compensate the lower engine load in order to keep constant the speed previously set.

Component failure	DTC	FMI	Error type	Visible anomaly	Possible cause	Recommended repairs	Notes
	00	00			Significant fuel blow–by inside the cylinder head from one or more high pressure pipes and almost total absence of pressure in the rail.	After having excluded all the other system electrical/electronic anomalies, disconnect (from the filter support) the injector blow–by return piping, put its end in a transparent container and try starting. If the fuel flow in the injector return is significantly much higher than the normal one, and at the same time the parameter reading displays the lack of pressurization of the rail, replace the damaged high pressure pipe.	This problem might be due to the lack of replacement of a pipe after disassembling, or to a wrong assembly of the pipe that have damaged its sealing end on the injector. After having positioned a new pipe in its seat (with the injector fastening screws loosen), it is necessary to progressively and alternatively tighten to the prescribed torque the injector screws and the pipe ring nut, making sure to ease the correct mating of the pipe end with the fuel arrival seat in the injector.
SENSORS – ATMOSPHERIC PRESSURE	01	00	NO AVAILABLE SYMPTOM	No reaction noticeable on behalf of the driver.	Environment pressure sensor short–circuited or open–circuited.	Reading of measurable parameters by means of the diagnostic instrument: in presence of this error, the supercharging air pressure will be fixed at 970 mbar Contact the Help Desk and follow the instructions for the possible replacement of the gearcase.	EDC pilot light off. The sensor is incorporated in the EDC gearcase and it is not individually replaceable. The possible painting of engine/gearcase may compromise the correct detection of the environment pressure.

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Component failure	DTC	FMI	Error type	Visible anomaly	Possible cause	Recommended repairs	Notes
SENSORS – ATMOSPHERIC PRESSURE	01	01	SHORT CIRCUIT TO POSITIVE	No reaction noticeable on behalf of the driver.	Environment pressure sensor short–circuited or open–circuited.	Reading of measurable parameters by means of the diagnostic instrument: in presence of this error, the supercharging air pressure will be fixed at 970 mbar Contact the Help Desk and follow the instructions for the possible replacement of the gearcase.	EDC pilot light off. The sensor is incorporated in the EDC gearcase and it is not individually replaceable. The possible painting of engine/gearcase may compromise the correct detection of the environment pressure.
SENSORS – ATMOSPHERIC PRESSURE	01	02	OPEN CIRCUIT OR SHORT CIRCUIT TO GROUND	No reaction noticeable on behalf of the driver.	Environment pressure sensor short–circuited or open–circuited.	Reading of measurable parameters by means of the diagnostic instrument: in presence of this error, the supercharging air pressure will be fixed at 970 mbar Contact the Help Desk and follow the instructions for the possible replacement of the gearcase.	EDC pilot light off. The sensor is incorporated in the EDC gearcase and it is not individually replaceable. The possible painting of engine/gearcase may compromise the correct detection of the environment pressure.
SENSORS – ATMOSPHERIC PRESSURE	01	03	NO SIGNAL	No reaction noticeable on behalf of the driver.	Environment pressure sensor short–circuited or open–circuited.	Reading of measurable parameters by means of the diagnostic instrument: in presence of this error, the supercharging air pressure will be fixed at 970 mbar Contact the Help Desk and follow the instructions for the possible replacement of the gearcase.	EDC pilot light off. The sensor is incorporated in the EDC gearcase and it is not individually replaceable. The possible painting of engine/gearcase may compromise the correct detection of the environment pressure.
SENSORS – ATMOSPHERIC PRESSURE	01	04	SIGNAL NOT PLAUSIBLE	No reaction noticeable on behalf of the driver.	Environment pressure sensor short–circuited or open–circuited.	Reading of measurable parameters by means of the diagnostic instrument: in presence of this error, the supercharging air pressure will be fixed at 970 mbar Contact the Help Desk and follow the instructions for the possible replacement of the gearcase.	EDC pilot light off. The sensor is incorporated in the EDC gearcase and it is not individually replaceable. The possible painting of engine/gearcase may compromise the correct detection of the environment pressure.

Component failure	DTC	FMI	Error type	Visible anomaly	Possible cause	Recommended repairs	Notes
SENSORS – ATMOSPHERIC PRESSURE	01	05	SUPPLY OVER THE NORMAL RANGE	No reaction noticeable on behalf of the driver.	Environment pressure sensor short–circuited or open–circuited.	Reading of measurable parameters by means of the diagnostic instrument: in presence of this error, the supercharging air pressure will be fixed at 970 mbar Contact the Help Desk and follow the instructions for the possible replacement of the gearcase.	EDC pilot light off. The sensor is incorporated in the EDC gearcase and it is not individually replaceable. The possible painting of engine/gearcase may compromise the correct detection of the environment pressure.
SENSORS – ATMOSPHERIC PRESSURE	01	06	SUPPLY BELOW THE RANGE	No reaction noticeable on behalf of the driver.	Environment pressure sensor short–circuited or open–circuited.	Reading of measurable parameters by means of the diagnostic instrument: in presence of this error, the supercharging air pressure will be fixed at 970 mbar Contact the Help Desk and follow the instructions for the possible replacement of the gearcase.	EDC pilot light off. The sensor is incorporated in the EDC gearcase and it is not individually replaceable. The possible painting of engine/gearcase may compromise the correct detection of the environment pressure.
SENSORS – ATMOSPHERIC PRESSURE	01	07	VALUE OVER THE NORMAL LIMIT	No reaction noticeable on behalf of the driver.	Environment pressure sensor short–circuited or open–circuited.	Reading of measurable parameters by means of the diagnostic instrument: in presence of this error, the supercharging air pressure will be fixed at 970 mbar Contact the Help Desk and follow the instructions for the possible replacement of the gearcase.	EDC pilot light off. The sensor is incorporated in the EDC gearcase and it is not individually replaceable. The possible painting of engine/gearcase may compromise the correct detection of the environment pressure.
SENSORS – ATMOSPHERIC PRESSURE	01	08	VALUE BELOW THE LIMIT	No reaction noticeable on behalf of the driver.	Environment pressure sensor short–circuited or open–circuited.	Reading of measurable parameters by means of the diagnostic instrument: in presence of this error, the supercharging air pressure will be fixed at 970 mbar Contact the Help Desk and follow the instructions for the possible replacement of the gearcase.	EDC pilot light off. The sensor is incorporated in the EDC gearcase and it is not individually replaceable. The possible painting of engine/gearcase may compromise the correct detection of the environment pressure.

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Component failure	DTC	FMI	Error type	Visible anomaly	Possible cause	Recommended repairs	Notes
SENSORS – COOLANT TEMPERATURE	02	00	NO AVAILABLE SYMPTOM	Indication on the water temperature instrument fixed at limit stop and pilot light lighted up.	Positively short–circuited, ground–short–circuited or open–circuited water tem?perature sensor	Reading of measurable parameters: in presence of this error, the water temperature read on the gearcase will be the same of the engine oil one. Check by means of a multimeter that the sensor is all right (R = approx. 2,5 kOhm at 20 °C) between pins 1 and 2 of sensor itself. If the sensor is not damaged, check the wiring between the sensor connector (wiring side) pin 1 and connector EDC pin C18, between sensor connector (wiring side) pin 2 and connector EDC pin C36.	EDC pilot light on.
SENSORS – COOLANT TEMPERATURE	02	01	SHORT CIRCUIT TO POSITIVE	Indication on the water temperature instrument fixed at limit stop and pilot light lighted up.	Positively short–circuited, ground–short–circuited or open–circuited water tem?perature sensor	Reading of measurable parameters: in presence of this error, the water temperature read on the gearcase will be the same of the engine oil one. Check by means of a multimeter that the sensor is all right (R = approx. 2,5 kOhm at 20 °C) between pins 1 and 2 of sensor itself. If the sensor is not damaged, check the wiring between the sensor connector (wiring side) pin 1 and connector EDC pin C18, between sensor connector (wiring side) pin 2 and connector EDC pin C36.	EDC pilot light on.

Component failure	DTC	FMI	Error type	Visible anomaly	Possible cause	Recommended repairs	Notes
SENSORS – COOLANT TEMPERATURE	02	02	OPEN CIRCUIT OR SHORT CIRCUIT TO GROUND	Indication on the water temperature instrument fixed at limit stop and pilot light lighted up.	Positively short–circuited, ground–short–circuited or open–circuited water tem?perature sensor	Reading of measurable parameters: in presence of this error, the water temperature read on the gearcase will be the same of the engine oil one. Check by means of a multimeter that the sensor is all right (R = approx. 2,5 kOhm at 20 °C) between pins 1 and 2 of sensor itself. If the sensor is not damaged, check the wiring between the sensor connector (wiring side) pin 1 and connector EDC pin C18, between sensor connector (wiring side) pin 2 and connector EDC pin C36.	EDC pilot light on.
SENSORS – COOLANT TEMPERATURE	02	03	NO SIGNAL	Indication on the water temperature instrument fixed at limit stop and pilot light lighted up.	Positively short–circuited, ground–short–circuited or open–circuited water tem?perature sensor	Reading of measurable parameters: in presence of this error, the water temperature read on the gearcase will be the same of the engine oil one. Check by means of a multimeter that the sensor is all right (R = approx. 2,5 kOhm at 20 °C) between pins 1 and 2 of sensor itself. If the sensor is not damaged, check the wiring between the sensor connector (wiring side) pin 1 and connector EDC pin C18, between sensor connector (wiring side) pin 2 and connector EDC pin C36.	EDC pilot light on.

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Component failure	DTC	FMI	Error type	Visible anomaly	Possible cause	Recommended repairs	Notes
SENSORS – COOLANT TEMPERATURE	02	04	SIGNAL NOT PLAUSIBLE	Indication on the water temperature instrument fixed at limit stop and pilot light lighted up.	Positively short–circuited, ground–short–circuited or open–circuited water tem?perature sensor	Reading of measurable parameters: in presence of this error, the water temperature read on the gearcase will be the same of the engine oil one. Check by means of a multimeter that the sensor is all right (R = approx. 2,5 kOhm at 20 °C) between pins 1 and 2 of sensor itself. If the sensor is not damaged, check the wiring between the sensor connector (wiring side) pin 1 and connector EDC pin C18, between sensor connector (wiring side) pin 2 and connector EDC pin C36.	EDC pilot light on.
SENSORS – COOLANT TEMPERATURE	02	05	SUPPLY OVER THE NORMAL RANGE	Indication on the water temperature instrument fixed at limit stop and pilot light lighted up.	Positively short–circuited, ground–short–circuited or open–circuited water tem?perature sensor	Reading of measurable parameters: in presence of this error, the water temperature read on the gearcase will be the same of the engine oil one. Check by means of a multimeter that the sensor is all right (R = approx. 2,5 kOhm at 20 °C) between pins 1 and 2 of sensor itself. If the sensor is not damaged, check the wiring between the sensor connector (wiring side) pin 1 and connector EDC pin C18, between sensor connector (wiring side) pin 2 and connector EDC pin C36.	EDC pilot light on.

Component failure	DTC	FMI	Error type	Visible anomaly	Possible cause	Recommended repairs	Notes
SENSORS – COOLANT TEMPERATURE	02	06	SUPPLY BELOW THE RANGE	Indication on the water temperature instrument fixed at limit stop and pilot light lighted up.	Positively short–circuited, ground–short–circuited or open–circuited water tem?perature sensor	Reading of measurable parameters: in presence of this error, the water temperature read on the gearcase will be the same of the engine oil one. Check by means of a multimeter that the sensor is all right (R = approx. 2,5 kOhm at 20 °C) between pins 1 and 2 of sensor itself. If the sensor is not damaged, check the wiring between the sensor connector (wiring side) pin 1 and connector EDC pin C18, between sensor connector (wiring side) pin 2 and connector EDC pin C36.	EDC pilot light on.
SENSORS – COOLANT TEMPERATURE	02	07	VALUE OVER THE NORMAL LIMIT	Indication on the water temperature instrument fixed at limit stop and pilot light lighted up.	Positively short–circuited, ground–short–circuited or open–circuited water tem?perature sensor	Reading of measurable parameters: in presence of this error, the water temperature read on the gearcase will be the same of the engine oil one. Check by means of a multimeter that the sensor is all right (R = approx. 2,5 kOhm at 20 °C) between pins 1 and 2 of sensor itself. If the sensor is not damaged, check the wiring between the sensor connector (wiring side) pin 1 and connector EDC pin C18, between sensor connector (wiring side) pin 2 and connector EDC pin C36.	EDC pilot light on.

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Component failure	DTC	FMI	Error type	Visible anomaly	Possible cause	Recommended repairs	Notes
SENSORS – ACCELERATOR PEDAL	03	00	NO AVAILABLE SYMPTOM	Power reduction With the accelerator pedal at rest, the engine runs at accelerated idling (approx. 1100 rpm.) Pressing the pedal, the engine progressively and uncontrollably increases the rpm up to approx 2600 rpm.	Accelerator pedal potentiometer short–circuited.	Reading of measurable parameters using the diagnostic instrument to verify the potentiometer malfunctioning (the signal doesn't vary from 0% to 100%). Check by means of a multimeter that the potentiometer is all right (Total R. = approx. 1 kOhm) between pins 2 and 3 of pedal connector (component side), check the linear resistance variance of the potentiometer between pins 1–3 and 2–3 between the idling and the peak If the potentiometer is all right check the wiring between the pedal connector (wiring side) pin 1 and connector EDC pin B83 passing through sleeve B pin 36, between pedal connector (wiring side) pin 2 and connector EDC pin B55 passing through sleeve B pin 35, between pedal connector (wiring side) pin 3 and connector EDC pin B81 passing through sleeve B pin 34.	EDC pilot light on.

Component failure	DTC	FMI	Error type	Visible anomaly	Possible cause	Recommended repairs	Notes
SENSORS – ACCELERATOR PEDAL	03	00	NO AVAILABLE SYMPTOM	a)idling accelerated at approx. 1100 rpm in idling position and standard acceleration when the pedal is pressed. b)standard idling but revolution and power reduction when accelerating.	Accelerator pedal: not plausible signal between idling switch and potentiometer	Reading of parameters by means of the diagnostic instrument to determine the faulty part of the accelerator (potentiometer or idling switch). a)check on the component that the idling switch is not damaged by means of the multimeter (ON–OFF switchover between pins 4 and 5 of pedal connector, component side). In case the switch is not damaged, research of the switch on wiring between pedal connector (wiring side) pin 4 and connector EDC pin B50 passingh through sleeve B pin 33, between pedal connector (wiring side) pin 5 and connector EDC pin B73 passing through sleeve B pin 32. b)By means of multimeter check directly on the component that the potentiometer is not damaged. In case the potentiometer is not damaged, check wiring between pedal connector and connector EDC.	EDC pilot light on. a) the potentiometer signal is valid and it shows that the pedal is released, but the state of the switch shows that the pedal is pressed b) the switch signal is valid and it shows that the pedal is released, but the potentiometer signal shows that the pedal is pressed.
SENSORS – ACCELERATOR PEDAL	03	00	NO AVAILABLE SYMPTOM	Power reduction Accelerated idling at approx. 1100 rpm in any pedal position.	No accelerator potentiometer signal (possible open circuit).	Check by means of a multimeter directly on the component that the potentiometer is all right (Total R. = approx. 1 kOhm) between pins 2 and 3 of connector (component side). If the potentiometer is all right, check the wiring between pedal connector and connector EDC.	EDC pilot light on.

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Component failure	DTC	FMI	Error type	Visible anomaly	Possible cause	Recommended repairs	Notes
SENSORS – FUEL TEMPERATURE	03	00	NO AVAILABLE SYMPTOM	No reaction noticeable on behalf of the driver.	Positively short–circuited, ground–short–circuited or open–circuited fuel temperature sensor	Reading of measurable parameters: in presence of this error, the fuel temperature will be fixed at 20 °C Check the sensor is all right (R = approx. 2,5 kOhm at 20 °C) If the sensor is not damaged, check the wiring between the sensor connector (wiring side) pin 1 and connector EDC pin C17, between sensor connector (wiring side) pin 2 and connector EDC pin C34.	EDC pilot light off
SENSORS – ACCELERATOR PEDAL	03	01	SHORT CIRCUIT TO POSITIVE	Power reduction With the accelerator pedal at rest, the engine runs at accelerated idling (approx. 1100 rpm.) Pressing the pedal, the engine progressively and uncontrollably increases the rpm up to approx 2600 rpm.	Accelerator pedal potentiometer short–circuited.	Reading of measurable parameters using the diagnostic instrument to verify the potentiometer malfunctioning (the signal doesn't vary from 0% to 100%). Check by means of a multimeter that the potentiometer is all right (Total R. = approx. 1 kOhm) between pins 2 and 3 of pedal connector (component side), check the linear resistance variance of the potentiometer between pins 1–3 and 2–3 between the idling and the peak If the potentiometer is all right check the wiring between the pedal connector (wiring side) pin 1 and connector EDC pin B83 passing through sleeve B pin 36, between pedal connector (wiring side) pin 2 and connector EDC pin B55 passing through sleeve B pin 35, between pedal connector (wiring side) pin 3 and connector EDC pin B81 passing through sleeve B pin 34.	EDC pilot light on.

Component failure	DTC	FMI	Error type	Visible anomaly	Possible cause	Recommended repairs	Notes
SENSORS – ACCELERATOR PEDAL	03	01	SHORT CIRCUIT TO POSITIVE	a)idling accelerated at approx. 1100 rpm in idling position and standard acceleration when the pedal is pressed. b)standard idling but revolution and power reduction when accelerating.	Accelerator pedal: not plausible signal between idling switch and potentiometer	Reading of parameters by means of the diagnostic instrument to determine the faulty part of the accelerator (potentiometer or idling switch). a)check on the component that the idling switch is not damaged by means of the multimeter (ON–OFF switchover between pins 4 and 5 of pedal connector, component side). In case the switch is not damaged, research of the switch on wiring between pedal connector (wiring side) pin 4 and connector EDC pin B50 passingh through sleeve B pin 33, between pedal connector (wiring side) pin 5 and connector EDC pin B73 passing through sleeve B pin 32. b)By means of multimeter check directly on the component that the potentiometer is not damaged. In case the potentiometer is not damaged, check wiring between pedal connector and connector EDC.	EDC pilot light on. a) the potentiometer signal is valid and it shows that the pedal is released, but the state of the switch shows that the pedal is pressed b) the switch signal is valid and it shows that the pedal is released, but the potentiometer signal shows that the pedal is pressed.
SENSORS – ACCELERATOR PEDAL	03	01	SHORT CIRCUIT TO POSITIVE	Power reduction Accelerated idling at approx. 1100 rpm in any pedal position.	No accelerator potentiometer signal (possible open circuit).	Check by means of a multimeter directly on the component that the potentiometer is all right (Total R. = approx. 1 kOhm) between pins 2 and 3 of connector (component side). If the potentiometer is all right, check the wiring between pedal connector and connector EDC.	EDC pilot light on.

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Component failure	DTC	FMI	Error type	Visible anomaly	Possible cause	Recommended repairs	Notes
SENSORS – FUEL TEMPERATURE	03	01	SHORT CIRCUIT TO POSITIVE	No reaction noticeable on behalf of the driver.	Positively short–circuited, ground–short–circuited or open–circuited fuel temperature sensor	Reading of measurable parameters: in presence of this error, the fuel temperature will be fixed at 20 5C Check the sensor is all right (R = approx. 2,5 kOhm at 20 5C) If the sensor is not damaged, check the wiring between the sensor connector (wiring side) pin 1 and connector EDC pin C17, between sensor connector (wiring side) pin 2 and connector EDC pin C34.	EDC pilot light off
SENSORS – ACCELERATOR PEDAL	03	02	OPEN CIRCUIT OR SHORT CIRCUIT TO GROUND	Power reduction With the accelerator pedal at rest, the engine runs at accelerated idling (approx. 1100 rpm.) Pressing the pedal, the engine progressively and uncontrollably increases the rpm up to approx 2600 rpm.	Accelerator pedal potentiometer short–circuited.	Reading of measurable parameters using the diagnostic instrument to verify the potentiometer malfunctioning (the signal doesn't vary from 0% to 100%). Check by means of a multimeter that the potentiometer is all right (Total R. = approx. 1 kOhm) between pins 2 and 3 of pedal connector (component side), check the linear resistance variance of the potentiometer between pins 1–3 and 2–3 between the idling and the peak If the potentiometer is all right check the wiring between the pedal connector (wiring side) pin 1 and connector EDC pin B83 passing through sleeve B pin 36, between pedal connector (wiring side) pin 2 and connector EDC pin B55 passing through sleeve B pin 35, between pedal connector (wiring side) pin 3 and connector EDC pin B81 passing through sleeve B pin 34.	EDC pilot light on.

Component failure	DTC	FMI	Error type	Visible anomaly	Possible cause	Recommended repairs	Notes
SENSORS – ACCELERATOR PEDAL	03	02	OPEN CIRCUIT OR SHORT CIRCUIT TO GROUND	a)idling accelerated at approx. 1100 rpm in idling position and standard acceleration when the pedal is pressed. b)standard idling but revolution and power reduction when accelerating.	Accelerator pedal: not plausible signal between idling switch and potentiometer	Reading of parameters by means of the diagnostic instrument to determine the faulty part of the accelerator (potentiometer or idling switch). a)check on the component that the idling switch is not damaged by means of the multimeter (ON–OFF switchover between pins 4 and 5 of pedal connector, component side). In case the switch is not damaged, research of the switch on wiring between pedal connector (wiring side) pin 4 and connector EDC pin B50 passingh through sleeve B pin 33, between pedal connector (wiring side) pin 5 and connector EDC pin B73 passing through sleeve B pin 32. b)By means of multimeter check directly on the component that the potentiometer is not damaged. In case the potentiometer is not damaged, check wiring between pedal connector and connector EDC.	EDC pilot light on. a) the potentiometer signal is valid and it shows that the pedal is released, but the state of the switch shows that the pedal is pressed b) the switch signal is valid and it shows that the pedal is released, but the potentiometer signal shows that the pedal is pressed.
SENSORS – ACCELERATOR PEDAL	03	02	OPEN CIRCUIT OR SHORT CIRCUIT TO GROUND	Power reduction Accelerated idling at approx. 1100 rpm in any pedal position.	No accelerator potentiometer signal (possible open circuit).	Check by means of a multimeter directly on the component that the potentiometer is all right (Total R. = approx. 1 kOhm) between pins 2 and 3 of connector (component side). If the potentiometer is all right, check the wiring between pedal connector and connector EDC.	EDC pilot light on.

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Component failure	DTC	FMI	Error type	Visible anomaly	Possible cause	Recommended repairs	Notes
SENSORS – FUEL TEMPERATURE	03	02	OPEN CIRCUIT OR SHORT CIRCUIT TO GROUND	No reaction noticeable on behalf of the driver.	Positively short–circuited, ground–short–circuited or open–circuited fuel temperature sensor	Reading of measurable parameters: in presence of this error, the fuel temperature will be fixed at 20 °C Check the sensor is all right (R = approx. 2,5 kOhm at 20 °C) If the sensor is not damaged, check the wiring between the sensor connector (wiring side) pin 1 and connector EDC pin C17, between sensor connector (wiring side) pin 2 and connector EDC pin C34.	EDC pilot light off
SENSORS – ACCELERATOR PEDAL	03	03	NO SIGNAL	a)idling accelerated at approx. 1100 rpm in idling position and standard acceleration when the pedal is pressed. b)standard idling but revolution and power reduction when accelerating.	Accelerator pedal: not plausible signal between idling switch and potentiometer	Reading of parameters by means of the diagnostic instrument to determine the faulty part of the accelerator (potentiometer or idling switch). a)check on the component that the idling switch is not damaged by means of the multimeter (ON–OFF switchover between pins 4 and 5 of pedal connector, component side). In case the switch is not damaged, research of the switch on wiring between pedal connector (wiring side) pin 4 and connector EDC pin B50 passingh through sleeve B pin 33, between pedal connector (wiring side) pin 5 and connector EDC pin B73 passing through sleeve B pin 32. b)By means of multimeter check directly on the component that the potentiometer is not damaged. In case the potentiometer is not damaged, check wiring between pedal connector and connector EDC.	EDC pilot light on. a) the potentiometer signal is valid and it shows that the pedal is released, but the state of the switch shows that the pedal is pressed b) the switch signal is valid and it shows that the pedal is released, but the potentiometer signal shows that the pedal is pressed.

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Component failure	DTC	FMI	Error type	Visible anomaly	Possible cause	Recommended repairs	Notes
SENSORS – ACCELERATOR PEDAL	03	03	NO SIGNAL	Power reduction Accelerated idling at approx. 1100 rpm in any pedal position.	No accelerator potentiometer signal (possible open circuit).	Check by means of a multimeter directly on the component that the potentiometer is all right (Total R. = approx. 1 kOhm) between pins 2 and 3 of connector (component side). If the potentiometer is all right, check the wiring between pedal connector and connector EDC.	EDC pilot light on.
SENSORS – ACCELERATOR PEDAL	03	03	NO SIGNAL	Power reduction With the accelerator pedal at rest, the engine runs at accelerated idling (approx. 1100 rpm.) Pressing the pedal, the engine progressively and uncontrollably increases the rpm up to approx 2600 rpm.	Accelerator pedal potentiometer short–circuited.	Reading of measurable parameters using the diagnostic instrument to verify the potentiometer malfunctioning (the signal doesn't vary from 0% to 100%). Check by means of a multimeter that the potentiometer is all right (Total R. = approx. 1 kOhm) between pins 2 and 3 of pedal connector (component side), check the linear resistance variance of the potentiometer between pins 1–3 and 2–3 between the idling and the peak If the potentiometer is all right check the wiring between the pedal connector (wiring side) pin 1 and connector EDC pin B83 passing through sleeve B pin 36, between pedal connector (wiring side) pin 2 and connector EDC pin B55 passing through sleeve B pin 35, between pedal connector (wiring side) pin 3 and connector EDC pin B81 passing through sleeve B pin 34.	EDC pilot light on.

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Component failure	DTC	FMI	Error type	Visible anomaly	Possible cause	Recommended repairs	Notes
SENSORS – FUEL TEMPERATURE	03	03	NO SIGNAL	No reaction noticeable on behalf of the driver.	Positively short–circuited, ground–short–circuited or open–circuited fuel temperature sensor	Reading of measurable parameters: in presence of this error, the fuel temperature will be fixed at 20 °C Check the sensor is all right (R = approx. 2,5 kOhm at 20 °C) If the sensor is not damaged, check the wiring between the sensor connector (wiring side) pin 1 and connector EDC pin C17, between sensor connector (wiring side) pin 2 and connector EDC pin C34.	EDC pilot light off
SENSORS – ACCELERATOR PEDAL	03	04	SIGNAL NOT PLAUSIBLE	a)idling accelerated at approx. 1100 rpm in idling position and standard acceleration when the pedal is pressed. b)standard idling but revolution and power reduction when accelerating.	Accelerator pedal: not plausible signal between idling switch and potentiometer	Reading of parameters by means of the diagnostic instrument to determine the faulty part of the accelerator (potentiometer or idling switch). a)check on the component that the idling switch is not damaged by means of the multimeter (ON–OFF switchover between pins 4 and 5 of pedal connector, component side). In case the switch is not damaged, research of the switch on wiring between pedal connector (wiring side) pin 4 and connector EDC pin B50 passingh through sleeve B pin 33, between pedal connector (wiring side) pin 5 and connector EDC pin B73 passing through sleeve B pin 32. b)By means of multimeter check directly on the component that the potentiometer is not damaged. In case the potentiometer is not damaged, check wiring between pedal connector and connector EDC.	EDC pilot light on. a) the potentiometer signal is valid and it shows that the pedal is released, but the state of the switch shows that the pedal is pressed b) the switch signal is valid and it shows that the pedal is released, but the potentiometer signal shows that the pedal is pressed.

Component failure	DTC	FMI	Error type	Visible anomaly	Possible cause	Recommended repairs	Notes
SENSORS – ACCELERATOR PEDAL	03	04	SIGNAL NOT PLAUSIBLE	Power reduction Accelerated idling at approx. 1100 rpm in any pedal position.	No accelerator potentiometer signal (possible open circuit).	Check by means of a multimeter directly on the component that the potentiometer is all right (Total R. = approx. 1 kOhm) between pins 2 and 3 of connector (component side). If the potentiometer is all right, check the wiring between pedal connector and connector EDC.	EDC pilot light on.
SENSORS – ACCELERATOR PEDAL	03	04	SIGNAL NOT PLAUSIBLE	Power reduction With the accelerator pedal at rest, the engine runs at accelerated idling (approx. 1100 rpm.) Pressing the pedal, the engine progressively and uncontrollably increases the rpm up to approx 2600 rpm.	Accelerator pedal potentiometer short–circuited.	Reading of measurable parameters using the diagnostic instrument to verify the potentiometer malfunctioning (the signal doesn't vary from 0% to 100%). Check by means of a multimeter that the potentiometer is all right (Total R. = approx. 1 kOhm) between pins 2 and 3 of pedal connector (component side), check the linear resistance variance of the potentiometer between pins 1–3 and 2–3 between the idling and the peak If the potentiometer is all right check the wiring between the pedal connector (wiring side) pin 1 and connector EDC pin B83 passing through sleeve B pin 36, between pedal connector (wiring side) pin 2 and connector EDC pin B55 passing through sleeve B pin 35, between pedal connector (wiring side) pin 3 and connector EDC pin B81 passing through sleeve B pin 34.	EDC pilot light on.

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Component failure	DTC	FMI	Error type	Visible anomaly	Possible cause	Recommended repairs	Notes
SENSORS – ACCELERATOR PEDAL	03	05	SUPPLY OVER THE NORMAL RANGE	Power reduction With the accelerator pedal at rest, the engine runs at accelerated idling (approx. 1100 rpm.) Pressing the pedal, the engine progressively and uncontrollably increases the rpm up to approx 2600 rpm.	Accelerator pedal potentiometer short–circuited.	Reading of measurable parameters using the diagnostic instrument to verify the potentiometer malfunctioning (the signal doesn't vary from 0% to 100%). Check by means of a multimeter that the potentiometer is all right (Total R. = approx. 1 kOhm) between pins 2 and 3 of pedal connector (component side), check the linear resistance variance of the potentiometer between pins 1–3 and 2–3 between the idling and the peak If the potentiometer is all right check the wiring between the pedal connector (wiring side) pin 1 and connector EDC pin B83 passing through sleeve B pin 36, between pedal connector (wiring side) pin 2 and connector EDC pin B55 passing through sleeve B pin 35, between pedal connector (wiring side) pin 3 and connector EDC pin B81 passing through sleeve B pin 34.	EDC pilot light on.

Component failure	DTC	FMI	Error type	Visible anomaly	Possible cause	Recommended repairs	Notes
SENSORS – ACCELERATOR PEDAL	03	05	SUPPLY OVER THE NORMAL RANGE	a)idling accelerated at approx. 1100 rpm in idling position and standard acceleration when the pedal is pressed. b)standard idling but revolution and power reduction when accelerating.	Accelerator pedal: not plausible signal between idling switch and potentiometer	Reading of parameters by means of the diagnostic instrument to determine the faulty part of the accelerator (potentiometer or idling switch). a)check on the component that the idling switch is not damaged by means of the multimeter (ON–OFF switchover between pins 4 and 5 of pedal connector, component side). In case the switch is not damaged, research of the switch on wiring between pedal connector (wiring side) pin 4 and connector EDC pin B50 passingh through sleeve B pin 33, between pedal connector (wiring side) pin 5 and connector EDC pin B73 passing through sleeve B pin 32. b)By means of multimeter check directly on the component that the potentiometer is not damaged. In case the potentiometer is not damaged, check wiring between pedal connector and connector EDC.	EDC pilot light on. a) the potentiometer signal is valid and it shows that the pedal is released, but the state of the switch shows that the pedal is pressed b) the switch signal is valid and it shows that the pedal is released, but the potentiometer signal shows that the pedal is pressed.
SENSORS – ACCELERATOR PEDAL	03	05	SUPPLY OVER THE NORMAL RANGE	Power reduction Accelerated idling at approx. 1100 rpm in any pedal position.	No accelerator potentiometer signal (possible open circuit).	Check by means of a multimeter directly on the component that the potentiometer is all right (Total R. = approx. 1 kOhm) between pins 2 and 3 of connector (component side). If the potentiometer is all right, check the wiring between pedal connector and connector EDC.	EDC pilot light on.

Component failure	DTC	FMI	Error type	Visible anomaly	Possible cause	Recommended repairs	Notes
SENSORS – ACCELERATOR PEDAL	03	06	SUPPLY BELOW THE RANGE	Power reduction With the accelerator pedal at rest, the engine runs at accelerated idling (approx. 1100 rpm.) Pressing the pedal, the engine progressively and uncontrollably increases the rpm up to approx 2600 rpm.	Accelerator pedal potentiometer short–circuited.	Reading of measurable parameters using the diagnostic instrument to verify the potentiometer malfunctioning (the signal doesn't vary from 0% to 100%). Check by means of a multimeter that the potentiometer is all right (Total R. = approx. 1 kOhm) between pins 2 and 3 of pedal connector (component side), check the linear resistance variance of the potentiometer between pins 1–3 and 2–3 between the idling and the peak If the potentiometer is all right check the wiring between the pedal connector (wiring side) pin 1 and connector EDC pin B83 passing through sleeve B pin 36, between pedal connector (wiring side) pin 2 and connector EDC pin B55 passing through sleeve B pin 35, between pedal connector (wiring side) pin 3 and connector EDC pin B81 passing through sleeve B pin 34.	EDC pilot light on.

Component failure	DTC	FMI	Error type	Visible anomaly	Possible cause	Recommended repairs	Notes
SENSORS – ACCELERATOR PEDAL	03	06	SUPPLY BELOW THE RANGE	a)idling accelerated at approx. 1100 rpm in idling position and standard acceleration when the pedal is pressed. b)standard idling but revolution and power reduction when accelerating.	Accelerator pedal: not plausible signal between idling switch and potentiometer	Reading of parameters by means of the diagnostic instrument to determine the faulty part of the accelerator (potentiometer or idling switch). a)check on the component that the idling switch is not damaged by means of the multimeter (ON–OFF switchover between pins 4 and 5 of pedal connector, component side). In case the switch is not damaged, research of the switch on wiring between pedal connector (wiring side) pin 4 and connector EDC pin B50 passingh through sleeve B pin 33, between pedal connector (wiring side) pin 5 and connector EDC pin B73 passing through sleeve B pin 32. b)By means of multimeter check directly on the component that the potentiometer is not damaged. In case the potentiometer is not damaged, check wiring between pedal connector and connector EDC.	EDC pilot light on. a) the potentiometer signal is valid and it shows that the pedal is released, but the state of the switch shows that the pedal is pressed b) the switch signal is valid and it shows that the pedal is released, but the potentiometer signal shows that the pedal is pressed.
SENSORS – ACCELERATOR PEDAL	03	06	SUPPLY BELOW THE RANGE	Power reduction Accelerated idling at approx. 1100 rpm in any pedal position.	No accelerator potentiometer signal (possible open circuit).	Check by means of a multimeter directly on the component that the potentiometer is all right (Total R. = approx. 1 kOhm) between pins 2 and 3 of connector (component side). If the potentiometer is all right, check the wiring between pedal connector and connector EDC.	EDC pilot light on.

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Component failure	DTC	FMI	Error type	Visible anomaly	Possible cause	Recommended repairs	Notes
SENSORS – ACCELERATOR PEDAL	03	07	VALUE OVER THE NORMAL LIMIT	Power reduction With the accelerator pedal at rest, the engine runs at accelerated idling (approx. 1100 rpm.) Pressing the pedal, the engine progressively and uncontrollably increases the rpm up to approx 2600 rpm.	Accelerator pedal potentiometer short–circuited.	Reading of measurable parameters using the diagnostic instrument to verify the potentiometer malfunctioning (the signal doesn't vary from 0% to 100%). Check by means of a multimeter that the potentiometer is all right (Total R. = approx. 1 kOhm) between pins 2 and 3 of pedal connector (component side), check the linear resistance variance of the potentiometer between pins 1–3 and 2–3 between the idling and the peak If the potentiometer is all right check the wiring between the pedal connector (wiring side) pin 1 and connector EDC pin B83 passing through sleeve B pin 36, between pedal connector (wiring side) pin 2 and connector EDC pin B55 passing through sleeve B pin 35, between pedal connector (wiring side) pin 3 and connector EDC pin B81 passing through sleeve B pin 34.	EDC pilot light on.

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Component failure	DTC	FMI	Error type	Visible anomaly	Possible cause	Recommended repairs	Notes
SENSORS – ACCELERATOR PEDAL	03	07	VALUE OVER THE NORMAL LIMIT	a)idling accelerated at approx. 1100 rpm in idling position and standard acceleration when the pedal is pressed. b)standard idling but revolution and power reduction when accelerating.	Accelerator pedal: not plausible signal between idling switch and potentiometer	Reading of parameters by means of the diagnostic instrument to determine the faulty part of the accelerator (potentiometer or idling switch). a)check on the component that the idling switch is not damaged by means of the multimeter (ON–OFF switchover between pins 4 and 5 of pedal connector, component side). In case the switch is not damaged, research of the switch on wiring between pedal connector (wiring side) pin 4 and connector EDC pin B50 passingh through sleeve B pin 33, between pedal connector (wiring side) pin 5 and connector EDC pin B73 passing through sleeve B pin 32. b)By means of multimeter check directly on the component that the potentiometer is not damaged. In case the potentiometer is not damaged, check wiring between pedal connector and connector EDC.	EDC pilot light on. a) the potentiometer signal is valid and it shows that the pedal is released, but the state of the switch shows that the pedal is pressed b) the switch signal is valid and it shows that the pedal is released, but the potentiometer signal shows that the pedal is pressed.
SENSORS – ACCELERATOR PEDAL	03	07	VALUE OVER THE NORMAL LIMIT	Power reduction Accelerated idling at approx. 1100 rpm in any pedal position.	No accelerator potentiometer signal (possible open circuit).	Check by means of a multimeter directly on the component that the potentiometer is all right (Total R. = approx. 1 kOhm) between pins 2 and 3 of connector (component side). If the potentiometer is all right, check the wiring between pedal connector and connector EDC.	EDC pilot light on.

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Component failure	DTC	FMI	Error type	Visible anomaly	Possible cause	Recommended repairs	Notes
SENSORS – COOLANT TEMPERATURE	03	08	VALUE BELOW THE LIMIT	Indication on the water temperature instrument fixed at limit stop and pilot light lighted up.	Positively short–circuited, ground–short–circuited or open–circuited water tem?perature sensor	Reading of measurable parameters: in presence of this error, the water temperature read on the gearcase will be the same of the engine oil one. Check by means of a multimeter that the sensor is all right (R = approx. 2,5 kOhm at 20 °C) between pins 1 and 2 of sensor itself. If the sensor is not damaged, check the wiring between the sensor connector (wiring side) pin 1 and connector EDC pin C18, between sensor connector (wiring side) pin 2 and connector EDC pin C36.	EDC pilot light on.
SENSORS – ACCELERATOR PEDAL	03	08	VALUE BELOW THE LIMIT	Power reduction Accelerated idling at approx. 1100 rpm in any pedal position.	No accelerator potentiometer signal (possible open circuit).	Check by means of a multimeter directly on the component that the potentiometer is all right (Total R. = approx. 1 kOhm) between pins 2 and 3 of connector (component side). If the potentiometer is all right, check the wiring between pedal connector and connector EDC.	EDC pilot light on.

Component failure	DTC	FMI	Error type	Visible anomaly	Possible cause	Recommended repairs	Notes
SENSORS – ACCELERATOR PEDAL	03	08	VALUE BELOW THE LIMIT	Power reduction With the accelerator pedal at rest, the engine runs at accelerated idling (approx. 1100 rpm.) Pressing the pedal, the engine progressively and uncontrollably increases the rpm up to approx 2600 rpm.	Accelerator pedal potentiometer short–circuited.	Reading of measurable parameters using the diagnostic instrument to verify the potentiometer malfunctioning (the signal doesn't vary from 0% to 100%). Check by means of a multimeter that the potentiometer is all right (Total R. = approx. 1 kOhm) between pins 2 and 3 of pedal connector (component side), check the linear resistance variance of the potentiometer between pins 1–3 and 2–3 between the idling and the peak If the potentiometer is all right check the wiring between the pedal connector (wiring side) pin 1 and connector EDC pin B83 passing through sleeve B pin 36, between pedal connector (wiring side) pin 2 and connector EDC pin B55 passing through sleeve B pin 35, between pedal connector (wiring side) pin 3 and connector EDC pin B81 passing through sleeve B pin 34.	EDC pilot light on.

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Component failure	DTC	FMI	Error type	Visible anomaly	Possible cause	Recommended repairs	Notes
SENSORS – ACCELERATOR PEDAL	03	08	VALUE BELOW THE LIMIT	a)idling accelerated at approx. 1100 rpm in idling position and standard acceleration when the pedal is pressed. b)standard idling but revolution and power reduction when accelerating.	Accelerator pedal: not plausible signal between idling switch and potentiometer	Reading of parameters by means of the diagnostic instrument to determine the faulty part of the accelerator (potentiometer or idling switch). a)check on the component that the idling switch is not damaged by means of the multimeter (ON–OFF switchover between pins 4 and 5 of pedal connector, component side). In case the switch is not damaged, research of the switch on wiring between pedal connector (wiring side) pin 4 and connector EDC pin B50 passingh through sleeve B pin 33, between pedal connector (wiring side) pin 5 and connector EDC pin B73 passing through sleeve B pin 32. b)By means of multimeter check directly on the component that the potentiometer is not damaged. In case the potentiometer is not damaged, check wiring between pedal connector and connector EDC.	EDC pilot light on. a) the potentiometer signal is valid and it shows that the pedal is released, but the state of the switch shows that the pedal is pressed b) the switch signal is valid and it shows that the pedal is released, but the potentiometer signal shows that the pedal is pressed.
SENSORS – FUEL PRESSURE	04	00	NO AVAILABLE SYMPTOM	Significant power reduction	Positively short–circuited, ground short–circuited or open–circuited rail pressure sensor	Check the wiring between sensor connector (wiring side) pin 1 and connector EDC pin C20, between sensor connector (wiring side) pin 2 and connector EDC pin C27, between sensor connector (wiring side) pin 3 and connector EDC pin C12. Replace the sensor after having excluded all the other possibilities.	EDC pilot light winking.

Component failure	DTC	FMI	Error type	Visible anomaly	Possible cause	Recommended repairs	Notes
SENSORS – FUEL PRESSURE	04	01	SHORT CIRCUIT TO POSITIVE	Significant power reduction	Positively short–circuited, ground short–circuited or open–circuited rail pressure sensor	Check the wiring between sensor connector (wiring side) pin 1 and connector EDC pin C20, between sensor connector (wiring side) pin 2 and connector EDC pin C27, between sensor connector (wiring side) pin 3 and connector EDC pin C12. Replace the sensor after having excluded all the other possibilities.	EDC pilot light winking.
SENSORS – FUEL PRESSURE	04	02	OPEN CIRCUIT OR SHORT CIRCUIT TO GROUND	Significant power reduction	Positively short–circuited, ground short–circuited or open–circuited rail pressure sensor	Check the wiring between sensor connector (wiring side) pin 1 and connector EDC pin C20, between sensor connector (wiring side) pin 2 and connector EDC pin C27, between sensor connector (wiring side) pin 3 and connector EDC pin C12. Replace the sensor after having excluded all the other possibilities.	EDC pilot light winking.
SENSORS – FUEL PRESSURE	04	03	NO SIGNAL	Significant power reduction	Positively short–circuited, ground short–circuited or open–circuited rail pressure sensor	Check the wiring between sensor connector (wiring side) pin 1 and connector EDC pin C20, between sensor connector (wiring side) pin 2 and connector EDC pin C27, between sensor connector (wiring side) pin 3 and connector EDC pin C12. Replace the sensor after having excluded all the other possibilities.	EDC pilot light winking.

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Component failure	DTC	FMI	Error type	Visible anomaly	Possible cause	Recommended repairs	Notes
SENSORS – FUEL TEMPERATURE	04	04	SIGNAL NOT PLAUSIBLE	No reaction noticeable on behalf of the driver.	Positively short–circuited, ground–short–circuited or open–circuited fuel temperature sensor	Reading of measurable parameters: in presence of this error, the fuel temperature will be fixed at 20 °C Check the sensor is all right (R = approx. 2,5 kOhm at 20 °C) If the sensor is not damaged, check the wiring between the sensor connector (wiring side) pin 1 and connector EDC pin C17, between sensor connector (wiring side) pin 2 and connector EDC pin C34.	EDC pilot light off
SENSORS – FUEL PRESSURE	04	04	SIGNAL NOT PLAUSIBLE	Significant power reduction	Positively short–circuited, ground short–circuited or open–circuited rail pressure sensor	Check the wiring between sensor connector (wiring side) pin 1 and connector EDC pin C20, between sensor connector (wiring side) pin 2 and connector EDC pin C27, between sensor connector (wiring side) pin 3 and connector EDC pin C12. Replace the sensor after having excluded all the other possibilities.	EDC pilot light winking.
SENSORS – FUEL TEMPERATURE	04	05	SUPPLY OVER THE NORMAL RANGE	No reaction noticeable on behalf of the driver.	Positively short–circuited, ground–short–circuited or open–circuited fuel temperature sensor	Reading of measurable parameters: in presence of this error, the fuel temperature will be fixed at 20 °C Check the sensor is all right (R = approx. 2,5 kOhm at 20 °C) If the sensor is not damaged, check the wiring between the sensor connector (wiring side) pin 1 and connector EDC pin C17, between sensor connector (wiring side) pin 2 and connector EDC pin C34.	EDC pilot light off

Component failure	DTC	FMI	Error type	Visible anomaly	Possible cause	Recommended repairs	Notes
SENSORS – FUEL PRESSURE	04	05	SUPPLY OVER THE NORMAL RANGE	Significant power reduction	Positively short–circuited, ground short–circuited or open–circuited rail pressure sensor	Check the wiring between sensor connector (wiring side) pin 1 and connector EDC pin C20, between sensor connector (wiring side) pin 2 and connector EDC pin C27, between sensor connector (wiring side) pin 3 and connector EDC pin C12. Replace the sensor after having excluded all the other possibilities.	EDC pilot light winking.
SENSORS – FUEL TEMPERATURE	04	06	SUPPLY BELOW THE RANGE	No reaction noticeable on behalf of the driver.	Positively short–circuited, ground–short–circuited or open–circuited fuel temperature sensor	Reading of measurable parameters: in presence of this error, the fuel temperature will be fixed at 20 °C Check the sensor is all right (R = approx. 2,5 kOhm at 20 °C) If the sensor is not damaged, check the wiring between the sensor connector (wiring side) pin 1 and connector EDC pin C17, between sensor connector (wiring side) pin 2 and connector EDC pin C34.	EDC pilot light off
SENSORS – FUEL PRESSURE	04	06	SUPPLY BELOW THE RANGE	Significant power reduction	Positively short–circuited, ground short–circuited or open–circuited rail pressure sensor	Check the wiring between sensor connector (wiring side) pin 1 and connector EDC pin C20, between sensor connector (wiring side) pin 2 and connector EDC pin C27, between sensor connector (wiring side) pin 3 and connector EDC pin C12. Replace the sensor after having excluded all the other possibilities.	EDC pilot light winking.

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Component failure	DTC	FMI	Error type	Visible anomaly	Possible cause	Recommended repairs	Notes
SENSORS – FUEL TEMPERATURE	04	07	VALUE OVER THE NORMAL LIMIT	No reaction noticeable on behalf of the driver.	Positively short–circuited, ground–short–circuited or open–circuited fuel temperature sensor	Reading of measurable parameters: in presence of this error, the fuel temperature will be fixed at 20 °C Check the sensor is all right (R = approx. 2,5 kOhm at 20 °C) If the sensor is not damaged, check the wiring between the sensor connector (wiring side) pin 1 and connector EDC pin C17, between sensor connector (wiring side) pin 2 and connector EDC pin C34.	EDC pilot light off
SENSORS – FUEL PRESSURE	04	07	VALUE OVER THE NORMAL LIMIT	Significant power reduction	Positively short–circuited, ground short–circuited or open–circuited rail pressure sensor	Check the wiring between sensor connector (wiring side) pin 1 and connector EDC pin C20, between sensor connector (wiring side) pin 2 and connector EDC pin C27, between sensor connector (wiring side) pin 3 and connector EDC pin C12. Replace the sensor after having excluded all the other possibilities.	EDC pilot light winking.
SENSORS – FUEL TEMPERATURE	04	08	VALUE BELOW THE LIMIT	No reaction noticeable on behalf of the driver.	Positively short–circuited, ground–short–circuited or open–circuited fuel temperature sensor	Reading of measurable parameters: in presence of this error, the fuel temperature will be fixed at 20 °C Check the sensor is all right (R = approx. 2,5 kOhm at 20 °C) If the sensor is not damaged, check the wiring between the sensor connector (wiring side) pin 1 and connector EDC pin C17, between sensor connector (wiring side) pin 2 and connector EDC pin C34.	EDC pilot light off

Component failure	DTC	FMI	Error type	Visible anomaly	Possible cause	Recommended repairs	Notes
SENSORS – FUEL PRESSURE	04	08	VALUE BELOW THE LIMIT	Significant power reduction	Positively short–circuited, ground short–circuited or open–circuited rail pressure sensor	Check the wiring between sensor connector (wiring side) pin 1 and connector EDC pin C20, between sensor connector (wiring side) pin 2 and connector EDC pin C27, between sensor connector (wiring side) pin 3 and connector EDC pin C12. Replace the sensor after having excluded all the other possibilities.	EDC pilot light winking.
SENSORS – OIL TEMPERATURE SIGNAL	05	00	NO AVAILABLE SYMPTOM	No reaction noticeable on behalf of the driver.	Oil temperature sensor short–circuited or open–circuited	Reading of measurable parameters: in presence of this error, the engine oil temperature will be fixed at 120 °C. Check that the sensor is all right (R = approx. 2,5 kOhm at 20 °C). If the sensor is all right, check the wiring between the sensor connector (wiring side) pin 1 and connector EDC pin C19, between sensor connector (wiring side) pin 2 and connector EDC pin C33.	EDC pilot light on. If the oil temperature is too low, a limitation of the engine rpm, depending upon the temperature itself, takes place immediately after starting, (engine protection strategy).

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Component failure	DTC	FMI	Error type	Visible anomaly	Possible cause	Recommended repairs	Notes
ENGINE – INJECTOR CYLINDER 1	05	00	NO AVAILABLE SYMPTOM	The engine runs at 3 (5) cylinders.	Electrical part of cylinder n° 1 injector short–circuited or open–circuited.	Check that the nuts fixing the cables on the injector solenoid valve are properly tightened to the torque of 1,5 Nm. Check the injector solenoid valve continuity and resistance (R = approx. 0,5 Ohm). If the solenoid valve is all right, check the wiring on the cylinder head between connector 1 pins 3 and 4 and electro–injector. If the head cylinder wiring is all right, check the engine cable between cylinder head connector 1 pin 3 and connector EDC pin A13, between cylinder head connector 1 pin 4 and connector EDC pin A9.	EDC pilot light on. It is possible that immediately afterwards the engine keeps on running at 2 (3) cylinders, because the injectors are driven by two power stages. In this case also the error 5.7 can be stored.
SENSORS – OIL TEMPERATURE SIGNAL	05	01	SHORT CIRCUIT TO POSITIVE	No reaction noticeable on behalf of the driver.	Oil temperature sensor short–circuited or open–circuited	Reading of measurable parameters: in presence of this error, the engine oil temperature will be fixed at 120 °C. Check that the sensor is all right (R = approx. 2,5 kOhm at 20 °C). If the sensor is all right, check the wiring between the sensor connector (wiring side) pin 1 and connector EDC pin C19, between sensor connector (wiring side) pin 2 and connector EDC pin C33.	EDC pilot light on. If the oil temperature is too low, a limitation of the engine rpm, depending upon the temperature itself, takes place immediately after starting, (engine protection strategy).

Component failure	DTC	FMI	Error type	Visible anomaly	Possible cause	Recommended repairs	Notes
ENGINE – INJECTOR CYLINDER 1	05	01	SHORT CIRCUIT TO POSITIVE	The engine runs at 3 (5) cylinders.	Electrical part of cylinder n° 1 injector short–circuited or open–circuited.	Check that the nuts fixing the cables on the injector solenoid valve are properly tightened to the torque of 1,5 Nm. Check the injector solenoid valve continuity and resistance (R = approx. 0,5 Ohm). If the solenoid valve is all right, check the wiring on the cylinder head between connector 1 pins 3 and 4 and electro–injector. If the head cylinder wiring is all right, check the engine cable between cylinder head connector 1 pin 3 and connector EDC pin A13, between cylinder head connector 1 pin 4 and connector EDC pin A9.	EDC pilot light on. It is possible that immediately afterwards the engine keeps on running at 2 (3) cylinders, because the injectors are driven by two power stages. In this case also the error 5.7 can be stored.
ENGINE – INJECTOR CYLINDER 1	05	02	OPEN CIRCUIT OR SHORT CIRCUIT TO GROUND	The engine runs at 3 (5) cylinders.	Electrical part of cylinder n° 1 injector short–circuited or open–circuited.	Check that the nuts fixing the cables on the injector solenoid valve are properly tightened to the torque of 1,5 Nm. Check the injector solenoid valve continuity and resistance (R = approx. 0,5 Ohm). If the solenoid valve is all right, check the wiring on the cylinder head between connector 1 pins 3 and 4 and electro–injector. If the head cylinder wiring is all right, check the engine cable between cylinder head connector 1 pin 3 and connector EDC pin A13, between cylinder head connector 1 pin 4 and connector EDC pin A9.	EDC pilot light on. It is possible that immediately afterwards the engine keeps on running at 2 (3) cylinders, because the injectors are driven by two power stages. In this case also the error 5.7 can be stored.

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Component failure	DTC	FMI	Error type	Visible anomaly	Possible cause	Recommended repairs	Notes
SENSORS – OIL TEMPERATURE SIGNAL	05	02	OPEN CIRCUIT OR SHORT CIRCUIT TO GROUND	No reaction noticeable on behalf of the driver.	Oil temperature sensor short–circuited or open–circuited	Reading of measurable parameters: in presence of this error, the engine oil temperature will be fixed at 120 °C. Check that the sensor is all right (R = approx. 2,5 kOhm at 20 °C). If the sensor is all right, check the wiring between the sensor connector (wiring side) pin 1 and connector EDC pin C19, between sensor connector (wiring side) pin 2 and connector EDC pin C33.	EDC pilot light on. If the oil temperature is too low, a limitation of the engine rpm, depending upon the temperature itself, takes place immediately after starting, (engine protection strategy).
ENGINE – INJECTOR CYLINDER 1	05	03	NO SIGNAL	The engine runs at 3 (5) cylinders.	Electrical part of cylinder n° 1 injector short–circuited or open–circuited.	Check that the nuts fixing the cables on the injector solenoid valve are properly tightened to the torque of 1,5 Nm. Check the injector solenoid valve continuity and resistance (R = approx. 0,5 Ohm). If the solenoid valve is all right, check the wiring on the cylinder head between connector 1 pins 3 and 4 and electro–injector. If the head cylinder wiring is all right, check the engine cable between cylinder head connector 1 pin 3 and connector EDC pin A13, between cylinder head connector 1 pin 4 and connector EDC pin A9.	EDC pilot light on. It is possible that immediately afterwards the engine keeps on running at 2 (3) cylinders, because the injectors are driven by two power stages. In this case also the error 5.7 can be stored.

Component failure	DTC	FMI	Error type	Visible anomaly	Possible cause	Recommended repairs	Notes
SENSORS – OIL TEMPERATURE SIGNAL	05	03	NO SIGNAL	No reaction noticeable on behalf of the driver.	Oil temperature sensor short–circuited or open–circuited	Reading of measurable parameters: in presence of this error, the engine oil temperature will be fixed at 120 °C. Check that the sensor is all right (R = approx. 2,5 kOhm at 20 °C). If the sensor is all right, check the wiring between the sensor connector (wiring side) pin 1 and connector EDC pin C19, between sensor connector (wiring side) pin 2 and connector EDC pin C33.	EDC pilot light on. If the oil temperature is too low, a limitation of the engine rpm, depending upon the temperature itself, takes place immediately after starting, (engine protection strategy).
SENSORS – OIL TEMPERATURE SIGNAL	05	04	SIGNAL NOT PLAUSIBLE	No reaction noticeable on behalf of the driver.	Oil temperature sensor short–circuited or open–circuited	Reading of measurable parameters: in presence of this error, the engine oil temperature will be fixed at 120 °C. Check that the sensor is all right (R = approx. 2,5 kOhm at 20 °C). If the sensor is all right, check the wiring between the sensor connector (wiring side) pin 1 and connector EDC pin C19, between sensor connector (wiring side) pin 2 and connector EDC pin C33.	EDC pilot light on. If the oil temperature is too low, a limitation of the engine rpm, depending upon the temperature itself, takes place immediately after starting, (engine protection strategy).

Component failure	DTC	FMI	Error type	Visible anomaly	Possible cause	Recommended repairs	Notes
ENGINE – INJECTOR CYLINDER 1	05	04	SIGNAL NOT PLAUSIBLE	The engine runs at 3 (5) cylinders.	Electrical part of cylinder n° 1 injector short–circuited or open–circuited.	Check that the nuts fixing the cables on the injector solenoid valve are properly tightened to the torque of 1,5 Nm. Check the injector solenoid valve continuity and resistance (R = approx. 0,5 Ohm). If the solenoid valve is all right, check the wiring on the cylinder head between connector 1 pins 3 and 4 and electro–injector. If the head cylinder wiring is all right, check the engine cable between cylinder head connector 1 pin 3 and connector EDC pin A13, between cylinder head connector 1 pin 4 and connector EDC pin A9.	EDC pilot light on. It is possible that immediately afterwards the engine keeps on running at 2 (3) cylinders, because the injectors are driven by two power stages. In this case also the error 5.7 can be stored.
SENSORS – OIL TEMPERATURE SIGNAL	05	05	SUPPLY OVER THE NORMAL RANGE	No reaction noticeable on behalf of the driver.	Oil temperature sensor short–circuited or open–circuited	Reading of measurable parameters: in presence of this error, the engine oil temperature will be fixed at 120 °C. Check that the sensor is all right (R = approx. 2,5 kOhm at 20 °C). If the sensor is all right, check the wiring between the sensor connector (wiring side) pin 1 and connector EDC pin C19, between sensor connector (wiring side) pin 2 and connector EDC pin C33.	EDC pilot light on. If the oil temperature is too low, a limitation of the engine rpm, depending upon the temperature itself, takes place immediately after starting, (engine protection strategy).

Component failure	DTC	FMI	Error type	Visible anomaly	Possible cause	Recommended repairs	Notes
ENGINE – INJECTOR CYLINDER 1	05	05	SUPPLY OVER THE NORMAL RANGE	The engine runs at 3 (5) cylinders.	Electrical part of cylinder n° 1 injector short–circuited or open–circuited.	Check that the nuts fixing the cables on the injector solenoid valve are properly tightened to the torque of 1,5 Nm. Check the injector solenoid valve continuity and resistance (R = approx. 0,5 Ohm). If the solenoid valve is all right, check the wiring on the cylinder head between connector 1 pins 3 and 4 and electro–injector. If the head cylinder wiring is all right, check the engine cable between cylinder head connector 1 pin 3 and connector EDC pin A13, between cylinder head connector 1 pin 4 and connector EDC pin A9.	EDC pilot light on. It is possible that immediately afterwards the engine keeps on running at 2 (3) cylinders, because the injectors are driven by two power stages. In this case also the error 5.7 can be stored.
SENSORS – OIL TEMPERATURE SIGNAL	05	06	SUPPLY BELOW THE RANGE	No reaction noticeable on behalf of the driver.	Oil temperature sensor short–circuited or open–circuited	Reading of measurable parameters: in presence of this error, the engine oil temperature will be fixed at 120 °C. Check that the sensor is all right (R = approx. 2,5 kOhm at 20 °C). If the sensor is all right, check the wiring between the sensor connector (wiring side) pin 1 and connector EDC pin C19, between sensor connector (wiring side) pin 2 and connector EDC pin C33.	EDC pilot light on. If the oil temperature is too low, a limitation of the engine rpm, depending upon the temperature itself, takes place immediately after starting, (engine protection strategy).

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Component failure	DTC	FMI	Error type	Visible anomaly	Possible cause	Recommended repairs	Notes
SENSORS – OIL TEMPERATURE SIGNAL	05	07	VALUE OVER THE NORMAL LIMIT	No reaction noticeable on behalf of the driver.	Oil temperature sensor short–circuited or open–circuited	Reading of measurable parameters: in presence of this error, the engine oil temperature will be fixed at 120 °C. Check that the sensor is all right (R = approx. 2,5 kOhm at 20 °C). If the sensor is all right, check the wiring between the sensor connector (wiring side) pin 1 and connector EDC pin C19, between sensor connector (wiring side) pin 2 and connector EDC pin C33.	EDC pilot light on. If the oil temperature is too low, a limitation of the engine rpm, depending upon the temperature itself, takes place immediately after starting, (engine protection strategy).
SENSORS – OIL TEMPERATURE SIGNAL	05	08	VALUE BELOW THE LIMIT	No reaction noticeable on behalf of the driver.	Oil temperature sensor short–circuited or open–circuited	Reading of measurable parameters: in presence of this error, the engine oil temperature will be fixed at 120 °C. Check that the sensor is all right (R = approx. 2,5 kOhm at 20 °C). If the sensor is all right, check the wiring between the sensor connector (wiring side) pin 1 and connector EDC pin C19, between sensor connector (wiring side) pin 2 and connector EDC pin C33.	EDC pilot light on. If the oil temperature is too low, a limitation of the engine rpm, depending upon the temperature itself, takes place immediately after starting, (engine protection strategy).

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Component failure	DTC	FMI	Error type	Visible anomaly	Possible cause	Recommended repairs	Notes
ENGINE – INJECTOR CYLINDER 5	06	00	NO AVAILABLE SYMPTOM	The engine runs at 5 cylinders.	Electrical part of cylinder n°5 injector short–circuited or open–circuited.	Check that the nuts fixing the cables on the injector solenoid valve are properly tightened to the torque of 1,5 Nm. Check the injector solenoid valve continuity and resistance (R = approx. 0,5 Ohm). If the solenoid valve is all right, check the wiring on cylinder head between connector 3 pins 1 and 2 and electro–injector. If the cylinder head wiring is all right, check the engine cable between the cylinder head connector 3 pin 1 and connector EDC pin A10, between cylinder head connector 3 pin 2 and connector EDC pin A15.	EDC pilot light on. It is possible that immediately afterwards the engine keeps on running at 3 cylinders, because the injectors are driven by two power stages. In this case also error 5.8 can be stored .
ENGINE – INJECTOR CYLINDER 3	06	00	NO AVAILABLE SYMPTOM	The engine runs at 3 (5) cylinders.	Electrical part of cylinder n°3 injector short–circuited or open–circuited.	Check that the nuts fixing the cables on the injector solenoid valve are properly tightened to the torque of 1,5 Nm. Check the injector solenoid valve continuity and resistance (R = approx. 0,5 Ohm). If the solenoid valve is all right, check the wiring on cylinder head between connector 2 pins 3 and 4 and electro–injector. If the cylinder head wiring is all right, check the engine cable between the cylinder head connector 2 pin 3 and connector EDC pin A12, between cylinder head connector 2 pin 4 and connector EDC pin A4.	EDC pilot light on. It is possible that immediately afterwards the engine keeps on running at 2 (3) cylinders, because the injectors are driven by two power stages. In this case also error 5.7 (6 cylinders) or 5.8 (4 cylinders) can be stored .

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Component failure	DTC	FMI	Error type	Visible anomaly	Possible cause	Recommended repairs	Notes
ENGINE – INJECTOR CYLINDER 5	06	01	SHORT CIRCUIT TO POSITIVE	The engine runs at 5 cylinders.	Electrical part of cylinder n°5 injector short–circuited or open–circuited.	Check that the nuts fixing the cables on the injector solenoid valve are properly tightened to the torque of 1,5 Nm. Check the injector solenoid valve continuity and resistance (R = approx. 0,5 Ohm). If the solenoid valve is all right, check the wiring on cylinder head between connector 3 pins 1 and 2 and electro–injector. If the cylinder head wiring is all right, check the engine cable between the cylinder head connector 3 pin 1 and connector EDC pin A10, between cylinder head connector 3 pin 2 and connector EDC pin A15.	EDC pilot light on. It is possible that immediately afterwards the engine keeps on running at 3 cylinders, because the injectors are driven by two power stages. In this case also error 5.8 can be stored .
ENGINE – INJECTOR CYLINDER 3	06	01	SHORT CIRCUIT TO POSITIVE	The engine runs at 3 (5) cylinders.	Electrical part of cylinder n°3 injector short–circuited or open–circuited.	Check that the nuts fixing the cables on the injector solenoid valve are properly tightened to the torque of 1,5 Nm. Check the injector solenoid valve continuity and resistance (R = approx. 0,5 Ohm). If the solenoid valve is all right, check the wiring on cylinder head between connector 2 pins 3 and 4 and electro–injector. If the cylinder head wiring is all right, check the engine cable between the cylinder head connector 2 pin 3 and connector EDC pin A12, between cylinder head connector 2 pin 4 and connector EDC pin A4.	EDC pilot light on. It is possible that immediately afterwards the engine keeps on running at 2 (3) cylinders, because the injectors are driven by two power stages. In this case also error 5.7 (6 cylinders) or 5.8 (4 cylinders) can be stored .

Component failure	DTC	FMI	Error type	Visible anomaly	Possible cause	Recommended repairs	Notes
ENGINE – INJECTOR CYLINDER 5	06	02	OPEN CIRCUIT OR SHORT CIRCUIT TO GROUND	The engine runs at 5 cylinders.	Electrical part of cylinder n°5 injector short–circuited or open–circuited.	Check that the nuts fixing the cables on the injector solenoid valve are properly tightened to the torque of 1,5 Nm. Check the injector solenoid valve continuity and resistance (R = approx. 0,5 Ohm). If the solenoid valve is all right, check the wiring on cylinder head between connector 3 pins 1 and 2 and electro–injector. If the cylinder head wiring is all right, check the engine cable between the cylinder head connector 3 pin 1 and connector EDC pin A10, between cylinder head connector 3 pin 2 and connector EDC pin A15.	EDC pilot light on. It is possible that immediately afterwards the engine keeps on running at 3 cylinders, because the injectors are driven by two power stages. In this case also error 5.8 can be stored .
ENGINE – INJECTOR CYLINDER 5	06	03	NO SIGNAL	The engine runs at 5 cylinders.	Electrical part of cylinder n°5 injector short–circuited or open–circuited.	Check that the nuts fixing the cables on the injector solenoid valve are properly tightened to the torque of 1,5 Nm. Check the injector solenoid valve continuity and resistance (R = approx. 0,5 Ohm). If the solenoid valve is all right, check the wiring on cylinder head between connector 3 pins 1 and 2 and electro–injector. If the cylinder head wiring is all right, check the engine cable between the cylinder head connector 3 pin 1 and connector EDC pin A10, between cylinder head connector 3 pin 2 and connector EDC pin A15.	EDC pilot light on. It is possible that immediately afterwards the engine keeps on running at 3 cylinders, because the injectors are driven by two power stages. In this case also error 5.8 can be stored .

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Component failure	DTC	FMI	Error type	Visible anomaly	Possible cause	Recommended repairs	Notes
ENGINE – INJECTOR CYLINDER 5	06	04	SIGNAL NOT PLAUSIBLE	The engine runs at 5 cylinders.	Electrical part of cylinder n°5 injector short–circuited or open–circuited.	Check that the nuts fixing the cables on the injector solenoid valve are properly tightened to the torque of 1,5 Nm. Check the injector solenoid valve continuity and resistance (R = approx. 0,5 Ohm). If the solenoid valve is all right, check the wiring on cylinder head between connector 3 pins 1 and 2 and electro–injector. If the cylinder head wiring is all right, check the engine cable between the cylinder head connector 3 pin 1 and connector EDC pin A10, between cylinder head connector 3 pin 2 and connector EDC pin A15.	EDC pilot light on. It is possible that immediately afterwards the engine keeps on running at 3 cylinders, because the injectors are driven by two power stages. In this case also error 5.8 can be stored .
ENGINE – INJECTOR CYLINDER 5	06	05	SUPPLY OVER THE NORMAL RANGE	The engine runs at 5 cylinders.	Electrical part of cylinder n°5 injector short–circuited or open–circuited.	Check that the nuts fixing the cables on the injector solenoid valve are properly tightened to the torque of 1,5 Nm. Check the injector solenoid valve continuity and resistance (R = approx. 0,5 Ohm). If the solenoid valve is all right, check the wiring on cylinder head between connector 3 pins 1 and 2 and electro–injector. If the cylinder head wiring is all right, check the engine cable between the cylinder head connector 3 pin 1 and connector EDC pin A10, between cylinder head connector 3 pin 2 and connector EDC pin A15.	EDC pilot light on. It is possible that immediately afterwards the engine keeps on running at 3 cylinders, because the injectors are driven by two power stages. In this case also error 5.8 can be stored .

Component failure	DTC	FMI	Error type	Visible anomaly	Possible cause	Recommended repairs	Notes
ENGINE – INJECTOR CYLINDER 1	06	06	SUPPLY BELOW THE RANGE	The engine runs at 3 (5) cylinders.	Electrical part of cylinder n° 1 injector short–circuited or open–circuited.	Check that the nuts fixing the cables on the injector solenoid valve are properly tightened to the torque of 1,5 Nm. Check the injector solenoid valve continuity and resistance (R = approx. 0,5 Ohm). If the solenoid valve is all right, check the wiring on the cylinder head between connector 1 pins 3 and 4 and electro–injector. If the head cylinder wiring is all right, check the engine cable between cylinder head connector 1 pin 3 and connector EDC pin A13, between cylinder head connector 1 pin 4 and connector EDC pin A9.	EDC pilot light on. It is possible that immediately afterwards the engine keeps on running at 2 (3) cylinders, because the injectors are driven by two power stages. In this case also the error 5.7 can be stored.
ENGINE – INJECTOR CYLINDER 5	06	06	SUPPLY BELOW THE RANGE	The engine runs at 5 cylinders.	Electrical part of cylinder n°5 injector short–circuited or open–circuited.	Check that the nuts fixing the cables on the injector solenoid valve are properly tightened to the torque of 1,5 Nm. Check the injector solenoid valve continuity and resistance (R = approx. 0,5 Ohm). If the solenoid valve is all right, check the wiring on cylinder head between connector 3 pins 1 and 2 and electro–injector. If the cylinder head wiring is all right, check the engine cable between the cylinder head connector 3 pin 1 and connector EDC pin A10, between cylinder head connector 3 pin 2 and connector EDC pin A15.	EDC pilot light on. It is possible that immediately afterwards the engine keeps on running at 3 cylinders, because the injectors are driven by two power stages. In this case also error 5.8 can be stored .

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Component failure	DTC	FMI	Error type	Visible anomaly	Possible cause	Recommended repairs	Notes
ENGINE – INJECTOR CYLINDER 1	06	07	VALUE OVER THE NORMAL LIMIT	The engine runs at 3 (5) cylinders.	Electrical part of cylinder n° 1 injector short–circuited or open–circuited.	Check that the nuts fixing the cables on the injector solenoid valve are properly tightened to the torque of 1,5 Nm. Check the injector solenoid valve continuity and resistance (R = approx. 0,5 Ohm). If the solenoid valve is all right, check the wiring on the cylinder head between connector 1 pins 3 and 4 and electro–injector. If the head cylinder wiring is all right, check the engine cable between cylinder head connector 1 pin 3 and connector EDC pin A13, between cylinder head connector 1 pin 4 and connector EDC pin A9.	EDC pilot light on. It is possible that immediately afterwards the engine keeps on running at 2 (3) cylinders, because the injectors are driven by two power stages. In this case also the error 5.7 can be stored.
ENGINE – INJECTOR CYLINDER 5	06	07	VALUE OVER THE NORMAL LIMIT	The engine runs at 5 cylinders.	Electrical part of cylinder n°5 injector short–circuited or open–circuited.	Check that the nuts fixing the cables on the injector solenoid valve are properly tightened to the torque of 1,5 Nm. Check the injector solenoid valve continuity and resistance (R = approx. 0,5 Ohm). If the solenoid valve is all right, check the wiring on cylinder head between connector 3 pins 1 and 2 and electro–injector. If the cylinder head wiring is all right, check the engine cable between the cylinder head connector 3 pin 1 and connector EDC pin A10, between cylinder head connector 3 pin 2 and connector EDC pin A15.	EDC pilot light on. It is possible that immediately afterwards the engine keeps on running at 3 cylinders, because the injectors are driven by two power stages. In this case also error 5.8 can be stored .

Component failure	DTC	FMI	Error type	Visible anomaly	Possible cause	Recommended repairs	Notes
ENGINE – INJECTOR CYLINDER 1	06	08	VALUE BELOW THE LIMIT	The engine runs at 3 (5) cylinders.	Electrical part of cylinder n° 1 injector short–circuited or open–circuited.	Check that the nuts fixing the cables on the injector solenoid valve are properly tightened to the torque of 1,5 Nm. Check the injector solenoid valve continuity and resistance (R = approx. 0,5 Ohm). If the solenoid valve is all right, check the wiring on the cylinder head between connector 1 pins 3 and 4 and electro–injector. If the head cylinder wiring is all right, check the engine cable between cylinder head connector 1 pin 3 and connector EDC pin A13, between cylinder head connector 1 pin 4 and connector EDC pin A9.	EDC pilot light on. It is possible that immediately afterwards the engine keeps on running at 2 (3) cylinders, because the injectors are driven by two power stages. In this case also the error 5.7 can be stored.
ENGINE – INJECTOR CYLINDER 5	06	08	VALUE BELOW THE LIMIT	The engine runs at 5 cylinders.	Electrical part of cylinder n°5 injector short–circuited or open–circuited.	Check that the nuts fixing the cables on the injector solenoid valve are properly tightened to the torque of 1,5 Nm. Check the injector solenoid valve continuity and resistance (R = approx. 0,5 Ohm). If the solenoid valve is all right, check the wiring on cylinder head between connector 3 pins 1 and 2 and electro–injector. If the cylinder head wiring is all right, check the engine cable between the cylinder head connector 3 pin 1 and connector EDC pin A10, between cylinder head connector 3 pin 2 and connector EDC pin A15.	EDC pilot light on. It is possible that immediately afterwards the engine keeps on running at 3 cylinders, because the injectors are driven by two power stages. In this case also error 5.8 can be stored .

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Component failure	DTC	FMI	Error type	Visible anomaly	Possible cause	Recommended repairs	Notes
ENGINE – INJECTOR CYLINDER 6	07	00	NO AVAILABLE SYMPTOM	The engine runs at 5 cylinders.	Electrical part of cylinder n°6 injector short–circuited or open–circuited.	Check that the nuts fixing the cables on the injector solenoid valve are properly tightened to the torque of 1,5 Nm. Check the injector solenoid valve continuity and resistance (R = approx. 0,5 Ohm). If the solenoid valve is all right, check the wiring on cylinder head between connector 3 pins 1 and 2 and electro–injector. If the cylinder head wiring is all right, check the engine cable between the cylinder head connector 3 pin 1 and connector EDC pin A10, between cylinder head connector 3 pin 2 and connector EDC pin A15.	EDC pilot light on. It is possible that immediately afterwards the engine keeps on running at 3 cylinders, because the injectors are driven by two power stages. In this case also error 5.8 can be stored .
ENGINE – INJECTOR CYLINDER 6	07	01	SHORT CIRCUIT TO POSITIVE	The engine runs at 5 cylinders.	Electrical part of cylinder n°6 injector short–circuited or open–circuited.	Check that the nuts fixing the cables on the injector solenoid valve are properly tightened to the torque of 1,5 Nm. Check the injector solenoid valve continuity and resistance (R = approx. 0,5 Ohm). If the solenoid valve is all right, check the wiring on cylinder head between connector 3 pins 1 and 2 and electro–injector. If the cylinder head wiring is all right, check the engine cable between the cylinder head connector 3 pin 1 and connector EDC pin A10, between cylinder head connector 3 pin 2 and connector EDC pin A15.	EDC pilot light on. It is possible that immediately afterwards the engine keeps on running at 3 cylinders, because the injectors are driven by two power stages. In this case also error 5.8 can be stored .

Component failure	DTC	FMI	Error type	Visible anomaly	Possible cause	Recommended repairs	Notes
ENGINE – INJECTOR CYLINDER 3	07	02	OPEN CIRCUIT OR SHORT CIRCUIT TO GROUND	The engine runs at 3 (5) cylinders.	Electrical part of cylinder n°3 injector short–circuited or open–circuited.	Check that the nuts fixing the cables on the injector solenoid valve are properly tightened to the torque of 1,5 Nm. Check the injector solenoid valve continuity and resistance (R = approx. 0,5 Ohm). If the solenoid valve is all right, check the wiring on cylinder head between connector 2 pins 3 and 4 and electro–injector. If the cylinder head wiring is all right, check the engine cable between the cylinder head connector 2 pin 3 and connector EDC pin A12, between cylinder head connector 2 pin 4 and connector EDC pin A4.	EDC pilot light on. It is possible that immediately afterwards the engine keeps on running at 2 (3) cylinders, because the injectors are driven by two power stages. In this case also error 5.7 (6 cylinders) or 5.8 (4 cylinders) can be stored .
ENGINE – INJECTOR CYLINDER 6	07	02	OPEN CIRCUIT OR SHORT CIRCUIT TO GROUND	The engine runs at 5 cylinders.	Electrical part of cylinder n°6 injector short–circuited or open–circuited.	Check that the nuts fixing the cables on the injector solenoid valve are properly tightened to the torque of 1,5 Nm. Check the injector solenoid valve continuity and resistance (R = approx. 0,5 Ohm). If the solenoid valve is all right, check the wiring on cylinder head between connector 3 pins 1 and 2 and electro–injector. If the cylinder head wiring is all right, check the engine cable between the cylinder head connector 3 pin 1 and connector EDC pin A10, between cylinder head connector 3 pin 2 and connector EDC pin A15.	EDC pilot light on. It is possible that immediately afterwards the engine keeps on running at 3 cylinders, because the injectors are driven by two power stages. In this case also error 5.8 can be stored .

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Component failure	DTC	FMI	Error type	Visible anomaly	Possible cause	Recommended repairs	Notes
ENGINE – INJECTOR CYLINDER 3	07	03	NO SIGNAL	The engine runs at 3 (5) cylinders.	Electrical part of cylinder n°3 injector short–circuited or open–circuited.	Check that the nuts fixing the cables on the injector solenoid valve are properly tightened to the torque of 1,5 Nm. Check the injector solenoid valve continuity and resistance (R = approx. 0,5 Ohm). If the solenoid valve is all right, check the wiring on cylinder head between connector 2 pins 3 and 4 and electro–injector. If the cylinder head wiring is all right, check the engine cable between the cylinder head connector 2 pin 3 and connector EDC pin A12, between cylinder head connector 2 pin 4 and connector EDC pin A4.	EDC pilot light on. It is possible that immediately afterwards the engine keeps on running at 2 (3) cylinders, because the injectors are driven by two power stages. In this case also error 5.7 (6 cylinders) or 5.8 (4 cylinders) can be stored .
ENGINE – INJECTOR CYLINDER 6	07	03	NO SIGNAL	The engine runs at 5 cylinders.	Electrical part of cylinder n°6 injector short–circuited or open–circuited.	Check that the nuts fixing the cables on the injector solenoid valve are properly tightened to the torque of 1,5 Nm. Check the injector solenoid valve continuity and resistance (R = approx. 0,5 Ohm). If the solenoid valve is all right, check the wiring on cylinder head between connector 3 pins 1 and 2 and electro–injector. If the cylinder head wiring is all right, check the engine cable between the cylinder head connector 3 pin 1 and connector EDC pin A10, between cylinder head connector 3 pin 2 and connector EDC pin A15.	EDC pilot light on. It is possible that immediately afterwards the engine keeps on running at 3 cylinders, because the injectors are driven by two power stages. In this case also error 5.8 can be stored .

Component failure	DTC	FMI	Error type	Visible anomaly	Possible cause	Recommended repairs	Notes
ENGINE – INJECTOR CYLINDER 3	07	04	SIGNAL NOT PLAUSIBLE	The engine runs at 3 (5) cylinders.	Electrical part of cylinder n°3 injector short–circuited or open–circuited.	Check that the nuts fixing the cables on the injector solenoid valve are properly tightened to the torque of 1,5 Nm. Check the injector solenoid valve continuity and resistance (R = approx. 0,5 Ohm). If the solenoid valve is all right, check the wiring on cylinder head between connector 2 pins 3 and 4 and electro–injector. If the cylinder head wiring is all right, check the engine cable between the cylinder head connector 2 pin 3 and connector EDC pin A12, between cylinder head connector 2 pin 4 and connector EDC pin A4.	EDC pilot light on. It is possible that immediately afterwards the engine keeps on running at 2 (3) cylinders, because the injectors are driven by two power stages. In this case also error 5.7 (6 cylinders) or 5.8 (4 cylinders) can be stored .
ENGINE – INJECTOR CYLINDER 6	07	04	SIGNAL NOT PLAUSIBLE	The engine runs at 5 cylinders.	Electrical part of cylinder n°6 injector short–circuited or open–circuited.	Check that the nuts fixing the cables on the injector solenoid valve are properly tightened to the torque of 1,5 Nm. Check the injector solenoid valve continuity and resistance (R = approx. 0,5 Ohm). If the solenoid valve is all right, check the wiring on cylinder head between connector 3 pins 1 and 2 and electro–injector. If the cylinder head wiring is all right, check the engine cable between the cylinder head connector 3 pin 1 and connector EDC pin A10, between cylinder head connector 3 pin 2 and connector EDC pin A15.	EDC pilot light on. It is possible that immediately afterwards the engine keeps on running at 3 cylinders, because the injectors are driven by two power stages. In this case also error 5.8 can be stored .

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Component failure	DTC	FMI	Error type	Visible anomaly	Possible cause	Recommended repairs	Notes
ENGINE – INJECTOR CYLINDER 3	07	05	SUPPLY OVER THE NORMAL RANGE	The engine runs at 3 (5) cylinders.	Electrical part of cylinder n°3 injector short–circuited or open–circuited.	Check that the nuts fixing the cables on the injector solenoid valve are properly tightened to the torque of 1,5 Nm. Check the injector solenoid valve continuity and resistance (R = approx. 0,5 Ohm). If the solenoid valve is all right, check the wiring on cylinder head between connector 2 pins 3 and 4 and electro–injector. If the cylinder head wiring is all right, check the engine cable between the cylinder head connector 2 pin 3 and connector EDC pin A12, between cylinder head connector 2 pin 4 and connector EDC pin A4.	EDC pilot light on. It is possible that immediately afterwards the engine keeps on running at 2 (3) cylinders, because the injectors are driven by two power stages. In this case also error 5.7 (6 cylinders) or 5.8 (4 cylinders) can be stored .
ENGINE – INJECTOR CYLINDER 6	07	05	SUPPLY OVER THE NORMAL RANGE	The engine runs at 5 cylinders.	Electrical part of cylinder n°6 injector short–circuited or open–circuited.	Check that the nuts fixing the cables on the injector solenoid valve are properly tightened to the torque of 1,5 Nm. Check the injector solenoid valve continuity and resistance (R = approx. 0,5 Ohm). If the solenoid valve is all right, check the wiring on cylinder head between connector 3 pins 1 and 2 and electro–injector. If the cylinder head wiring is all right, check the engine cable between the cylinder head connector 3 pin 1 and connector EDC pin A10, between cylinder head connector 3 pin 2 and connector EDC pin A15.	EDC pilot light on. It is possible that immediately afterwards the engine keeps on running at 3 cylinders, because the injectors are driven by two power stages. In this case also error 5.8 can be stored .

Component failure	DTC	FMI	Error type	Visible anomaly	Possible cause	Recommended repairs	Notes
ENGINE – INJECTOR CYLINDER 3	07	06	SUPPLY BELOW THE RANGE	The engine runs at 3 (5) cylinders.	Electrical part of cylinder n°3 injector short–circuited or open–circuited.	Check that the nuts fixing the cables on the injector solenoid valve are properly tightened to the torque of 1,5 Nm. Check the injector solenoid valve continuity and resistance (R = approx. 0,5 Ohm). If the solenoid valve is all right, check the wiring on cylinder head between connector 2 pins 3 and 4 and electro–injector. If the cylinder head wiring is all right, check the engine cable between the cylinder head connector 2 pin 3 and connector EDC pin A12, between cylinder head connector 2 pin 4 and connector EDC pin A4.	EDC pilot light on. It is possible that immediately afterwards the engine keeps on running at 2 (3) cylinders, because the injectors are driven by two power stages. In this case also error 5.7 (6 cylinders) or 5.8 (4 cylinders) can be stored .
ENGINE – INJECTOR CYLINDER 6	07	06	SUPPLY BELOW THE RANGE	The engine runs at 5 cylinders.	Electrical part of cylinder n°6 injector short–circuited or open–circuited.	Check that the nuts fixing the cables on the injector solenoid valve are properly tightened to the torque of 1,5 Nm. Check the injector solenoid valve continuity and resistance (R = approx. 0,5 Ohm). If the solenoid valve is all right, check the wiring on cylinder head between connector 3 pins 1 and 2 and electro–injector. If the cylinder head wiring is all right, check the engine cable between the cylinder head connector 3 pin 1 and connector EDC pin A10, between cylinder head connector 3 pin 2 and connector EDC pin A15.	EDC pilot light on. It is possible that immediately afterwards the engine keeps on running at 3 cylinders, because the injectors are driven by two power stages. In this case also error 5.8 can be stored .

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Component failure	DTC	FMI	Error type	Visible anomaly	Possible cause	Recommended repairs	Notes
ENGINE – INJECTOR CYLINDER 3	07	07	VALUE OVER THE NORMAL LIMIT	The engine runs at 3 (5) cylinders.	Electrical part of cylinder n°3 injector short–circuited or open–circuited.	Check that the nuts fixing the cables on the injector solenoid valve are properly tightened to the torque of 1,5 Nm. Check the injector solenoid valve continuity and resistance (R = approx. 0,5 Ohm). If the solenoid valve is all right, check the wiring on cylinder head between connector 2 pins 3 and 4 and electro–injector. If the cylinder head wiring is all right, check the engine cable between the cylinder head connector 2 pin 3 and connector EDC pin A12, between cylinder head connector 2 pin 4 and connector EDC pin A4.	EDC pilot light on. It is possible that immediately afterwards the engine keeps on running at 2 (3) cylinders, because the injectors are driven by two power stages. In this case also error 5.7 (6 cylinders) or 5.8 (4 cylinders) can be stored .
ENGINE – INJECTOR CYLINDER 6	07	07	VALUE OVER THE NORMAL LIMIT	The engine runs at 5 cylinders.	Electrical part of cylinder n°6 injector short–circuited or open–circuited.	Check that the nuts fixing the cables on the injector solenoid valve are properly tightened to the torque of 1,5 Nm. Check the injector solenoid valve continuity and resistance (R = approx. 0,5 Ohm). If the solenoid valve is all right, check the wiring on cylinder head between connector 3 pins 1 and 2 and electro–injector. If the cylinder head wiring is all right, check the engine cable between the cylinder head connector 3 pin 1 and connector EDC pin A10, between cylinder head connector 3 pin 2 and connector EDC pin A15.	EDC pilot light on. It is possible that immediately afterwards the engine keeps on running at 3 cylinders, because the injectors are driven by two power stages. In this case also error 5.8 can be stored .

Component failure	DTC	FMI	Error type	Visible anomaly	Possible cause	Recommended repairs	Notes
ENGINE – INJECTOR CYLINDER 3	07	08	VALUE BELOW THE LIMIT	The engine runs at 3 (5) cylinders.	Electrical part of cylinder n°3 injector short–circuited or open–circuited.	Check that the nuts fixing the cables on the injector solenoid valve are properly tightened to the torque of 1,5 Nm. Check the injector solenoid valve continuity and resistance (R = approx. 0,5 Ohm). If the solenoid valve is all right, check the wiring on cylinder head between connector 2 pins 3 and 4 and electro–injector. If the cylinder head wiring is all right, check the engine cable between the cylinder head connector 2 pin 3 and connector EDC pin A12, between cylinder head connector 2 pin 4 and connector EDC pin A4.	EDC pilot light on. It is possible that immediately afterwards the engine keeps on running at 2 (3) cylinders, because the injectors are driven by two power stages. In this case also error 5.7 (6 cylinders) or 5.8 (4 cylinders) can be stored .
ENGINE – INJECTOR CYLINDER 4	08	00	NO AVAILABLE SYMPTOM	The engine runs at 3 (5) cylinders.	Electrical part of cylinder n°4 injector short–circuited or open–circuited.	Check that the nuts fixing the cables on the injector solenoid valve are properly tightened to the torque of 1,5 Nm. Check the injector solenoid valve continuity and resistance (R = approx. 0,5 Ohm). If the solenoid valve is all right, check the wiring on cylinder head between connector 3 pins 1 and 2 and electro–injector. If the cylinder head wiring is all right, check the engine cable between the cylinder head connector 3 pin 1 and connector EDC pin A10, between cylinder head connector 3 pin 2 and connector EDC pin A15.	EDC pilot light on. It is possible that immediately afterwards the engine keeps on running at 2 (3) cylinders, because the injectors are driven by two power stages. In this case also error 5.7 (4 cylinders) or 5.8 (6 cylinders) can be stored .

Component failure	DTC	FMI	Error type	Visible anomaly	Possible cause	Recommended repairs	Notes
ENGINE – INJECTOR CYLINDER 2	08	00	NO AVAILABLE SYMPTOM	The engine runs at 3 (5) cylinders.	Cylinder n°2 injector electrical part short–circuited or open–circuited.	Check that the nuts fixing the cables on the injector solenoid valve are properly tightened to the torque of 1,5 Nm Check the continuity and resistance of the injector solenoid valve (R = approx. 0,5 Ohm) If the solenoid valve is all right, check the wiring on cylinder head between connector 1 pins 1 and 2 and electro–injector If the cylinder head wiring is all right, check the engine cable between cylinder head connector 1 pin 1 and connector EDC pin A3, between cylinder head connector 1 pin 2 and connector EDC pin A6.	EDC pilot light on. It is possible that immediately afterwards the engine keeps on running at 2 (3) cylinders, because the injectors are driven by two power stages. In this case also error 5.7 (6 cylinders) or 5.8 (4 cylinders) can be stored.
ENGINE – INJECTOR CYLINDER 4	08	01	SHORT CIRCUIT TO POSITIVE	The engine runs at 3 (5) cylinders.	Electrical part of cylinder n°4 injector short–circuited or open–circuited.	Check that the nuts fixing the cables on the injector solenoid valve are properly tightened to the torque of 1,5 Nm. Check the injector solenoid valve continuity and resistance (R = approx. 0,5 Ohm). If the solenoid valve is all right, check the wiring on cylinder head between connector 3 pins 1 and 2 and electro–injector. If the cylinder head wiring is all right, check the engine cable between the cylinder head connector 3 pin 1 and connector EDC pin A10, between cylinder head connector 3 pin 2 and connector EDC pin A15.	EDC pilot light on. It is possible that immediately afterwards the engine keeps on running at 2 (3) cylinders, because the injectors are driven by two power stages. In this case also error 5.7 (4 cylinders) or 5.8 (6 cylinders) can be stored .

Component failure	DTC	FMI	Error type	Visible anomaly	Possible cause	Recommended repairs	Notes
ENGINE – INJECTOR CYLINDER 2	08	01	SHORT CIRCUIT TO POSITIVE	The engine runs at 3 (5) cylinders.	Cylinder n°2 injector electrical part short–circuited or open–circuited.	Check that the nuts fixing the cables on the injector solenoid valve are properly tightened to the torque of 1,5 Nm Check the continuity and resistance of the injector solenoid valve (R = approx. 0,5 Ohm) If the solenoid valve is all right, check the wiring on cylinder head between connector 1 pins 1 and 2 and electro–injector If the cylinder head wiring is all right, check the engine cable between cylinder head connector 1 pin 1 and connector EDC pin A3, between cylinder head connector 1 pin 2 and connector EDC pin A6.	EDC pilot light on. It is possible that immediately afterwards the engine keeps on running at 2 (3) cylinders, because the injectors are driven by two power stages. In this case also error 5.7 (6 cylinders) or 5.8 (4 cylinders) can be stored.
ENGINE – INJECTOR CYLINDER 2	08	02	OPEN CIRCUIT OR SHORT CIRCUIT TO GROUND	The engine runs at 3 (5) cylinders.	Cylinder n°2 injector electrical part short–circuited or open–circuited.	Check that the nuts fixing the cables on the injector solenoid valve are properly tightened to the torque of 1,5 Nm Check the continuity and resistance of the injector solenoid valve (R = approx. 0,5 Ohm) If the solenoid valve is all right, check the wiring on cylinder head between connector 1 pins 1 and 2 and electro–injector If the cylinder head wiring is all right, check the engine cable between cylinder head connector 1 pin 1 and connector EDC pin A3, between cylinder head connector 1 pin 2 and connector EDC pin A6.	EDC pilot light on. It is possible that immediately afterwards the engine keeps on running at 2 (3) cylinders, because the injectors are driven by two power stages. In this case also error 5.7 (6 cylinders) or 5.8 (4 cylinders) can be stored.

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Component failure	DTC	FMI	Error type	Visible anomaly	Possible cause	Recommended repairs	Notes
ENGINE – INJECTOR CYLINDER 4	08	02	OPEN CIRCUIT OR SHORT CIRCUIT TO GROUND	The engine runs at 3 (5) cylinders.	Electrical part of cylinder n°4 injector short–circuited or open–circuited.	Check that the nuts fixing the cables on the injector solenoid valve are properly tightened to the torque of 1,5 Nm. Check the injector solenoid valve continuity and resistance (R = approx. 0,5 Ohm). If the solenoid valve is all right, check the wiring on cylinder head between connector 3 pins 1 and 2 and electro–injector. If the cylinder head wiring is all right, check the engine cable between the cylinder head connector 3 pin 1 and connector EDC pin A10, between cylinder head connector 3 pin 2 and connector EDC pin A15.	EDC pilot light on. It is possible that immediately afterwards the engine keeps on running at 2 (3) cylinders, because the injectors are driven by two power stages. In this case also error 5.7 (4 cylinders) or 5.8 (6 cylinders) can be stored .
ENGINE – INJECTOR CYLINDER 2	08	03	NO SIGNAL	The engine runs at 3 (5) cylinders.	Cylinder n°2 injector electrical part short–circuited or open–circuited.	Check that the nuts fixing the cables on the injector solenoid valve are properly tightened to the torque of 1,5 Nm Check the continuity and resistance of the injector solenoid valve (R = approx. 0,5 Ohm) If the solenoid valve is all right, check the wiring on cylinder head between connector 1 pins 1 and 2 and electro–injector If the cylinder head wiring is all right, check the engine cable between cylinder head connector 1 pin 1 and connector EDC pin A3, between cylinder head connector 1 pin 2 and connector EDC pin A6.	EDC pilot light on. It is possible that immediately afterwards the engine keeps on running at 2 (3) cylinders, because the injectors are driven by two power stages. In this case also error 5.7 (6 cylinders) or 5.8 (4 cylinders) can be stored.

Component failure	DTC	FMI	Error type	Visible anomaly	Possible cause	Recommended repairs	Notes
ENGINE – INJECTOR CYLINDER 4	08	03	NO SIGNAL	The engine runs at 3 (5) cylinders.	Electrical part of cylinder n°4 injector short–circuited or open–circuited.	Check that the nuts fixing the cables on the injector solenoid valve are properly tightened to the torque of 1,5 Nm. Check the injector solenoid valve continuity and resistance (R = approx. 0,5 Ohm). If the solenoid valve is all right, check the wiring on cylinder head between connector 3 pins 1 and 2 and electro–injector. If the cylinder head wiring is all right, check the engine cable between the cylinder head connector 3 pin 1 and connector EDC pin A10, between cylinder head connector 3 pin 2 and connector EDC pin A15.	EDC pilot light on. It is possible that immediately afterwards the engine keeps on running at 2 (3) cylinders, because the injectors are driven by two power stages. In this case also error 5.7 (4 cylinders) or 5.8 (6 cylinders) can be stored .
ENGINE – INJECTOR CYLINDER 2	08	04	SIGNAL NOT PLAUSIBLE	The engine runs at 3 (5) cylinders.	Cylinder n°2 injector electrical part short–circuited or open–circuited.	Check that the nuts fixing the cables on the injector solenoid valve are properly tightened to the torque of 1,5 Nm Check the continuity and resistance of the injector solenoid valve (R = approx. 0,5 Ohm) If the solenoid valve is all right, check the wiring on cylinder head between connector 1 pins 1 and 2 and electro–injector If the cylinder head wiring is all right, check the engine cable between cylinder head connector 1 pin 1 and connector EDC pin A3, between cylinder head connector 1 pin 2 and connector EDC pin A6.	EDC pilot light on. It is possible that immediately afterwards the engine keeps on running at 2 (3) cylinders, because the injectors are driven by two power stages. In this case also error 5.7 (6 cylinders) or 5.8 (4 cylinders) can be stored.

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Component failure	DTC	FMI	Error type	Visible anomaly	Possible cause	Recommended repairs	Notes
ENGINE – INJECTOR CYLINDER 2	08	05	SUPPLY OVER THE NORMAL RANGE	The engine runs at 3 (5) cylinders.	Cylinder n°2 injector electrical part short–circuited or open–circuited.	Check that the nuts fixing the cables on the injector solenoid valve are properly tightened to the torque of 1,5 Nm Check the continuity and resistance of the injector solenoid valve (R = approx. 0,5 Ohm) If the solenoid valve is all right, check the wiring on cylinder head between connector 1 pins 1 and 2 and electro–injector If the cylinder head wiring is all right, check the engine cable between cylinder head connector 1 pin 1 and connector EDC pin A3, between cylinder head connector 1 pin 2 and connector EDC pin A6.	EDC pilot light on. It is possible that immediately afterwards the engine keeps on running at 2 (3) cylinders, because the injectors are driven by two power stages. In this case also error 5.7 (6 cylinders) or 5.8 (4 cylinders) can be stored.
ENGINE – INJECTOR CYLINDER 2	08	06	SUPPLY BELOW THE RANGE	The engine runs at 3 (5) cylinders.	Cylinder n°2 injector electrical part short–circuited or open–circuited.	Check that the nuts fixing the cables on the injector solenoid valve are properly tightened to the torque of 1,5 Nm Check the continuity and resistance of the injector solenoid valve (R = approx. 0,5 Ohm) If the solenoid valve is all right, check the wiring on cylinder head between connector 1 pins 1 and 2 and electro–injector If the cylinder head wiring is all right, check the engine cable between cylinder head connector 1 pin 1 and connector EDC pin A3, between cylinder head connector 1 pin 2 and connector EDC pin A6.	EDC pilot light on. It is possible that immediately afterwards the engine keeps on running at 2 (3) cylinders, because the injectors are driven by two power stages. In this case also error 5.7 (6 cylinders) or 5.8 (4 cylinders) can be stored.

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Component failure	DTC	FMI	Error type	Visible anomaly	Possible cause	Recommended repairs	Notes
ENGINE – INJECTOR CYLINDER 2	08	07	VALUE OVER THE NORMAL LIMIT	The engine runs at 3 (5) cylinders.	Cylinder n°2 injector electrical part short–circuited or open–circuited.	Check that the nuts fixing the cables on the injector solenoid valve are properly tightened to the torque of 1,5 Nm Check the continuity and resistance of the injector solenoid valve (R = approx. 0,5 Ohm) If the solenoid valve is all right, check the wiring on cylinder head between connector 1 pins 1 and 2 and electro–injector If the cylinder head wiring is all right, check the engine cable between cylinder head connector 1 pin 1 and connector EDC pin A3, between cylinder head connector 1 pin 2 and connector EDC pin A6.	EDC pilot light on. It is possible that immediately afterwards the engine keeps on running at 2 (3) cylinders, because the injectors are driven by two power stages. In this case also error 5.7 (6 cylinders) or 5.8 (4 cylinders) can be stored.
ENGINE – INJECTOR CYLINDER 6	08	08	VALUE BELOW THE LIMIT	The engine runs at 5 cylinders.	Electrical part of cylinder n°6 injector short–circuited or open–circuited.	Check that the nuts fixing the cables on the injector solenoid valve are properly tightened to the torque of 1,5 Nm. Check the injector solenoid valve continuity and resistance (R = approx. 0,5 Ohm). If the solenoid valve is all right, check the wiring on cylinder head between connector 3 pins 1 and 2 and electro–injector. If the cylinder head wiring is all right, check the engine cable between the cylinder head connector 3 pin 1 and connector EDC pin A10, between cylinder head connector 3 pin 2 and connector EDC pin A15.	EDC pilot light on. It is possible that immediately afterwards the engine keeps on running at 3 cylinders, because the injectors are driven by two power stages. In this case also error 5.8 can be stored .

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Component failure	DTC	FMI	Error type	Visible anomaly	Possible cause	Recommended repairs	Notes
ENGINE – INJECTOR CYLINDER 2	08	08	VALUE BELOW THE LIMIT	The engine runs at 3 (5) cylinders.	Cylinder n°2 injector electrical part short–circuited or open–circuited.	Check that the nuts fixing the cables on the injector solenoid valve are properly tightened to the torque of 1,5 Nm Check the continuity and resistance of the injector solenoid valve (R = approx. 0,5 Ohm) If the solenoid valve is all right, check the wiring on cylinder head between connector 1 pins 1 and 2 and electro–injector If the cylinder head wiring is all right, check the engine cable between cylinder head connector 1 pin 1 and connector EDC pin A3, between cylinder head connector 1 pin 2 and connector EDC pin A6.	EDC pilot light on. It is possible that immediately afterwards the engine keeps on running at 2 (3) cylinders, because the injectors are driven by two power stages. In this case also error 5.7 (6 cylinders) or 5.8 (4 cylinders) can be stored.
ENGINE – ENGINE OVERSPEED	09	00	NO AVAILABLE SYMPTOM	No reaction noticeable on behalf of the driver.	Excessive engine revolutions	Flight Recorder (Stored Data) reading with Modus IWT–IT2000Driver sensibilization	EDC pilot light winking. Make sure the driver understands the importance of proper driving.
ENGINE – ENGINE OVERSPEED	09	01	ENGINE OVERSPEED	No reaction noticeable on behalf of the driver.	Excessive engine revolutions	Flight Recorder (Stored Data) reading with Modus IWT–IT2000Driver sensibilization	EDC pilot light winking. Make sure the driver understands the importance of proper driving.

Component failure	DTC	FMI	Error type	Visible anomaly	Possible cause	Recommended repairs	Notes
ENGINE – INJECTOR CYLINDER 4	09	04	SIGNAL NOT PLAUSIBLE	The engine runs at 3 (5) cylinders.	Electrical part of cylinder n°4 injector short–circuited or open–circuited.	Check that the nuts fixing the cables on the injector solenoid valve are properly tightened to the torque of 1,5 Nm. Check the injector solenoid valve continuity and resistance (R = approx. 0,5 Ohm). If the solenoid valve is all right, check the wiring on cylinder head between connector 3 pins 1 and 2 and electro–injector. If the cylinder head wiring is all right, check the engine cable between the cylinder head connector 3 pin 1 and connector EDC pin A10, between cylinder head connector 3 pin 2 and connector EDC pin A15.	EDC pilot light on. It is possible that immediately afterwards the engine keeps on running at 2 (3) cylinders, because the injectors are driven by two power stages. In this case also error 5.7 (4 cylinders) or 5.8 (6 cylinders) can be stored .
ENGINE – INJECTOR CYLINDER 4	09	05	SUPPLY OVER THE NORMAL RANGE	The engine runs at 3 (5) cylinders.	Electrical part of cylinder n°4 injector short–circuited or open–circuited.	Check that the nuts fixing the cables on the injector solenoid valve are properly tightened to the torque of 1,5 Nm. Check the injector solenoid valve continuity and resistance (R = approx. 0,5 Ohm). If the solenoid valve is all right, check the wiring on cylinder head between connector 3 pins 1 and 2 and electro–injector. If the cylinder head wiring is all right, check the engine cable between the cylinder head connector 3 pin 1 and connector EDC pin A10, between cylinder head connector 3 pin 2 and connector EDC pin A15.	EDC pilot light on. It is possible that immediately afterwards the engine keeps on running at 2 (3) cylinders, because the injectors are driven by two power stages. In this case also error 5.7 (4 cylinders) or 5.8 (6 cylinders) can be stored .

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Component failure	DTC	FMI	Error type	Visible anomaly	Possible cause	Recommended repairs	Notes
ENGINE – INJECTOR CYLINDER 4	09	06	SUPPLY BELOW THE RANGE	The engine runs at 3 (5) cylinders.	Electrical part of cylinder n°4 injector short–circuited or open–circuited.	Check that the nuts fixing the cables on the injector solenoid valve are properly tightened to the torque of 1,5 Nm. Check the injector solenoid valve continuity and resistance (R = approx. 0,5 Ohm). If the solenoid valve is all right, check the wiring on cylinder head between connector 3 pins 1 and 2 and electro–injector. If the cylinder head wiring is all right, check the engine cable between the cylinder head connector 3 pin 1 and connector EDC pin A10, between cylinder head connector 3 pin 2 and connector EDC pin A15.	EDC pilot light on. It is possible that immediately afterwards the engine keeps on running at 2 (3) cylinders, because the injectors are driven by two power stages. In this case also error 5.7 (4 cylinders) or 5.8 (6 cylinders) can be stored .
ENGINE – INJECTOR CYLINDER 4	09	07	VALUE OVER THE NORMAL LIMIT	The engine runs at 3 (5) cylinders.	Electrical part of cylinder n°4 injector short–circuited or open–circuited.	Check that the nuts fixing the cables on the injector solenoid valve are properly tightened to the torque of 1,5 Nm. Check the injector solenoid valve continuity and resistance (R = approx. 0,5 Ohm). If the solenoid valve is all right, check the wiring on cylinder head between connector 3 pins 1 and 2 and electro–injector. If the cylinder head wiring is all right, check the engine cable between the cylinder head connector 3 pin 1 and connector EDC pin A10, between cylinder head connector 3 pin 2 and connector EDC pin A15.	EDC pilot light on. It is possible that immediately afterwards the engine keeps on running at 2 (3) cylinders, because the injectors are driven by two power stages. In this case also error 5.7 (4 cylinders) or 5.8 (6 cylinders) can be stored .

Component failure	DTC	FMI	Error type	Visible anomaly	Possible cause	Recommended repairs	Notes
ENGINE – INJECTOR CYLINDER 4	09	08	VALUE BELOW THE LIMIT	The engine runs at 3 (5) cylinders.	Electrical part of cylinder n°4 injector short–circuited or open–circuited.	Check that the nuts fixing the cables on the injector solenoid valve are properly tightened to the torque of 1,5 Nm. Check the injector solenoid valve continuity and resistance (R = approx. 0,5 Ohm). If the solenoid valve is all right, check the wiring on cylinder head between connector 3 pins 1 and 2 and electro–injector. If the cylinder head wiring is all right, check the engine cable between the cylinder head connector 3 pin 1 and connector EDC pin A10, between cylinder head connector 3 pin 2 and connector EDC pin A15.	EDC pilot light on. It is possible that immediately afterwards the engine keeps on running at 2 (3) cylinders, because the injectors are driven by two power stages. In this case also error 5.7 (4 cylinders) or 5.8 (6 cylinders) can be stored .
SENSORS – ACCELERATOR PEDAL/BRAKE PEDAL SUSPECT	0A	00	NO AVAILABLE SYMPTOM	Engine revolutions drop to minimum speed	Brake/accelerator pedal feasibility, or simultaneous activation of brake and accelerator	Parameters reading on Modus IWT–IT2000, check that accelerator pedal potentiometer signal is reset upon release, otherwise it is possible that the driver has pressed brake and accelerator together	EDC pilot light off. This error is stored only if the brake and accelerator signals are not damaged. If the brake is operated while the accelerator pedal is being pressed, the engine runs to idle until the brake is released, so that the vehicle can be stopped even if the accelerator pedal should block in an intermediate position. On the contrary it is possible to accelerate while the brake pedal is pressed without the intervention of any safety strategies.

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Component failure	DTC	FMI	Error type	Visible anomaly	Possible cause	Recommended repairs	Notes
SENSORS – ACCELERATOR PEDAL/BRAKE PEDAL SUSPECT	0A	01	SHORT CIRCUIT TO POSITIVE	Engine revolutions drop to minimum speed	Brake/accelerator pedal feasibility, or simultaneous activation of brake and accelerator	Parameters reading on Modus IWT–IT2000, check that accelerator pedal potentiometer signal is reset upon release, otherwise it is possible that the driver has pressed brake and accelerator together	EDC pilot light off. This error is stored only if the brake and accelerator signals are not damaged. If the brake is operated while the accelerator pedal is being pressed, the engine runs to idle until the brake is released, so that the vehicle can be stopped even if the accelerator pedal should block in an intermediate position. On the contrary it is possible to accelerate while the brake pedal is pressed without the intervention of any safety strategies.
SENSORS – ACCELERATOR PEDAL/BRAKE PEDAL SUSPECT	0A	02	OPEN CIRCUIT OR SHORT CIRCUIT TO GROUND	Engine revolutions drop to minimum speed	Brake/accelerator pedal feasibility, or simultaneous activation of brake and accelerator	Parameters reading on Modus IWT–IT2000, check that accelerator pedal potentiometer signal is reset upon release, otherwise it is possible that the driver has pressed brake and accelerator together	EDC pilot light off. This error is stored only if the brake and accelerator signals are not damaged. If the brake is operated while the accelerator pedal is being pressed, the engine runs to idle until the brake is released, so that the vehicle can be stopped even if the accelerator pedal should block in an intermediate position. On the contrary it is possible to accelerate while the brake pedal is pressed without the intervention of any safety strategies.

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Component failure	DTC	FMI	Error type	Visible anomaly	Possible cause	Recommended repairs	Notes
SENSORS – ACCELERATOR PEDAL/BRAKE PEDAL SUSPECT	0A	03	NO SIGNAL	Engine revolutions drop to minimum speed	Brake/accelerator pedal feasibility, or simultaneous activation of brake and accelerator	Parameters reading on Modus IWT–IT2000, check that accelerator pedal potentiometer signal is reset upon release, otherwise it is possible that the driver has pressed brake and accelerator together	EDC pilot light off. This error is stored only if the brake and accelerator signals are not damaged. If the brake is operated while the accelerator pedal is being pressed, the engine runs to idle until the brake is released, so that the vehicle can be stopped even if the accelerator pedal should block in an intermediate position. On the contrary it is possible to accelerate while the brake pedal is pressed without the intervention of any safety strategies.
SENSORS – ACCELERATOR PEDAL/BRAKE PEDAL SUSPECT	0A	04	SIGNAL NOT PLAUSIBLE	Engine revolutions drop to minimum speed	Brake/accelerator pedal feasibility, or simultaneous activation of brake and accelerator	Parameters reading on Modus IWT–IT2000, check that accelerator pedal potentiometer signal is reset upon release, otherwise it is possible that the driver has pressed brake and accelerator together	EDC pilot light off. This error is stored only if the brake and accelerator signals are not damaged. If the brake is operated while the accelerator pedal is being pressed, the engine runs to idle until the brake is released, so that the vehicle can be stopped even if the accelerator pedal should block in an intermediate position. On the contrary it is possible to accelerate while the brake pedal is pressed without the intervention of any safety strategies.

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Component failure	DTC	FMI	Error type	Visible anomaly	Possible cause	Recommended repairs	Notes
SENSORS – ACCELERATOR PEDAL/BRAKE PEDAL SUSPECT	0A	05	SUPPLY OVER THE NORMAL RANGE	Engine revolutions drop to minimum speed	Brake/accelerator pedal feasibility, or simultaneous activation of brake and accelerator	Parameters reading on Modus IWT–IT2000, check that accelerator pedal potentiometer signal is reset upon release, otherwise it is possible that the driver has pressed brake and accelerator together	EDC pilot light off. This error is stored only if the brake and accelerator signals are not damaged. If the brake is operated while the accelerator pedal is being pressed, the engine runs to idle until the brake is released, so that the vehicle can be stopped even if the accelerator pedal should block in an intermediate position. On the contrary it is possible to accelerate while the brake pedal is pressed without the intervention of any safety strategies.
SENSORS – ACCELERATOR PEDAL/BRAKE PEDAL SUSPECT	0A	06	SUPPLY BELOW THE RANGE	Engine revolutions drop to minimum speed	Brake/accelerator pedal feasibility, or simultaneous activation of brake and accelerator	Parameters reading on Modus IWT–IT2000, check that accelerator pedal potentiometer signal is reset upon release, otherwise it is possible that the driver has pressed brake and accelerator together	EDC pilot light off. This error is stored only if the brake and accelerator signals are not damaged. If the brake is operated while the accelerator pedal is being pressed, the engine runs to idle until the brake is released, so that the vehicle can be stopped even if the accelerator pedal should block in an intermediate position. On the contrary it is possible to accelerate while the brake pedal is pressed without the intervention of any safety strategies.

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Component failure	DTC	FMI	Error type	Visible anomaly	Possible cause	Recommended repairs	Notes
SENSORS – ACCELERATOR PEDAL/BRAKE PEDAL SUSPECT	0A	07	VALUE OVER THE NORMAL LIMIT	Engine revolutions drop to minimum speed	Brake/accelerator pedal feasibility, or simultaneous activation of brake and accelerator	Parameters reading on Modus IWT–IT2000, check that accelerator pedal potentiometer signal is reset upon release, otherwise it is possible that the driver has pressed brake and accelerator together	EDC pilot light off. This error is stored only if the brake and accelerator signals are not damaged. If the brake is operated while the accelerator pedal is being pressed, the engine runs to idle until the brake is released, so that the vehicle can be stopped even if the accelerator pedal should block in an intermediate position. On the contrary it is possible to accelerate while the brake pedal is pressed without the intervention of any safety strategies.
SENSORS – ACCELERATOR PEDAL/BRAKE PEDAL SUSPECT	0A	08	VALUE BELOW THE LIMIT	Engine revolutions drop to minimum speed	Brake/accelerator pedal feasibility, or simultaneous activation of brake and accelerator	Parameters reading on Modus IWT–IT2000, check that accelerator pedal potentiometer signal is reset upon release, otherwise it is possible that the driver has pressed brake and accelerator together	EDC pilot light off. This error is stored only if the brake and accelerator signals are not damaged. If the brake is operated while the accelerator pedal is being pressed, the engine runs to idle until the brake is released, so that the vehicle can be stopped even if the accelerator pedal should block in an intermediate position. On the contrary it is possible to accelerate while the brake pedal is pressed without the intervention of any safety strategies.

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Component failure	DTC	FMI	Error type	Visible anomaly	Possible cause	Recommended repairs	Notes
SENSORS – BOOST PRESSURE	0B	00	NO AVAILABLE SYMPTOM	No reaction noticeable on behalf of the driver. Power reduction (only in the software version for engine with single–stage overpressure valve).	Positively short–circuited, ground–short–circuited or open–circuited air pressure sensor on suction manifold, or sensor supplied by a current that exceeds the minimum or maximum limit	Reading of measurable parameters by means of the diagnostic instrument: in presence of this error, the overcharging pressure will be fixed at 1600 mbar. Check the wiring between the sensor connector (wiring side) pin 3 and connector EDC pin C10, between sensor connector (wiring side) pin 4 and connector EDC pin C28.	EDC pilot light on. The pressure sensor is incorporated in the temperature one. If the electrical part is all right, check the functionality of the wastegate valve of the turbocompressor.
SENSORS – BOOST PRESSURE	0B	01	SHORT CIRCUIT TO POSITIVE	No reaction noticeable on behalf of the driver. Power reduction (only in the software version for engine with single–stage overpressure valve).	Positively short–circuited, ground–short–circuited or open–circuited air pressure sensor on suction manifold, or sensor supplied by a current that exceeds the minimum or maximum limit	Reading of measurable parameters by means of the diagnostic instrument: in presence of this error, the overcharging pressure will be fixed at 1600 mbar. Check the wiring between the sensor connector (wiring side) pin 3 and connector EDC pin C10, between sensor connector (wiring side) pin 4 and connector EDC pin C28.	EDC pilot light on. The pressure sensor is incorporated in the temperature one. If the electrical part is all right, check the functionality of the wastegate valve of the turbocompressor.
SENSORS – BOOST PRESSURE	0B	02	OPEN CIRCUIT OR SHORT CIRCUIT TO GROUND	No reaction noticeable on behalf of the driver. Power reduction (only in the software version for engine with single–stage overpressure valve).	Positively short–circuited, ground–short–circuited or open–circuited air pressure sensor on suction manifold, or sensor supplied by a current that exceeds the minimum or maximum limit	Reading of measurable parameters by means of the diagnostic instrument: in presence of this error, the overcharging pressure will be fixed at 1600 mbar. Check the wiring between the sensor connector (wiring side) pin 3 and connector EDC pin C10, between sensor connector (wiring side) pin 4 and connector EDC pin C28.	EDC pilot light on. The pressure sensor is incorporated in the temperature one. If the electrical part is all right, check the functionality of the wastegate valve of the turbocompressor.

Component failure	DTC	FMI	Error type	Visible anomaly	Possible cause	Recommended repairs	Notes
SENSORS – BOOST PRESSURE	0B	03	NO SIGNAL	No reaction noticeable on behalf of the driver. Power reduction (only in the software version for engine with single–stage overpressure valve).	Positively short–circuited, ground–short–circuited or open–circuited air pressure sensor on suction manifold, or sensor supplied by a current that exceeds the minimum or maximum limit	Reading of measurable parameters by means of the diagnostic instrument: in presence of this error, the overcharging pressure will be fixed at 1600 mbar. Check the wiring between the sensor connector (wiring side) pin 3 and connector EDC pin C10, between sensor connector (wiring side) pin 4 and connector EDC pin C28.	EDC pilot light on. The pressure sensor is incorporated in the temperature one. If the electrical part is all right, check the functionality of the wastegate valve of the turbocompressor.
SENSORS – BOOST PRESSURE	0B	04	SIGNAL NOT PLAUSIBLE	No reaction noticeable on behalf of the driver. Power reduction (only in the software version for engine with single–stage overpressure valve).	Positively short–circuited, ground–short–circuited or open–circuited air pressure sensor on suction manifold, or sensor supplied by a current that exceeds the minimum or maximum limit	Reading of measurable parameters by means of the diagnostic instrument: in presence of this error, the overcharging pressure will be fixed at 1600 mbar. Check the wiring between the sensor connector (wiring side) pin 3 and connector EDC pin C10, between sensor connector (wiring side) pin 4 and connector EDC pin C28.	EDC pilot light on. The pressure sensor is incorporated in the temperature one. If the electrical part is all right, check the functionality of the wastegate valve of the turbocompressor.
SENSORS – BOOST PRESSURE	0B	05	SUPPLY OVER THE NORMAL RANGE	No reaction noticeable on behalf of the driver. Power reduction (only in the software version for engine with single–stage overpressure valve).	Positively short–circuited, ground–short–circuited or open–circuited air pressure sensor on suction manifold, or sensor supplied by a current that exceeds the minimum or maximum limit	Reading of measurable parameters by means of the diagnostic instrument: in presence of this error, the overcharging pressure will be fixed at 1600 mbar. Check the wiring between the sensor connector (wiring side) pin 3 and connector EDC pin C10, between sensor connector (wiring side) pin 4 and connector EDC pin C28.	EDC pilot light on. The pressure sensor is incorporated in the temperature one. If the electrical part is all right, check the functionality of the wastegate valve of the turbocompressor.

Component failure	DTC	FMI	Error type	Visible anomaly	Possible cause	Recommended repairs	Notes
SENSORS – BOOST PRESSURE	0B	06	SUPPLY BELOW THE RANGE	No reaction noticeable on behalf of the driver. Power reduction (only in the software version for engine with single–stage overpressure valve).	Positively short–circuited, ground–short–circuited or open–circuited air pressure sensor on suction manifold, or sensor supplied by a current that exceeds the minimum or maximum limit	Reading of measurable parameters by means of the diagnostic instrument: in presence of this error, the overcharging pressure will be fixed at 1600 mbar. Check the wiring between the sensor connector (wiring side) pin 3 and connector EDC pin C10, between sensor connector (wiring side) pin 4 and connector EDC pin C28.	EDC pilot light on. The pressure sensor is incorporated in the temperature one. If the electrical part is all right, check the functionality of the wastegate valve of the turbocompressor.
SENSORS – BOOST PRESSURE	0B	07	VALUE OVER THE NORMAL LIMIT	No reaction noticeable on behalf of the driver. Power reduction (only in the software version for engine with single–stage overpressure valve).	Positively short–circuited, ground–short–circuited or open–circuited air pressure sensor on suction manifold, or sensor supplied by a current that exceeds the minimum or maximum limit	Reading of measurable parameters by means of the diagnostic instrument: in presence of this error, the overcharging pressure will be fixed at 1600 mbar. Check the wiring between the sensor connector (wiring side) pin 3 and connector EDC pin C10, between sensor connector (wiring side) pin 4 and connector EDC pin C28.	EDC pilot light on. The pressure sensor is incorporated in the temperature one. If the electrical part is all right, check the functionality of the wastegate valve of the turbocompressor.
SENSORS – BOOST PRESSURE	0B	08	VALUE BELOW THE LIMIT	No reaction noticeable on behalf of the driver. Power reduction (only in the software version for engine with single–stage overpressure valve).	Positively short–circuited, ground–short–circuited or open–circuited air pressure sensor on suction manifold, or sensor supplied by a current that exceeds the minimum or maximum limit	Reading of measurable parameters by means of the diagnostic instrument: in presence of this error, the overcharging pressure will be fixed at 1600 mbar. Check the wiring between the sensor connector (wiring side) pin 3 and connector EDC pin C10, between sensor connector (wiring side) pin 4 and connector EDC pin C28.	EDC pilot light on. The pressure sensor is incorporated in the temperature one. If the electrical part is all right, check the functionality of the wastegate valve of the turbocompressor.

Component failure	DTC	FMI	Error type	Visible anomaly	Possible cause	Recommended repairs	Notes
SENSORS – CRANKSHAFT	0F	00	NO AVAILABLE SYMPTOM	The engine doesn't start. Light power reduction.	Drive shaft sensor: lack of signal or unfeasible signal	Check the cleaning and the proper fastening of the sensor. Check the phonic wheel is not damaged and verify its cleaning. Check the sensor is all right (R = approx. 920 Ohm). If the sensor is not damaged, check the wiring between the sensor connector (wiring side) pin 1 and connector EDC pin C25, between sensor connector (wiring side) pin 2 and connector EDC pin C24.	EDC pilot light on. Error 6.1 is always combined with 6.3 The engine doesn't start because after a few revolutions the gearcase disables the starter.
SENSORS – CRANKSHAFT	0F	03	NO SIGNAL	The engine doesn't start. Light power reduction.	Drive shaft sensor: lack of signal or unfeasible signal	Check the cleaning and the proper fastening of the sensor. Check the phonic wheel is not damaged and verify its cleaning. Check the sensor is all right (R = approx. 920 Ohm). If the sensor is not damaged, check the wiring between the sensor connector (wiring side) pin 1 and connector EDC pin C25, between sensor connector (wiring side) pin 2 and connector EDC pin C24.	EDC pilot light on. Error 6.1 is always combined with 6.3 The engine doesn't start because after a few revolutions the gearcase disables the starter.
SENSORS – CRANKSHAFT	0F	04	SIGNAL NOT PLAUSIBLE	The engine doesn't start. Light power reduction.	Drive shaft sensor: lack of signal or unfeasible signal	Check the cleaning and the proper fastening of the sensor. Check the phonic wheel is not damaged and verify its cleaning. Check the sensor is all right (R = approx. 920 Ohm). If the sensor is not damaged, check the wiring between the sensor connector (wiring side) pin 1 and connector EDC pin C25, between sensor connector (wiring side) pin 2 and connector EDC pin C24.	EDC pilot light on. Error 6.1 is always combined with 6.3 The engine doesn't start because after a few revolutions the gearcase disables the starter.

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Component failure	DTC	FMI	Error type	Visible anomaly	Possible cause	Recommended repairs	Notes
SENSORS – CRANKSHAFT	0F	05	NOISY SIGNAL ON WUP 1	The engine doesn't start. Light power reduction.	Drive shaft sensor: lack of signal or unfeasible signal	Check the cleaning and the proper fastening of the sensor. Check the phonic wheel is not damaged and verify its cleaning. Check the sensor is all right (R = approx. 920 Ohm). If the sensor is not damaged, check the wiring between the sensor connector (wiring side) pin 1 and connector EDC pin C25, between sensor connector (wiring side) pin 2 and connector EDC pin C24.	EDC pilot light on. Error 6.1 is always combined with 6.3 The engine doesn't start because after a few revolutions the gearcase disables the starter.
SENSORS – CAMSHAFT	10	00	NO AVAILABLE SYMPTOM	Difficult starting in every condition. False injections and grade of smoke at the exhaust during starting.	Distribution shaft sensor: lack of signal or unfeasible signal	Check the correct sensor fastening and its cleaning. Check that the sensor is not damaged (R = approx. 890 Ohm). If the sensor is all right, check the wiring between the sensor connector (wiring side) pin 1 and connector EDC pin C23, between sensor connector (wiring side) pin 2 and connector EDC pin C30.	EDC pilot light on. This error is always combined with 6.3.
SENSORS – CAMSHAFT	10	03	NO SIGNAL	Difficult starting in every condition. False injections and grade of smoke at the exhaust during starting.	Distribution shaft sensor: lack of signal or unfeasible signal	Check the correct sensor fastening and its cleaning. Check that the sensor is not damaged (R = approx. 890 Ohm). If the sensor is all right, check the wiring between the sensor connector (wiring side) pin 1 and connector EDC pin C23, between sensor connector (wiring side) pin 2 and connector EDC pin C30.	EDC pilot light on. This error is always combined with 6.3.

Component failure	DTC	FMI	Error type	Visible anomaly	Possible cause	Recommended repairs	Notes
SENSORS – CAMSHAFT	10	04	SIGNAL NOT PLAUSIBLE	Difficult starting in every condition. False injections and grade of smoke at the exhaust during starting.	Distribution shaft sensor: lack of signal or unfeasible signal	Check the correct sensor fastening and its cleaning. Check that the sensor is not damaged (R = approx. 890 Ohm). If the sensor is all right, check the wiring between the sensor connector (wiring side) pin 1 and connector EDC pin C23, between sensor connector (wiring side) pin 2 and connector EDC pin C30.	EDC pilot light on. This error is always combined with 6.3.
SENSORS – CRANKSHAFT	10	06	NOISY SIGNAL ON WUP 2	The engine doesn't start. Light power reduction.	Drive shaft sensor: lack of signal or unfeasible signal	Check the cleaning and the proper fastening of the sensor. Check the phonic wheel is not damaged and verify its cleaning. Check the sensor is all right (R = approx. 920 Ohm). If the sensor is not damaged, check the wiring between the sensor connector (wiring side) pin 1 and connector EDC pin C25, between sensor connector (wiring side) pin 2 and connector EDC pin C24.	EDC pilot light on. Error 6.1 is always combined with 6.3 The engine doesn't start because after a few revolutions the gearcase disables the starter.
SENSORS – VEHICLE SPEED	11	00	NO AVAILABLE SYMPTOM	The speedometer doesn't work (if the failure is between the sensor and the speedometer) Cruise Control doesn't work.	Vehicle speed signal over the maximum threshold or below the minimum one (likely short circuit).	Reading of the parameters measurable with the diagnostic instrument: in presence of this error, the vehicle speed read on the gearcase will be fixed at 5 km/h. Failure memory reading by means of the diagnostic instrument: in case of intermittent error, check the connectors for a possible uncertain contact. If the error occurs, carry out the following checks: If the tachograph doesn't work, check the wiring and the sensor–tachograph connections; If the tachograph works but it displays an unreasonable speed, check the proper assembly, the cleaning and the sensor air gap; In case the defect persists, check the wiring and the connections between the tachograph connector (wiring side) and the connector EDC pin B74, passing through sleeve B pin 13.	EDC pilot light on. Error detected only with running vehicle, and only in case of short circuit. If the signal is missing, no error is detected because according to the gearcase the vehicle stands still.

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Component failure	DTC	FMI	Error type	Visible anomaly	Possible cause	Recommended repairs	Notes
SENSORS – VEHICLE SPEED	11	01	SHORT CIRCUIT TO POSITIVE	The speedometer doesn't work (if the failure is between the sensor and the speedometer) Cruise Control doesn't work.	Vehicle speed signal over the maximum threshold or below the minimum one (likely short circuit).	Reading of the parameters measurable with the diagnostic instrument: in presence of this error, the vehicle speed read on the gearcase will be fixed at 5 km/h. Failure memory reading by means of the diagnostic instrument: in case of intermittent error, check the connectors for a possible uncertain contact. If the error occurs, carry out the following checks: If the tachograph doesn't work, check the wiring and the sensor–tachograph connections; If the tachograph works but it displays an unreasonable speed, check the proper assembly, the cleaning and the sensor air gap; In case the defect persists, check the wiring and the connections between the tachograph connector (wiring side) and the connector EDC pin B74, passing through sleeve B pin 13.	EDC pilot light on. Error detected only with running vehicle, and only in case of short circuit. If the signal is missing, no error is detected because according to the gearcase the vehicle stands still.

Component failure	DTC	FMI	Error type	Visible anomaly	Possible cause	Recommended repairs	Notes
SENSORS – VEHICLE SPEED	11	02	OPEN CIRCUIT OR SHORT CIRCUIT TO GROUND	The speedometer doesn't work (if the failure is between the sensor and the speedometer) Cruise Control doesn't work.	Vehicle speed signal over the maximum threshold or below the minimum one (likely short circuit).	Reading of the parameters measurable with the diagnostic instrument: in presence of this error, the vehicle speed read on the gearcase will be fixed at 5 km/h. Failure memory reading by means of the diagnostic instrument: in case of intermittent error, check the connectors for a possible uncertain contact. If the error occurs, carry out the following checks: If the tachograph doesn't work, check the wiring and the sensor–tachograph connections; If the tachograph works but it displays an unreasonable speed, check the proper assembly, the cleaning and the sensor air gap; In case the defect persists, check the wiring and the connections between the tachograph connector (wiring side) and the connector EDC pin B74, passing through sleeve B pin 13.	EDC pilot light on. Error detected only with running vehicle, and only in case of short circuit. If the signal is missing, no error is detected because according to the gearcase the vehicle stands still.

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Component failure	DTC	FMI	Error type	Visible anomaly	Possible cause	Recommended repairs	Notes
SENSORS – VEHICLE SPEED	11	03	NO SIGNAL	The speedometer doesn't work (if the failure is between the sensor and the speedometer) Cruise Control doesn't work.	Vehicle speed signal over the maximum threshold or below the minimum one (likely short circuit).	Reading of the parameters measurable with the diagnostic instrument: in presence of this error, the vehicle speed read on the gearcase will be fixed at 5 km/h. Failure memory reading by means of the diagnostic instrument: in case of intermittent error, check the connectors for a possible uncertain contact. If the error occurs, carry out the following checks: If the tachograph doesn't work, check the wiring and the sensor–tachograph connections; If the tachograph works but it displays an unreasonable speed, check the proper assembly, the cleaning and the sensor air gap; In case the defect persists, check the wiring and the connections between the tachograph connector (wiring side) and the connector EDC pin B74, passing through sleeve B pin 13.	EDC pilot light on. Error detected only with running vehicle, and only in case of short circuit. If the signal is missing, no error is detected because according to the gearcase the vehicle stands still.

Component failure	DTC	FMI	Error type	Visible anomaly	Possible cause	Recommended repairs	Notes
SENSORS – VEHICLE SPEED	11	04	SIGNAL NOT PLAUSIBLE	The speedometer doesn't work (if the failure is between the sensor and the speedometer) Cruise Control doesn't work.	Vehicle speed signal over the maximum threshold or below the minimum one (likely short circuit).	Reading of the parameters measurable with the diagnostic instrument: in presence of this error, the vehicle speed read on the gearcase will be fixed at 5 km/h. Failure memory reading by means of the diagnostic instrument: in case of intermittent error, check the connectors for a possible uncertain contact. If the error occurs, carry out the following checks: If the tachograph doesn't work, check the wiring and the sensor–tachograph connections; If the tachograph works but it displays an unreasonable speed, check the proper assembly, the cleaning and the sensor air gap; In case the defect persists, check the wiring and the connections between the tachograph connector (wiring side) and the connector EDC pin B74, passing through sleeve B pin 13.	EDC pilot light on. Error detected only with running vehicle, and only in case of short circuit. If the signal is missing, no error is detected because according to the gearcase the vehicle stands still.

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Component failure	DTC	FMI	Error type	Visible anomaly	Possible cause	Recommended repairs	Notes
SENSORS – VEHICLE SPEED	11	05	SUPPLY OVER THE NORMAL RANGE	The speedometer doesn't work (if the failure is between the sensor and the speedometer) Cruise Control doesn't work.	Vehicle speed signal over the maximum threshold or below the minimum one (likely short circuit).	Reading of the parameters measurable with the diagnostic instrument: in presence of this error, the vehicle speed read on the gearcase will be fixed at 5 km/h. Failure memory reading by means of the diagnostic instrument: in case of intermittent error, check the connectors for a possible uncertain contact. If the error occurs, carry out the following checks: If the tachograph doesn't work, check the wiring and the sensor–tachograph connections; If the tachograph works but it displays an unreasonable speed, check the proper assembly, the cleaning and the sensor air gap; In case the defect persists, check the wiring and the connections between the tachograph connector (wiring side) and the connector EDC pin B74, passing through sleeve B pin 13.	EDC pilot light on. Error detected only with running vehicle, and only in case of short circuit. If the signal is missing, no error is detected because according to the gearcase the vehicle stands still.

Component failure	DTC	FMI	Error type	Visible anomaly	Possible cause	Recommended repairs	Notes
SENSORS – VEHICLE SPEED	11	06	SUPPLY BELOW THE RANGE	The speedometer doesn't work (if the failure is between the sensor and the speedometer) Cruise Control doesn't work.	Vehicle speed signal over the maximum threshold or below the minimum one (likely short circuit).	Reading of the parameters measurable with the diagnostic instrument: in presence of this error, the vehicle speed read on the gearcase will be fixed at 5 km/h. Failure memory reading by means of the diagnostic instrument: in case of intermittent error, check the connectors for a possible uncertain contact. If the error occurs, carry out the following checks: If the tachograph doesn't work, check the wiring and the sensor–tachograph connections; If the tachograph works but it displays an unreasonable speed, check the proper assembly, the cleaning and the sensor air gap; In case the defect persists, check the wiring and the connections between the tachograph connector (wiring side) and the connector EDC pin B74, passing through sleeve B pin 13.	EDC pilot light on. Error detected only with running vehicle, and only in case of short circuit. If the signal is missing, no error is detected because according to the gearcase the vehicle stands still.

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Component failure	DTC	FMI	Error type	Visible anomaly	Possible cause	Recommended repairs	Notes
SENSORS – VEHICLE SPEED	11	07	VALUE OVER THE NORMAL LIMIT	The speedometer doesn't work (if the failure is between the sensor and the speedometer) Cruise Control doesn't work.	Vehicle speed signal over the maximum threshold or below the minimum one (likely short circuit).	Reading of the parameters measurable with the diagnostic instrument: in presence of this error, the vehicle speed read on the gearcase will be fixed at 5 km/h. Failure memory reading by means of the diagnostic instrument: in case of intermittent error, check the connectors for a possible uncertain contact. If the error occurs, carry out the following checks: If the tachograph doesn't work, check the wiring and the sensor–tachograph connections; If the tachograph works but it displays an unreasonable speed, check the proper assembly, the cleaning and the sensor air gap; In case the defect persists, check the wiring and the connections between the tachograph connector (wiring side) and the connector EDC pin B74, passing through sleeve B pin 13.	EDC pilot light on. Error detected only with running vehicle, and only in case of short circuit. If the signal is missing, no error is detected because according to the gearcase the vehicle stands still.
VOLTAGE	12	00	NO AVAILABLE SYMPTOM	Idling accelerated (depending upon the detected voltage), up to a maximum of 200 rpm over the standard idling speed.	Too low battery voltage signal.	Reading of measurable parameters to check the battery voltage Carry out the appropriate checks on voltage regulator, batteries and recharge system.	
VOLTAGE	12	01	VOLTAGE TOO HIGH	Idling accelerated (depending upon the detected voltage), up to a maximum of 200 rpm over the standard idling speed.	Too low battery voltage signal.	Reading of measurable parameters to check the battery voltage Carry out the appropriate checks on voltage regulator, batteries and recharge system.	
VOLTAGE	12	02	VOLTAGE TOO LOW	Idling accelerated (depending upon the detected voltage), up to a maximum of 200 rpm over the standard idling speed.	Too low battery voltage signal.	Reading of measurable parameters to check the battery voltage Carry out the appropriate checks on voltage regulator, batteries and recharge system.	

Component failure	DTC	FMI	Error type	Visible anomaly	Possible cause	Recommended repairs	Notes
SENSORS – VEHICLE SPEED	12	08	VALUE BELOW THE LIMIT	The speedometer doesn't work (if the failure is between the sensor and the speedometer) Cruise Control doesn't work.	Vehicle speed signal over the maximum threshold or below the minimum one (likely short circuit).	Reading of the parameters measurable with the diagnostic instrument: in presence of this error, the vehicle speed read on the gearcase will be fixed at 5 km/h. Failure memory reading by means of the diagnostic instrument: in case of intermittent error, check the connectors for a possible uncertain contact. If the error occurs, carry out the following checks: If the tachograph doesn't work, check the wiring and the sensor–tachograph connections; If the tachograph works but it displays an unreasonable speed, check the proper assembly, the cleaning and the sensor air gap; In case the defect persists, check the wiring and the connections between the tachograph connector (wiring side) and the connector EDC pin B74, passing through sleeve B pin 13.	EDC pilot light on. Error detected only with running vehicle, and only in case of short circuit. If the signal is missing, no error is detected because according to the gearcase the vehicle stands still.
ELECTRONIC CONTROL UNIT – SENSOR POWER SUPPLY	13	00	NO AVAILABLE SYMPTOM	Anomalous engine operation due to incorrectly powered sensors. Reduced power.	Sensor power circuit fault in ECU.	Erase the failure memory and retry. If the problem persists, contact the Help Desk and follow the instructions for the possible replacement of the gearcase.	EDC pilot light on. Possible defect warning regarding various sensors powered by the gearcase.
ELECTRONIC CONTROL UNIT – SENSOR POWER SUPPLY	13	01	SHORT CIRCUIT TO POSITIVE	Anomalous engine operation due to incorrectly powered sensors. Reduced power.	Sensor power circuit fault in ECU.	Erase the failure memory and retry. If the problem persists, contact the Help Desk and follow the instructions for the possible replacement of the gearcase.	EDC pilot light on. Possible defect warning regarding various sensors powered by the gearcase.
ELECTRONIC CONTROL UNIT – SENSOR POWER SUPPLY	13	02	OPEN CIRCUIT OR SHORT CIRCUIT TO GROUND	Anomalous engine operation due to incorrectly powered sensors. Reduced power.	Sensor power circuit fault in ECU.	Erase the failure memory and retry. If the problem persists, contact the Help Desk and follow the instructions for the possible replacement of the gearcase.	EDC pilot light on. Possible defect warning regarding various sensors powered by the gearcase.

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Component failure	DTC	FMI	Error type	Visible anomaly	Possible cause	Recommended repairs	Notes
ELECTRONIC CONTROL UNIT – SENSOR POWER SUPPLY	13	03	NO SIGNAL	Anomalous engine operation due to incorrectly powered sensors. Reduced power.	Sensor power circuit fault in ECU.	Erase the failure memory and retry. If the problem persists, contact the Help Desk and follow the instructions for the possible replacement of the gearcase.	EDC pilot light on. Possible defect warning regarding various sensors powered by the gearcase.
ELECTRONIC CONTROL UNIT – SENSOR POWER SUPPLY	13	04	SIGNAL NOT PLAUSIBLE	Anomalous engine operation due to incorrectly powered sensors. Reduced power.	Sensor power circuit fault in ECU.	Erase the failure memory and retry. If the problem persists, contact the Help Desk and follow the instructions for the possible replacement of the gearcase.	EDC pilot light on. Possible defect warning regarding various sensors powered by the gearcase.
ELECTRONIC CONTROL UNIT – SENSOR POWER SUPPLY	13	05	SUPPLY OVER THE NORMAL RANGE	Anomalous engine operation due to incorrectly powered sensors. Reduced power.	Sensor power circuit fault in ECU.	Erase the failure memory and retry. If the problem persists, contact the Help Desk and follow the instructions for the possible replacement of the gearcase.	EDC pilot light on. Possible defect warning regarding various sensors powered by the gearcase.
ELECTRONIC CONTROL UNIT – SENSOR POWER SUPPLY	13	06	SUPPLY BELOW THE RANGE	Anomalous engine operation due to incorrectly powered sensors. Reduced power.	Sensor power circuit fault in ECU.	Erase the failure memory and retry. If the problem persists, contact the Help Desk and follow the instructions for the possible replacement of the gearcase.	EDC pilot light on. Possible defect warning regarding various sensors powered by the gearcase.
VOLTAGE	13	07	VOLTAGE HIGH	Idling accelerated (depending upon the detected voltage), up to a maximum of 200 rpm over the standard idling speed.	Too low battery voltage signal.	Reading of measurable parameters to check the battery voltage. Carry out the appropriate checks on voltage regulator, batteries and recharge system.	
ELECTRONIC CONTROL UNIT – SENSOR POWER SUPPLY	13	07	VALUE OVER THE NORMAL LIMIT	Anomalous engine operation due to incorrectly powered sensors. Reduced power.	Sensor power circuit fault in ECU.	Erase the failure memory and retry. If the problem persists, contact the Help Desk and follow the instructions for the possible replacement of the gearcase.	EDC pilot light on. Possible defect warning regarding various sensors powered by the gearcase.
VOLTAGE	13	08	VOLTAGE LOW	Idling accelerated (depending upon the detected voltage), up to a maximum of 200 rpm over the standard idling speed.	Too low battery voltage signal.	Reading of measurable parameters to check the battery voltage. Carry out the appropriate checks on voltage regulator, batteries and recharge system.	

Component failure	DTC	FMI	Error type	Visible anomaly	Possible cause	Recommended repairs	Notes
ELECTRONIC CONTROL UNIT – SENSOR POWER SUPPLY	13	08	VALUE BELOW THE LIMIT	Anomalous engine operation due to incorrectly powered sensors. Reduced power.	Sensor power circuit fault in ECU.	Erase the failure memory and retry. If the problem persists, contact the Help Desk and follow the instructions for the possible replacement of the gearcase.	EDC pilot light on. Possible defect warning regarding various sensors powered by the gearcase.
SWITCH – BRAKE PEDAL	14	00	NO AVAILABLE SYMPTOM	Possible lack of stop lights operationPossible lack of cruise con?trol/power takeoff operation	Unfeasible brake switches – signals between primary and secondary	Reading of status parameters by means of the diagnostic instrument to check the proper and contemporary switchover (inverse) of the brake switches, primary and secondary. If the result is negative, check, directly on the component by means of a multimeter, the proper switchover. If the component is not damaged, check wiring and connections between the component connector (wiring side) pin 4 and connector EDC pin B76, between component connector (wiring side) pin 2 and connector EDC pin B80 passing through the Body Computer and the sleeve B pin 31.	EDC pilot light on. Check the proper fitting up of switch assembly on duplex.
SWITCH – BRAKE PEDAL	14	01	SHORT CIRCUIT TO POSITIVE	Possible lack of stop lights operationPossible lack of cruise con?trol/power takeoff operation	Unfeasible brake switches – signals between primary and secondary	Reading of status parameters by means of the diagnostic instrument to check the proper and contemporary switchover (inverse) of the brake switches, primary and secondary. If the result is negative, check, directly on the component by means of a multimeter, the proper switchover. If the component is not damaged, check wiring and connections between the component connector (wiring side) pin 4 and connector EDC pin B76, between component connector (wiring side) pin 2 and connector EDC pin B80 passing through the Body Computer and the sleeve B pin 31.	EDC pilot light on. Check the proper fitting up of switch assembly on duplex.

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Component failure	DTC	FMI	Error type	Visible anomaly	Possible cause	Recommended repairs	Notes
SWITCH – BRAKE PEDAL	14	02	OPEN CIRCUIT OR SHORT CIRCUIT TO GROUND	Possible lack of stop lights operationPossible lack of cruise con?trol/power takeoff operation	Unfeasible brake switches – signals between primary and secondary	Reading of status parameters by means of the diagnostic instrument to check the proper and contemporary switchover (inverse) of the brake switches, primary and secondary. If the result is negative, check, directly on the component by means of a multimeter, the proper switchover. If the component is not damaged, check wiring and connections between the component connector (wiring side) pin 4 and connector EDC pin B76, between component connector (wiring side) pin 2 and connector EDC pin B80 passing through the Body Computer and the sleeve B pin 31.	EDC pilot light on. Check the proper fitting up of switch assembly on duplex.
SWITCH – BRAKE PEDAL	14	03	NO SIGNAL	Possible lack of stop lights operationPossible lack of cruise con?trol/power takeoff operation	Unfeasible brake switches – signals between primary and secondary	Reading of status parameters by means of the diagnostic instrument to check the proper and contemporary switchover (inverse) of the brake switches, primary and secondary. If the result is negative, check, directly on the component by means of a multimeter, the proper switchover. If the component is not damaged, check wiring and connections between the component connector (wiring side) pin 4 and connector EDC pin B76, between component connector (wiring side) pin 2 and connector EDC pin B80 passing through the Body Computer and the sleeve B pin 31.	EDC pilot light on. Check the proper fitting up of switch assembly on duplex.

Component failure	DTC	FMI	Error type	Visible anomaly	Possible cause	Recommended repairs	Notes
SWITCH – BRAKE PEDAL	14	04	SIGNAL NOT PLAUSIBLE	Possible lack of stop lights operationPossible lack of cruise con?trol/power takeoff operation	Unfeasible brake switches – signals between primary and secondary	Reading of status parameters by means of the diagnostic instrument to check the proper and contemporary switchover (inverse) of the brake switches, primary and secondary. If the result is negative, check, directly on the component by means of a multimeter, the proper switchover. If the component is not damaged, check wiring and connections between the component connector (wiring side) pin 4 and connector EDC pin B76, between component connector (wiring side) pin 2 and connector EDC pin B80 passing through the Body Computer and the sleeve B pin 31.	EDC pilot light on. Check the proper fitting up of switch assembly on duplex.
SWITCH – BRAKE PEDAL	14	05	SUPPLY OVER THE NORMAL RANGE	Possible lack of stop lights operationPossible lack of cruise con?trol/power takeoff operation	Unfeasible brake switches – signals between primary and secondary	Reading of status parameters by means of the diagnostic instrument to check the proper and contemporary switchover (inverse) of the brake switches, primary and secondary. If the result is negative, check, directly on the component by means of a multimeter, the proper switchover. If the component is not damaged, check wiring and connections between the component connector (wiring side) pin 4 and connector EDC pin B76, between component connector (wiring side) pin 2 and connector EDC pin B80 passing through the Body Computer and the sleeve B pin 31.	EDC pilot light on. Check the proper fitting up of switch assembly on duplex.

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Component failure	DTC	FMI	Error type	Visible anomaly	Possible cause	Recommended repairs	Notes
SWITCH – CRUISE CONTROL	15	00	NO AVAILABLE SYMPTOM	Cruise control/power takeoffare not operating	Unfeasibility of cruise control/power takeoff control keys	Read state parameters (EDC ECU and Body Controller) to identify faulty button.If the switches work correctly, check that the CAN message is not present on the Cluster and that the CAN line is up: impedance between pin 21 and pin 22 of the 30–pin connector must be approximately 60 ohm (measured with key off and all ECUs connected).	
SWITCH – CRUISE CONTROL	15	01	SHORT CIRCUIT TO POSITIVE	Cruise control/power takeoffare not operating	Unfeasibility of cruise control/power takeoff control keys	Read state parameters (EDC ECU and Body Controller) to identify faulty button.If the switches work correctly, check that the CAN message is not present on the Cluster and that the CAN line is up: impedance between pin 21 and pin 22 of the 30–pin connector must be approximately 60 ohm (measured with key off and all ECUs connected).	
SWITCH – CRUISE CONTROL	15	02	OPEN CIRCUIT OR SHORT CIRCUIT TO GROUND	Cruise control/power takeoffare not operating	Unfeasibility of cruise control/power takeoff control keys	Read state parameters (EDC ECU and Body Controller) to identify faulty button.If the switches work correctly, check that the CAN message is not present on the Cluster and that the CAN line is up: impedance between pin 21 and pin 22 of the 30–pin connector must be approximately 60 ohm (measured with key off and all ECUs connected).	

Component failure	DTC	FMI	Error type	Visible anomaly	Possible cause	Recommended repairs	Notes
SWITCH – CRUISE CONTROL	15	03	NO SIGNAL	Cruise control/power takeoffare not operating	Unfeasibility of cruise control/power takeoff control keys	Read state parameters (EDC ECU and Body Controller) to identify faulty button.If the switches work correctly, check that the CAN message is not present on the Cluster and that the CAN line is up: impedance between pin 21 and pin 22 of the 30–pin connector must be approximately 60 ohm (measured with key off and all ECUs connected).	
SWITCH – CRUISE CONTROL	15	04	SIGNAL NOT PLAUSIBLE	Cruise control/power takeoffare not operating	Unfeasibility of cruise control/power takeoff control keys	Read state parameters (EDC ECU and Body Controller) to identify faulty button.If the switches work correctly, check that the CAN message is not present on the Cluster and that the CAN line is up: impedance between pin 21 and pin 22 of the 30–pin connector must be approximately 60 ohm (measured with key off and all ECUs connected).	
SWITCH – CRUISE CONTROL	15	05	SUPPLY OVER THE NORMAL RANGE	Cruise control/power takeoffare not operating	Unfeasibility of cruise control/power takeoff control keys	Read state parameters (EDC ECU and Body Controller) to identify faulty button.If the switches work correctly, check that the CAN message is not present on the Cluster and that the CAN line is up: impedance between pin 21 and pin 22 of the 30–pin connector must be approximately 60 ohm (measured with key off and all ECUs connected).	

Component failure	DTC	FMI	Error type	Visible anomaly	Possible cause	Recommended repairs	Notes
SWITCH – BRAKE PEDAL	15	06	SUPPLY BELOW THE RANGE	Possible lack of stop lights operationPossible lack of cruise con?trol/power takeoff operation	Unfeasible brake switches – signals between primary and secondary	Reading of status parameters by means of the diagnostic instrument to check the proper and contemporary switchover (inverse) of the brake switches, primary and secondary. If the result is negative, check, directly on the component by means of a multimeter, the proper switchover. If the component is not damaged, check wiring and connections between the component connector (wiring side) pin 4 and connector EDC pin B76, between component connector (wiring side) pin 2 and connector EDC pin B80 passing through the Body Computer and the sleeve B pin 31.	EDC pilot light on. Check the proper fitting up of switch assembly on duplex.
SWITCH – CRUISE CONTROL	15	06	SUPPLY BELOW THE RANGE	Cruise control/power takeoffare not operating	Unfeasibility of cruise control/power takeoff control keys	Read state parameters (EDC ECU and Body Controller) to identify faulty button.If the switches work correctly, check that the CAN message is not present on the Cluster and that the CAN line is up: impedance between pin 21 and pin 22 of the 30–pin connector must be approximately 60 ohm (measured with key off and all ECUs connected).	

Component failure	DTC	FMI	Error type	Visible anomaly	Possible cause	Recommended repairs	Notes
SWITCH – BRAKE PEDAL	15	07	VALUE OVER THE NORMAL LIMIT	Possible lack of stop lights operationPossible lack of cruise con?trol/power takeoff operation	Unfeasible brake switches – signals between primary and secondary	Reading of status parameters by means of the diagnostic instrument to check the proper and contemporary switchover (inverse) of the brake switches, primary and secondary. If the result is negative, check, directly on the component by means of a multimeter, the proper switchover. If the component is not damaged, check wiring and connections between the component connector (wiring side) pin 4 and connector EDC pin B76, between component connector (wiring side) pin 2 and connector EDC pin B80 passing through the Body Computer and the sleeve B pin 31.	EDC pilot light on. Check the proper fitting up of switch assembly on duplex.
SWITCH – CRUISE CONTROL	15	07	VALUE OVER THE NORMAL LIMIT	Cruise control/power takeoffare not operating	Unfeasibility of cruise control/power takeoff control keys	Read state parameters (EDC ECU and Body Controller) to identify faulty button.If the switches work correctly, check that the CAN message is not present on the Cluster and that the CAN line is up: impedance between pin 21 and pin 22 of the 30–pin connector must be approximately 60 ohm (measured with key off and all ECUs connected).	

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Component failure	DTC	FMI	Error type	Visible anomaly	Possible cause	Recommended repairs	Notes
SWITCH – BRAKE PEDAL	15	08	VALUE BELOW THE LIMIT	Possible lack of stop lights operationPossible lack of cruise con?trol/power takeoff operation	Unfeasible brake switches – signals between primary and secondary	Reading of status parameters by means of the diagnostic instrument to check the proper and contemporary switchover (inverse) of the brake switches, primary and secondary. If the result is negative, check, directly on the component by means of a multimeter, the proper switchover. If the component is not damaged, check wiring and connections between the component connector (wiring side) pin 4 and connector EDC pin B76, between component connector (wiring side) pin 2 and connector EDC pin B80 passing through the Body Computer and the sleeve B pin 31.	EDC pilot light on. Check the proper fitting up of switch assembly on duplex.
SWITCH – CRUISE CONTROL	15	08	VALUE BELOW THE LIMIT	Cruise control/power takeoffare not operating	Unfeasibility of cruise control/power takeoff control keys	Read state parameters (EDC ECU and Body Controller) to identify faulty button.If the switches work correctly, check that the CAN message is not present on the Cluster and that the CAN line is up: impedance between pin 21 and pin 22 of the 30–pin connector must be approximately 60 ohm (measured with key off and all ECUs connected).	
SWITCH – PTO SELECTOR	17	00	NO AVAILABLE SYMPTOM	The PTO Selector does not work	Open circuit or short circuit on the wiring between EDC and switch.	Disconnect the 'Italamec 732.24' component (resistances group) from the UCI and check that the resistance between pin 1 and 2 (UCI side) is of 5,6 Kohm. Check that reading between pin 32 and 87 of the connector 89 pin (EDC) are those indicated in the "Notes".	PTO 0 = 4,5 ÷ 3,5 Volt PTO 1 = 3,5 ÷ 2,5 Volt PTO 2 = 2,5 ÷ 1,5 Volt PTO 3 = 1,5 ÷ 0,5 Volt

Component failure	DTC	FMI	Error type	Visible anomaly	Possible cause	Recommended repairs	Notes
SWITCH – CLUTCH	17	00	NO AVAILABLE SYMPTOM	Not operating cruise control/power takeoff	Clutch switch: unfeasible signal (signals the unit that the clutch is pressed while it is not)	Operate the clutch by completley pressing the pedal and by reading status parameters on MODUS IWT–IT2000Visual LED check on sensor head under plastic guard (wth released clutch the LED must be on)If the switch is not broken and well adjusted, check wiring, connections and correct switch assembly (distance from pedal 1–3 mm)	EDC pilot light: On (software version for single–stage valve). Off (software version for double–stage valve). (If the pressed–clutch signal is missing, the gearcase doesn't realize it because it regards this state as normal). Cruise Control/Power takeoff do not work because according to the gearcase the clutch pedal is always pressed. CAUTION: take care of the cable path to prevent it from being squashed and damaged while operating the pedal.
SWITCH – PTO SELECTOR	17	01	SHORT CIRCUIT TO POSITIVE	The PTO Selector does not work	Open circuit or short circuit on the wiring between EDC and switch.	Disconnect the 'Italamec 732.24' component (resistances group) from the UCI and check that the resistance between pin 1 and 2 (UCI side) is of 5,6 Kohm. Check that reading between pin 32 and 87 of the connector 89 pin (EDC) are those indicated in the "Notes".	PTO 0 = 4,5 ÷ 3,5 Volt PTO 1 = 3,5 ÷ 2,5 Volt PTO 2 = 2,5 ÷ 1,5 Volt PTO 3 = 1,5 ÷ 0,5 Volt

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Component failure	DTC	FMI	Error type	Visible anomaly	Possible cause	Recommended repairs	Notes
SWITCH – CLUTCH	17	01	SHORT CIRCUIT TO POSITIVE	Not operating cruise control/power takeoff	Clutch switch: unfeasible signal (signals the unit that the clutch is pressed while it is not)	Operate the clutch by completley pressing the pedal and by reading status parameters on MODUS IWT–IT2000Visual LED check on sensor head under plastic guard (wth released clutch the LED must be on)If the switch is not broken and well adjusted, check wiring, connections and correct switch assembly (distance from pedal 1–3 mm)	EDC pilot light: On (software version for single–stage valve). Off (software version for double–stage valve). (If the pressed–clutch signal is missing, the gearcase doesn't realize it because it regards this state as normal). Cruise Control/Power takeoff do not work because according to the gearcase the clutch pedal is always pressed. CAUTION: take care of the cable path to prevent it from being squashed and damaged while operating the pedal.
SWITCH – PTO SELECTOR	17	02	OPEN CIRCUIT OR SHORT CIRCUIT TO GROUND	The PTO Selector does not work	Open circuit or short circuit on the wiring between EDC and switch.	Disconnect the 'Italamec 732.24' component (resistances group) from the UCI and check that the resistance between pin 1 and 2 (UCI side) is of 5,6 Kohm. Check that reading between pin 32 and 87 of the connector 89 pin (EDC) are those indicated in the ''Notes''.	PTO 0 = 4,5 ÷ 3,5 Volt PTO 1 = 3,5 ÷ 2,5 Volt PTO 2 = 2,5 ÷ 1,5 Volt PTO 3 = 1,5 ÷ 0,5 Volt

Component failure	DTC	FMI	Error type	Visible anomaly	Possible cause	Recommended repairs	Notes
SWITCH – CLUTCH	17	02	OPEN CIRCUIT OR SHORT CIRCUIT TO GROUND	Not operating cruise control/power takeoff	Clutch switch: unfeasible signal (signals the unit that the clutch is pressed while it is not)	Operate the clutch by completley pressing the pedal and by reading status parameters on MODUS IWT–IT2000Visual LED check on sensor head under plastic guard (wth released clutch the LED must be on)If the switch is not broken and well adjusted, check wiring, connections and correct switch assembly (distance from pedal 1–3 mm)	EDC pilot light: On (software version for single–stage valve). Off (software version for double–stage valve). (If the pressed–clutch signal is missing, the gearcase doesn't realize it because it regards this state as normal). Cruise Control/Power takeoff do not work because according to the gearcase the clutch pedal is always pressed. CAUTION: take care of the cable path to prevent it from being squashed and damaged while operating the pedal.
SWITCH – PTO SELECTOR	17	03	NO SIGNAL	The PTO Selector does not work	Open circuit or short circuit on the wiring between EDC and switch.	Disconnect the 'Italamec 732.24' component (resistances group) from the UCI and check that the resistance between pin 1 and 2 (UCI side) is of 5,6 Kohm. Check that reading between pin 32 and 87 of the connector 89 pin (EDC) are those indicated in the "Notes".	PTO 0 = 4,5 ÷ 3,5 Volt PTO 1 = 3,5 ÷ 2,5 Volt PTO 2 = 2,5 ÷ 1,5 Volt PTO 3 = 1,5 ÷ 0,5 Volt

Component failure	DTC	FMI	Error type	Visible anomaly	Possible cause	Recommended repairs	Notes
SWITCH – CLUTCH	17	03	NO SIGNAL	Not operating cruise control/power takeoff	Clutch switch: unfeasible signal (signals the unit that the clutch is pressed while it is not)	Operate the clutch by completley pressing the pedal and by reading status parameters on MODUS IWT–IT2000Visual LED check on sensor head under plastic guard (wth released clutch the LED must be on)If the switch is not broken and well adjusted, check wiring, connections and correct switch assembly (distance from pedal 1–3 mm)	EDC pilot light: On (software version for single–stage valve). Off (software version for double–stage valve). (If the pressed–clutch signal is missing, the gearcase doesn't realize it because it regards this state as normal). Cruise Control/Power takeoff do not work because according to the gearcase the clutch pedal is always pressed. CAUTION: take care of the cable path to prevent it from being squashed and damaged while operating the pedal.
SWITCH – PTO SELECTOR	17	04	SIGNAL NOT PLAUSIBLE	The PTO Selector does not work	Open circuit or short circuit on the wiring between EDC and switch.	Disconnect the 'Italamec 732.24' component (resistances group) from the UCI and check that the resistance between pin 1 and 2 (UCI side) is of 5,6 Kohm. Check that reading between pin 32 and 87 of the connector 89 pin (EDC) are those indicated in the "Notes".	PTO 0 = 4,5 ÷ 3,5 Volt PTO 1 = 3,5 ÷ 2,5 Volt PTO 2 = 2,5 ÷ 1,5 Volt PTO 3 = 1,5 ÷ 0,5 Volt
SWITCH – PTO SELECTOR	17	05	SUPPLY OVER THE NORMAL RANGE	The PTO Selector does not work	Open circuit or short circuit on the wiring between EDC and switch.	Disconnect the 'Italamec 732.24' component (resistances group) from the UCI and check that the resistance between pin 1 and 2 (UCI side) is of 5,6 Kohm. Check that reading between pin 32 and 87 of the connector 89 pin (EDC) are those indicated in the "Notes".	PTO 0 = 4,5 ÷ 3,5 Volt PTO 1 = 3,5 ÷ 2,5 Volt PTO 2 = 2,5 ÷ 1,5 Volt PTO 3 = 1,5 ÷ 0,5 Volt

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Component failure	DTC	FMI	Error type	Visible anomaly	Possible cause	Recommended repairs	Notes
SWITCH – PTO SELECTOR	17	06	SUPPLY BELOW THE RANGE	The PTO Selector does not work	Open circuit or short circuit on the wiring between EDC and switch.	Disconnect the 'Italamec 732.24' component (resistances group) from the UCI and check that the resistance between pin 1 and 2 (UCI side) is of 5,6 Kohm. Check that reading between pin 32 and 87 of the connector 89 pin (EDC) are those indicated in the "Notes".	PTO 0 = 4,5 ÷ 3,5 Volt PTO 1 = 3,5 ÷ 2,5 Volt PTO 2 = 2,5 ÷ 1,5 Volt PTO 3 = 1,5 ÷ 0,5 Volt
SWITCH – PTO SELECTOR	17	07	VALUE OVER THE NORMAL LIMIT	The PTO Selector does not work	Open circuit or short circuit on the wiring between EDC and switch.	Disconnect the 'Italamec 732.24' component (resistances group) from the UCI and check that the resistance between pin 1 and 2 (UCI side) is of 5,6 Kohm. Check that reading between pin 32 and 87 of the connector 89 pin (EDC) are those indicated in the "Notes".	PTO 0 = 4,5 ÷ 3,5 Volt PTO 1 = 3,5 ÷ 2,5 Volt PTO 2 = 2,5 ÷ 1,5 Volt PTO 3 = 1,5 ÷ 0,5 Volt
SWITCH – PTO SELECTOR	17	08	VALUE BELOW THE LIMIT	The PTO Selector does not work	Open circuit or short circuit on the wiring between EDC and switch.	Disconnect the 'Italamec 732.24' component (resistances group) from the UCI and check that the resistance between pin 1 and 2 (UCI side) is of 5,6 Kohm. Check that reading between pin 32 and 87 of the connector 89 pin (EDC) are those indicated in the "Notes".	PTO 0 = 4,5 ÷ 3,5 Volt PTO 1 = 3,5 ÷ 2,5 Volt PTO 2 = 2,5 ÷ 1,5 Volt PTO 3 = 1,5 ÷ 0,5 Volt

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Component failure	DTC	FMI	Error type	Visible anomaly	Possible cause	Recommended repairs	Notes
SWITCH – CLUTCH	18	04	SIGNAL NOT PLAUSIBLE	Not operating cruise control/power takeoff	Clutch switch: unfeasible signal (signals the unit that the clutch is pressed while it is not)	Operate the clutch by completley pressing the pedal and by reading status parameters on MODUS IWT–IT2000Visual LED check on sensor head under plastic guard (wth released clutch the LED must be on)If the switch is not broken and well adjusted, check wiring, connections and correct switch assembly (distance from pedal 1–3 mm)	EDC pilot light: On (software version for single–stage valve). Off (software version for double–stage valve). (If the pressed–clutch signal is missing, the gearcase doesn't realize it because it regards this state as normal). Cruise Control/Power takeoff do not work because according to the gearcase the clutch pedal is always pressed. CAUTION: take care of the cable path to prevent it from being squashed and damaged while operating the pedal.
SWITCH – CLUTCH	18	05	SUPPLY OVER THE NORMAL RANGE	Not operating cruise control/power takeoff	Clutch switch: unfeasible signal (signals the unit that the clutch is pressed while it is not)	Operate the clutch by completley pressing the pedal and by reading status parameters on MODUS IWT–IT2000Visual LED check on sensor head under plastic guard (wth released clutch the LED must be on)If the switch is not broken and well adjusted, check wiring, connections and correct switch assembly (distance from pedal 1–3 mm)	EDC pilot light: On (software version for single–stage valve). Off (software version for double–stage valve). (If the pressed–clutch signal is missing, the gearcase doesn't realize it because it regards this state as normal). Cruise Control/Power takeoff do not work because according to the gearcase the clutch pedal is always pressed. CAUTION: take care of the cable path to prevent it from being squashed and damaged while operating the pedal.

Component failure	DTC	FMI	Error type	Visible anomaly	Possible cause	Recommended repairs	Notes
SWITCH – CLUTCH	18	06	SUPPLY BELOW THE RANGE	Not operating cruise control/power takeoff	Clutch switch: unfeasible signal (signals the unit that the clutch is pressed while it is not)	Operate the clutch by completley pressing the pedal and by reading status parameters on MODUS IWT–IT2000Visual LED check on sensor head under plastic guard (wth released clutch the LED must be on)If the switch is not broken and well adjusted, check wiring, connections and correct switch assembly (distance from pedal 1–3 mm)	EDC pilot light: On (software version for single–stage valve). Off (software version for double–stage valve). (If the pressed–clutch signal is missing, the gearcase doesn't realize it because it regards this state as normal). Cruise Control/Power takeoff do not work because according to the gearcase the clutch pedal is always pressed. CAUTION: take care of the cable path to prevent it from being squashed and damaged while operating the pedal.
SWITCH – CLUTCH	18	07	VALUE OVER THE NORMAL LIMIT	Not operating cruise control/power takeoff	Clutch switch: unfeasible signal (signals the unit that the clutch is pressed while it is not)	Operate the clutch by completley pressing the pedal and by reading status parameters on MODUS IWT–IT2000Visual LED check on sensor head under plastic guard (wth released clutch the LED must be on)If the switch is not broken and well adjusted, check wiring, connections and correct switch assembly (distance from pedal 1–3 mm)	EDC pilot light: On (software version for single–stage valve). Off (software version for double–stage valve). (If the pressed–clutch signal is missing, the gearcase doesn't realize it because it regards this state as normal). Cruise Control/Power takeoff do not work because according to the gearcase the clutch pedal is always pressed. CAUTION: take care of the cable path to prevent it from being squashed and damaged while operating the pedal.

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Component failure	DTC	FMI	Error type	Visible anomaly	Possible cause	Recommended repairs	Notes
SWITCH – CLUTCH	18	08	VALUE BELOW THE LIMIT	Not operating cruise control/power takeoff	Clutch switch: unfeasible signal (signals the unit that the clutch is pressed while it is not)	Operate the clutch by completley pressing the pedal and by reading status parameters on MODUS IWT–IT2000Visual LED check on sensor head under plastic guard (wth released clutch the LED must be on)If the switch is not broken and well adjusted, check wiring, connections and correct switch assembly (distance from pedal 1–3 mm)	EDC pilot light: On (software version for single–stage valve). Off (software version for double–stage valve). (If the pressed–clutch signal is missing, the gearcase doesn't realize it because it regards this state as normal). Cruise Control/Power takeoff do not work because according to the gearcase the clutch pedal is always pressed. CAUTION: take care of the cable path to prevent it from being squashed and damaged while operating the pedal.
ELECTRONIC CONTROL UNIT – SELF TEST SHUTOFF PATHS AFTER–RUN	1A	00	NO AVAILABLE SYMPTOM	Significant power reduction.	Failure of the internal test procedure that takes place in the control unit each time the engine stops.	It might occur if the engine is stopped but it keeps on running (vehicle moving with engaged gear). Check the wiring between +15 of the key and gearcase connector pin B39 passing through the sleeve B pin 2. Erase the failure memory and retry: if in case of engine normal stop the error signal persists, contact the Help Desk for the possible replacement of the gearcase.	EDC pilot light on. The engine doesn't stop in the foreseen times when the key +15 is OFF–positioned.

Component failure	DTC	FMI	Error type	Visible anomaly	Possible cause	Recommended repairs	Notes
ELECTRONIC CONTROL UNIT – SELF TEST SHUTOFF PATHS AFTER–RUN	1A	01	SHORT CIRCUIT TO POSITIVE	Significant power reduction.	Failure of the internal test procedure that takes place in the control unit each time the engine stops.	It might occur if the engine is stopped but it keeps on running (vehicle moving with engaged gear). Check the wiring between +15 of the key and gearcase connector pin B39 passing through the sleeve B pin 2. Erase the failure memory and retry: if in case of engine normal stop the error signal persists, contact the Help Desk for the possible replacement of the gearcase.	EDC pilot light on. The engine doesn't stop in the foreseen times when the key +15 is OFF–positioned.
COMMUNICATION LINES – IMMOBILISER	1B	00	NO AVAILABLE SYMPTOM	The engine doesn't start. Possible 7.2.	The engine does not start.Communication problems with short–circuited or open–circuited Immobilizer on CAN line	Check wiring, connections, components.Carry out an Immobilizer diagnosis.	EDC pilot light winking. In case of wrong key, also the Immobilizer pilot light winks (the problem is not in the EDC gearcase).
COMMUNICATION LINES – IMMOBILISER	1B	01	SHORT CIRCUIT TO POSITIVE	The engine doesn't start. Possible 7.2.	The engine does not start.Communication problems with short–circuited or open–circuited Immobilizer on CAN line	Check wiring, connections, components.Carry out an Immobilizer diagnosis.	EDC pilot light winking. In case of wrong key, also the Immobilizer pilot light winks (the problem is not in the EDC gearcase).
ELECTRONIC CONTROL UNIT – SELF TEST SHUTOFF PATHS AFTER–RUN	1B	02	OPEN CIRCUIT OR SHORT CIRCUIT TO GROUND	Significant power reduction.	Failure of the internal test procedure that takes place in the control unit each time the engine stops.	It might occur if the engine is stopped but it keeps on running (vehicle moving with engaged gear). Check the wiring between +15 of the key and gearcase connector pin B39 passing through the sleeve B pin 2. Erase the failure memory and retry: if in case of engine normal stop the error signal persists, contact the Help Desk for the possible replacement of the gearcase.	EDC pilot light on. The engine doesn't stop in the foreseen times when the key +15 is OFF–positioned.

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Component failure	DTC	FMI	Error type	Visible anomaly	Possible cause	Recommended repairs	Notes
COMMUNICATION LINES – IMMOBILISER	1B	02	OPEN CIRCUIT OR SHORT CIRCUIT TO GROUND	The engine doesn't start. Possible 7.2.	The engine does not start.Communication problems with short–circuited or open–circuited Immobilizer on CAN line	Check wiring, connections, components.Carry out an Immobilizer diagnosis.	EDC pilot light winking. In case of wrong key, also the Immobilizer pilot light winks (the problem is not in the EDC gearcase).
ELECTRONIC CONTROL UNIT – SELF TEST SHUTOFF PATHS AFTER–RUN	1B	03	NO SIGNAL	Significant power reduction.	Failure of the internal test procedure that takes place in the control unit each time the engine stops.	It might occur if the engine is stopped but it keeps on running (vehicle moving with engaged gear). Check the wiring between +15 of the key and gearcase connector pin B39 passing through the sleeve B pin 2. Erase the failure memory and retry: if in case of engine normal stop the error signal persists, contact the Help Desk for the possible replacement of the gearcase.	EDC pilot light on. The engine doesn't stop in the foreseen times when the key +15 is OFF–positioned.
COMMUNICATION LINES – IMMOBILISER	1B	03	NO SIGNAL	The engine doesn't start. Possible 7.2.	The engine does not start.Communication problems with short–circuited or open–circuited Immobilizer on CAN line	Check wiring, connections, components.Carry out an Immobilizer diagnosis.	EDC pilot light winking. In case of wrong key, also the Immobilizer pilot light winks (the problem is not in the EDC gearcase).
ELECTRONIC CONTROL UNIT – SELF TEST SHUTOFF PATHS AFTER–RUN	1B	04	SIGNAL NOT PLAUSIBLE	Significant power reduction.	Failure of the internal test procedure that takes place in the control unit each time the engine stops.	It might occur if the engine is stopped but it keeps on running (vehicle moving with engaged gear). Check the wiring between +15 of the key and gearcase connector pin B39 passing through the sleeve B pin 2. Erase the failure memory and retry: if in case of engine normal stop the error signal persists, contact the Help Desk for the possible replacement of the gearcase.	EDC pilot light on. The engine doesn't stop in the foreseen times when the key +15 is OFF–positioned.

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COMMUNICATION LINES – IMMOBILISER	1B	04	SIGNAL NOT PLAUSIBLE	The engine doesn't start. Possible 7.2.	The engine does not start.Communication problems with short–circuited or open–circuited Immobilizer on CAN line	Check wiring, connections, components.Carry out an Immobilizer diagnosis.	EDC pilot light winking. In case of wrong key, also the Immobilizer pilot light winks (the problem is not in the EDC gearcase).
ELECTRONIC CONTROL UNIT – SELF TEST SHUTOFF PATHS AFTER–RUN	1B	05	SUPPLY OVER THE NORMAL RANGE	Significant power reduction.	Failure of the internal test procedure that takes place in the control unit each time the engine stops.	It might occur if the engine is stopped but it keeps on running (vehicle moving with engaged gear). Check the wiring between +15 of the key and gearcase connector pin B39 passing through the sleeve B pin 2. Erase the failure memory and retry: if in case of engine normal stop the error signal persists, contact the Help Desk for the possible replacement of the gearcase.	EDC pilot light on. The engine doesn't stop in the foreseen times when the key +15 is OFF–positioned.
COMMUNICATION LINES – IMMOBILISER	1B	05	SUPPLY OVER THE NORMAL RANGE	The engine doesn't start. Possible 7.2.	The engine does not start.Communication problems with short–circuited or open–circuited Immobilizer on CAN line	Check wiring, connections, components.Carry out an Immobilizer diagnosis.	EDC pilot light winking. In case of wrong key, also the Immobilizer pilot light winks (the problem is not in the EDC gearcase).
ELECTRONIC CONTROL UNIT – SELF TEST SHUTOFF PATHS AFTER–RUN	1B	06	SUPPLY BELOW THE RANGE	Significant power reduction.	Failure of the internal test procedure that takes place in the control unit each time the engine stops.	It might occur if the engine is stopped but it keeps on running (vehicle moving with engaged gear). Check the wiring between +15 of the key and gearcase connector pin B39 passing through the sleeve B pin 2. Erase the failure memory and retry: if in case of engine normal stop the error signal persists, contact the Help Desk for the possible replacement of the gearcase.	EDC pilot light on. The engine doesn't stop in the foreseen times when the key +15 is OFF–positioned.

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ELECTRONIC CONTROL UNIT – SELF TEST SHUTOFF PATHS AFTER–RUN	1B	07	VALUE OVER THE NORMAL LIMIT	Significant power reduction.	Failure of the internal test procedure that takes place in the control unit each time the engine stops.	It might occur if the engine is stopped but it keeps on running (vehicle moving with engaged gear). Check the wiring between +15 of the key and gearcase connector pin B39 passing through the sleeve B pin 2. Erase the failure memory and retry: if in case of engine normal stop the error signal persists, contact the Help Desk for the possible replacement of the gearcase.	EDC pilot light on. The engine doesn't stop in the foreseen times when the key +15 is OFF–positioned.
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ELECTRONIC CONTROL UNIT – SELF TEST SHUTOFF PATHS AFTER–RUN	1B	08	VALUE BELOW THE LIMIT	Significant power reduction.	Failure of the internal test procedure that takes place in the control unit each time the engine stops.	It might occur if the engine is stopped but it keeps on running (vehicle moving with engaged gear). Check the wiring between +15 of the key and gearcase connector pin B39 passing through the sleeve B pin 2. Erase the failure memory and retry: if in case of engine normal stop the error signal persists, contact the Help Desk for the possible replacement of the gearcase.	EDC pilot light on. The engine doesn't stop in the foreseen times when the key +15 is OFF–positioned.

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ELECTRONIC CONTROL UNIT – BOOSTER 1	1D	00	NO AVAILABLE SYMPTOM	The engine rotates with 2 (3) cylinders	Power stage for cylinder block 1 or cylinder block 2	Delete failure memory and try again.If the error remains, and only after having excluded an injector failure (see 5.x note), contact the Help Desk and comply with its instructions for possible unit replacement.	EDC pilot light on.
ELECTRONIC CONTROL UNIT – BOOSTER 1	1D	01	VOLTAGE TOO HIGH	The engine rotates with 2 (3) cylinders	Power stage for cylinder block 1 or cylinder block 2	Delete failure memory and try again.If the error remains, and only after having excluded an injector failure (see 5.x note), contact the Help Desk and comply with its instructions for possible unit replacement.	EDC pilot light on.
ELECTRONIC CONTROL UNIT – BOOSTER 1	1D	02	VOLTAGE TOO LOW	The engine rotates with 2 (3) cylinders	Power stage for cylinder block 1 or cylinder block 2	Delete failure memory and try again.If the error remains, and only after having excluded an injector failure (see 5.x note), contact the Help Desk and comply with its instructions for possible unit replacement.	EDC pilot light on.
ELECTRONIC CONTROL UNIT – BOOSTER 2	1E	00	NO AVAILABLE SYMPTOM	The engine runs at 2 (3) cylinders.	Power stage for the electro–injectors of cylinders 2–3 (four–cylinder engine) or 4–5–6 (six–cylinder engine) faulty.	Erase the failure memory and retry. In case the error persists, and only after having excluded the injector defect (see note of 5.x) contact the Help Desk and follow the instructions for the possible replacement of the gearcase.	EDC pilot light on.
ELECTRONIC CONTROL UNIT – BOOSTER 2	1E	01	VOLTAGE TOO HIGH	The engine runs at 2 (3) cylinders.	Power stage for the electro–injectors of cylinders 2–3 (four–cylinder engine) or 4–5–6 (six–cylinder engine) faulty.	Erase the failure memory and retry. In case the error persists, and only after having excluded the injector defect (see note of 5.x) contact the Help Desk and follow the instructions for the possible replacement of the gearcase.	EDC pilot light on.

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Component failure	DTC	FMI	Error type	Visible anomaly	Possible cause	Recommended repairs	Notes
ELECTRONIC CONTROL UNIT – BOOSTER 2	1E	02	VOLTAGE TOO LOW	The engine runs at 2 (3) cylinders.	Power stage for the electro–injectors of cylinders 2–3 (four–cylinder engine) or 4–5–6 (six–cylinder engine) faulty.	Erase the failure memory and retry. In case the error persists, and only after having excluded the injector defect (see note of 5.x) contact the Help Desk and follow the instructions for the possible replacement of the gearcase.	EDC pilot light on.
COMMUNICATION LINES – Can A Module	1F	00	NO AVAILABLE SYMPTOM		CAN line.	Check wiring, connections and closing resistance (120 ohms)	EDC pilot light: Off (software version for single–stage valve). On (software version for double–stage valve). Immobilizer either does not intervene or it does not allow starting.
COMMUNICATION LINES – Can A Module	1F	00	NO AVAILABLE SYMPTOM	CAN message appears on Cluster.CAN messages cannot be viewed on Cluster. Possible communication problem with IMMOBILIZER for cranking. Possible ECAS suspension levelling operation problem via remote control in cab. Speedometer may stay off.	Possible CAN line problem: CAN line short–circuit to earth or CAN H and CAN L lines reciprocally short–circuiting. Check that all vehicle ECUs are connected.	Check CAN VDB line: 1) Resistance measured with key off directly on EDC ECU between pin B52 (CAN L) and pin B53 (CAN H) must be equal to 120 ohm. 2) Resistance measured with key off on wiring between pin B52 and pin B53 must be equal to 120 ohm. 3) Impedance measured between 30–pin connector pin 21 (CAN H) and pin 22 (CAN L) must be equal to 60 ohm +/–3% (measured with key off and ECUs connected).	

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Component failure	DTC	FMI	Error type	Visible anomaly	Possible cause	Recommended repairs	Notes
COMMUNICATION LINES – PTO: Power Take Off Information	1F	00	NO AVAILABLE SYMPTOM	CAN message appears on Cluster.CAN messages cannot be viewed on Cluster. Possible communication problem with IMMOBILIZER for cranking. Possible ECAS suspension levelling operation problem via remote control in cab. Speedometer may stay off.	Possible CAN line problem: CAN line short–circuit to earth or CAN H and CAN L lines reciprocally short–circuiting. Check that all vehicle ECUs are connected.	Check CAN VDB line: 1) Resistance measured with key off directly on EDC ECU between pin B52 (CAN L) and pin B53 (CAN H) must be equal to 120 ohm. 2) Resistance measured with key off on wiring between pin B52 and pin B53 must be equal to 120 ohm. 3) Impedance measured between 30–pin connector pin 21 (CAN H) and pin 22 (CAN L) must be equal to 60 ohm +/–3% (measured with key off and ECUs connected).	
COMMUNICATION LINES – Can A Module	1F	01	SHORT CIRCUIT TO POSITIVE		CAN line.	Check wiring, connections and closing resistance (120 ohms)	EDC pilot light: Off (software version for single–stage valve). On (software version for double–stage valve). Immobilizer either does not intervene or it does not allow starting.

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COMMUNICATION LINES – Can A Module	1F	02	OPEN CIRCUIT OR SHORT CIRCUIT TO GROUND	CAN message appears on Cluster.CAN messages cannot be viewed on Cluster. Possible communication problem with IMMOBILIZER for cranking. Possible ECAS suspension levelling operation problem via remote control in cab. Speedometer may stay off.	Possible CAN line problem: CAN line short–circuit to earth or CAN H and CAN L lines reciprocally short–circuiting. Check that all vehicle ECUs are connected.	Check CAN VDB line: 1) Resistance measured with key off directly on EDC ECU between pin B52 (CAN L) and pin B53 (CAN H) must be equal to 120 ohm. 2) Resistance measured with key off on wiring between pin B52 and pin B53 must be equal to 120 ohm. 3) Impedance measured between 30–pin connector pin 21 (CAN H) and pin 22 (CAN L) must be equal to 60 ohm +/–3% (measured with key off and ECUs connected).	
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COMMUNICATI ON LINES – Can A Module	1F	04	SIGNAL NOT PLAUSIBLE		CAN line.	Check wiring, connections and closing resistance (120 ohms)	EDC pilot light: Off (software version for single–stage valve). On (software version for double–stage valve). Immobilizer either does not intervene or it does not allow starting.

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COMMUNICATION LINES – Can A Module	1F	05	SUPPLY OVER THE NORMAL RANGE		CAN line.	Check wiring, connections and closing resistance (120 ohms)	EDC pilot light: Off (software version for single–stage valve). On (software version for double–stage valve). Immobilizer either does not intervene or it does not allow starting.

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COMMUNICATION LINES – TCO1: Tachograph Output	20	00	NO AVAILABLE SYMPTOM	CAN message appears on Cluster.CAN messages cannot be viewed on Cluster. Possible communication problem with IMMOBILIZER for cranking. Possible ECAS suspension levelling operation problem via remote control in cab. Speedometer may stay off.	Possible CAN line problem: CAN line short–circuit to earth or CAN H and CAN L lines reciprocally short–circuiting. Check that all vehicle ECUs are connected.	Check CAN VDB line: 1) Resistance measured with key off directly on EDC ECU between pin B52 (CAN L) and pin B53 (CAN H) must be equal to 120 ohm. 2) Resistance measured with key off on wiring between pin B52 and pin B53 must be equal to 120 ohm. 3) Impedance measured between 30–pin connector pin 21 (CAN H) and pin 22 (CAN L) must be equal to 60 ohm +/–3% (measured with key off and ECUs connected).	

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COMMUNICATION LINES – TCO1: Tachograph Output	20	01	SHORT CIRCUIT TO POSITIVE	CAN message appears on Cluster.CAN messages cannot be viewed on Cluster. Possible communication problem with IMMOBILIZER for cranking. Possible ECAS suspension levelling operation problem via remote control in cab. Speedometer may stay off.	Possible CAN line problem: CAN line short–circuit to earth or CAN H and CAN L lines reciprocally short–circuiting. Check that all vehicle ECUs are connected.	Check CAN VDB line: 1) Resistance measured with key off directly on EDC ECU between pin B52 (CAN L) and pin B53 (CAN H) must be equal to 120 ohm. 2) Resistance measured with key off on wiring between pin B52 and pin B53 must be equal to 120 ohm. 3) Impedance measured between 30–pin connector pin 21 (CAN H) and pin 22 (CAN L) must be equal to 60 ohm +/–3% (measured with key off and ECUs connected).	
COMMUNICATION LINES – PTO: Power Take Off Information	20	02	OPEN CIRCUIT OR SHORT CIRCUIT TO GROUND	CAN message appears on Cluster.CAN messages cannot be viewed on Cluster. Possible communication problem with IMMOBILIZER for cranking. Possible ECAS suspension levelling operation problem via remote control in cab. Speedometer may stay off.	Possible CAN line problem: CAN line short–circuit to earth or CAN H and CAN L lines reciprocally short–circuiting. Check that all vehicle ECUs are connected.	Check CAN VDB line: 1) Resistance measured with key off directly on EDC ECU between pin B52 (CAN L) and pin B53 (CAN H) must be equal to 120 ohm. 2) Resistance measured with key off on wiring between pin B52 and pin B53 must be equal to 120 ohm. 3) Impedance measured between 30–pin connector pin 21 (CAN H) and pin 22 (CAN L) must be equal to 60 ohm +/–3% (measured with key off and ECUs connected).	

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COMMUNICATION LINES – PTO: Power Take Off Information	20	04	SIGNAL NOT PLAUSIBLE	CAN message appears on Cluster.CAN messages cannot be viewed on Cluster. Possible communication problem with IMMOBILIZER for cranking. Possible ECAS suspension levelling operation problem via remote control in cab. Speedometer may stay off.	Possible CAN line problem: CAN line short–circuit to earth or CAN H and CAN L lines reciprocally short–circuiting. Check that all vehicle ECUs are connected.	Check CAN VDB line: 1) Resistance measured with key off directly on EDC ECU between pin B52 (CAN L) and pin B53 (CAN H) must be equal to 120 ohm. 2) Resistance measured with key off on wiring between pin B52 and pin B53 must be equal to 120 ohm. 3) Impedance measured between 30–pin connector pin 21 (CAN H) and pin 22 (CAN L) must be equal to 60 ohm +/–3% (measured with key off and ECUs connected).	

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Component failure	DTC	FMI	Error type	Visible anomaly	Possible cause	Recommended repairs	Notes
COMMUNICATION LINES – TCO1: Tachograph Output	20	04	SIGNAL NOT PLAUSIBLE	CAN message appears on Cluster.CAN messages cannot be viewed on Cluster. Possible communication problem with IMMOBILIZER for cranking. Possible ECAS suspension levelling operation problem via remote control in cab. Speedometer may stay off.	Possible CAN line problem: CAN line short–circuit to earth or CAN H and CAN L lines reciprocally short–circuiting. Check that all vehicle ECUs are connected.	Check CAN VDB line: 1) Resistance measured with key off directly on EDC ECU between pin B52 (CAN L) and pin B53 (CAN H) must be equal to 120 ohm. 2) Resistance measured with key off on wiring between pin B52 and pin B53 must be equal to 120 ohm. 3) Impedance measured between 30–pin connector pin 21 (CAN H) and pin 22 (CAN L) must be equal to 60 ohm +/–3% (measured with key off and ECUs connected).	
COMMUNICATION LINES – PTO: Power Take Off Information	20	05	SUPPLY OVER THE NORMAL RANGE	CAN message appears on Cluster.CAN messages cannot be viewed on Cluster. Possible communication problem with IMMOBILIZER for cranking. Possible ECAS suspension levelling operation problem via remote control in cab. Speedometer may stay off.	Possible CAN line problem: CAN line short–circuit to earth or CAN H and CAN L lines reciprocally short–circuiting. Check that all vehicle ECUs are connected.	Check CAN VDB line: 1) Resistance measured with key off directly on EDC ECU between pin B52 (CAN L) and pin B53 (CAN H) must be equal to 120 ohm. 2) Resistance measured with key off on wiring between pin B52 and pin B53 must be equal to 120 ohm. 3) Impedance measured between 30–pin connector pin 21 (CAN H) and pin 22 (CAN L) must be equal to 60 ohm +/–3% (measured with key off and ECUs connected).	

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Component failure	DTC	FMI	Error type	Visible anomaly	Possible cause	Recommended repairs	Notes
COMMUNICATION LINES – TCO1: Tachograph Output	20	05	SUPPLY OVER THE NORMAL RANGE	CAN message appears on Cluster.CAN messages cannot be viewed on Cluster. Possible communication problem with IMMOBILIZER for cranking. Possible ECAS suspension levelling operation problem via remote control in cab. Speedometer may stay off.	Possible CAN line problem: CAN line short–circuit to earth or CAN H and CAN L lines reciprocally short–circuiting. Check that all vehicle ECUs are connected.	Check CAN VDB line: 1) Resistance measured with key off directly on EDC ECU between pin B52 (CAN L) and pin B53 (CAN H) must be equal to 120 ohm. 2) Resistance measured with key off on wiring between pin B52 and pin B53 must be equal to 120 ohm. 3) Impedance measured between 30–pin connector pin 21 (CAN H) and pin 22 (CAN L) must be equal to 60 ohm +/–3% (measured with key off and ECUs connected).	
COMMUNICATION LINES – PTO: Power Take Off Information	20	06	SUPPLY BELOW THE RANGE	CAN message appears on Cluster.CAN messages cannot be viewed on Cluster. Possible communication problem with IMMOBILIZER for cranking. Possible ECAS suspension levelling operation problem via remote control in cab. Speedometer may stay off.	Possible CAN line problem: CAN line short–circuit to earth or CAN H and CAN L lines reciprocally short–circuiting. Check that all vehicle ECUs are connected.	Check CAN VDB line: 1) Resistance measured with key off directly on EDC ECU between pin B52 (CAN L) and pin B53 (CAN H) must be equal to 120 ohm. 2) Resistance measured with key off on wiring between pin B52 and pin B53 must be equal to 120 ohm. 3) Impedance measured between 30–pin connector pin 21 (CAN H) and pin 22 (CAN L) must be equal to 60 ohm +/–3% (measured with key off and ECUs connected).	

Component failure	DTC	FMI	Error type	Visible anomaly	Possible cause	Recommended repairs	Notes
COMMUNICATION LINES – TCO1: Tachograph Output	20	06	SUPPLY BELOW THE RANGE	CAN message appears on Cluster.CAN messages cannot be viewed on Cluster. Possible communication problem with IMMOBILIZER for cranking. Possible ECAS suspension levelling operation problem via remote control in cab. Speedometer may stay off.	Possible CAN line problem: CAN line short–circuit to earth or CAN H and CAN L lines reciprocally short–circuiting. Check that all vehicle ECUs are connected.	Check CAN VDB line: 1) Resistance measured with key off directly on EDC ECU between pin B52 (CAN L) and pin B53 (CAN H) must be equal to 120 ohm. 2) Resistance measured with key off on wiring between pin B52 and pin B53 must be equal to 120 ohm. 3) Impedance measured between 30–pin connector pin 21 (CAN H) and pin 22 (CAN L) must be equal to 60 ohm +/–3% (measured with key off and ECUs connected).	
COMMUNICATION LINES – PTO: Power Take Off Information	20	07	VALUE OVER THE NORMAL LIMIT	CAN message appears on Cluster.CAN messages cannot be viewed on Cluster. Possible communication problem with IMMOBILIZER for cranking. Possible ECAS suspension levelling operation problem via remote control in cab. Speedometer may stay off.	Possible CAN line problem: CAN line short–circuit to earth or CAN H and CAN L lines reciprocally short–circuiting. Check that all vehicle ECUs are connected.	Check CAN VDB line: 1) Resistance measured with key off directly on EDC ECU between pin B52 (CAN L) and pin B53 (CAN H) must be equal to 120 ohm. 2) Resistance measured with key off on wiring between pin B52 and pin B53 must be equal to 120 ohm. 3) Impedance measured between 30–pin connector pin 21 (CAN H) and pin 22 (CAN L) must be equal to 60 ohm +/–3% (measured with key off and ECUs connected).	

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Component failure	DTC	FMI	Error type	Visible anomaly	Possible cause	Recommended repairs	Notes
COMMUNICATION LINES – TCO1: Tachograph Output	20	07	VALUE OVER THE NORMAL LIMIT	CAN message appears on Cluster.CAN messages cannot be viewed on Cluster. Possible communication problem with IMMOBILIZER for cranking. Possible ECAS suspension levelling operation problem via remote control in cab. Speedometer may stay off.	Possible CAN line problem: CAN line short–circuit to earth or CAN H and CAN L lines reciprocally short–circuiting. Check that all vehicle ECUs are connected.	Check CAN VDB line: 1) Resistance measured with key off directly on EDC ECU between pin B52 (CAN L) and pin B53 (CAN H) must be equal to 120 ohm. 2) Resistance measured with key off on wiring between pin B52 and pin B53 must be equal to 120 ohm. 3) Impedance measured between 30–pin connector pin 21 (CAN H) and pin 22 (CAN L) must be equal to 60 ohm +/–3% (measured with key off and ECUs connected).	
COMMUNICATION LINES – PTO: Power Take Off Information	20	08	VALUE BELOW THE LIMIT	CAN message appears on Cluster.CAN messages cannot be viewed on Cluster. Possible communication problem with IMMOBILIZER for cranking. Possible ECAS suspension levelling operation problem via remote control in cab. Speedometer may stay off.	Possible CAN line problem: CAN line short–circuit to earth or CAN H and CAN L lines reciprocally short–circuiting. Check that all vehicle ECUs are connected.	Check CAN VDB line: 1) Resistance measured with key off directly on EDC ECU between pin B52 (CAN L) and pin B53 (CAN H) must be equal to 120 ohm. 2) Resistance measured with key off on wiring between pin B52 and pin B53 must be equal to 120 ohm. 3) Impedance measured between 30–pin connector pin 21 (CAN H) and pin 22 (CAN L) must be equal to 60 ohm +/–3% (measured with key off and ECUs connected).	
RELAY – MAIN	21	00	NO AVAILABLE SYMPTOM	The unit remains always supplied and the EDC warning light remains on also with an Off keyThe battery discharges.	Main relay is not disconnected	Check wiring and connections(note: the main relay is embedded into the EDC unit).Try and remove the fuse and put it again in place. If the inconvenience remains, contact the Help Desk for possible unit replacement.	EDC pilot light on. The main relay is incorporated in the EDC gearcase and can't be individually replaced

Component failure	DTC	FMI	Error type	Visible anomaly	Possible cause	Recommended repairs	Notes
RELAY – MAIN	21	01	SHORT CIRCUIT TO POSITIVE	The unit remains always supplied and the EDC warning light remains on also with an Off keyThe battery discharges.	Main relay is not disconnected	Check wiring and connections(note: the main relay is embedded into the EDC unit).Try and remove the fuse and put it again in place. If the inconvenience remains, contact the Help Desk for possible unit replacement.	EDC pilot light on. The main relay is incorporated in the EDC gearcase and can't be individually replaced
RELAY – MAIN	21	02	OPEN CIRCUIT OR SHORT CIRCUIT TO GROUND	The unit remains always supplied and the EDC warning light remains on also with an Off keyThe battery discharges.	Main relay is not disconnected	Check wiring and connections(note: the main relay is embedded into the EDC unit).Try and remove the fuse and put it again in place. If the inconvenience remains, contact the Help Desk for possible unit replacement.	EDC pilot light on. The main relay is incorporated in the EDC gearcase and can't be individually replaced
RELAY – MAIN	21	03	NO SIGNAL	The unit remains always supplied and the EDC warning light remains on also with an Off keyThe battery discharges.	Main relay is not disconnected	Check wiring and connections(note: the main relay is embedded into the EDC unit).Try and remove the fuse and put it again in place. If the inconvenience remains, contact the Help Desk for possible unit replacement.	EDC pilot light on. The main relay is incorporated in the EDC gearcase and can't be individually replaced
COMMUNICATION LINES – TCO1: Tachograph Output	21	08	VALUE BELOW THE LIMIT	CAN message appears on Cluster.CAN messages cannot be viewed on Cluster. Possible communication problem with IMMOBILIZER for cranking. Possible ECAS suspension levelling operation problem via remote control in cab. Speedometer may stay off.	Possible CAN line problem: CAN line short–circuit to earth or CAN H and CAN L lines reciprocally short–circuiting. Check that all vehicle ECUs are connected.	Check CAN VDB line: 1) Resistance measured with key off directly on EDC ECU between pin B52 (CAN L) and pin B53 (CAN H) must be equal to 120 ohm. 2) Resistance measured with key off on wiring between pin B52 and pin B53 must be equal to 120 ohm. 3) Impedance measured between 30–pin connector pin 21 (CAN H) and pin 22 (CAN L) must be equal to 60 ohm +/–3% (measured with key off and ECUs connected).	
RELAY – MAIN	22	04	SIGNAL NOT PLAUSIBLE	The unit remains always supplied and the EDC warning light remains on also with an Off keyThe battery discharges.	Main relay is not disconnected	Check wiring and connections(note: the main relay is embedded into the EDC unit).Try and remove the fuse and put it again in place. If the inconvenience remains, contact the Help Desk for possible unit replacement.	EDC pilot light on. The main relay is incorporated in the EDC gearcase and can't be individually replaced

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Component failure	DTC	FMI	Error type	Visible anomaly	Possible cause	Recommended repairs	Notes
RELAY – MAIN	22	05	SUPPLY OVER THE NORMAL RANGE	The unit remains always supplied and the EDC warning light remains on also with an Off keyThe battery discharges.	Main relay is not disconnected	Check wiring and connections(note: the main relay is embedded into the EDC unit).Try and remove the fuse and put it again in place. If the inconvenience remains, contact the Help Desk for possible unit replacement.	EDC pilot light on. The main relay is incorporated in the EDC gearcase and can't be individually replaced
RELAY – MAIN	22	06	SUPPLY BELOW THE RANGE	The unit remains always supplied and the EDC warning light remains on also with an Off keyThe battery discharges.	Main relay is not disconnected	Check wiring and connections(note: the main relay is embedded into the EDC unit).Try and remove the fuse and put it again in place. If the inconvenience remains, contact the Help Desk for possible unit replacement.	EDC pilot light on. The main relay is incorporated in the EDC gearcase and can't be individually replaced
RELAY – MAIN	22	07	VALUE OVER THE NORMAL LIMIT	The unit remains always supplied and the EDC warning light remains on also with an Off keyThe battery discharges.	Main relay is not disconnected	Check wiring and connections(note: the main relay is embedded into the EDC unit).Try and remove the fuse and put it again in place. If the inconvenience remains, contact the Help Desk for possible unit replacement.	EDC pilot light on. The main relay is incorporated in the EDC gearcase and can't be individually replaced
RELAY – MAIN	22	08	VALUE BELOW THE LIMIT	The unit remains always supplied and the EDC warning light remains on also with an Off keyThe battery discharges.	Main relay is not disconnected	Check wiring and connections(note: the main relay is embedded into the EDC unit).Try and remove the fuse and put it again in place. If the inconvenience remains, contact the Help Desk for possible unit replacement.	EDC pilot light on. The main relay is incorporated in the EDC gearcase and can't be individually replaced
WARNING LIGHTS – PRE–POSTHEAT ING	24	00	NO AVAILABLE SYMPTOM	a)Preheating pilot light always on b)Preheating pilot light always off.		1) The pre–heater warning light should come on for a few seconds at key–on (lamp test). 2) Run Cluster active diagnostic procedure (pre–heater warning light) with a diagnostic tool.	EDC pilot light off. Possible cold start difficult because preheating is working, but no indications are received from the pilot light.
SWITCH – SECOND SPEED LIMITER SWITCH	24	00	NO AVAILABLE SYMPTOM	The programmable overspeed governor either doesn't start or it remains always engaged.		Read Body Controller state parameters (PROGRAMMABLE SPEED LIMITER BUTTON) to test correct operation of button. Check correct on/off switching with a multimeter if outcome is negative. Run Body Controller diagnostic procedure.	

Component failure	DTC	FMI	Error type	Visible anomaly	Possible cause	Recommended repairs	Notes
WARNING LIGHTS – PRE–POSTHEATING	24	01	SHORT CIRCUIT TO POSITIVE	a)Preheating pilot light always on b)Preheating pilot light always off.		1) The pre–heater warning light should come on for a few seconds at key–on (lamp test). 2) Run Cluster active diagnostic procedure (pre–heater warning light) with a diagnostic tool.	EDC pilot light off. Possible cold start difficult because preheating is working, but no indications are received from the pilot light.
SWITCH – SECOND SPEED LIMITER SWITCH	24	01	SHORT CIRCUIT TO POSITIVE	The programmable overspeed governor either doesn't start or it remains always engaged.		Read Body Controller state parameters (PROGRAMMABLE SPEED LIMITER BUTTON) to test correct operation of button. Check correct on/off switching with a multimeter if outcome is negative. Run Body Controller diagnostic procedure.	
WARNING LIGHTS – PRE–POSTHEATING	24	02	OPEN CIRCUIT OR SHORT CIRCUIT TO GROUND	a)Preheating pilot light always on b)Preheating pilot light always off.		1) The pre–heater warning light should come on for a few seconds at key–on (lamp test). 2) Run Cluster active diagnostic procedure (pre–heater warning light) with a diagnostic tool.	EDC pilot light off. Possible cold start difficult because preheating is working, but no indications are received from the pilot light.
WARNING LIGHTS – PRE–POSTHEATING	24	03	NO SIGNAL	a)Preheating pilot light always on b)Preheating pilot light always off.		1) The pre–heater warning light should come on for a few seconds at key–on (lamp test). 2) Run Cluster active diagnostic procedure (pre–heater warning light) with a diagnostic tool.	EDC pilot light off. Possible cold start difficult because preheating is working, but no indications are received from the pilot light.
WARNING LIGHTS – PRE–POSTHEATING	24	04	SIGNAL NOT PLAUSIBLE	a)Preheating pilot light always on b)Preheating pilot light always off.		1) The pre–heater warning light should come on for a few seconds at key–on (lamp test). 2) Run Cluster active diagnostic procedure (pre–heater warning light) with a diagnostic tool.	EDC pilot light off. Possible cold start difficult because preheating is working, but no indications are received from the pilot light.

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Component failure	DTC	FMI	Error type	Visible anomaly	Possible cause	Recommended repairs	Notes
WARNING LIGHTS – PRE–POSTHEATING	24	05	SUPPLY OVER THE NORMAL RANGE	a)Preheating pilot light always on b)Preheating pilot light always off.		1) The pre–heater warning light should come on for a few seconds at key–on (lamp test). 2) Run Cluster active diagnostic procedure (pre–heater warning light) with a diagnostic tool.	EDC pilot light off. Possible cold start difficult because preheating is working, but no indications are received from the pilot light.
WARNING LIGHTS – PRE–POSTHEATING	24	06	SUPPLY BELOW THE RANGE	a)Preheating pilot light always on b)Preheating pilot light always off.		1) The pre–heater warning light should come on for a few seconds at key–on (lamp test). 2) Run Cluster active diagnostic procedure (pre–heater warning light) with a diagnostic tool.	EDC pilot light off. Possible cold start difficult because preheating is working, but no indications are received from the pilot light.
WARNING LIGHTS – PRE–POSTHEATING	24	07	VALUE OVER THE NORMAL LIMIT	a)Preheating pilot light always on b)Preheating pilot light always off.		1) The pre–heater warning light should come on for a few seconds at key–on (lamp test). 2) Run Cluster active diagnostic procedure (pre–heater warning light) with a diagnostic tool.	EDC pilot light off. Possible cold start difficult because preheating is working, but no indications are received from the pilot light.
WARNING LIGHTS – PRE–POSTHEATING	24	08	VALUE BELOW THE LIMIT	a)Preheating pilot light always on b)Preheating pilot light always off.		1) The pre–heater warning light should come on for a few seconds at key–on (lamp test). 2) Run Cluster active diagnostic procedure (pre–heater warning light) with a diagnostic tool.	EDC pilot light off. Possible cold start difficult because preheating is working, but no indications are received from the pilot light.
WARNING LIGHTS – ENGINE BRAKE	25	00	NO AVAILABLE SYMPTOM	The pilot light either doesn't work or it remains always lighted up.	CAN line failure.	1) Run warning light/indicator active diagnostics in the Cluster diagnostic procedure. 2) Check that the CAN line is up: impedance between pin 21 and pin 22 of the 30–pin connector must be approximately 60 ohm (measured with key off and all ECUs connected).	

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Component failure	DTC	FMI	Error type	Visible anomaly	Possible cause	Recommended repairs	Notes
WARNING LIGHTS – ENGINE BRAKE	25	01	SHORT CIRCUIT TO POSITIVE	The pilot light either doesn't work or it remains always lighted up.	CAN line failure.	1) Run warning light/indicator active diagnostics in the Cluster diagnostic procedure. 2) Check that the CAN line is up: impedance between pin 21 and pin 22 of the 30–pin connector must be approximately 60 ohm (measured with key off and all ECUs connected).	
SWITCH – SECOND SPEED LIMITER SWITCH	25	02	OPEN CIRCUIT OR SHORT CIRCUIT TO GROUND	The programmable overspeed governor either doesn't start or it remains always engaged.		Read Body Controller state parameters (PROGRAMMABLE SPEED LIMITER BUTTON) to test correct operation of button. Check correct on/off switching with a multimeter if outcome is negative. Run Body Controller diagnostic procedure.	
WARNING LIGHTS – ENGINE BRAKE	25	02	OPEN CIRCUIT OR SHORT CIRCUIT TO GROUND	The pilot light either doesn't work or it remains always lighted up.	CAN line failure.	1) Run warning light/indicator active diagnostics in the Cluster diagnostic procedure. 2) Check that the CAN line is up: impedance between pin 21 and pin 22 of the 30–pin connector must be approximately 60 ohm (measured with key off and all ECUs connected).	
SWITCH – SECOND SPEED LIMITER SWITCH	25	03	NO SIGNAL	The programmable overspeed governor either doesn't start or it remains always engaged.		Read Body Controller state parameters (PROGRAMMABLE SPEED LIMITER BUTTON) to test correct operation of button. Check correct on/off switching with a multimeter if outcome is negative. Run Body Controller diagnostic procedure.	

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Component failure	DTC	FMI	Error type	Visible anomaly	Possible cause	Recommended repairs	Notes
WARNING LIGHTS – ENGINE BRAKE	25	03	NO SIGNAL	The pilot light either doesn't work or it remains always lighted up.	CAN line failure.	1) Run warning light/indicator active diagnostics in the Cluster diagnostic procedure. 2) Check that the CAN line is up: impedance between pin 21 and pin 22 of the 30–pin connector must be approximately 60 ohm (measured with key off and all ECUs connected).	
SWITCH – SECOND SPEED LIMITER SWITCH	25	04	SIGNAL NOT PLAUSIBLE	The programmable overspeed governor either doesn't start or it remains always engaged.		Read Body Controller state parameters (PROGRAMMABLE SPEED LIMITER BUTTON) to test correct operation of button. Check correct on/off switching with a multimeter if outcome is negative. Run Body Controller diagnostic procedure.	
SWITCH – SECOND SPEED LIMITER SWITCH	25	05	SUPPLY OVER THE NORMAL RANGE	The programmable overspeed governor either doesn't start or it remains always engaged.		Read Body Controller state parameters (PROGRAMMABLE SPEED LIMITER BUTTON) to test correct operation of button. Check correct on/off switching with a multimeter if outcome is negative. Run Body Controller diagnostic procedure.	
WARNING LIGHTS – ENGINE BRAKE	25	05	SUPPLY OVER THE NORMAL RANGE	The pilot light either doesn't work or it remains always lighted up.	CAN line failure.	1) Run warning light/indicator active diagnostics in the Cluster diagnostic procedure. 2) Check that the CAN line is up: impedance between pin 21 and pin 22 of the 30–pin connector must be approximately 60 ohm (measured with key off and all ECUs connected).	

Component failure	DTC	FMI	Error type	Visible anomaly	Possible cause	Recommended repairs	Notes
SWITCH – SECOND SPEED LIMITER SWITCH	25	06	SUPPLY BELOW THE RANGE	The programmable overspeed governor either doesn't start or it remains always engaged.		Read Body Controller state parameters (PROGRAMMABLE SPEED LIMITER BUTTON) to test correct operation of button. Check correct on/off switching with a multimeter if outcome is negative. Run Body Controller diagnostic procedure.	
WARNING LIGHTS – ENGINE BRAKE	25	06	SUPPLY BELOW THE RANGE	The pilot light either doesn't work or it remains always lighted up.	CAN line failure.	1) Run warning light/indicator active diagnostics in the Cluster diagnostic procedure. 2) Check that the CAN line is up: impedance between pin 21 and pin 22 of the 30–pin connector must be approximately 60 ohm (measured with key off and all ECUs connected).	
SWITCH – SECOND SPEED LIMITER SWITCH	25	07	VALUE OVER THE NORMAL LIMIT	The programmable overspeed governor either doesn't start or it remains always engaged.		Read Body Controller state parameters (PROGRAMMABLE SPEED LIMITER BUTTON) to test correct operation of button. Check correct on/off switching with a multimeter if outcome is negative. Run Body Controller diagnostic procedure.	
WARNING LIGHTS – ENGINE BRAKE	25	07	VALUE OVER THE NORMAL LIMIT	The pilot light either doesn't work or it remains always lighted up.	CAN line failure.	1) Run warning light/indicator active diagnostics in the Cluster diagnostic procedure. 2) Check that the CAN line is up: impedance between pin 21 and pin 22 of the 30–pin connector must be approximately 60 ohm (measured with key off and all ECUs connected).	

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Component failure	DTC	FMI	Error type	Visible anomaly	Possible cause	Recommended repairs	Notes
SWITCH – SECOND SPEED LIMITER SWITCH	25	08	VALUE BELOW THE LIMIT	The programmable overspeed governor either doesn't start or it remains always engaged.		Read Body Controller state parameters (PROGRAMMABLE SPEED LIMITER BUTTON) to test correct operation of button. Check correct on/off switching with a multimeter if outcome is negative. Run Body Controller diagnostic procedure.	
WARNING LIGHTS – OIL LOW PRESSURE	26	00	NO AVAILABLE SYMPTOM	The pilot light either doesn't work or it remains always lighted up.	CAN line failure.	Check that the CAN line is up: impedance between pin 21 and pin 22 of the 30–pin connector must be approximately 60 ohm (measured with key off and all ECUs connected). Check engine oil level. Run Cluster and Body Controller diagnostic procedures.	
RELAY – GLOW PLUG	26	00	NO AVAILABLE SYMPTOM	A) the pre–post heating resistance is not powered, possible cold start difficult and grade of smoke when starting B)the pre–post heating resistance is always powered: early wear of the resistance, the batteries become rapidly discharged.	Pre–post heating resistance control relay faulty.	Active diagnosis. Check the wiring between relay pin 85 and connector EDC pin B4, between relay pin 86 and connector EDC pin B16.	EDC pilot light on.
WARNING LIGHTS – OIL LOW PRESSURE	26	01	SHORT CIRCUIT TO POSITIVE	The pilot light either doesn't work or it remains always lighted up.	CAN line failure.	Check that the CAN line is up: impedance between pin 21 and pin 22 of the 30–pin connector must be approximately 60 ohm (measured with key off and all ECUs connected). Check engine oil level. Run Cluster and Body Controller diagnostic procedures.	

Component failure	DTC	FMI	Error type	Visible anomaly	Possible cause	Recommended repairs	Notes
RELAY – GLOW PLUG	26	01	SHORT CIRCUIT TO POSITIVE	A) the pre–post heating resistance is not powered, possible cold start difficult and grade of smoke when starting B)the pre–post heating resistance is always powered: early wear of the resistance, the batteries become rapidly discharged.	Pre–post heating resistance control relay faulty.	Active diagnosis. Check the wiring between relay pin 85 and connector EDC pin B4, between relay pin 86 and connector EDC pin B16.	EDC pilot light on.
WARNING LIGHTS – OIL LOW PRESSURE	26	02	OPEN CIRCUIT OR SHORT CIRCUIT TO GROUND	The pilot light either doesn't work or it remains always lighted up.	CAN line failure.	Check that the CAN line is up: impedance between pin 21 and pin 22 of the 30–pin connector must be approximately 60 ohm (measured with key off and all ECUs connected). Check engine oil level. Run Cluster and Body Controller diagnostic procedures.	
RELAY – GLOW PLUG	26	02	OPEN CIRCUIT OR SHORT CIRCUIT TO GROUND	A) the pre–post heating resistance is not powered, possible cold start difficult and grade of smoke when starting B)the pre–post heating resistance is always powered: early wear of the resistance, the batteries become rapidly discharged.	Pre–post heating resistance control relay faulty.	Active diagnosis. Check the wiring between relay pin 85 and connector EDC pin B4, between relay pin 86 and connector EDC pin B16.	EDC pilot light on.
WARNING LIGHTS – OIL LOW PRESSURE	26	03	NO SIGNAL	The pilot light either doesn't work or it remains always lighted up.	CAN line failure.	Check that the CAN line is up: impedance between pin 21 and pin 22 of the 30–pin connector must be approximately 60 ohm (measured with key off and all ECUs connected). Check engine oil level. Run Cluster and Body Controller diagnostic procedures.	

Component failure	DTC	FMI	Error type	Visible anomaly	Possible cause	Recommended repairs	Notes
RELAY – GLOW PLUG	26	03	NO SIGNAL	A) the pre–post heating resistance is not powered, possible cold start difficult and grade of smoke when starting B)the pre–post heating resistance is always powered: early wear of the resistance, the batteries become rapidly discharged.	Pre–post heating resistance control relay faulty.	Active diagnosis. Check the wiring between relay pin 85 and connector EDC pin B4, between relay pin 86 and connector EDC pin B16.	EDC pilot light on.
WARNING LIGHTS – OIL LOW PRESSURE	26	04	SIGNAL NOT PLAUSIBLE	The pilot light either doesn't work or it remains always lighted up.	CAN line failure.	Check that the CAN line is up: impedance between pin 21 and pin 22 of the 30–pin connector must be approximately 60 ohm (measured with key off and all ECUs connected). Check engine oil level. Run Cluster and Body Controller diagnostic procedures.	
WARNING LIGHTS – OIL LOW PRESSURE	26	05	SUPPLY OVER THE NORMAL RANGE	The pilot light either doesn't work or it remains always lighted up.	CAN line failure.	Check that the CAN line is up: impedance between pin 21 and pin 22 of the 30–pin connector must be approximately 60 ohm (measured with key off and all ECUs connected). Check engine oil level. Run Cluster and Body Controller diagnostic procedures.	
WARNING LIGHTS – OIL LOW PRESSURE	26	06	SUPPLY BELOW THE RANGE	The pilot light either doesn't work or it remains always lighted up.	CAN line failure.	Check that the CAN line is up: impedance between pin 21 and pin 22 of the 30–pin connector must be approximately 60 ohm (measured with key off and all ECUs connected). Check engine oil level. Run Cluster and Body Controller diagnostic procedures.	

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Component failure	DTC	FMI	Error type	Visible anomaly	Possible cause	Recommended repairs	Notes
WARNING LIGHTS – OIL LOW PRESSURE	26	07	VALUE OVER THE NORMAL LIMIT	The pilot light either doesn't work or it remains always lighted up.	CAN line failure.	Check that the CAN line is up: impedance between pin 21 and pin 22 of the 30–pin connector must be approximately 60 ohm (measured with key off and all ECUs connected). Check engine oil level. Run Cluster and Body Controller diagnostic procedures.	
WARNING LIGHTS – ENGINE BRAKE	26	08	VALUE BELOW THE LIMIT	The pilot light either doesn't work or it remains always lighted up.	CAN line failure.	1) Run warning light/indicator active diagnostics in the Cluster diagnostic procedure. 2) Check that the CAN line is up: impedance between pin 21 and pin 22 of the 30–pin connector must be approximately 60 ohm (measured with key off and all ECUs connected).	
WARNING LIGHTS – OIL LOW PRESSURE	26	08	VALUE BELOW THE LIMIT	The pilot light either doesn't work or it remains always lighted up.	CAN line failure.	Check that the CAN line is up: impedance between pin 21 and pin 22 of the 30–pin connector must be approximately 60 ohm (measured with key off and all ECUs connected). Check engine oil level. Run Cluster and Body Controller diagnostic procedures.	
RELAY – GLOW PLUG	27	04	SIGNAL NOT PLAUSIBLE	A) the pre–post heating resistance is not powered, possible cold start difficult and grade of smoke when starting B)the pre–post heating resistance is always powered: early wear of the resistance, the batteries become rapidly discharged.	Pre–post heating resistance control relay faulty.	Active diagnosis. Check the wiring between relay pin 85 and connector EDC pin B4, between relay pin 86 and connector EDC pin B16.	EDC pilot light on.

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Component failure	DTC	FMI	Error type	Visible anomaly	Possible cause	Recommended repairs	Notes
RELAY – GLOW PLUG	27	05	SUPPLY OVER THE NORMAL RANGE	A) the pre–post heating resistance is not powered, possible cold start difficult and grade of smoke when starting B)the pre–post heating resistance is always powered: early wear of the resistance, the batteries become rapidly discharged.	Pre–post heating resistance control relay faulty.	Active diagnosis. Check the wiring between relay pin 85 and connector EDC pin B4, between relay pin 86 and connector EDC pin B16.	EDC pilot light on.
RELAY – GLOW PLUG	27	06	SUPPLY BELOW THE RANGE	A) the pre–post heating resistance is not powered, possible cold start difficult and grade of smoke when starting B)the pre–post heating resistance is always powered: early wear of the resistance, the batteries become rapidly discharged.	Pre–post heating resistance control relay faulty.	Active diagnosis. Check the wiring between relay pin 85 and connector EDC pin B4, between relay pin 86 and connector EDC pin B16.	EDC pilot light on.
RELAY – GLOW PLUG	27	07	VALUE OVER THE NORMAL LIMIT	A) the pre–post heating resistance is not powered, possible cold start difficult and grade of smoke when starting B)the pre–post heating resistance is always powered: early wear of the resistance, the batteries become rapidly discharged.	Pre–post heating resistance control relay faulty.	Active diagnosis. Check the wiring between relay pin 85 and connector EDC pin B4, between relay pin 86 and connector EDC pin B16.	EDC pilot light on.
RELAY – GLOW PLUG	27	08	VALUE BELOW THE LIMIT	A) the pre–post heating resistance is not powered, possible cold start difficult and grade of smoke when starting B)the pre–post heating resistance is always powered: early wear of the resistance, the batteries become rapidly discharged.	Pre–post heating resistance control relay faulty.	Active diagnosis. Check the wiring between relay pin 85 and connector EDC pin B4, between relay pin 86 and connector EDC pin B16.	EDC pilot light on.

Component failure	DTC	FMI	Error type	Visible anomaly	Possible cause	Recommended repairs	Notes
ELECTROVALVES – ENGINE BRAKE	28	00	NO AVAILABLE SYMPTOM	The engine brake is not operating or is always activated above 1000 rpm	Positively short–circuited, ground–short–circuited or open–circuited engine brake solenoid valve	Exhaust brake solenoid valve active diagnosis Reading of status parameters. If the result is negative, check the solenoid valve continuity and resistance (R = approx. 35 Ohm). If the solenoid valve is all right, check the wiring between solenoid valve connection pin 1 and connector EDC pin B4, between solenoid valve connection pin 2 and connector EDC pin B11.	EDC pilot light on.
ELECTROVALVES – ENGINE BRAKE	28	01	SHORT CIRCUIT TO POSITIVE	The engine brake is not operating or is always activated above 1000 rpm	Positively short–circuited, ground–short–circuited or open–circuited engine brake solenoid valve	Exhaust brake solenoid valve active diagnosis Reading of status parameters. If the result is negative, check the solenoid valve continuity and resistance (R = approx. 35 Ohm). If the solenoid valve is all right, check the wiring between solenoid valve connection pin 1 and connector EDC pin B4, between solenoid valve connection pin 2 and connector EDC pin B11.	EDC pilot light on.
ELECTROVALVES – ENGINE BRAKE	28	02	OPEN CIRCUIT OR SHORT CIRCUIT TO GROUND	The engine brake is not operating or is always activated above 1000 rpm	Positively short–circuited, ground–short–circuited or open–circuited engine brake solenoid valve	Exhaust brake solenoid valve active diagnosis Reading of status parameters. If the result is negative, check the solenoid valve continuity and resistance (R = approx. 35 Ohm). If the solenoid valve is all right, check the wiring between solenoid valve connection pin 1 and connector EDC pin B4, between solenoid valve connection pin 2 and connector EDC pin B11.	EDC pilot light on.

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Component failure	DTC	FMI	Error type	Visible anomaly	Possible cause	Recommended repairs	Notes
ELECTROVALVES – ENGINE BRAKE	28	03	NO SIGNAL	The engine brake is not operating or is always activated above 1000 rpm	Positively short–circuited, ground–short–circuited or open–circuited engine brake solenoid valve	Exhaust brake solenoid valve active diagnosis Reading of status parameters. If the result is negative, check the solenoid valve continuity and resistance (R = approx. 35 Ohm). If the solenoid valve is all right, check the wiring between solenoid valve connection pin 1 and connector EDC pin B4, between solenoid valve connection pin 2 and connector EDC pin B11.	EDC pilot light on.
ELECTROVALVES – ENGINE BRAKE	28	04	SIGNAL NOT PLAUSIBLE	The engine brake is not operating or is always activated above 1000 rpm	Positively short–circuited, ground–short–circuited or open–circuited engine brake solenoid valve	Exhaust brake solenoid valve active diagnosis Reading of status parameters. If the result is negative, check the solenoid valve continuity and resistance (R = approx. 35 Ohm). If the solenoid valve is all right, check the wiring between solenoid valve connection pin 1 and connector EDC pin B4, between solenoid valve connection pin 2 and connector EDC pin B11.	EDC pilot light on.
ELECTROVALVES – ENGINE BRAKE	28	05	SUPPLY OVER THE NORMAL RANGE	The engine brake is not operating or is always activated above 1000 rpm	Positively short–circuited, ground–short–circuited or open–circuited engine brake solenoid valve	Exhaust brake solenoid valve active diagnosis Reading of status parameters. If the result is negative, check the solenoid valve continuity and resistance (R = approx. 35 Ohm). If the solenoid valve is all right, check the wiring between solenoid valve connection pin 1 and connector EDC pin B4, between solenoid valve connection pin 2 and connector EDC pin B11.	EDC pilot light on.
RELAY – AIR–CONDITIONER COMPRESSOR	29	00	NO AVAILABLE SYMPTOM	A/C compressor always on or not working.		Check wiring and connections. Replace relay if required.	
RELAY – AIR–CONDITIONER COMPRESSOR	29	01	SHORT CIRCUIT TO POSITIVE	A/C compressor always on or not working.		Check wiring and connections. Replace relay if required.	

Component failure	DTC	FMI	Error type	Visible anomaly	Possible cause	Recommended repairs	Notes
ELECTROVALVES – ENGINE BRAKE	29	06	SUPPLY BELOW THE RANGE	The engine brake is not operating or is always activated above 1000 rpm	Positively short–circuited, ground–short–circuited or open–circuited engine brake solenoid valve	Exhaust brake solenoid valve active diagnosis Reading of status parameters. If the result is negative, check the solenoid valve continuity and resistance (R = approx. 35 Ohm). If the solenoid valve is all right, check the wiring between solenoid valve connection pin 1 and connector EDC pin B4, between solenoid valve connection pin 2 and connector EDC pin B11.	EDC pilot light on.
ELECTROVALVES – ENGINE BRAKE	29	07	VALUE OVER THE NORMAL LIMIT	The engine brake is not operating or is always activated above 1000 rpm	Positively short–circuited, ground–short–circuited or open–circuited engine brake solenoid valve	Exhaust brake solenoid valve active diagnosis Reading of status parameters. If the result is negative, check the solenoid valve continuity and resistance (R = approx. 35 Ohm). If the solenoid valve is all right, check the wiring between solenoid valve connection pin 1 and connector EDC pin B4, between solenoid valve connection pin 2 and connector EDC pin B11.	EDC pilot light on.
ELECTROVALVES – ENGINE BRAKE	29	08	VALUE BELOW THE LIMIT	The engine brake is not operating or is always activated above 1000 rpm	Positively short–circuited, ground–short–circuited or open–circuited engine brake solenoid valve	Exhaust brake solenoid valve active diagnosis Reading of status parameters. If the result is negative, check the solenoid valve continuity and resistance (R = approx. 35 Ohm). If the solenoid valve is all right, check the wiring between solenoid valve connection pin 1 and connector EDC pin B4, between solenoid valve connection pin 2 and connector EDC pin B11.	EDC pilot light on.
RELAY – HEATED FUEL FILTER	2A	00	NO AVAILABLE SYMPTOM	a) Heater always engaged. The battery becomes discharged. b)Heater never engaged. Possible filter clogging due to paraffin traces in the fuel in presence of too low external temperatures (< –15 °C).	Fuel filter heater relay faulty.	Active diagnosis. Check the wiring between relay pin 85 and connector EDC pin B2 passing through sleeve E pin 38, between relay pin 86 and connector EDC pin B36 passing through sleeve E pin 29.	EDC pilot light off. a)Possible storage of 2.3 because the fuel overheats.

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Component failure	DTC	FMI	Error type	Visible anomaly	Possible cause	Recommended repairs	Notes
RELAY – HEATED FUEL FILTER	2A	01	SHORT CIRCUIT TO POSITIVE	a) Heater always engaged. The battery becomes discharged. b)Heater never engaged. Possible filter clogging due to paraffin traces in the fuel in presence of too low external temperatures (< –15 °C).	Fuel filter heater relay faulty.	Active diagnosis. Check the wiring between relay pin 85 and connector EDC pin B2 passing through sleeve E pin 38, between relay pin 86 and connector EDC pin B36 passing through sleeve E pin 29.	EDC pilot light off. a)Possible storage of 2.3 because the fuel overheats.
RELAY – AIR–CONDITIONER COMPRESSOR	2A	02	OPEN CIRCUIT OR SHORT CIRCUIT TO GROUND	A/C compressor always on or not working.		Check wiring and connections. Replace relay if required.	
RELAY – HEATED FUEL FILTER	2A	02	OPEN CIRCUIT OR SHORT CIRCUIT TO GROUND	a) Heater always engaged. The battery becomes discharged. b)Heater never engaged. Possible filter clogging due to paraffin traces in the fuel in presence of too low external temperatures (< –15 °C).	Fuel filter heater relay faulty.	Active diagnosis. Check the wiring between relay pin 85 and connector EDC pin B2 passing through sleeve E pin 38, between relay pin 86 and connector EDC pin B36 passing through sleeve E pin 29.	EDC pilot light off. a)Possible storage of 2.3 because the fuel overheats.
RELAY – AIR–CONDITIONER COMPRESSOR	2A	03	NO SIGNAL	A/C compressor always on or not working.		Check wiring and connections. Replace relay if required.	
RELAY – HEATED FUEL FILTER	2A	03	NO SIGNAL	a) Heater always engaged. The battery becomes discharged. b)Heater never engaged. Possible filter clogging due to paraffin traces in the fuel in presence of too low external temperatures (< –15 °C).	Fuel filter heater relay faulty.	Active diagnosis. Check the wiring between relay pin 85 and connector EDC pin B2 passing through sleeve E pin 38, between relay pin 86 and connector EDC pin B36 passing through sleeve E pin 29.	EDC pilot light off. a)Possible storage of 2.3 because the fuel overheats.
RELAY – AIR–CONDITIONER COMPRESSOR	2A	04	SIGNAL NOT PLAUSIBLE	A/C compressor always on or not working.		Check wiring and connections. Replace relay if required.	

Component failure	DTC	FMI	Error type	Visible anomaly	Possible cause	Recommended repairs	Notes
RELAY – HEATED FUEL FILTER	2A	04	SIGNAL NOT PLAUSIBLE	a) Heater always engaged. The battery becomes discharged. b)Heater never engaged. Possible filter clogging due to paraffin traces in the fuel in presence of too low external temperatures (< –15 °C).	Fuel filter heater relay faulty.	Active diagnosis. Check the wiring between relay pin 85 and connector EDC pin B2 passing through sleeve E pin 38, between relay pin 86 and connector EDC pin B36 passing through sleeve E pin 29.	EDC pilot light off. a)Possible storage of 2.3 because the fuel overheats.
RELAY – AIR–CONDITIONER COMPRESSOR	2A	05	SUPPLY OVER THE NORMAL RANGE	A/C compressor always on or not working.		Check wiring and connections. Replace relay if required.	
RELAY – HEATED FUEL FILTER	2A	05	SUPPLY OVER THE NORMAL RANGE	a) Heater always engaged. The battery becomes discharged. b)Heater never engaged. Possible filter clogging due to paraffin traces in the fuel in presence of too low external temperatures (< –15 °C).	Fuel filter heater relay faulty.	Active diagnosis. Check the wiring between relay pin 85 and connector EDC pin B2 passing through sleeve E pin 38, between relay pin 86 and connector EDC pin B36 passing through sleeve E pin 29.	EDC pilot light off. a)Possible storage of 2.3 because the fuel overheats.
RELAY – AIR–CONDITIONER COMPRESSOR	2A	06	SUPPLY BELOW THE RANGE	A/C compressor always on or not working.		Check wiring and connections. Replace relay if required.	
RELAY – HEATED FUEL FILTER	2A	06	SUPPLY BELOW THE RANGE	a) Heater always engaged. The battery becomes discharged. b)Heater never engaged. Possible filter clogging due to paraffin traces in the fuel in presence of too low external temperatures (< –15 °C).	Fuel filter heater relay faulty.	Active diagnosis. Check the wiring between relay pin 85 and connector EDC pin B2 passing through sleeve E pin 38, between relay pin 86 and connector EDC pin B36 passing through sleeve E pin 29.	EDC pilot light off. a)Possible storage of 2.3 because the fuel overheats.
RELAY – AIR–CONDITIONER COMPRESSOR	2A	07	VALUE OVER THE NORMAL LIMIT	A/C compressor always on or not working.		Check wiring and connections. Replace relay if required.	

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Component failure	DTC	FMI	Error type	Visible anomaly	Possible cause	Recommended repairs	Notes
RELAY – HEATED FUEL FILTER	2A	07	VALUE OVER THE NORMAL LIMIT	a) Heater always engaged. The battery becomes discharged. b)Heater never engaged. Possible filter clogging due to paraffin traces in the fuel in presence of too low external temperatures (< –15 °C).	Fuel filter heater relay faulty.	Active diagnosis. Check the wiring between relay pin 85 and connector EDC pin B2 passing through sleeve E pin 38, between relay pin 86 and connector EDC pin B36 passing through sleeve E pin 29.	EDC pilot light off. a)Possible storage of 2.3 because the fuel overheats.
RELAY – AIR–CONDITIONER COMPRESSOR	2A	08	VALUE BELOW THE LIMIT	A/C compressor always on or not working.		Check wiring and connections. Replace relay if required.	
RELAY – START	2B	00	NO AVAILABLE SYMPTOM	The engine doesn't start. In case it is already running, it stops.	Starter relay short–circuited or open–circuited.	Check the component is all right. Check the wiring between relay and connector EDC pin B37.	EDC pilot light on.
ENGINE – CONTROL SYSTEM PRE–POSTHEATING	2B	00	NO AVAILABLE SYMPTOM	Possible grade of smoke after starting.	Pre–post heating procedure monitoring.	Check that the cables are properly connected to the pre–post heating resistance terminals. Check that the pre–post heating resistance is all right (R = approx. 0,5 Ohm) Check wiring and connections between the pre–post heating resistance remote control switch pin 87 and the terminal (+) of the resistance, passing through sleeve E pin 40. Check wiring and connections between terminal (–) of the resistance and earth.	EDC pilot light on. The gearcase doesn't detect, by means of the air temperature sensor in the suction manifold, the increase in the temperature due to the operation of the resistance.
RELAY – START	2B	01	SHORT CIRCUIT TO POSITIVE	The engine doesn't start. In case it is already running, it stops.	Starter relay short–circuited or open–circuited.	Check the component is all right. Check the wiring between relay and connector EDC pin B37.	EDC pilot light on.

Component failure	DTC	FMI	Error type	Visible anomaly	Possible cause	Recommended repairs	Notes
ENGINE – CONTROL SYSTEM PRE–POSTHEATING	2B	01	SHORT CIRCUIT TO POSITIVE	Possible grade of smoke after starting.	Pre–post heating procedure monitoring.	Check that the cables are properly connected to the pre–post heating resistance terminals. Check that the pre–post heating resistance is all right (R = approx. 0,5 Ohm) Check wiring and connections between the pre–post heating resistance remote control switch pin 87 and the terminal (+) of the resistance, passing through sleeve E pin 40. Check wiring and connections between terminal (–) of the resistance and earth.	EDC pilot light on. The gearcase doesn't detect, by means of the air temperature sensor in the suction manifold, the increase in the temperature due to the operation of the resistance.
RELAY – START	2B	02	OPEN CIRCUIT OR SHORT CIRCUIT TO GROUND	The engine doesn't start. In case it is already running, it stops.	Starter relay short–circuited or open–circuited.	Check the component is all right. Check the wiring between relay and connector EDC pin B37.	EDC pilot light on.
ENGINE – CONTROL SYSTEM PRE–POSTHEATING	2B	02	OPEN CIRCUIT OR SHORT CIRCUIT TO GROUND	Possible grade of smoke after starting.	Pre–post heating procedure monitoring.	Check that the cables are properly connected to the pre–post heating resistance terminals. Check that the pre–post heating resistance is all right (R = approx. 0,5 Ohm) Check wiring and connections between the pre–post heating resistance remote control switch pin 87 and the terminal (+) of the resistance, passing through sleeve E pin 40. Check wiring and connections between terminal (–) of the resistance and earth.	EDC pilot light on. The gearcase doesn't detect, by means of the air temperature sensor in the suction manifold, the increase in the temperature due to the operation of the resistance.
RELAY – START	2B	03	NO SIGNAL	The engine doesn't start. In case it is already running, it stops.	Starter relay short–circuited or open–circuited.	Check the component is all right. Check the wiring between relay and connector EDC pin B37.	EDC pilot light on.

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Component failure	DTC	FMI	Error type	Visible anomaly	Possible cause	Recommended repairs	Notes
ENGINE – CONTROL SYSTEM PRE–POSTHEATING	2B	03	NO SIGNAL	Possible grade of smoke after starting.	Pre–post heating procedure monitoring.	Check that the cables are properly connected to the pre–post heating resistance terminals. Check that the pre–post heating resistance is all right (R = approx. 0,5 Ohm) Check wiring and connections between the pre–post heating resistance remote control switch pin 87 and the terminal (+) of the resistance, passing through sleeve E pin 40. Check wiring and connections between terminal (–) of the resistance and earth.	EDC pilot light on. The gearcase doesn't detect, by means of the air temperature sensor in the suction manifold, the increase in the temperature due to the operation of the resistance.
RELAY – START	2B	04	SIGNAL NOT PLAUSIBLE	The engine doesn't start. In case it is already running, it stops.	Starter relay short–circuited or open–circuited.	Check the component is all right. Check the wiring between relay and connector EDC pin B37.	EDC pilot light on.
RELAY – START	2B	05	SUPPLY OVER THE NORMAL RANGE	The engine doesn't start. In case it is already running, it stops.	Starter relay short–circuited or open–circuited.	Check the component is all right. Check the wiring between relay and connector EDC pin B37.	EDC pilot light on.
RELAY – START	2B	06	SUPPLY BELOW THE RANGE	The engine doesn't start. In case it is already running, it stops.	Starter relay short–circuited or open–circuited.	Check the component is all right. Check the wiring between relay and connector EDC pin B37.	EDC pilot light on.
RELAY – START	2B	07	VALUE OVER THE NORMAL LIMIT	The engine doesn't start. In case it is already running, it stops.	Starter relay short–circuited or open–circuited.	Check the component is all right. Check the wiring between relay and connector EDC pin B37.	EDC pilot light on.
RELAY – HEATED FUEL FILTER	2B	08	VALUE BELOW THE LIMIT	a) Heater always engaged. The battery becomes discharged. b)Heater never engaged. Possible filter clogging due to paraffin traces in the fuel in presence of too low external temperatures (< –15 °C).	Fuel filter heater relay faulty.	Active diagnosis. Check the wiring between relay pin 85 and connector EDC pin B2 passing through sleeve E pin 38, between relay pin 86 and connector EDC pin B36 passing through sleeve E pin 29.	EDC pilot light off. a)Possible storage of 2.3 because the fuel overheats.
RELAY – START	2B	08	VALUE BELOW THE LIMIT	The engine doesn't start. In case it is already running, it stops.	Starter relay short–circuited or open–circuited.	Check the component is all right. Check the wiring between relay and connector EDC pin B37.	EDC pilot light on.

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Component failure	DTC	FMI	Error type	Visible anomaly	Possible cause	Recommended repairs	Notes
SENSORS – BOOST AIR TEMPERATURE	2C	00	NO AVAILABLE SYMPTOM	Slight power reduction	Positively short–circuited, ground–short–circuited or open–circuited air tempe?rature sensor on suction manifold	Reading of measurable parameters by means of the diagnostic instrument: in presence of this error, the supercharging air temperature will be fixed at 30 °C. If the temperature is fixed at 30 °C, check the sensor is all right (R = approx. 2,5 kOhm at 20 °C) pins 1 and 2 of the sensor itself. If the sensor is not damaged, check the wiring between the sensor connector (wiring side) pin 1 and connector EDC pin C21, between sensor connector (wiring side) pin 2 and connector EDC pin C29.	EDC pilot light off. The temperature sensor is incorporated in the pressure one.
SENSORS – BOOST AIR TEMPERATURE	2C	01	SHORT CIRCUIT TO POSITIVE	Slight power reduction	Positively short–circuited, ground–short–circuited or open–circuited air tempe?rature sensor on suction manifold	Reading of measurable parameters by means of the diagnostic instrument: in presence of this error, the supercharging air temperature will be fixed at 30 °C. If the temperature is fixed at 30 °C, check the sensor is all right (R = approx. 2,5 kOhm at 20 °C) pins 1 and 2 of the sensor itself. If the sensor is not damaged, check the wiring between the sensor connector (wiring side) pin 1 and connector EDC pin C21, between sensor connector (wiring side) pin 2 and connector EDC pin C29.	EDC pilot light off. The temperature sensor is incorporated in the pressure one.

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Component failure	DTC	FMI	Error type	Visible anomaly	Possible cause	Recommended repairs	Notes
SENSORS – BOOST AIR TEMPERATURE	2C	02	OPEN CIRCUIT OR SHORT CIRCUIT TO GROUND	Slight power reduction	Positively short–circuited, ground–short–circuited or open–circuited air tempe?rature sensor on suction manifold	Reading of measurable parameters by means of the diagnostic instrument: in presence of this error, the supercharging air temperature will be fixed at 30 °C. If the temperature is fixed at 30 °C, check the sensor is all right (R = approx. 2,5 kOhm at 20 °C) pins 1 and 2 of the sensor itself. If the sensor is not damaged, check the wiring between the sensor connector (wiring side) pin 1 and connector EDC pin C21, between sensor connector (wiring side) pin 2 and connector EDC pin C29.	EDC pilot light off. The temperature sensor is incorporated in the pressure one.
SENSORS – BOOST AIR TEMPERATURE	2C	03	NO SIGNAL	Slight power reduction	Positively short–circuited, ground–short–circuited or open–circuited air tempe?rature sensor on suction manifold	Reading of measurable parameters by means of the diagnostic instrument: in presence of this error, the supercharging air temperature will be fixed at 30 °C. If the temperature is fixed at 30 °C, check the sensor is all right (R = approx. 2,5 kOhm at 20 °C) pins 1 and 2 of the sensor itself. If the sensor is not damaged, check the wiring between the sensor connector (wiring side) pin 1 and connector EDC pin C21, between sensor connector (wiring side) pin 2 and connector EDC pin C29.	EDC pilot light off. The temperature sensor is incorporated in the pressure one.

Component failure	DTC	FMI	Error type	Visible anomaly	Possible cause	Recommended repairs	Notes
ENGINE – CONTROL SYSTEM PRE–POSTHEATING	2C	04	SIGNAL NOT PLAUSIBLE	Possible grade of smoke after starting.	Pre–post heating procedure monitoring.	Check that the cables are properly connected to the pre–post heating resistance terminals. Check that the pre–post heating resistance is all right (R = approx. 0,5 Ohm) Check wiring and connections between the pre–post heating resistance remote control switch pin 87 and the terminal (+) of the resistance, passing through sleeve E pin 40. Check wiring and connections between terminal (–) of the resistance and earth.	EDC pilot light on. The gearcase doesn't detect, by means of the air temperature sensor in the suction manifold, the increase in the temperature due to the operation of the resistance.
SENSORS – BOOST AIR TEMPERATURE	2C	04	SIGNAL NOT PLAUSIBLE	Slight power reduction	Positively short–circuited, ground–short–circuited or open–circuited air tempe?rature sensor on suction manifold	Reading of measurable parameters by means of the diagnostic instrument: in presence of this error, the supercharging air temperature will be fixed at 30 °C. If the temperature is fixed at 30 °C, check the sensor is all right (R = approx. 2,5 kOhm at 20 °C) pins 1 and 2 of the sensor itself. If the sensor is not damaged, check the wiring between the sensor connector (wiring side) pin 1 and connector EDC pin C21, between sensor connector (wiring side) pin 2 and connector EDC pin C29.	EDC pilot light off. The temperature sensor is incorporated in the pressure one.

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Component failure	DTC	FMI	Error type	Visible anomaly	Possible cause	Recommended repairs	Notes
ENGINE – CONTROL SYSTEM PRE–POSTHEAT ING	2C	05	SUPPLY OVER THE NORMAL RANGE	Possible grade of smoke after starting.	Pre–post heating procedure monitoring.	Check that the cables are properly connected to the pre–post heating resistance terminals. Check that the pre–post heating resistance is all right (R = approx. 0,5 Ohm) Check wiring and connections between the pre–post heating resistance remote control switch pin 87 and the terminal (+) of the resistance, passing through sleeve E pin 40. Check wiring and connections between terminal (–) of the resistance and earth.	EDC pilot light on. The gearcase doesn't detect, by means of the air temperature sensor in the suction manifold, the increase in the temperature due to the operation of the resistance.
SENSORS – BOOST AIR TEMPERATURE	2C	05	SUPPLY OVER THE NORMAL RANGE	Slight power reduction	Positively short–circuited, ground–short–circuited or open–circuited air tempe?rature sensor on suction manifold	Reading of measurable parameters by means of the diagnostic instrument: in presence of this error, the supercharging air temperature will be fixed at 30 °C. If the temperature is fixed at 30 °C, check the sensor is all right (R = approx. 2,5 kOhm at 20 °C) pins 1 and 2 of the sensor itself. If the sensor is not damaged, check the wiring between the sensor connector (wiring side) pin 1 and connector EDC pin C21, between sensor connector (wiring side) pin 2 and connector EDC pin C29.	EDC pilot light off. The temperature sensor is incorporated in the pressure one.

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Component failure	DTC	FMI	Error type	Visible anomaly	Possible cause	Recommended repairs	Notes
ENGINE – CONTROL SYSTEM PRE–POSTHEAT ING	2C	06	SUPPLY BELOW THE RANGE	Possible grade of smoke after starting.	Pre–post heating procedure monitoring.	Check that the cables are properly connected to the pre–post heating resistance terminals. Check that the pre–post heating resistance is all right (R = approx. 0,5 Ohm) Check wiring and connections between the pre–post heating resistance remote control switch pin 87 and the terminal (+) of the resistance, passing through sleeve E pin 40. Check wiring and connections between terminal (–) of the resistance and earth.	EDC pilot light on. The gearcase doesn't detect, by means of the air temperature sensor in the suction manifold, the increase in the temperature due to the operation of the resistance.
SENSORS – BOOST AIR TEMPERATURE	2C	06	SUPPLY BELOW THE RANGE	Slight power reduction	Positively short–circuited, ground–short–circuited or open–circuited air tempe?rature sensor on suction manifold	Reading of measurable parameters by means of the diagnostic instrument: in presence of this error, the supercharging air temperature will be fixed at 30 °C. If the temperature is fixed at 30 °C, check the sensor is all right (R = approx. 2,5 kOhm at 20 °C) pins 1 and 2 of the sensor itself. If the sensor is not damaged, check the wiring between the sensor connector (wiring side) pin 1 and connector EDC pin C21, between sensor connector (wiring side) pin 2 and connector EDC pin C29.	EDC pilot light off. The temperature sensor is incorporated in the pressure one.

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Component failure	DTC	FMI	Error type	Visible anomaly	Possible cause	Recommended repairs	Notes
ENGINE – CONTROL SYSTEM PRE–POSTHEATING	2C	07	VALUE OVER THE NORMAL LIMIT	Possible grade of smoke after starting.	Pre–post heating procedure monitoring.	Check that the cables are properly connected to the pre–post heating resistance terminals. Check that the pre–post heating resistance is all right (R = approx. 0,5 Ohm) Check wiring and connections between the pre–post heating resistance remote control switch pin 87 and the terminal (+) of the resistance, passing through sleeve E pin 40. Check wiring and connections between terminal (–) of the resistance and earth.	EDC pilot light on. The gearcase doesn't detect, by means of the air temperature sensor in the suction manifold, the increase in the temperature due to the operation of the resistance.
SENSORS – BOOST AIR TEMPERATURE	2C	07	VALUE OVER THE NORMAL LIMIT	Slight power reduction	Positively short–circuited, ground–short–circuited or open–circuited air tempe?rature sensor on suction manifold	Reading of measurable parameters by means of the diagnostic instrument: in presence of this error, the supercharging air temperature will be fixed at 30 °C. If the temperature is fixed at 30 °C, check the sensor is all right (R = approx. 2,5 kOhm at 20 °C) pins 1 and 2 of the sensor itself. If the sensor is not damaged, check the wiring between the sensor connector (wiring side) pin 1 and connector EDC pin C21, between sensor connector (wiring side) pin 2 and connector EDC pin C29.	EDC pilot light off. The temperature sensor is incorporated in the pressure one.

Component failure	DTC	FMI	Error type	Visible anomaly	Possible cause	Recommended repairs	Notes
ENGINE – CONTROL SYSTEM PRE–POSTHEAT ING	2C	08	VALUE BELOW THE LIMIT	Possible grade of smoke after starting.	Pre–post heating procedure monitoring.	Check that the cables are properly connected to the pre–post heating resistance terminals. Check that the pre–post heating resistance is all right (R = approx. 0,5 Ohm) Check wiring and connections between the pre–post heating resistance remote control switch pin 87 and the terminal (+) of the resistance, passing through sleeve E pin 40. Check wiring and connections between terminal (–) of the resistance and earth.	EDC pilot light on. The gearcase doesn't detect, by means of the air temperature sensor in the suction manifold, the increase in the temperature due to the operation of the resistance.
SENSORS – BOOST AIR TEMPERATURE	2C	08	VALUE BELOW THE LIMIT	Slight power reduction	Positively short–circuited, ground–short–circuited or open–circuited air tempe?rature sensor on suction manifold	Reading of measurable parameters by means of the diagnostic instrument: in presence of this error, the supercharging air temperature will be fixed at 30 °C. If the temperature is fixed at 30 °C, check the sensor is all right (R = approx. 2,5 kOhm at 20 °C) pins 1 and 2 of the sensor itself. If the sensor is not damaged, check the wiring between the sensor connector (wiring side) pin 1 and connector EDC pin C21, between sensor connector (wiring side) pin 2 and connector EDC pin C29.	EDC pilot light off. The temperature sensor is incorporated in the pressure one.

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Component failure	DTC	FMI	Error type	Visible anomaly	Possible cause	Recommended repairs	Notes
ENGINE – ENGINE SPEED SENSING	2D	00	NO AVAILABLE SYMPTOM	Light power reduction.	No plausibility between the flywheel sensor and the camshaft sensor signals.	Presence of error 6.3 alone is not significant: clear failure memory and pass the vehicle in this case. Error 6.3 is significant when it appears along with error 6.1 and/or 6.2. Read failure memory: check environmental conditions associated to error. Delete error if stored at engine speed less than 650 rpm, clear failure memory and pass the vehicle. Otherwise, check integrity of damper flywheel and camshaft phonic wheel, cleanness and correct fastening of the two sensors.	EDC pilot light on. Sometimes only the error 6.3 is stored, whereas actually it is the camshaft signal that is faulty. In this case carry out the inspections foreseen to solve problem 6.2 This error might be stored now and then in case of engine stop using the under–cabin push–button. If the damper flywheel is worn, it will be locally deformed and, if the case mating areas have begun yielding, signs of silicone will the visible in the surrounding zone. Check that on the phonic wheel there are no shreds of adhesive tape and that it turns with no axial oscillations due to possible impact–strains.
WARNING LIGHTS – COOLANT TEMPERATURE	2D	00	NO AVAILABLE SYMPTOM	The pilot light either doesn't work or it remains always lighted up.	CAN line failure.	1) Run warning light/indicator active diagnostics in the Cluster diagnostic procedure. 2) Check that the CAN line is up: impedance between pin 21 and pin 22 of the 30–pin connector must be approximately 60 ohm (measured with key off and all ECUs connected).	

Component failure	DTC	FMI	Error type	Visible anomaly	Possible cause	Recommended repairs	Notes
ENGINE – ENGINE SPEED SENSING	2D	01	SHORT CIRCUIT TO POSITIVE	Light power reduction.	No plausibility between the flywheel sensor and the camshaft sensor signals.	Presence of error 6.3 alone is not significant: clear failure memory and pass the vehicle in this case. Error 6.3 is significant when it appears along with error 6.1 and/or 6.2. Read failure memory: check environmental conditions associated to error. Delete error if stored at engine speed less than 650 rpm, clear failure memory and pass the vehicle. Otherwise, check integrity of damper flywheel and camshaft phonic wheel, cleanness and correct fastening of the two sensors.	EDC pilot light on. Sometimes only the error 6.3 is stored, whereas actually it is the camshaft signal that is faulty. In this case carry out the inspections foreseen to solve problem 6.2 This error might be stored now and then in case of engine stop using the under–cabin push–button. If the damper flywheel is worn, it will be locally deformed and, if the case mating areas have begun yielding, signs of silicone will the visible in the surrounding zone. Check that on the phonic wheel there are no shreds of adhesive tape and that it turns with no axial oscillations due to possible impact–strains.
WARNING LIGHTS – COOLANT TEMPERATURE	2D	01	SHORT CIRCUIT TO POSITIVE	The pilot light either doesn't work or it remains always lighted up.	CAN line failure.	1) Run warning light/indicator active diagnostics in the Cluster diagnostic procedure. 2) Check that the CAN line is up: impedance between pin 21 and pin 22 of the 30–pin connector must be approximately 60 ohm (measured with key off and all ECUs connected).	

Component failure	DTC	FMI	Error type	Visible anomaly	Possible cause	Recommended repairs	Notes
ENGINE – ENGINE SPEED SENSING	2D	02	OPEN CIRCUIT OR SHORT CIRCUIT TO GROUND	Light power reduction.	No plausibility between the flywheel sensor and the camshaft sensor signals.	Presence of error 6.3 alone is not significant: clear failure memory and pass the vehicle in this case. Error 6.3 is significant when it appears along with error 6.1 and/or 6.2. Read failure memory: check environmental conditions associated to error. Delete error if stored at engine speed less than 650 rpm, clear failure memory and pass the vehicle. Otherwise, check integrity of damper flywheel and camshaft phonic wheel, cleanness and correct fastening of the two sensors.	EDC pilot light on. Sometimes only the error 6.3 is stored, whereas actually it is the camshaft signal that is faulty. In this case carry out the inspections foreseen to solve problem 6.2 This error might be stored now and then in case of engine stop using the under–cabin push–button. If the damper flywheel is worn, it will be locally deformed and, if the case mating areas have begun yielding, signs of silicone will the visible in the surrounding zone. Check that on the phonic wheel there are no shreds of adhesive tape and that it turns with no axial oscillations due to possible impact–strains.
WARNING LIGHTS – COOLANT TEMPERATURE	2D	02	OPEN CIRCUIT OR SHORT CIRCUIT TO GROUND	The pilot light either doesn't work or it remains always lighted up.	CAN line failure.	1) Run warning light/indicator active diagnostics in the Cluster diagnostic procedure. 2) Check that the CAN line is up: impedance between pin 21 and pin 22 of the 30–pin connector must be approximately 60 ohm (measured with key off and all ECUs connected).	
WARNING LIGHTS – COOLANT TEMPERATURE	2D	03	NO SIGNAL	The pilot light either doesn't work or it remains always lighted up.	CAN line failure.	1) Run warning light/indicator active diagnostics in the Cluster diagnostic procedure. 2) Check that the CAN line is up: impedance between pin 21 and pin 22 of the 30–pin connector must be approximately 60 ohm (measured with key off and all ECUs connected).	

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Component failure	DTC	FMI	Error type	Visible anomaly	Possible cause	Recommended repairs	Notes
ENGINE – ENGINE SPEED SENSING	2D	03	NO VALID SIGNAL FROM CRK SENSOR	Light power reduction.	No plausibility between the flywheel sensor and the camshaft sensor signals.	Presence of error 6.3 alone is not significant: clear failure memory and pass the vehicle in this case. Error 6.3 is significant when it appears along with error 6.1 and/or 6.2. Read failure memory: check environmental conditions associated to error. Delete error if stored at engine speed less than 650 rpm, clear failure memory and pass the vehicle. Otherwise, check integrity of damper flywheel and camshaft phonic wheel, cleanness and correct fastening of the two sensors.	EDC pilot light on. Sometimes only the error 6.3 is stored, whereas actually it is the camshaft signal that is faulty. In this case carry out the inspections foreseen to solve problem 6.2 This error might be stored now and then in case of engine stop using the under–cabin push–button. If the damper flywheel is worn, it will be locally deformed and, if the case mating areas have begun yielding, signs of silicone will the visible in the surrounding zone. Check that on the phonic wheel there are no shreds of adhesive tape and that it turns with no axial oscillations due to possible impact–strains.
WARNING LIGHTS – COOLANT TEMPERATURE	2D	04	SIGNAL NOT PLAUSIBLE	The pilot light either doesn't work or it remains always lighted up.	CAN line failure.	1) Run warning light/indicator active diagnostics in the Cluster diagnostic procedure. 2) Check that the CAN line is up: impedance between pin 21 and pin 22 of the 30–pin connector must be approximately 60 ohm (measured with key off and all ECUs connected).	

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Component failure	DTC	FMI	Error type	Visible anomaly	Possible cause	Recommended repairs	Notes
ENGINE – ENGINE SPEED SENSING	2D	04	SIGNAL NOT PLAUSIBLE	Light power reduction.	No plausibility between the flywheel sensor and the camshaft sensor signals.	Presence of error 6.3 alone is not significant: clear failure memory and pass the vehicle in this case. Error 6.3 is significant when it appears along with error 6.1 and/or 6.2. Read failure memory: check environmental conditions associated to error. Delete error if stored at engine speed less than 650 rpm, clear failure memory and pass the vehicle. Otherwise, check integrity of damper flywheel and camshaft phonic wheel, cleanness and correct fastening of the two sensors.	EDC pilot light on. Sometimes only the error 6.3 is stored, whereas actually it is the camshaft signal that is faulty. In this case carry out the inspections foreseen to solve problem 6.2 This error might be stored now and then in case of engine stop using the under–cabin push–button. If the damper flywheel is worn, it will be locally deformed and, if the case mating areas have begun yielding, signs of silicone will the visible in the surrounding zone. Check that on the phonic wheel there are no shreds of adhesive tape and that it turns with no axial oscillations due to possible impact–strains.
WARNING LIGHTS – COOLANT TEMPERATURE	2D	05	SUPPLY OVER THE NORMAL RANGE	The pilot light either doesn't work or it remains always lighted up.	CAN line failure.	1) Run warning light/indicator active diagnostics in the Cluster diagnostic procedure. 2) Check that the CAN line is up: impedance between pin 21 and pin 22 of the 30–pin connector must be approximately 60 ohm (measured with key off and all ECUs connected).	

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Component failure	DTC	FMI	Error type	Visible anomaly	Possible cause	Recommended repairs	Notes
ENGINE – ENGINE SPEED SENSING	2D	05	SUPPLY OVER THE NORMAL RANGE	Light power reduction.	No plausibility between the flywheel sensor and the camshaft sensor signals.	Presence of error 6.3 alone is not significant: clear failure memory and pass the vehicle in this case. Error 6.3 is significant when it appears along with error 6.1 and/or 6.2. Read failure memory: check environmental conditions associated to error. Delete error if stored at engine speed less than 650 rpm, clear failure memory and pass the vehicle. Otherwise, check integrity of damper flywheel and camshaft phonic wheel, cleanness and correct fastening of the two sensors.	EDC pilot light on. Sometimes only the error 6.3 is stored, whereas actually it is the camshaft signal that is faulty. In this case carry out the inspections foreseen to solve problem 6.2 This error might be stored now and then in case of engine stop using the under–cabin push–button. If the damper flywheel is worn, it will be locally deformed and, if the case mating areas have begun yielding, signs of silicone will the visible in the surrounding zone. Check that on the phonic wheel there are no shreds of adhesive tape and that it turns with no axial oscillations due to possible impact–strains.

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Component failure	DTC	FMI	Error type	Visible anomaly	Possible cause	Recommended repairs	Notes
ENGINE – ENGINE SPEED SENSING	2D	06	SUPPLY BELOW THE RANGE	Light power reduction.	No plausibility between the flywheel sensor and the camshaft sensor signals.	Presence of error 6.3 alone is not significant: clear failure memory and pass the vehicle in this case. Error 6.3 is significant when it appears along with error 6.1 and/or 6.2. Read failure memory: check environmental conditions associated to error. Delete error if stored at engine speed less than 650 rpm, clear failure memory and pass the vehicle. Otherwise, check integrity of damper flywheel and camshaft phonic wheel, cleanness and correct fastening of the two sensors.	EDC pilot light on. Sometimes only the error 6.3 is stored, whereas actually it is the camshaft signal that is faulty. In this case carry out the inspections foreseen to solve problem 6.2 This error might be stored now and then in case of engine stop using the under–cabin push–button. If the damper flywheel is worn, it will be locally deformed and, if the case mating areas have begun yielding, signs of silicone will the visible in the surrounding zone. Check that on the phonic wheel there are no shreds of adhesive tape and that it turns with no axial oscillations due to possible impact–strains.

Component failure	DTC	FMI	Error type	Visible anomaly	Possible cause	Recommended repairs	Notes
ENGINE – ENGINE SPEED SENSING	2D	07	VALUE OVER THE NORMAL LIMIT	Light power reduction.	No plausibility between the flywheel sensor and the camshaft sensor signals.	Presence of error 6.3 alone is not significant: clear failure memory and pass the vehicle in this case. Error 6.3 is significant when it appears along with error 6.1 and/or 6.2. Read failure memory: check environmental conditions associated to error. Delete error if stored at engine speed less than 650 rpm, clear failure memory and pass the vehicle. Otherwise, check integrity of damper flywheel and camshaft phonic wheel, cleanness and correct fastening of the two sensors.	EDC pilot light on. Sometimes only the error 6.3 is stored, whereas actually it is the camshaft signal that is faulty. In this case carry out the inspections foreseen to solve problem 6.2 This error might be stored now and then in case of engine stop using the under–cabin push–button. If the damper flywheel is worn, it will be locally deformed and, if the case mating areas have begun yielding, signs of silicone will the visible in the surrounding zone. Check that on the phonic wheel there are no shreds of adhesive tape and that it turns with no axial oscillations due to possible impact–strains.

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Component failure	DTC	FMI	Error type	Visible anomaly	Possible cause	Recommended repairs	Notes
ENGINE – ENGINE SPEED SENSING	2D	08	NO VALID SIGNAL FROM CAM SENSOR	Light power reduction.	No plausibility between the flywheel sensor and the camshaft sensor signals.	Presence of error 6.3 alone is not significant: clear failure memory and pass the vehicle in this case. Error 6.3 is significant when it appears along with error 6.1 and/or 6.2. Read failure memory: check environmental conditions associated to error. Delete error if stored at engine speed less than 650 rpm, clear failure memory and pass the vehicle. Otherwise, check integrity of damper flywheel and camshaft phonic wheel, cleanness and correct fastening of the two sensors.	EDC pilot light on. Sometimes only the error 6.3 is stored, whereas actually it is the camshaft signal that is faulty. In this case carry out the inspections foreseen to solve problem 6.2 This error might be stored now and then in case of engine stop using the under–cabin push–button. If the damper flywheel is worn, it will be locally deformed and, if the case mating areas have begun yielding, signs of silicone will the visible in the surrounding zone. Check that on the phonic wheel there are no shreds of adhesive tape and that it turns with no axial oscillations due to possible impact–strains.
WARNING LIGHTS – EDC	2E	00	NO AVAILABLE SYMPTOM	The pilot light either doesn't work or it remains always lighted up.	CAN line failure.	Check that the CAN line is up: impedance between pin 21 and pin 22 of the 30–pin connector must be approximately 60 ohm (measured with key off and all ECUs connected). Run Cluster and Body Controller diagnostic procedures.	

Component failure	DTC	FMI	Error type	Visible anomaly	Possible cause	Recommended repairs	Notes
ELECTROVALVES – FUEL PRESSURE REGULATION	2E	00	NO AVAILABLE SYMPTOM	Significant power reduction.	Positively short–circuited, ground short–circuited or open–circuited pressure regulator	Check that the connector is properly connected to the pressure regulator. Check by means of a multimeter that the pressure regulator solenoid valve is all right (r = APPROX. 3,2 Ohm). If the component is all right, check the wiring between the pressure regulator connector and the connector EDC pin C5–C7.	
WARNING LIGHTS – EDC	2E	01	SHORT CIRCUIT TO POSITIVE	The pilot light either doesn't work or it remains always lighted up.	CAN line failure.	Check that the CAN line is up: impedance between pin 21 and pin 22 of the 30–pin connector must be approximately 60 ohm (measured with key off and all ECUs connected). Run Cluster and Body Controller diagnostic procedures.	
ELECTROVALVES – FUEL PRESSURE REGULATION	2E	01	SHORT CIRCUIT TO POSITIVE	Significant power reduction.	Positively short–circuited, ground short–circuited or open–circuited pressure regulator	Check that the connector is properly connected to the pressure regulator. Check by means of a multimeter that the pressure regulator solenoid valve is all right (r = APPROX. 3,2 Ohm). If the component is all right, check the wiring between the pressure regulator connector and the connector EDC pin C5–C7.	
WARNING LIGHTS – EDC	2E	02	OPEN CIRCUIT OR SHORT CIRCUIT TO GROUND	The pilot light either doesn't work or it remains always lighted up.	CAN line failure.	Check that the CAN line is up: impedance between pin 21 and pin 22 of the 30–pin connector must be approximately 60 ohm (measured with key off and all ECUs connected). Run Cluster and Body Controller diagnostic procedures.	

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Component failure	DTC	FMI	Error type	Visible anomaly	Possible cause	Recommended repairs	Notes
WARNING LIGHTS – EDC	2E	03	NO SIGNAL	The pilot light either doesn't work or it remains always lighted up.	CAN line failure.	Check that the CAN line is up: impedance between pin 21 and pin 22 of the 30–pin connector must be approximately 60 ohm (measured with key off and all ECUs connected). Run Cluster and Body Controller diagnostic procedures.	
WARNING LIGHTS – EDC	2E	04	SIGNAL NOT PLAUSIBLE	The pilot light either doesn't work or it remains always lighted up.	CAN line failure.	Check that the CAN line is up: impedance between pin 21 and pin 22 of the 30–pin connector must be approximately 60 ohm (measured with key off and all ECUs connected). Run Cluster and Body Controller diagnostic procedures.	
WARNING LIGHTS – EDC	2E	05	SUPPLY OVER THE NORMAL RANGE	The pilot light either doesn't work or it remains always lighted up.	CAN line failure.	Check that the CAN line is up: impedance between pin 21 and pin 22 of the 30–pin connector must be approximately 60 ohm (measured with key off and all ECUs connected). Run Cluster and Body Controller diagnostic procedures.	
WARNING LIGHTS – COOLANT TEMPERATURE	2E	06	SUPPLY BELOW THE RANGE	The pilot light either doesn't work or it remains always lighted up.	CAN line failure.	1) Run warning light/indicator active diagnostics in the Cluster diagnostic procedure. 2) Check that the CAN line is up: impedance between pin 21 and pin 22 of the 30–pin connector must be approximately 60 ohm (measured with key off and all ECUs connected).	
WARNING LIGHTS – EDC	2E	06	SUPPLY BELOW THE RANGE	The pilot light either doesn't work or it remains always lighted up.	CAN line failure.	Check that the CAN line is up: impedance between pin 21 and pin 22 of the 30–pin connector must be approximately 60 ohm (measured with key off and all ECUs connected). Run Cluster and Body Controller diagnostic procedures.	

Component failure	DTC	FMI	Error type	Visible anomaly	Possible cause	Recommended repairs	Notes
WARNING LIGHTS – COOLANT TEMPERATURE	2E	07	VALUE OVER THE NORMAL LIMIT	The pilot light either doesn't work or it remains always lighted up.	CAN line failure.	1) Run warning light/indicator active diagnostics in the Cluster diagnostic procedure. 2) Check that the CAN line is up: impedance between pin 21 and pin 22 of the 30–pin connector must be approximately 60 ohm (measured with key off and all ECUs connected).	
WARNING LIGHTS – EDC	2E	07	VALUE OVER THE NORMAL LIMIT	The pilot light either doesn't work or it remains always lighted up.	CAN line failure.	Check that the CAN line is up: impedance between pin 21 and pin 22 of the 30–pin connector must be approximately 60 ohm (measured with key off and all ECUs connected). Run Cluster and Body Controller diagnostic procedures.	
WARNING LIGHTS – COOLANT TEMPERATURE	2E	08	VALUE BELOW THE LIMIT	The pilot light either doesn't work or it remains always lighted up.	CAN line failure.	1) Run warning light/indicator active diagnostics in the Cluster diagnostic procedure. 2) Check that the CAN line is up: impedance between pin 21 and pin 22 of the 30–pin connector must be approximately 60 ohm (measured with key off and all ECUs connected).	
WARNING LIGHTS – EDC	2E	08	VALUE BELOW THE LIMIT	The pilot light either doesn't work or it remains always lighted up.	CAN line failure.	Check that the CAN line is up: impedance between pin 21 and pin 22 of the 30–pin connector must be approximately 60 ohm (measured with key off and all ECUs connected). Run Cluster and Body Controller diagnostic procedures.	

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Component failure	DTC	FMI	Error type	Visible anomaly	Possible cause	Recommended repairs	Notes
ELECTROVALVES – FUEL PRESSURE REGULATION	2F	02	OPEN CIRCUIT OR SHORT CIRCUIT TO GROUND	Significant power reduction.	Positively short–circuited, ground short–circuited or open–circuited pressure regulator	Check that the connector is properly connected to the pressure regulator. Check by means of a multimeter that the pressure regulator solenoid valve is all right (r = APPROX. 3,2 Ohm). If the component is all right, check the wiring between the pressure regulator connector and the connector EDC pin C5–C7.	
ELECTROVALVES – FUEL PRESSURE REGULATION	2F	03	NO SIGNAL	Significant power reduction.	Positively short–circuited, ground short–circuited or open–circuited pressure regulator	Check that the connector is properly connected to the pressure regulator. Check by means of a multimeter that the pressure regulator solenoid valve is all right (r = APPROX. 3,2 Ohm). If the component is all right, check the wiring between the pressure regulator connector and the connector EDC pin C5–C7.	
ELECTROVALVES – FUEL PRESSURE REGULATION	2F	04	SIGNAL NOT PLAUSIBLE	Significant power reduction.	Positively short–circuited, ground short–circuited or open–circuited pressure regulator	Check that the connector is properly connected to the pressure regulator. Check by means of a multimeter that the pressure regulator solenoid valve is all right (r = APPROX. 3,2 Ohm). If the component is all right, check the wiring between the pressure regulator connector and the connector EDC pin C5–C7.	

Component failure	DTC	FMI	Error type	Visible anomaly	Possible cause	Recommended repairs	Notes
ELECTROVALVES – FUEL PRESSURE REGULATION	2F	05	SUPPLY OVER THE NORMAL RANGE	Significant power reduction.	Positively short–circuited, ground short–circuited or open–circuited pressure regulator	Check that the connector is properly connected to the pressure regulator. Check by means of a multimeter that the pressure regulator solenoid valve is all right (r = APPROX. 3,2 Ohm). If the component is all right, check the wiring between the pressure regulator connector and the connector EDC pin C5–C7.	
ELECTROVALVES – FUEL PRESSURE REGULATION	2F	06	SUPPLY BELOW THE RANGE	Significant power reduction.	Positively short–circuited, ground short–circuited or open–circuited pressure regulator	Check that the connector is properly connected to the pressure regulator. Check by means of a multimeter that the pressure regulator solenoid valve is all right (r = APPROX. 3,2 Ohm). If the component is all right, check the wiring between the pressure regulator connector and the connector EDC pin C5–C7.	
ELECTROVALVES – FUEL PRESSURE REGULATION	2F	07	VALUE OVER THE NORMAL LIMIT	Significant power reduction.	Positively short–circuited, ground short–circuited or open–circuited pressure regulator	Check that the connector is properly connected to the pressure regulator. Check by means of a multimeter that the pressure regulator solenoid valve is all right (r = APPROX. 3,2 Ohm). If the component is all right, check the wiring between the pressure regulator connector and the connector EDC pin C5–C7.	

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Component failure	DTC	FMI	Error type	Visible anomaly	Possible cause	Recommended repairs	Notes
ELECTROVALVES – FUEL PRESSURE REGULATION	2F	08	VALUE BELOW THE LIMIT	Significant power reduction.	Positively short–circuited, ground short–circuited or open–circuited pressure regulator	Check that the connector is properly connected to the pressure regulator. Check by means of a multimeter that the pressure regulator solenoid valve is all right (r = APPROX. 3,2 Ohm). If the component is all right, check the wiring between the pressure regulator connector and the connector EDC pin C5–C7.	
ENGINE – POWER STAGE FOR TD SIGNAL	30	00	NO AVAILABLE SYMPTOM	The speed indicator doesn't work.	Speed indicator signal short–circuited or open–circuited.	Check the wiring between pin 3 of the instrument and connector EDC pin B49.	Check CAN VDB line: 1) Resistance measured with key off directly on EDC ECU between pin B52 (CAN L) and pin B53 (CAN H) must be equal to 120 ohm. 2) Resistance measured with key off on wiring between pin B52 and pin B53 must be equal to 120 ohm. 3) Impedance measured between 30–pin connector pin 21 (CAN H) and pin 22 (CAN L) must be equal to 60 ohm +/–3% (measured with key off and ECUs connected).

Component failure	DTC	FMI	Error type	Visible anomaly	Possible cause	Recommended repairs	Notes
ENGINE – POWER STAGE FOR TD SIGNAL	30	01	SHORT CIRCUIT TO POSITIVE	The speed indicator doesn't work.	Speed indicator signal short–circuited or open–circuited.	Check the wiring between pin 3 of the instrument and connector EDC pin B49.	Check CAN VDB line: 1) Resistance measured with key off directly on EDC ECU between pin B52 (CAN L) and pin B53 (CAN H) must be equal to 120 ohm. 2) Resistance measured with key off on wiring between pin B52 and pin B53 must be equal to 120 ohm. 3) Impedance measured between 30–pin connector pin 21 (CAN H) and pin 22 (CAN L) must be equal to 60 ohm +/–3% (measured with key off and ECUs connected).
ENGINE – POWER STAGE FOR TD SIGNAL	30	02	OPEN CIRCUIT OR SHORT CIRCUIT TO GROUND	The speed indicator doesn't work.	Speed indicator signal short–circuited or open–circuited.	Check the wiring between pin 3 of the instrument and connector EDC pin B49.	Check CAN VDB line: 1) Resistance measured with key off directly on EDC ECU between pin B52 (CAN L) and pin B53 (CAN H) must be equal to 120 ohm. 2) Resistance measured with key off on wiring between pin B52 and pin B53 must be equal to 120 ohm. 3) Impedance measured between 30–pin connector pin 21 (CAN H) and pin 22 (CAN L) must be equal to 60 ohm +/–3% (measured with key off and ECUs connected).

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Component failure	DTC	FMI	Error type	Visible anomaly	Possible cause	Recommended repairs	Notes
ENGINE – POWER STAGE FOR TD SIGNAL	30	03	NO SIGNAL	The speed indicator doesn't work.	Speed indicator signal short–circuited or open–circuited.	Check the wiring between pin 3 of the instrument and connector EDC pin B49.	Check CAN VDB line: 1) Resistance measured with key off directly on EDC ECU between pin B52 (CAN L) and pin B53 (CAN H) must be equal to 120 ohm. 2) Resistance measured with key off on wiring between pin B52 and pin B53 must be equal to 120 ohm. 3) Impedance measured between 30–pin connector pin 21 (CAN H) and pin 22 (CAN L) must be equal to 60 ohm +/–3% (measured with key off and ECUs connected).
ENGINE – POWER STAGE FOR SYNC. SIGNAL (MODUS)	31	00	NO AVAILABLE SYMPTOM		EDC to diagnostic instrument synchronization signal short–circuited or open–circuited.	Check that the wiring between connector EDC pin B48 and diagnosis plug pin 23, passing through the brown sleeve B pin 11, is all right.	EDC pilot light off
ENGINE – POWER STAGE FOR SYNC. SIGNAL (MODUS)	31	01	SHORT CIRCUIT TO POSITIVE		EDC to diagnostic instrument synchronization signal short–circuited or open–circuited.	Check that the wiring between connector EDC pin B48 and diagnosis plug pin 23, passing through the brown sleeve B pin 11, is all right.	EDC pilot light off
ENGINE – POWER STAGE FOR SYNC. SIGNAL (MODUS)	31	02	OPEN CIRCUIT OR SHORT CIRCUIT TO GROUND		EDC to diagnostic instrument synchronization signal short–circuited or open–circuited.	Check that the wiring between connector EDC pin B48 and diagnosis plug pin 23, passing through the brown sleeve B pin 11, is all right.	EDC pilot light off
ENGINE – POWER STAGE FOR SYNC. SIGNAL (MODUS)	31	03	NO SIGNAL		EDC to diagnostic instrument synchronization signal short–circuited or open–circuited.	Check that the wiring between connector EDC pin B48 and diagnosis plug pin 23, passing through the brown sleeve B pin 11, is all right.	EDC pilot light off

Component failure	DTC	FMI	Error type	Visible anomaly	Possible cause	Recommended repairs	Notes
ENGINE – POWER STAGE FOR TD SIGNAL	31	04	SIGNAL NOT PLAUSIBLE	The speed indicator doesn't work.	Speed indicator signal short–circuited or open–circuited.	Check the wiring between pin 3 of the instrument and connector EDC pin B49.	Check CAN VDB line: 1) Resistance measured with key off directly on EDC ECU between pin B52 (CAN L) and pin B53 (CAN H) must be equal to 120 ohm. 2) Resistance measured with key off on wiring between pin B52 and pin B53 must be equal to 120 ohm. 3) Impedance measured between 30–pin connector pin 21 (CAN H) and pin 22 (CAN L) must be equal to 60 ohm +/–3% (measured with key off and ECUs connected).
ENGINE – POWER STAGE FOR SYNC. SIGNAL (MODUS)	31	04	SIGNAL NOT PLAUSIBLE		EDC to diagnostic instrument synchronization signal short–circuited or open–circuited.	Check that the wiring between connector EDC pin B48 and diagnosis plug pin 23, passing through the brown sleeve B pin 11, is all right.	EDC pilot light off
ENGINE – POWER STAGE FOR TD SIGNAL	31	05	SUPPLY OVER THE NORMAL RANGE	The speed indicator doesn't work.	Speed indicator signal short–circuited or open–circuited.	Check the wiring between pin 3 of the instrument and connector EDC pin B49.	Check CAN VDB line: 1) Resistance measured with key off directly on EDC ECU between pin B52 (CAN L) and pin B53 (CAN H) must be equal to 120 ohm. 2) Resistance measured with key off on wiring between pin B52 and pin B53 must be equal to 120 ohm. 3) Impedance measured between 30–pin connector pin 21 (CAN H) and pin 22 (CAN L) must be equal to 60 ohm +/–3% (measured with key off and ECUs connected).

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Component failure	DTC	FMI	Error type	Visible anomaly	Possible cause	Recommended repairs	Notes
ENGINE – POWER STAGE FOR SYNC. SIGNAL (MODUS)	31	05	SUPPLY OVER THE NORMAL RANGE		EDC to diagnostic instrument synchronization signal short–circuited or open–circuited.	Check that the wiring between connector EDC pin B48 and diagnosis plug pin 23, passing through the brown sleeve B pin 11, is all right.	EDC pilot light off
ENGINE – POWER STAGE FOR TD SIGNAL	31	06	SUPPLY BELOW THE RANGE	The speed indicator doesn't work.	Speed indicator signal short–circuited or open–circuited.	Check the wiring between pin 3 of the instrument and connector EDC pin B49.	Check CAN VDB line: 1) Resistance measured with key off directly on EDC ECU between pin B52 (CAN L) and pin B53 (CAN H) must be equal to 120 ohm. 2) Resistance measured with key off on wiring between pin B52 and pin B53 must be equal to 120 ohm. 3) Impedance measured between 30–pin connector pin 21 (CAN H) and pin 22 (CAN L) must be equal to 60 ohm +/–3% (measured with key off and ECUs connected).
ENGINE – POWER STAGE FOR SYNC. SIGNAL (MODUS)	31	06	SUPPLY BELOW THE RANGE		EDC to diagnostic instrument synchronization signal short–circuited or open–circuited.	Check that the wiring between connector EDC pin B48 and diagnosis plug pin 23, passing through the brown sleeve B pin 11, is all right.	EDC pilot light off

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Component failure	DTC	FMI	Error type	Visible anomaly	Possible cause	Recommended repairs	Notes
ENGINE – POWER STAGE FOR TD SIGNAL	31	07	VALUE OVER THE NORMAL LIMIT	The speed indicator doesn't work.	Speed indicator signal short–circuited or open–circuited.	Check the wiring between pin 3 of the instrument and connector EDC pin B49.	Check CAN VDB line: 1) Resistance measured with key off directly on EDC ECU between pin B52 (CAN L) and pin B53 (CAN H) must be equal to 120 ohm. 2) Resistance measured with key off on wiring between pin B52 and pin B53 must be equal to 120 ohm. 3) Impedance measured between 30–pin connector pin 21 (CAN H) and pin 22 (CAN L) must be equal to 60 ohm +/–3% (measured with key off and ECUs connected).
ENGINE – POWER STAGE FOR SYNC. SIGNAL (MODUS)	31	07	VALUE OVER THE NORMAL LIMIT		EDC to diagnostic instrument synchronization signal short–circuited or open–circuited.	Check that the wiring between connector EDC pin B48 and diagnosis plug pin 23, passing through the brown sleeve B pin 11, is all right.	EDC pilot light off
ENGINE – POWER STAGE FOR TD SIGNAL	31	08	VALUE BELOW THE LIMIT	The speed indicator doesn't work.	Speed indicator signal short–circuited or open–circuited.	Check the wiring between pin 3 of the instrument and connector EDC pin B49.	Check CAN VDB line: 1) Resistance measured with key off directly on EDC ECU between pin B52 (CAN L) and pin B53 (CAN H) must be equal to 120 ohm. 2) Resistance measured with key off on wiring between pin B52 and pin B53 must be equal to 120 ohm. 3) Impedance measured between 30–pin connector pin 21 (CAN H) and pin 22 (CAN L) must be equal to 60 ohm +/–3% (measured with key off and ECUs connected).

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Component failure	DTC	FMI	Error type	Visible anomaly	Possible cause	Recommended repairs	Notes
ENGINE – POWER STAGE FOR SYNC. SIGNAL (MODUS)	31	08	VALUE BELOW THE LIMIT		EDC to diagnostic instrument synchronization signal short–circuited or open–circuited.	Check that the wiring between connector EDC pin B48 and diagnosis plug pin 23, passing through the brown sleeve B pin 11, is all right.	EDC pilot light off
WARNING LIGHTS – OIL PRESSURE GAUGE	32	00	NO AVAILABLE SYMPTOM	The pilot light either doesn't work or it remains always lighted up.	CAN line failure.	Check that the CAN line is up: impedance between pin 21 and pin 22 of the 30–pin connector must be approximately 60 ohm (measured with key off and all ECUs connected). Run Cluster and Body Controller diagnostic procedures.	
WARNING LIGHTS – COOLANT TEMPERATUR GAUGE	32	00	NO AVAILABLE SYMPTOM	Incorrect display of the engine coolant temperature.	CAN line failure.	1) Run warning light/indicator active diagnostics in the Cluster diagnostic procedure. 2) Check that the CAN line is up: impedance between pin 21 and pin 22 of the 30–pin connector must be approximately 60 ohm (measured with key off and all ECUs connected).	

Component failure	DTC	FMI	Error type	Visible anomaly	Possible cause	Recommended repairs	Notes
WARNING LIGHTS – OIL PRESSURE GAUGE	32	01	SHORT CIRCUIT TO POSITIVE	The pilot light either doesn't work or it remains always lighted up.	CAN line failure.	Check that the CAN line is up: impedance between pin 21 and pin 22 of the 30–pin connector must be approximately 60 ohm (measured with key off and all ECUs connected). Run Cluster and Body Controller diagnostic procedures.	
WARNING LIGHTS – COOLANT TEMPERATUR GAUGE	32	01	SHORT CIRCUIT TO POSITIVE	Incorrect display of the engine coolant temperature.	CAN line failure.	1) Run warning light/indicator active diagnostics in the Cluster diagnostic procedure. 2) Check that the CAN line is up: impedance between pin 21 and pin 22 of the 30–pin connector must be approximately 60 ohm (measured with key off and all ECUs connected).	
WARNING LIGHTS – OIL PRESSURE GAUGE	32	02	OPEN CIRCUIT OR SHORT CIRCUIT TO GROUND	The pilot light either doesn't work or it remains always lighted up.	CAN line failure.	Check that the CAN line is up: impedance between pin 21 and pin 22 of the 30–pin connector must be approximately 60 ohm (measured with key off and all ECUs connected). Run Cluster and Body Controller diagnostic procedures.	
WARNING LIGHTS – COOLANT TEMPERATUR GAUGE	32	02	OPEN CIRCUIT OR SHORT CIRCUIT TO GROUND	Incorrect display of the engine coolant temperature.	CAN line failure.	1) Run warning light/indicator active diagnostics in the Cluster diagnostic procedure. 2) Check that the CAN line is up: impedance between pin 21 and pin 22 of the 30–pin connector must be approximately 60 ohm (measured with key off and all ECUs connected).	

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Component failure	DTC	FMI	Error type	Visible anomaly	Possible cause	Recommended repairs	Notes
WARNING LIGHTS – OIL PRESSURE GAUGE	32	03	NO SIGNAL	The pilot light either doesn't work or it remains always lighted up.	CAN line failure.	Check that the CAN line is up: impedance between pin 21 and pin 22 of the 30–pin connector must be approximately 60 ohm (measured with key off and all ECUs connected). Run Cluster and Body Controller diagnostic procedures.	
WARNING LIGHTS – COOLANT TEMPERATUR GAUGE	32	03	NO SIGNAL	Incorrect display of the engine coolant temperature.	CAN line failure.	1) Run warning light/indicator active diagnostics in the Cluster diagnostic procedure. 2) Check that the CAN line is up: impedance between pin 21 and pin 22 of the 30–pin connector must be approximately 60 ohm (measured with key off and all ECUs connected).	
WARNING LIGHTS – OIL PRESSURE GAUGE	32	04	SIGNAL NOT PLAUSIBLE	The pilot light either doesn't work or it remains always lighted up.	CAN line failure.	Check that the CAN line is up: impedance between pin 21 and pin 22 of the 30–pin connector must be approximately 60 ohm (measured with key off and all ECUs connected). Run Cluster and Body Controller diagnostic procedures.	
WARNING LIGHTS – COOLANT TEMPERATUR GAUGE	32	04	SIGNAL NOT PLAUSIBLE	Incorrect display of the engine coolant temperature.	CAN line failure.	1) Run warning light/indicator active diagnostics in the Cluster diagnostic procedure. 2) Check that the CAN line is up: impedance between pin 21 and pin 22 of the 30–pin connector must be approximately 60 ohm (measured with key off and all ECUs connected).	

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Component failure	DTC	FMI	Error type	Visible anomaly	Possible cause	Recommended repairs	Notes
WARNING LIGHTS – OIL PRESSURE GAUGE	32	05	SUPPLY OVER THE NORMAL RANGE	The pilot light either doesn't work or it remains always lighted up.	CAN line failure.	Check that the CAN line is up: impedance between pin 21 and pin 22 of the 30–pin connector must be approximately 60 ohm (measured with key off and all ECUs connected). Run Cluster and Body Controller diagnostic procedures.	
WARNING LIGHTS – COOLANT TEMPERATUR GAUGE	32	05	SUPPLY OVER THE NORMAL RANGE	Incorrect display of the engine coolant temperature.	CAN line failure.	1) Run warning light/indicator active diagnostics in the Cluster diagnostic procedure. 2) Check that the CAN line is up: impedance between pin 21 and pin 22 of the 30–pin connector must be approximately 60 ohm (measured with key off and all ECUs connected).	
WARNING LIGHTS – OIL PRESSURE GAUGE	32	06	SUPPLY BELOW THE RANGE	The pilot light either doesn't work or it remains always lighted up.	CAN line failure.	Check that the CAN line is up: impedance between pin 21 and pin 22 of the 30–pin connector must be approximately 60 ohm (measured with key off and all ECUs connected). Run Cluster and Body Controller diagnostic procedures.	
WARNING LIGHTS – OIL PRESSURE GAUGE	32	07	VALUE OVER THE NORMAL LIMIT	The pilot light either doesn't work or it remains always lighted up.	CAN line failure.	Check that the CAN line is up: impedance between pin 21 and pin 22 of the 30–pin connector must be approximately 60 ohm (measured with key off and all ECUs connected). Run Cluster and Body Controller diagnostic procedures.	
WARNING LIGHTS – OIL PRESSURE GAUGE	32	08	VALUE BELOW THE LIMIT	The pilot light either doesn't work or it remains always lighted up.	CAN line failure.	Check that the CAN line is up: impedance between pin 21 and pin 22 of the 30–pin connector must be approximately 60 ohm (measured with key off and all ECUs connected). Run Cluster and Body Controller diagnostic procedures.	

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Component failure	DTC	FMI	Error type	Visible anomaly	Possible cause	Recommended repairs	Notes
SWITCH – ENGINE BRAKE PRESELECTION BUTTON	33	00	NO AVAILABLE SYMPTOM	The exhaust brake engages only if operated by means of the push–button on the floor, or if operated by the push–button on the floor and only by means of one of the other two ways, even if a different selection has been chosen.	Exhaust brake selector: not plausible signal or lack of switchover of the exhaust brake control mode.	Read Body Controller state parameters with diagnostic tool (engine brake switch not managed by EDC).	
ENGINE – MONITORING OF PRESSURE RELIEF VALVE	33	00	NO AVAILABLE SYMPTOM	Significant power reduction.	Intervention of the double–stage overpressure valve.	Carry out the checks foreseen for 8.2 and 8.3.	EDC pilot light winking.
SWITCH – ENGINE BRAKE PRESELECTION BUTTON	33	01	SHORT CIRCUIT TO POSITIVE	The exhaust brake engages only if operated by means of the push–button on the floor, or if operated by the push–button on the floor and only by means of one of the other two ways, even if a different selection has been chosen.	Exhaust brake selector: not plausible signal or lack of switchover of the exhaust brake control mode.	Read Body Controller state parameters with diagnostic tool (engine brake switch not managed by EDC).	
ENGINE – MONITORING OF PRESSURE RELIEF VALVE	33	01	SHORT CIRCUIT TO POSITIVE	Significant power reduction.	Intervention of the double–stage overpressure valve.	Carry out the checks foreseen for 8.2 and 8.3.	EDC pilot light winking.
SWITCH – ENGINE BRAKE PRESELECTION BUTTON	33	02	OPEN CIRCUIT OR SHORT CIRCUIT TO GROUND	The exhaust brake engages only if operated by means of the push–button on the floor, or if operated by the push–button on the floor and only by means of one of the other two ways, even if a different selection has been chosen.	Exhaust brake selector: not plausible signal or lack of switchover of the exhaust brake control mode.	Read Body Controller state parameters with diagnostic tool (engine brake switch not managed by EDC).	
SWITCH – ENGINE BRAKE PRESELECTION BUTTON	33	03	NO SIGNAL	The exhaust brake engages only if operated by means of the push–button on the floor, or if operated by the push–button on the floor and only by means of one of the other two ways, even if a different selection has been chosen.	Exhaust brake selector: not plausible signal or lack of switchover of the exhaust brake control mode.	Read Body Controller state parameters with diagnostic tool (engine brake switch not managed by EDC).	

Component failure	DTC	FMI	Error type	Visible anomaly	Possible cause	Recommended repairs	Notes
SWITCH – ENGINE BRAKE PRESELECTION BUTTON	33	04	SIGNAL NOT PLAUSIBLE	The exhaust brake engages only if operated by means of the push–button on the floor, or if operated by the push–button on the floor and only by means of one of the other two ways, even if a different selection has been chosen.	Exhaust brake selector: not plausible signal or lack of switchover of the exhaust brake control mode.	Read Body Controller state parameters with diagnostic tool (engine brake switch not managed by EDC).	
SWITCH – ENGINE BRAKE PRESELECTION BUTTON	33	05	SUPPLY OVER THE NORMAL RANGE	The exhaust brake engages only if operated by means of the push–button on the floor, or if operated by the push–button on the floor and only by means of one of the other two ways, even if a different selection has been chosen.	Exhaust brake selector: not plausible signal or lack of switchover of the exhaust brake control mode.	Read Body Controller state parameters with diagnostic tool (engine brake switch not managed by EDC).	
WARNING LIGHTS – COOLANT TEMPERATUR GAUGE	33	06	SUPPLY BELOW THE RANGE	Incorrect display of the engine coolant temperature.	CAN line failure.	1) Run warning light/indicator active diagnostics in the Cluster diagnostic procedure. 2) Check that the CAN line is up: impedance between pin 21 and pin 22 of the 30–pin connector must be approximately 60 ohm (measured with key off and all ECUs connected).	
SWITCH – ENGINE BRAKE PRESELECTION BUTTON	33	06	SUPPLY BELOW THE RANGE	The exhaust brake engages only if operated by means of the push–button on the floor, or if operated by the push–button on the floor and only by means of one of the other two ways, even if a different selection has been chosen.	Exhaust brake selector: not plausible signal or lack of switchover of the exhaust brake control mode.	Read Body Controller state parameters with diagnostic tool (engine brake switch not managed by EDC).	

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Component failure	DTC	FMI	Error type	Visible anomaly	Possible cause	Recommended repairs	Notes
WARNING LIGHTS – COOLANT TEMPERATUR GAUGE	33	07	VALUE OVER THE NORMAL LIMIT	Incorrect display of the engine coolant temperature.	CAN line failure.	1) Run warning light/indicator active diagnostics in the Cluster diagnostic procedure. 2) Check that the CAN line is up: impedance between pin 21 and pin 22 of the 30–pin connector must be approximately 60 ohm (measured with key off and all ECUs connected).	
SWITCH – ENGINE BRAKE PRESELECTION BUTTON	33	07	VALUE OVER THE NORMAL LIMIT	The exhaust brake engages only if operated by means of the push–button on the floor, or if operated by the push–button on the floor and only by means of one of the other two ways, even if a different selection has been chosen.	Exhaust brake selector: not plausible signal or lack of switchover of the exhaust brake control mode.	Read Body Controller state parameters with diagnostic tool (engine brake switch not managed by EDC).	
WARNING LIGHTS – COOLANT TEMPERATUR GAUGE	33	08	VALUE BELOW THE LIMIT	Incorrect display of the engine coolant temperature.	CAN line failure.	1) Run warning light/indicator active diagnostics in the Cluster diagnostic procedure. 2) Check that the CAN line is up: impedance between pin 21 and pin 22 of the 30–pin connector must be approximately 60 ohm (measured with key off and all ECUs connected).	
SWITCH – ENGINE BRAKE PRESELECTION BUTTON	33	08	VALUE BELOW THE LIMIT	The exhaust brake engages only if operated by means of the push–button on the floor, or if operated by the push–button on the floor and only by means of one of the other two ways, even if a different selection has been chosen.	Exhaust brake selector: not plausible signal or lack of switchover of the exhaust brake control mode.	Read Body Controller state parameters with diagnostic tool (engine brake switch not managed by EDC).	
ENGINE – FUEL PRESSURE MONITORING	34	00	NO AVAILABLE SYMPTOM		Air intake upstream of the fuel gear pump.	Check the O–Rings and the proper connection of the pipe unions between the tank and the fuel pump (fasteners must be out and unions well hooked).	EDC pilot light winking.

Component failure	DTC	FMI	Error type	Visible anomaly	Possible cause	Recommended repairs	Notes
ENGINE – FUEL PRESSURE MONITORING	34	00	NO AVAILABLE SYMPTOM		Fuel leaks from the pipe unions or low–pressure pipes downstream of the fuel pump. Possible defect of the signal of the rail pressure sensor	Check the O–Rings and the proper connection of the pipe unions downstream of the fuel pump (fasteners must be out and unions well hooked). Check visually that the low–pressure pipes are not damaged. Carry out the inspections of 8.2.	EDC pilot light winking.
ENGINE – FUEL PRESSURE MONITORING	34	00	NO AVAILABLE SYMPTOM		Fuel suction pipe in the tank partially clogged due to impurities or distortion caused by overheating.	Check whether the priming pump on the prefilter works properly. If the pump knob remains sucked downwards because of the suction pressure, disassemble and check the tank suction pipe. If the suction pipe is all right, replace the filter.	EDC pilot light winking. In case some shavings have been sucked (due to works carried out by the producer on the fuel tank) perform an accurate cleaning of the tank. As a matter of fact the problem might occur again because of other shavings remained inside the tank.
ENGINE – FUEL PRESSURE MONITORING	34	00	NO AVAILABLE SYMPTOM		Insufficient fuel level in the tank.	Check fuel level.	EDC pilot light winking.
ENGINE – FUEL PRESSURE MONITORING	34	00	NO AVAILABLE SYMPTOM	Significant power reduction.	Fuel pressure adjustment: pressure in the rail is lower or higher than the one evaluated by the gearcase.	Reading of measurable parameters: ?Duty Cycle rail pressure solenoid valve? (with release 2–2001 and subsequent ones): in normal conditions, at idling speed, loadless, and steady state engine, the value must be lower than 5%.	EDC pilot light winking.
ENGINE – FUEL PRESSURE MONITORING	34	01	TOO HIGH RAIL PRESSURE	Engine stop.	Max–min pressure error in the rail Check that suction and return lines of gasoil are not inverted (tank sensor)	Replace the overpressure valve If the problem persists, carry out the checks foreseen for 8.2 and 8.3.	EDC pilot light winking.

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Component failure	DTC	FMI	Error type	Visible anomaly	Possible cause	Recommended repairs	Notes
ENGINE – FUEL PRESSURE MONITORING	34	02	OPEN CIRCUIT OR SHORT CIRCUIT TO GROUND	Significant power reduction.	Fuel pressure adjustment: pressure in the rail is lower or higher than the one evaluated by the gearcase.	Reading of measurable parameters: ?Duty Cycle rail pressure solenoid valve? (with release 2–2001 and subsequent ones): in normal conditions, at idling speed, loadless, and steady state engine, the value must be lower than 5%.	EDC pilot light winking.
ENGINE – FUEL PRESSURE MONITORING	34	02	OPEN CIRCUIT OR SHORT CIRCUIT TO GROUND		Air intake upstream of the fuel gear pump.	Check the O–Rings and the proper connection of the pipe unions between the tank and the fuel pump (fasteners must be out and unions well hooked).	EDC pilot light winking.
ENGINE – MONITORING OF PRESSURE RELIEF VALVE	34	02	OPEN CIRCUIT OR SHORT CIRCUIT TO GROUND	Significant power reduction.	Intervention of the double–stage overpressure valve.	Carry out the checks foreseen for 8.2 and 8.3.	EDC pilot light winking.
ENGINE – FUEL PRESSURE MONITORING	34	02	OPEN CIRCUIT OR SHORT CIRCUIT TO GROUND		Fuel leaks from the pipe unions or low–pressure pipes downstream of the fuel pump. Possible defect of the signal of the rail pressure sensor	Check the O–Rings and the proper connection of the pipe unions downstream of the fuel pump (fasteners must be out and unions well hooked). Check visually that the low–pressure pipes are not damaged. Carry out the inspections of 8.2.	EDC pilot light winking.
ENGINE – FUEL PRESSURE MONITORING	34	02	OPEN CIRCUIT OR SHORT CIRCUIT TO GROUND		Fuel suction pipe in the tank partially clogged due to impurities or distortion caused by overheating.	Check whether the priming pump on the prefilter works properly. If the pump knob remains sucked downwards because of the suction pressure, disassemble and check the tank suction pipe. If the suction pipe is all right, replace the filter.	EDC pilot light winking. In case some shavings have been sucked (due to works carried out by the producer on the fuel tank) perform an accurate cleaning of the tank. As a matter of fact the problem might occur again because of other shavings remained inside the tank.
ENGINE – FUEL PRESSURE MONITORING	34	02	OPEN CIRCUIT OR SHORT CIRCUIT TO GROUND		Insufficient fuel level in the tank.	Check fuel level.	EDC pilot light winking.

Component failure	DTC	FMI	Error type	Visible anomaly	Possible cause	Recommended repairs	Notes
ENGINE – MONITORING OF PRESSURE RELIEF VALVE	34	03	NO SIGNAL	Significant power reduction.	Intervention of the double–stage overpressure valve.	Carry out the checks foreseen for 8.2 and 8.3.	EDC pilot light winking.
ENGINE – FUEL PRESSURE MONITORING	34	03	TOO LOW RAIL PRESSURE	Engine stop.	Max–min pressure error in the rail Check that suction and return lines of gasoil are not inverted (tank sensor)	Replace the overpressure valve If the problem persists, carry out the checks foreseen for 8.2 and 8.3.	EDC pilot light winking.
ENGINE – MONITORING OF PRESSURE RELIEF VALVE	34	04	SIGNAL NOT PLAUSIBLE	Significant power reduction.	Intervention of the double–stage overpressure valve.	Carry out the checks foreseen for 8.2 and 8.3.	EDC pilot light winking.
ENGINE – FUEL PRESSURE MONITORING	34	04	NEGATIVE FUEL PRESSURE DEVIATION	Significant power reduction.	Fuel pressure adjustment: pressure in the rail is lower or higher than the one evaluated by the gearcase.	Reading of measurable parameters: ?Duty Cycle rail pressure solenoid valve? (with release 2–2001 and subsequent ones): in normal conditions, at idling speed, loadless, and steady state engine, the value must be lower than 5%.	EDC pilot light winking.
ENGINE – FUEL PRESSURE MONITORING	34	04	NEGATIVE FUEL PRESSURE DEVIATION		Insufficient fuel level in the tank.	Check fuel level.	EDC pilot light winking.
ENGINE – FUEL PRESSURE MONITORING	34	04	NEGATIVE FUEL PRESSURE DEVIATION		Fuel suction pipe in the tank partially clogged due to impurities or distortion caused by overheating.	Check whether the priming pump on the prefilter works properly. If the pump knob remains sucked downwards because of the suction pressure, disassemble and check the tank suction pipe. If the suction pipe is all right, replace the filter.	EDC pilot light winking. In case some shavings have been sucked (due to works carried out by the producer on the fuel tank) perform an accurate cleaning of the tank. As a matter of fact the problem might occur again because of other shavings remained inside the tank.
ENGINE – FUEL PRESSURE MONITORING	34	04	NEGATIVE FUEL PRESSURE DEVIATION		Air intake upstream of the fuel gear pump.	Check the O–Rings and the proper connection of the pipe unions between the tank and the fuel pump (fasteners must be out and unions well hooked).	EDC pilot light winking.

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Component failure	DTC	FMI	Error type	Visible anomaly	Possible cause	Recommended repairs	Notes
ENGINE – FUEL PRESSURE MONITORING	34	04	NEGATIVE FUEL PRESSURE DEVIATION		Fuel leaks from the pipe unions or low–pressure pipes downstream of the fuel pump. Possible defect of the signal of the rail pressure sensor	Check the O–Rings and the proper connection of the pipe unions downstream of the fuel pump (fasteners must be out and unions well hooked). Check visually that the low–pressure pipes are not damaged. Carry out the inspections of 8.2.	EDC pilot light winking.
ENGINE – MONITORING OF PRESSURE RELIEF VALVE	34	05	SUPPLY OVER THE NORMAL RANGE	Significant power reduction.	Intervention of the double–stage overpressure valve.	Carry out the checks foreseen for 8.2 and 8.3.	EDC pilot light winking.
ENGINE – FUEL PRESSURE MONITORING	34	05	POSITIVE FUEL PRESSURE DEVIATION		Air intake upstream of the fuel gear pump.	Check the O–Rings and the proper connection of the pipe unions between the tank and the fuel pump (fasteners must be out and unions well hooked).	EDC pilot light winking.
ENGINE – FUEL PRESSURE MONITORING	34	05	POSITIVE FUEL PRESSURE DEVIATION	Significant power reduction.	Fuel pressure adjustment: pressure in the rail is lower or higher than the one evaluated by the gearcase.	Reading of measurable parameters: ?Duty Cycle rail pressure solenoid valve? (with release 2–2001 and subsequent ones): in normal conditions, at idling speed, loadless, and steady state engine, the value must be lower than 5%.	EDC pilot light winking.
ENGINE – FUEL PRESSURE MONITORING	34	05	POSITIVE FUEL PRESSURE DEVIATION		Fuel leaks from the pipe unions or low–pressure pipes downstream of the fuel pump. Possible defect of the signal of the rail pressure sensor	Check the O–Rings and the proper connection of the pipe unions downstream of the fuel pump (fasteners must be out and unions well hooked). Check visually that the low–pressure pipes are not damaged. Carry out the inspections of 8.2.	EDC pilot light winking.
ENGINE – FUEL PRESSURE MONITORING	34	05	POSITIVE FUEL PRESSURE DEVIATION		Insufficient fuel level in the tank.	Check fuel level.	EDC pilot light winking.

Component failure	DTC	FMI	Error type	Visible anomaly	Possible cause	Recommended repairs	Notes
ENGINE – FUEL PRESSURE MONITORING	34	05	POSITIVE FUEL PRESSURE DEVIATION		Fuel suction pipe in the tank partially clogged due to impurities or distortion caused by overheating.	Check whether the priming pump on the prefilter works properly. If the pump knob remains sucked downwards because of the suction pressure, disassemble and check the tank suction pipe. If the suction pipe is all right, replace the filter.	EDC pilot light winking. In case some shavings have been sucked (due to works carried out by the producer on the fuel tank) perform an accurate cleaning of the tank. As a matter of fact the problem might occur again because of other shavings remained inside the tank.
ENGINE – MONITORING OF PRESSURE RELIEF VALVE	34	06	SUPPLY BELOW THE RANGE	Significant power reduction.	Intervention of the double–stage overpressure valve.	Carry out the checks foreseen for 8.2 and 8.3.	EDC pilot light winking.
ENGINE – FUEL PRESSURE MONITORING	34	06	LEAKAGE IN OVERRUN		Air intake upstream of the fuel gear pump.	Check the O–Rings and the proper connection of the pipe unions between the tank and the fuel pump (fasteners must be out and unions well hooked).	EDC pilot light winking.
ENGINE – FUEL PRESSURE MONITORING	34	06	LEAKAGE IN OVERRUN		Fuel leaks from the pipe unions or low–pressure pipes downstream of the fuel pump. Possible defect of the signal of the rail pressure sensor	Check the O–Rings and the proper connection of the pipe unions downstream of the fuel pump (fasteners must be out and unions well hooked). Check visually that the low–pressure pipes are not damaged. Carry out the inspections of 8.2.	EDC pilot light winking.
ENGINE – FUEL PRESSURE MONITORING	34	06	LEAKAGE IN OVERRUN		Fuel suction pipe in the tank partially clogged due to impurities or distortion caused by overheating.	Check whether the priming pump on the prefilter works properly. If the pump knob remains sucked downwards because of the suction pressure, disassemble and check the tank suction pipe. If the suction pipe is all right, replace the filter.	EDC pilot light winking. In case some shavings have been sucked (due to works carried out by the producer on the fuel tank) perform an accurate cleaning of the tank. As a matter of fact the problem might occur again because of other shavings remained inside the tank.

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Component failure	DTC	FMI	Error type	Visible anomaly	Possible cause	Recommended repairs	Notes
ENGINE – FUEL PRESSURE MONITORING	34	06	LEAKAGE IN OVERRUN		Insufficient fuel level in the tank.	Check fuel level.	EDC pilot light winking.
ENGINE – FUEL PRESSURE MONITORING	34	06	LEAKAGE IN OVERRUN	Significant power reduction.	Fuel pressure adjustment: pressure in the rail is lower or higher than the one evaluated by the gearcase.	Reading of measurable parameters: ?Duty Cycle rail pressure solenoid valve? (with release 2–2001 and subsequent ones): in normal conditions, at idling speed, loadless, and steady state engine, the value must be lower than 5%.	EDC pilot light winking.
ENGINE – FUEL PRESSURE MONITORING	34	07	LEAKAGE Q–BAL		Fuel suction pipe in the tank partially clogged due to impurities or distortion caused by overheating.	Check whether the priming pump on the prefilter works properly. If the pump knob remains sucked downwards because of the suction pressure, disassemble and check the tank suction pipe. If the suction pipe is all right, replace the filter.	EDC pilot light winking. In case some shavings have been sucked (due to works carried out by the producer on the fuel tank) perform an accurate cleaning of the tank. As a matter of fact the problem might occur again because of other shavings remained inside the tank.
ENGINE – FUEL PRESSURE MONITORING	34	07	LEAKAGE Q–BAL		Insufficient fuel level in the tank.	Check fuel level.	EDC pilot light winking.
ENGINE – MONITORING OF PRESSURE RELIEF VALVE	34	07	VALUE OVER THE NORMAL LIMIT	Significant power reduction.	Intervention of the double–stage overpressure valve.	Carry out the checks foreseen for 8.2 and 8.3.	EDC pilot light winking.
ENGINE – FUEL PRESSURE MONITORING	34	07	LEAKAGE Q–BAL	Significant power reduction.	Fuel pressure adjustment: pressure in the rail is lower or higher than the one evaluated by the gearcase.	Reading of measurable parameters: ?Duty Cycle rail pressure solenoid valve? (with release 2–2001 and subsequent ones): in normal conditions, at idling speed, loadless, and steady state engine, the value must be lower than 5%.	EDC pilot light winking.
ENGINE – FUEL PRESSURE MONITORING	34	07	LEAKAGE Q–BAL		Air intake upstream of the fuel gear pump.	Check the O–Rings and the proper connection of the pipe unions between the tank and the fuel pump (fasteners must be out and unions well hooked).	EDC pilot light winking.

Component failure	DTC	FMI	Error type	Visible anomaly	Possible cause	Recommended repairs	Notes
ENGINE – FUEL PRESSURE MONITORING	34	07	LEAKAGE Q–BAL		Fuel leaks from the pipe unions or low–pressure pipes downstream of the fuel pump. Possible defect of the signal of the rail pressure sensor	Check the O–Rings and the proper connection of the pipe unions downstream of the fuel pump (fasteners must be out and unions well hooked). Check visually that the low–pressure pipes are not damaged. Carry out the inspections of 8.2.	EDC pilot light winking.
ENGINE – MONITORING OF PRESSURE RELIEF VALVE	34	08	VALUE BELOW THE LIMIT	Significant power reduction.	Intervention of the double–stage overpressure valve.	Carry out the checks foreseen for 8.2 and 8.3.	EDC pilot light winking.
SENSORS – OIL PRESSURE	35	00	NO AVAILABLE SYMPTOM	Power reduction	Oil pressure sensor short–circuited or open–circuited.	Reading of measurable parameters by means of the diagnostic instrument: in presence of this error, the oil pressure will be fixed at 60 mbar. Verify the wiring between the sensor connector (wiring side) pin 3 and connector EDC pin C9, between sensor connector (wiring side) pin 4 and connector EDC pin C35.	EDC pilot light on. The pressure sensor is incorporated in the temperature one.
ELECTRONIC CONTROL UNIT – SELF TEST SHUTOFF PATHS START–UP	35	00	NO AVAILABLE SYMPTOM	Significant power reduction.	The internal ECU test which occurs when the engine is switched on does not succeed.	Check wiring between +15 of the key and ecu connector pin B39 coming from passaparete connector B pin 2. Erase fault memory and retry: if after engines shuts down the fault persists, contact the Help Desk for a possible ecu change	EDC pilot light on. The engine doesn't stop in the foreseen times when the key +15 is OFF–positioned.

Component failure	DTC	FMI	Error type	Visible anomaly	Possible cause	Recommended repairs	Notes
SENSORS – OIL PRESSURE	35	01	SHORT CIRCUIT TO POSITIVE	Power reduction	Oil pressure sensor short–circuited or open–circuited.	Reading of measurable parameters by means of the diagnostic instrument: in presence of this error, the oil pressure will be fixed at 60 mbar. Verify the wiring between the sensor connector (wiring side) pin 3 and connector EDC pin C9, between sensor connector (wiring side) pin 4 and connector EDC pin C35.	EDC pilot light on. The pressure sensor is incorporated in the temperature one.
ELECTRONIC CONTROL UNIT – SELF TEST SHUTOFF PATHS START–UP	35	01	SHORT CIRCUIT TO POSITIVE	Significant power reduction.	The internal ECU test which occurs when the engine is switched on does not succeed.	Check wiring between +15 of the key and ecu connector pin B39 coming from passaparete connector B pin 2. Erase fault memory and retry: if after engines shuts down the fault persists, contact the Help Desk for a possible ecu change	EDC pilot light on. The engine doesn't stop in the foreseen times when the key +15 is OFF–positioned.
SENSORS – OIL PRESSURE	35	02	OPEN CIRCUIT OR SHORT CIRCUIT TO GROUND	Power reduction	Oil pressure sensor short–circuited or open–circuited.	Reading of measurable parameters by means of the diagnostic instrument: in presence of this error, the oil pressure will be fixed at 60 mbar. Verify the wiring between the sensor connector (wiring side) pin 3 and connector EDC pin C9, between sensor connector (wiring side) pin 4 and connector EDC pin C35.	EDC pilot light on. The pressure sensor is incorporated in the temperature one.
ELECTRONIC CONTROL UNIT – SELF TEST SHUTOFF PATHS START–UP	35	02	OPEN CIRCUIT OR SHORT CIRCUIT TO GROUND	Significant power reduction.	The internal ECU test which occurs when the engine is switched on does not succeed.	Check wiring between +15 of the key and ecu connector pin B39 coming from passaparete connector B pin 2. Erase fault memory and retry: if after engines shuts down the fault persists, contact the Help Desk for a possible ecu change	EDC pilot light on. The engine doesn't stop in the foreseen times when the key +15 is OFF–positioned.

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Component failure	DTC	FMI	Error type	Visible anomaly	Possible cause	Recommended repairs	Notes
SENSORS – OIL PRESSURE	35	03	NO SIGNAL	Power reduction	Oil pressure sensor short–circuited or open–circuited.	Reading of measurable parameters by means of the diagnostic instrument: in presence of this error, the oil pressure will be fixed at 60 mbar. Verify the wiring between the sensor connector (wiring side) pin 3 and connector EDC pin C9, between sensor connector (wiring side) pin 4 and connector EDC pin C35.	EDC pilot light on. The pressure sensor is incorporated in the temperature one.
ELECTRONIC CONTROL UNIT – SELF TEST SHUTOFF PATHS START–UP	35	03	NO SIGNAL	Significant power reduction.	The internal ECU test which occurs when the engine is switched on does not succeed.	Check wiring between +15 of the key and ecu connector pin B39 coming from passaparete connector B pin 2. Erase fault memory and retry: if after engines shuts down the fault persists, contact the Help Desk for a possible ecu change	EDC pilot light on. The engine doesn't stop in the foreseen times when the key +15 is OFF–positioned.
SENSORS – OIL PRESSURE	35	04	SIGNAL NOT PLAUSIBLE	Power reduction	Oil pressure sensor short–circuited or open–circuited.	Reading of measurable parameters by means of the diagnostic instrument: in presence of this error, the oil pressure will be fixed at 60 mbar. Verify the wiring between the sensor connector (wiring side) pin 3 and connector EDC pin C9, between sensor connector (wiring side) pin 4 and connector EDC pin C35.	EDC pilot light on. The pressure sensor is incorporated in the temperature one.
SENSORS – OIL PRESSURE	35	05	SUPPLY OVER THE NORMAL RANGE	Power reduction	Oil pressure sensor short–circuited or open–circuited.	Reading of measurable parameters by means of the diagnostic instrument: in presence of this error, the oil pressure will be fixed at 60 mbar. Verify the wiring between the sensor connector (wiring side) pin 3 and connector EDC pin C9, between sensor connector (wiring side) pin 4 and connector EDC pin C35.	EDC pilot light on. The pressure sensor is incorporated in the temperature one.

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Component failure	DTC	FMI	Error type	Visible anomaly	Possible cause	Recommended repairs	Notes
SENSORS – OIL PRESSURE	35	06	SUPPLY BELOW THE RANGE	Power reduction	Oil pressure sensor short–circuited or open–circuited.	Reading of measurable parameters by means of the diagnostic instrument: in presence of this error, the oil pressure will be fixed at 60 mbar. Verify the wiring between the sensor connector (wiring side) pin 3 and connector EDC pin C9, between sensor connector (wiring side) pin 4 and connector EDC pin C35.	EDC pilot light on. The pressure sensor is incorporated in the temperature one.
SENSORS – OIL PRESSURE	35	07	VALUE OVER THE NORMAL LIMIT	Power reduction	Oil pressure sensor short–circuited or open–circuited.	Reading of measurable parameters by means of the diagnostic instrument: in presence of this error, the oil pressure will be fixed at 60 mbar. Verify the wiring between the sensor connector (wiring side) pin 3 and connector EDC pin C9, between sensor connector (wiring side) pin 4 and connector EDC pin C35.	EDC pilot light on. The pressure sensor is incorporated in the temperature one.
ENGINE – FUEL PRESSURE MONITORING	35	08	LEAKAGE IN LOWIDLE		Fuel leaks from the pipe unions or low–pressure pipes downstream of the fuel pump. Possible defect of the signal of the rail pressure sensor	Check the O–Rings and the proper connection of the pipe unions downstream of the fuel pump (fasteners must be out and unions well hooked). Check visually that the low–pressure pipes are not damaged. Carry out the inspections of 8.2.	EDC pilot light winking.
ENGINE – FUEL PRESSURE MONITORING	35	08	LEAKAGE IN LOWIDLE	Significant power reduction.	Fuel pressure adjustment: pressure in the rail is lower or higher than the one evaluated by the gearcase.	Reading of measurable parameters: ?Duty Cycle rail pressure solenoid valve? (with release 2–2001 and subsequent ones): in normal conditions, at idling speed, loadless, and steady state engine, the value must be lower than 5%.	EDC pilot light winking.

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Component failure	DTC	FMI	Error type	Visible anomaly	Possible cause	Recommended repairs	Notes
ENGINE – FUEL PRESSURE MONITORING	35	08	LEAKAGE IN LOWIDLE		Fuel suction pipe in the tank partially clogged due to impurities or distortion caused by overheating.	Check whether the priming pump on the prefilter works properly. If the pump knob remains sucked downwards because of the suction pressure, disassemble and check the tank suction pipe. If the suction pipe is all right, replace the filter.	EDC pilot light winking. In case some shavings have been sucked (due to works carried out by the producer on the fuel tank) perform an accurate cleaning of the tank. As a matter of fact the problem might occur again because of other shavings remained inside the tank.
ENGINE – FUEL PRESSURE MONITORING	35	08	LEAKAGE IN LOWIDLE		Air intake upstream of the fuel gear pump.	Check the O–Rings and the proper connection of the pipe unions between the tank and the fuel pump (fasteners must be out and unions well hooked).	EDC pilot light winking.
ENGINE – FUEL PRESSURE MONITORING	35	08	LEAKAGE IN LOWIDLE		Insufficient fuel level in the tank.	Check fuel level.	EDC pilot light winking.
SENSORS – OIL PRESSURE	35	08	VALUE BELOW THE LIMIT	Power reduction	Oil pressure sensor short–circuited or open–circuited.	Reading of measurable parameters by means of the diagnostic instrument: in presence of this error, the oil pressure will be fixed at 60 mbar. Verify the wiring between the sensor connector (wiring side) pin 3 and connector EDC pin C9, between sensor connector (wiring side) pin 4 and connector EDC pin C35.	EDC pilot light on. The pressure sensor is incorporated in the temperature one.
COMMUNICATION LINES – Can B Module	36	00	NO AVAILABLE SYMPTOM		CAN line.	Check wiring, connections and closing resistance (120 ohms)	EDC pilot light: Off (software version for single–stage valve). On (software version for double–stage valve). Immobilizer either does not intervene or it does not allow starting.

Component failure	DTC	FMI	Error type	Visible anomaly	Possible cause	Recommended repairs	Notes
COMMUNICATION LINES – Can B Module	36	00	NO AVAILABLE SYMPTOM	CAN message appears on Cluster.CAN messages cannot be viewed on Cluster. Possible communication problem with IMMOBILIZER for cranking. Possible ECAS suspension levelling operation problem via remote control in cab. Speedometer may stay off.	Possible CAN line problem: CAN line short–circuit to earth or CAN H and CAN L lines reciprocally short–circuiting. Check that all vehicle ECUs are connected.	Check CAN VDB line: 1) Resistance measured with key off directly on EDC ECU between pin B52 (CAN L) and pin B53 (CAN H) must be equal to 120 ohm. 2) Resistance measured with key off on wiring between pin B52 and pin B53 must be equal to 120 ohm. 3) Impedance measured between 30–pin connector pin 21 (CAN H) and pin 22 (CAN L) must be equal to 60 ohm +/–3% (measured with key off and ECUs connected).	
COMMUNICATION LINES – Can B Module	36	01	SHORT CIRCUIT TO POSITIVE		CAN line.	Check wiring, connections and closing resistance (120 ohms)	EDC pilot light: Off (software version for single–stage valve). On (software version for double–stage valve). Immobilizer either does not intervene or it does not allow starting.
COMMUNICATION LINES – Can B Module	36	01	SHORT CIRCUIT TO POSITIVE	CAN message appears on Cluster.CAN messages cannot be viewed on Cluster. Possible communication problem with IMMOBILIZER for cranking. Possible ECAS suspension levelling operation problem via remote control in cab. Speedometer may stay off.	Possible CAN line problem: CAN line short–circuit to earth or CAN H and CAN L lines reciprocally short–circuiting. Check that all vehicle ECUs are connected.	Check CAN VDB line: 1) Resistance measured with key off directly on EDC ECU between pin B52 (CAN L) and pin B53 (CAN H) must be equal to 120 ohm. 2) Resistance measured with key off on wiring between pin B52 and pin B53 must be equal to 120 ohm. 3) Impedance measured between 30–pin connector pin 21 (CAN H) and pin 22 (CAN L) must be equal to 60 ohm +/–3% (measured with key off and ECUs connected).	

Component failure	DTC	FMI	Error type	Visible anomaly	Possible cause	Recommended repairs	Notes
COMMUNICATION LINES – Can B Module	36	02	OPEN CIRCUIT OR SHORT CIRCUIT TO GROUND		CAN line.	Check wiring, connections and closing resistance (120 ohms)	EDC pilot light: Off (software version for single–stage valve). On (software version for double–stage valve). Immobilizer either does not intervene or it does not allow starting.
COMMUNICATION LINES – Can B Module	36	02	OPEN CIRCUIT OR SHORT CIRCUIT TO GROUND	CAN message appears on Cluster.CAN messages cannot be viewed on Cluster. Possible communication problem with IMMOBILIZER for cranking. Possible ECAS suspension levelling operation problem via remote control in cab. Speedometer may stay off.	Possible CAN line problem: CAN line short–circuit to earth or CAN H and CAN L lines reciprocally short–circuiting. Check that all vehicle ECUs are connected.	Check CAN VDB line: 1) Resistance measured with key off directly on EDC ECU between pin B52 (CAN L) and pin B53 (CAN H) must be equal to 120 ohm. 2) Resistance measured with key off on wiring between pin B52 and pin B53 must be equal to 120 ohm. 3) Impedance measured between 30–pin connector pin 21 (CAN H) and pin 22 (CAN L) must be equal to 60 ohm +/–3% (measured with key off and ECUs connected).	
COMMUNICATION LINES – Can B Module	36	03	NO SIGNAL		CAN line.	Check wiring, connections and closing resistance (120 ohms)	EDC pilot light: Off (software version for single–stage valve). On (software version for double–stage valve). Immobilizer either does not intervene or it does not allow starting.

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Component failure	DTC	FMI	Error type	Visible anomaly	Possible cause	Recommended repairs	Notes
COMMUNICATION LINES – Can B Module	36	03	NO SIGNAL	CAN message appears on Cluster.CAN messages cannot be viewed on Cluster. Possible communication problem with IMMOBILIZER for cranking. Possible ECAS suspension levelling operation problem via remote control in cab. Speedometer may stay off.	Possible CAN line problem: CAN line short–circuit to earth or CAN H and CAN L lines reciprocally short–circuiting. Check that all vehicle ECUs are connected.	Check CAN VDB line: 1) Resistance measured with key off directly on EDC ECU between pin B52 (CAN L) and pin B53 (CAN H) must be equal to 120 ohm. 2) Resistance measured with key off on wiring between pin B52 and pin B53 must be equal to 120 ohm. 3) Impedance measured between 30–pin connector pin 21 (CAN H) and pin 22 (CAN L) must be equal to 60 ohm +/–3% (measured with key off and ECUs connected).	
ELECTRONIC CONTROL UNIT – SELF TEST SHUTOFF PATHS START–UP	36	04	SIGNAL NOT PLAUSIBLE	Significant power reduction.	The internal ECU test which occurs when the engine is switched on does not succeed.	Check wiring between +15 of the key and ecu connector pin B39 coming from passaparete connector B pin 2. Erase fault memory and retry: if after engines shuts down the fault persists, contact the Help Desk for a possible ecu change	EDC pilot light on. The engine doesn't stop in the foreseen times when the key +15 is OFF–positioned.
COMMUNICATION LINES – Can B Module	36	04	SIGNAL NOT PLAUSIBLE		CAN line.	Check wiring, connections and closing resistance (120 ohms)	EDC pilot light: Off (software version for single–stage valve). On (software version for double–stage valve). Immobilizer either does not intervene or it does not allow starting.

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Component failure	DTC	FMI	Error type	Visible anomaly	Possible cause	Recommended repairs	Notes
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ELECTRONIC CONTROL UNIT – SELF TEST SHUTOFF PATHS START–UP	36	05	SUPPLY OVER THE NORMAL RANGE	Significant power reduction.	The internal ECU test which occurs when the engine is switched on does not succeed.	Check wiring between +15 of the key and ecu connector pin B39 coming from passaparete connector B pin 2. Erase fault memory and retry: if after engines shuts down the fault persists, contact the Help Desk for a possible ecu change	EDC pilot light on. The engine doesn't stop in the foreseen times when the key +15 is OFF–positioned.
COMMUNICATION LINES – Can B Module	36	05	SUPPLY OVER THE NORMAL RANGE		CAN line.	Check wiring, connections and closing resistance (120 ohms)	EDC pilot light: Off (software version for single–stage valve). On (software version for double–stage valve). Immobilizer either does not intervene or it does not allow starting.

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Component failure	DTC	FMI	Error type	Visible anomaly	Possible cause	Recommended repairs	Notes
COMMUNICATION LINES – Can B Module	36	05	SUPPLY OVER THE NORMAL RANGE	CAN message appears on Cluster.CAN messages cannot be viewed on Cluster. Possible communication problem with IMMOBILIZER for cranking. Possible ECAS suspension levelling operation problem via remote control in cab. Speedometer may stay off.	Possible CAN line problem: CAN line short–circuit to earth or CAN H and CAN L lines reciprocally short–circuiting. Check that all vehicle ECUs are connected.	Check CAN VDB line: 1) Resistance measured with key off directly on EDC ECU between pin B52 (CAN L) and pin B53 (CAN H) must be equal to 120 ohm. 2) Resistance measured with key off on wiring between pin B52 and pin B53 must be equal to 120 ohm. 3) Impedance measured between 30–pin connector pin 21 (CAN H) and pin 22 (CAN L) must be equal to 60 ohm +/–3% (measured with key off and ECUs connected).	
ELECTRONIC CONTROL UNIT – SELF TEST SHUTOFF PATHS START–UP	36	06	SUPPLY BELOW THE RANGE	Significant power reduction.	The internal ECU test which occurs when the engine is switched on does not succeed.	Check wiring between +15 of the key and ecu connector pin B39 coming from passaparete connector B pin 2. Erase fault memory and retry: if after engines shuts down the fault persists, contact the Help Desk for a possible ecu change	EDC pilot light on. The engine doesn't stop in the foreseen times when the key +15 is OFF–positioned.
COMMUNICATION LINES – Can B Module	36	06	SUPPLY BELOW THE RANGE		CAN line.	Check wiring, connections and closing resistance (120 ohms)	EDC pilot light: Off (software version for single–stage valve). On (software version for double–stage valve). Immobilizer either does not intervene or it does not allow starting.

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Component failure	DTC	FMI	Error type	Visible anomaly	Possible cause	Recommended repairs	Notes
COMMUNICATION LINES – Can B Module	36	06	SUPPLY BELOW THE RANGE	CAN message appears on Cluster.CAN messages cannot be viewed on Cluster. Possible communication problem with IMMOBILIZER for cranking. Possible ECAS suspension levelling operation problem via remote control in cab. Speedometer may stay off.	Possible CAN line problem: CAN line short–circuit to earth or CAN H and CAN L lines reciprocally short–circuiting. Check that all vehicle ECUs are connected.	Check CAN VDB line: 1) Resistance measured with key off directly on EDC ECU between pin B52 (CAN L) and pin B53 (CAN H) must be equal to 120 ohm. 2) Resistance measured with key off on wiring between pin B52 and pin B53 must be equal to 120 ohm. 3) Impedance measured between 30–pin connector pin 21 (CAN H) and pin 22 (CAN L) must be equal to 60 ohm +/–3% (measured with key off and ECUs connected).	
ELECTRONIC CONTROL UNIT – SELF TEST SHUTOFF PATHS START–UP	36	07	VALUE OVER THE NORMAL LIMIT	Significant power reduction.	The internal ECU test which occurs when the engine is switched on does not succeed.	Check wiring between +15 of the key and ecu connector pin B39 coming from passaparete connector B pin 2. Erase fault memory and retry: if after engines shuts down the fault persists, contact the Help Desk for a possible ecu change	EDC pilot light on. The engine doesn't stop in the foreseen times when the key +15 is OFF–positioned.
COMMUNICATION LINES – Can B Module	36	07	VALUE OVER THE NORMAL LIMIT		CAN line.	Check wiring, connections and closing resistance (120 ohms)	EDC pilot light: Off (software version for single–stage valve). On (software version for double–stage valve). Immobilizer either does not intervene or it does not allow starting.

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Component failure	DTC	FMI	Error type	Visible anomaly	Possible cause	Recommended repairs	Notes
COMMUNICATION LINES – Can B Module	36	07	VALUE OVER THE NORMAL LIMIT	CAN message appears on Cluster.CAN messages cannot be viewed on Cluster. Possible communication problem with IMMOBILIZER for cranking. Possible ECAS suspension levelling operation problem via remote control in cab. Speedometer may stay off.	Possible CAN line problem: CAN line short–circuit to earth or CAN H and CAN L lines reciprocally short–circuiting. Check that all vehicle ECUs are connected.	Check CAN VDB line: 1) Resistance measured with key off directly on EDC ECU between pin B52 (CAN L) and pin B53 (CAN H) must be equal to 120 ohm. 2) Resistance measured with key off on wiring between pin B52 and pin B53 must be equal to 120 ohm. 3) Impedance measured between 30–pin connector pin 21 (CAN H) and pin 22 (CAN L) must be equal to 60 ohm +/–3% (measured with key off and ECUs connected).	
ELECTRONIC CONTROL UNIT – SELF TEST SHUTOFF PATHS START–UP	36	08	VALUE BELOW THE LIMIT	Significant power reduction.	The internal ECU test which occurs when the engine is switched on does not succeed.	Check wiring between +15 of the key and ecu connector pin B39 coming from passaparete connector B pin 2. Erase fault memory and retry: if after engines shuts down the fault persists, contact the Help Desk for a possible ecu change	EDC pilot light on. The engine doesn't stop in the foreseen times when the key +15 is OFF–positioned.
COMMUNICATION LINES – Can B Module	36	08	VALUE BELOW THE LIMIT		CAN line.	Check wiring, connections and closing resistance (120 ohms)	EDC pilot light: Off (software version for single–stage valve). On (software version for double–stage valve). Immobilizer either does not intervene or it does not allow starting.

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Component failure	DTC	FMI	Error type	Visible anomaly	Possible cause	Recommended repairs	Notes
COMMUNICATION LINES – Can B Module	36	08	VALUE BELOW THE LIMIT	CAN message appears on Cluster.CAN messages cannot be viewed on Cluster. Possible communication problem with IMMOBILIZER for cranking. Possible ECAS suspension levelling operation problem via remote control in cab. Speedometer may stay off.	Possible CAN line problem: CAN line short–circuit to earth or CAN H and CAN L lines reciprocally short–circuiting. Check that all vehicle ECUs are connected.	Check CAN VDB line: 1) Resistance measured with key off directly on EDC ECU between pin B52 (CAN L) and pin B53 (CAN H) must be equal to 120 ohm. 2) Resistance measured with key off on wiring between pin B52 and pin B53 must be equal to 120 ohm. 3) Impedance measured between 30–pin connector pin 21 (CAN H) and pin 22 (CAN L) must be equal to 60 ohm +/–3% (measured with key off and ECUs connected).	
COMMUNICATION LINES – BC2EDC1: Body Computer to EDC #1	37	00	NO AVAILABLE SYMPTOM	CAN message appears on Cluster.CAN messages cannot be viewed on Cluster. Possible communication problem with IMMOBILIZER for cranking. Possible ECAS suspension levelling operation problem via remote control in cab. Speedometer may stay off.	Possible CAN line problem: CAN line short–circuit to earth or CAN H and CAN L lines reciprocally short–circuiting. Check that all vehicle ECUs are connected.	Check CAN VDB line: 1) Resistance measured with key off directly on EDC ECU between pin B52 (CAN L) and pin B53 (CAN H) must be equal to 120 ohm. 2) Resistance measured with key off on wiring between pin B52 and pin B53 must be equal to 120 ohm. 3) Impedance measured between 30–pin connector pin 21 (CAN H) and pin 22 (CAN L) must be equal to 60 ohm +/–3% (measured with key off and ECUs connected).	

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Component failure	DTC	FMI	Error type	Visible anomaly	Possible cause	Recommended repairs	Notes
COMMUNICATION LINES – BC2EDC2: Body Computer to EDC #2	37	00	NO AVAILABLE SYMPTOM	CAN message appears on Cluster.CAN messages cannot be viewed on Cluster. Possible communication problem with IMMOBILIZER for cranking. Possible ECAS suspension levelling operation problem via remote control in cab. Speedometer may stay off.	Possible CAN line problem: CAN line short–circuit to earth or CAN H and CAN L lines reciprocally short–circuiting. Check that all vehicle ECUs are connected.	Check CAN VDB line: 1) Resistance measured with key off directly on EDC ECU between pin B52 (CAN L) and pin B53 (CAN H) must be equal to 120 ohm. 2) Resistance measured with key off on wiring between pin B52 and pin B53 must be equal to 120 ohm. 3) Impedance measured between 30–pin connector pin 21 (CAN H) and pin 22 (CAN L) must be equal to 60 ohm +/–3% (measured with key off and ECUs connected).	
COMMUNICATION LINES – BC2EDC1: Body Computer to EDC #1	37	01	SHORT CIRCUIT TO POSITIVE	CAN message appears on Cluster.CAN messages cannot be viewed on Cluster. Possible communication problem with IMMOBILIZER for cranking. Possible ECAS suspension levelling operation problem via remote control in cab. Speedometer may stay off.	Possible CAN line problem: CAN line short–circuit to earth or CAN H and CAN L lines reciprocally short–circuiting. Check that all vehicle ECUs are connected.	Check CAN VDB line: 1) Resistance measured with key off directly on EDC ECU between pin B52 (CAN L) and pin B53 (CAN H) must be equal to 120 ohm. 2) Resistance measured with key off on wiring between pin B52 and pin B53 must be equal to 120 ohm. 3) Impedance measured between 30–pin connector pin 21 (CAN H) and pin 22 (CAN L) must be equal to 60 ohm +/–3% (measured with key off and ECUs connected).	

Component failure	DTC	FMI	Error type	Visible anomaly	Possible cause	Recommended repairs	Notes
COMMUNICATION LINES – BC2EDC2: Body Computer to EDC #2	37	01	SHORT CIRCUIT TO POSITIVE	CAN message appears on Cluster.CAN messages cannot be viewed on Cluster. Possible communication problem with IMMOBILIZER for cranking. Possible ECAS suspension levelling operation problem via remote control in cab. Speedometer may stay off.	Possible CAN line problem: CAN line short–circuit to earth or CAN H and CAN L lines reciprocally short–circuiting. Check that all vehicle ECUs are connected.	Check CAN VDB line: 1) Resistance measured with key off directly on EDC ECU between pin B52 (CAN L) and pin B53 (CAN H) must be equal to 120 ohm. 2) Resistance measured with key off on wiring between pin B52 and pin B53 must be equal to 120 ohm. 3) Impedance measured between 30–pin connector pin 21 (CAN H) and pin 22 (CAN L) must be equal to 60 ohm +/–3% (measured with key off and ECUs connected).	
COMMUNICATION LINES – BC2EDC1: Body Computer to EDC #1	37	02	OPEN CIRCUIT OR SHORT CIRCUIT TO GROUND	CAN message appears on Cluster.CAN messages cannot be viewed on Cluster. Possible communication problem with IMMOBILIZER for cranking. Possible ECAS suspension levelling operation problem via remote control in cab. Speedometer may stay off.	Possible CAN line problem: CAN line short–circuit to earth or CAN H and CAN L lines reciprocally short–circuiting. Check that all vehicle ECUs are connected.	Check CAN VDB line: 1) Resistance measured with key off directly on EDC ECU between pin B52 (CAN L) and pin B53 (CAN H) must be equal to 120 ohm. 2) Resistance measured with key off on wiring between pin B52 and pin B53 must be equal to 120 ohm. 3) Impedance measured between 30–pin connector pin 21 (CAN H) and pin 22 (CAN L) must be equal to 60 ohm +/–3% (measured with key off and ECUs connected).	

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Component failure	DTC	FMI	Error type	Visible anomaly	Possible cause	Recommended repairs	Notes
COMMUNICATION LINES – BC2EDC2: Body Computer to EDC #2	37	02	OPEN CIRCUIT OR SHORT CIRCUIT TO GROUND	CAN message appears on Cluster.CAN messages cannot be viewed on Cluster. Possible communication problem with IMMOBILIZER for cranking. Possible ECAS suspension levelling operation problem via remote control in cab. Speedometer may stay off.	Possible CAN line problem: CAN line short–circuit to earth or CAN H and CAN L lines reciprocally short–circuiting. Check that all vehicle ECUs are connected.	Check CAN VDB line: 1) Resistance measured with key off directly on EDC ECU between pin B52 (CAN L) and pin B53 (CAN H) must be equal to 120 ohm. 2) Resistance measured with key off on wiring between pin B52 and pin B53 must be equal to 120 ohm. 3) Impedance measured between 30–pin connector pin 21 (CAN H) and pin 22 (CAN L) must be equal to 60 ohm +/–3% (measured with key off and ECUs connected).	
COMMUNICATION LINES – BC2EDC2: Body Computer to EDC #2	37	03	NO SIGNAL	CAN message appears on Cluster.CAN messages cannot be viewed on Cluster. Possible communication problem with IMMOBILIZER for cranking. Possible ECAS suspension levelling operation problem via remote control in cab. Speedometer may stay off.	Possible CAN line problem: CAN line short–circuit to earth or CAN H and CAN L lines reciprocally short–circuiting. Check that all vehicle ECUs are connected.	Check CAN VDB line: 1) Resistance measured with key off directly on EDC ECU between pin B52 (CAN L) and pin B53 (CAN H) must be equal to 120 ohm. 2) Resistance measured with key off on wiring between pin B52 and pin B53 must be equal to 120 ohm. 3) Impedance measured between 30–pin connector pin 21 (CAN H) and pin 22 (CAN L) must be equal to 60 ohm +/–3% (measured with key off and ECUs connected).	

Component failure	DTC	FMI	Error type	Visible anomaly	Possible cause	Recommended repairs	Notes
COMMUNICATION LINES – BC2EDC1: Body Computer to EDC #1	37	03	NO SIGNAL	CAN message appears on Cluster.CAN messages cannot be viewed on Cluster. Possible communication problem with IMMOBILIZER for cranking. Possible ECAS suspension levelling operation problem via remote control in cab. Speedometer may stay off.	Possible CAN line problem: CAN line short–circuit to earth or CAN H and CAN L lines reciprocally short–circuiting. Check that all vehicle ECUs are connected.	Check CAN VDB line: 1) Resistance measured with key off directly on EDC ECU between pin B52 (CAN L) and pin B53 (CAN H) must be equal to 120 ohm. 2) Resistance measured with key off on wiring between pin B52 and pin B53 must be equal to 120 ohm. 3) Impedance measured between 30–pin connector pin 21 (CAN H) and pin 22 (CAN L) must be equal to 60 ohm +/–3% (measured with key off and ECUs connected).	
COMMUNICATION LINES – BC2EDC2: Body Computer to EDC #2	37	04	SIGNAL NOT PLAUSIBLE	CAN message appears on Cluster.CAN messages cannot be viewed on Cluster. Possible communication problem with IMMOBILIZER for cranking. Possible ECAS suspension levelling operation problem via remote control in cab. Speedometer may stay off.	Possible CAN line problem: CAN line short–circuit to earth or CAN H and CAN L lines reciprocally short–circuiting. Check that all vehicle ECUs are connected.	Check CAN VDB line: 1) Resistance measured with key off directly on EDC ECU between pin B52 (CAN L) and pin B53 (CAN H) must be equal to 120 ohm. 2) Resistance measured with key off on wiring between pin B52 and pin B53 must be equal to 120 ohm. 3) Impedance measured between 30–pin connector pin 21 (CAN H) and pin 22 (CAN L) must be equal to 60 ohm +/–3% (measured with key off and ECUs connected).	

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Component failure	DTC	FMI	Error type	Visible anomaly	Possible cause	Recommended repairs	Notes
COMMUNICATION LINES – BC2EDC1: Body Computer to EDC #1	37	04	SIGNAL NOT PLAUSIBLE	CAN message appears on Cluster.CAN messages cannot be viewed on Cluster. Possible communication problem with IMMOBILIZER for cranking. Possible ECAS suspension levelling operation problem via remote control in cab. Speedometer may stay off.	Possible CAN line problem: CAN line short–circuit to earth or CAN H and CAN L lines reciprocally short–circuiting. Check that all vehicle ECUs are connected.	Check CAN VDB line: 1) Resistance measured with key off directly on EDC ECU between pin B52 (CAN L) and pin B53 (CAN H) must be equal to 120 ohm. 2) Resistance measured with key off on wiring between pin B52 and pin B53 must be equal to 120 ohm. 3) Impedance measured between 30–pin connector pin 21 (CAN H) and pin 22 (CAN L) must be equal to 60 ohm +/–3% (measured with key off and ECUs connected).	
COMMUNICATION LINES – BC2EDC2: Body Computer to EDC #2	37	05	SUPPLY OVER THE NORMAL RANGE	CAN message appears on Cluster.CAN messages cannot be viewed on Cluster. Possible communication problem with IMMOBILIZER for cranking. Possible ECAS suspension levelling operation problem via remote control in cab. Speedometer may stay off.	Possible CAN line problem: CAN line short–circuit to earth or CAN H and CAN L lines reciprocally short–circuiting. Check that all vehicle ECUs are connected.	Check CAN VDB line: 1) Resistance measured with key off directly on EDC ECU between pin B52 (CAN L) and pin B53 (CAN H) must be equal to 120 ohm. 2) Resistance measured with key off on wiring between pin B52 and pin B53 must be equal to 120 ohm. 3) Impedance measured between 30–pin connector pin 21 (CAN H) and pin 22 (CAN L) must be equal to 60 ohm +/–3% (measured with key off and ECUs connected).	

Component failure	DTC	FMI	Error type	Visible anomaly	Possible cause	Recommended repairs	Notes
COMMUNICATION LINES – BC2EDC1: Body Computer to EDC #1	37	05	SUPPLY OVER THE NORMAL RANGE	CAN message appears on Cluster.CAN messages cannot be viewed on Cluster. Possible communication problem with IMMOBILIZER for cranking. Possible ECAS suspension levelling operation problem via remote control in cab. Speedometer may stay off.	Possible CAN line problem: CAN line short–circuit to earth or CAN H and CAN L lines reciprocally short–circuiting. Check that all vehicle ECUs are connected.	Check CAN VDB line: 1) Resistance measured with key off directly on EDC ECU between pin B52 (CAN L) and pin B53 (CAN H) must be equal to 120 ohm. 2) Resistance measured with key off on wiring between pin B52 and pin B53 must be equal to 120 ohm. 3) Impedance measured between 30–pin connector pin 21 (CAN H) and pin 22 (CAN L) must be equal to 60 ohm +/–3% (measured with key off and ECUs connected).	
COMMUNICATION LINES – BC2EDC1: Body Computer to EDC #1	37	06	SUPPLY BELOW THE RANGE	CAN message appears on Cluster.CAN messages cannot be viewed on Cluster. Possible communication problem with IMMOBILIZER for cranking. Possible ECAS suspension levelling operation problem via remote control in cab. Speedometer may stay off.	Possible CAN line problem: CAN line short–circuit to earth or CAN H and CAN L lines reciprocally short–circuiting. Check that all vehicle ECUs are connected.	Check CAN VDB line: 1) Resistance measured with key off directly on EDC ECU between pin B52 (CAN L) and pin B53 (CAN H) must be equal to 120 ohm. 2) Resistance measured with key off on wiring between pin B52 and pin B53 must be equal to 120 ohm. 3) Impedance measured between 30–pin connector pin 21 (CAN H) and pin 22 (CAN L) must be equal to 60 ohm +/–3% (measured with key off and ECUs connected).	

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Component failure	DTC	FMI	Error type	Visible anomaly	Possible cause	Recommended repairs	Notes
COMMUNICATION LINES – BC2EDC1: Body Computer to EDC #1	37	07	VALUE OVER THE NORMAL LIMIT	CAN message appears on Cluster.CAN messages cannot be viewed on Cluster. Possible communication problem with IMMOBILIZER for cranking. Possible ECAS suspension levelling operation problem via remote control in cab. Speedometer may stay off.	Possible CAN line problem: CAN line short–circuit to earth or CAN H and CAN L lines reciprocally short–circuiting. Check that all vehicle ECUs are connected.	Check CAN VDB line: 1) Resistance measured with key off directly on EDC ECU between pin B52 (CAN L) and pin B53 (CAN H) must be equal to 120 ohm. 2) Resistance measured with key off on wiring between pin B52 and pin B53 must be equal to 120 ohm. 3) Impedance measured between 30–pin connector pin 21 (CAN H) and pin 22 (CAN L) must be equal to 60 ohm +/–3% (measured with key off and ECUs connected).	
COMMUNICATION LINES – BC2EDC1: Body Computer to EDC #1	37	08	VALUE BELOW THE LIMIT	CAN message appears on Cluster.CAN messages cannot be viewed on Cluster. Possible communication problem with IMMOBILIZER for cranking. Possible ECAS suspension levelling operation problem via remote control in cab. Speedometer may stay off.	Possible CAN line problem: CAN line short–circuit to earth or CAN H and CAN L lines reciprocally short–circuiting. Check that all vehicle ECUs are connected.	Check CAN VDB line: 1) Resistance measured with key off directly on EDC ECU between pin B52 (CAN L) and pin B53 (CAN H) must be equal to 120 ohm. 2) Resistance measured with key off on wiring between pin B52 and pin B53 must be equal to 120 ohm. 3) Impedance measured between 30–pin connector pin 21 (CAN H) and pin 22 (CAN L) must be equal to 60 ohm +/–3% (measured with key off and ECUs connected).	

Component failure	DTC	FMI	Error type	Visible anomaly	Possible cause	Recommended repairs	Notes
COMMUNICATION LINES – EBC1: Electronic Brake Controller	38	00	NO AVAILABLE SYMPTOM	CAN message appears on Cluster.CAN messages cannot be viewed on Cluster. Possible communication problem with IMMOBILIZER for cranking. Possible ECAS suspension levelling operation problem via remote control in cab. Speedometer may stay off.	Possible CAN line problem: CAN line short–circuit to earth or CAN H and CAN L lines reciprocally short–circuiting. Check that all vehicle ECUs are connected.	Check CAN VDB line: 1) Resistance measured with key off directly on EDC ECU between pin B52 (CAN L) and pin B53 (CAN H) must be equal to 120 ohm. 2) Resistance measured with key off on wiring between pin B52 and pin B53 must be equal to 120 ohm. 3) Impedance measured between 30–pin connector pin 21 (CAN H) and pin 22 (CAN L) must be equal to 60 ohm +/–3% (measured with key off and ECUs connected).	
COMMUNICATION LINES – CCVSV: Cruise Control from Vehicle Controller	38	00	NO AVAILABLE SYMPTOM	CAN message appears on Cluster.CAN messages cannot be viewed on Cluster. Possible communication problem with IMMOBILIZER for cranking. Possible ECAS suspension levelling operation problem via remote control in cab. Speedometer may stay off.	Possible CAN line problem: CAN line short–circuit to earth or CAN H and CAN L lines reciprocally short–circuiting. Check that all vehicle ECUs are connected.	Check CAN VDB line: 1) Resistance measured with key off directly on EDC ECU between pin B52 (CAN L) and pin B53 (CAN H) must be equal to 120 ohm. 2) Resistance measured with key off on wiring between pin B52 and pin B53 must be equal to 120 ohm. 3) Impedance measured between 30–pin connector pin 21 (CAN H) and pin 22 (CAN L) must be equal to 60 ohm +/–3% (measured with key off and ECUs connected).	

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Component failure	DTC	FMI	Error type	Visible anomaly	Possible cause	Recommended repairs	Notes
COMMUNICATION LINES – CCVSV: Cruise Control from Vehicle Controller	38	01	SHORT CIRCUIT TO POSITIVE	CAN message appears on Cluster.CAN messages cannot be viewed on Cluster. Possible communication problem with IMMOBILIZER for cranking. Possible ECAS suspension levelling operation problem via remote control in cab. Speedometer may stay off.	Possible CAN line problem: CAN line short–circuit to earth or CAN H and CAN L lines reciprocally short–circuiting. Check that all vehicle ECUs are connected.	Check CAN VDB line: 1) Resistance measured with key off directly on EDC ECU between pin B52 (CAN L) and pin B53 (CAN H) must be equal to 120 ohm. 2) Resistance measured with key off on wiring between pin B52 and pin B53 must be equal to 120 ohm. 3) Impedance measured between 30–pin connector pin 21 (CAN H) and pin 22 (CAN L) must be equal to 60 ohm +/–3% (measured with key off and ECUs connected).	
COMMUNICATION LINES – EBC1: Electronic Brake Controller	38	01	SHORT CIRCUIT TO POSITIVE	CAN message appears on Cluster.CAN messages cannot be viewed on Cluster. Possible communication problem with IMMOBILIZER for cranking. Possible ECAS suspension levelling operation problem via remote control in cab. Speedometer may stay off.	Possible CAN line problem: CAN line short–circuit to earth or CAN H and CAN L lines reciprocally short–circuiting. Check that all vehicle ECUs are connected.	Check CAN VDB line: 1) Resistance measured with key off directly on EDC ECU between pin B52 (CAN L) and pin B53 (CAN H) must be equal to 120 ohm. 2) Resistance measured with key off on wiring between pin B52 and pin B53 must be equal to 120 ohm. 3) Impedance measured between 30–pin connector pin 21 (CAN H) and pin 22 (CAN L) must be equal to 60 ohm +/–3% (measured with key off and ECUs connected).	

Component failure	DTC	FMI	Error type	Visible anomaly	Possible cause	Recommended repairs	Notes
COMMUNICATION LINES – CCVSV: Cruise Control from Vehicle Controller	38	02	OPEN CIRCUIT OR SHORT CIRCUIT TO GROUND	CAN message appears on Cluster.CAN messages cannot be viewed on Cluster. Possible communication problem with IMMOBILIZER for cranking. Possible ECAS suspension levelling operation problem via remote control in cab. Speedometer may stay off.	Possible CAN line problem: CAN line short–circuit to earth or CAN H and CAN L lines reciprocally short–circuiting. Check that all vehicle ECUs are connected.	Check CAN VDB line: 1) Resistance measured with key off directly on EDC ECU between pin B52 (CAN L) and pin B53 (CAN H) must be equal to 120 ohm. 2) Resistance measured with key off on wiring between pin B52 and pin B53 must be equal to 120 ohm. 3) Impedance measured between 30–pin connector pin 21 (CAN H) and pin 22 (CAN L) must be equal to 60 ohm +/–3% (measured with key off and ECUs connected).	
COMMUNICATION LINES – CCVSV: Cruise Control from Vehicle Controller	38	03	NO SIGNAL	CAN message appears on Cluster.CAN messages cannot be viewed on Cluster. Possible communication problem with IMMOBILIZER for cranking. Possible ECAS suspension levelling operation problem via remote control in cab. Speedometer may stay off.	Possible CAN line problem: CAN line short–circuit to earth or CAN H and CAN L lines reciprocally short–circuiting. Check that all vehicle ECUs are connected.	Check CAN VDB line: 1) Resistance measured with key off directly on EDC ECU between pin B52 (CAN L) and pin B53 (CAN H) must be equal to 120 ohm. 2) Resistance measured with key off on wiring between pin B52 and pin B53 must be equal to 120 ohm. 3) Impedance measured between 30–pin connector pin 21 (CAN H) and pin 22 (CAN L) must be equal to 60 ohm +/–3% (measured with key off and ECUs connected).	

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Component failure	DTC	FMI	Error type	Visible anomaly	Possible cause	Recommended repairs	Notes
COMMUNICATION LINES – CCVSV: Cruise Control from Vehicle Controller	38	04	SIGNAL NOT PLAUSIBLE	CAN message appears on Cluster.CAN messages cannot be viewed on Cluster. Possible communication problem with IMMOBILIZER for cranking. Possible ECAS suspension levelling operation problem via remote control in cab. Speedometer may stay off.	Possible CAN line problem: CAN line short–circuit to earth or CAN H and CAN L lines reciprocally short–circuiting. Check that all vehicle ECUs are connected.	Check CAN VDB line: 1) Resistance measured with key off directly on EDC ECU between pin B52 (CAN L) and pin B53 (CAN H) must be equal to 120 ohm. 2) Resistance measured with key off on wiring between pin B52 and pin B53 must be equal to 120 ohm. 3) Impedance measured between 30–pin connector pin 21 (CAN H) and pin 22 (CAN L) must be equal to 60 ohm +/–3% (measured with key off and ECUs connected).	
COMMUNICATION LINES – CCVSV: Cruise Control from Vehicle Controller	38	05	SUPPLY OVER THE NORMAL RANGE	CAN message appears on Cluster.CAN messages cannot be viewed on Cluster. Possible communication problem with IMMOBILIZER for cranking. Possible ECAS suspension levelling operation problem via remote control in cab. Speedometer may stay off.	Possible CAN line problem: CAN line short–circuit to earth or CAN H and CAN L lines reciprocally short–circuiting. Check that all vehicle ECUs are connected.	Check CAN VDB line: 1) Resistance measured with key off directly on EDC ECU between pin B52 (CAN L) and pin B53 (CAN H) must be equal to 120 ohm. 2) Resistance measured with key off on wiring between pin B52 and pin B53 must be equal to 120 ohm. 3) Impedance measured between 30–pin connector pin 21 (CAN H) and pin 22 (CAN L) must be equal to 60 ohm +/–3% (measured with key off and ECUs connected).	

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Component failure	DTC	FMI	Error type	Visible anomaly	Possible cause	Recommended repairs	Notes
COMMUNICATION LINES – BC2EDC2: Body Computer to EDC #2	38	06	SUPPLY BELOW THE RANGE	CAN message appears on Cluster.CAN messages cannot be viewed on Cluster. Possible communication problem with IMMOBILIZER for cranking. Possible ECAS suspension levelling operation problem via remote control in cab. Speedometer may stay off.	Possible CAN line problem: CAN line short–circuit to earth or CAN H and CAN L lines reciprocally short–circuiting. Check that all vehicle ECUs are connected.	Check CAN VDB line: 1) Resistance measured with key off directly on EDC ECU between pin B52 (CAN L) and pin B53 (CAN H) must be equal to 120 ohm. 2) Resistance measured with key off on wiring between pin B52 and pin B53 must be equal to 120 ohm. 3) Impedance measured between 30–pin connector pin 21 (CAN H) and pin 22 (CAN L) must be equal to 60 ohm +/–3% (measured with key off and ECUs connected).	
COMMUNICATION LINES – CCVSV: Cruise Control from Vehicle Controller	38	06	SUPPLY BELOW THE RANGE	CAN message appears on Cluster.CAN messages cannot be viewed on Cluster. Possible communication problem with IMMOBILIZER for cranking. Possible ECAS suspension levelling operation problem via remote control in cab. Speedometer may stay off.	Possible CAN line problem: CAN line short–circuit to earth or CAN H and CAN L lines reciprocally short–circuiting. Check that all vehicle ECUs are connected.	Check CAN VDB line: 1) Resistance measured with key off directly on EDC ECU between pin B52 (CAN L) and pin B53 (CAN H) must be equal to 120 ohm. 2) Resistance measured with key off on wiring between pin B52 and pin B53 must be equal to 120 ohm. 3) Impedance measured between 30–pin connector pin 21 (CAN H) and pin 22 (CAN L) must be equal to 60 ohm +/–3% (measured with key off and ECUs connected).	

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Component failure	DTC	FMI	Error type	Visible anomaly	Possible cause	Recommended repairs	Notes
COMMUNICATION LINES – BC2EDC2: Body Computer to EDC #2	38	07	VALUE OVER THE NORMAL LIMIT	CAN message appears on Cluster.CAN messages cannot be viewed on Cluster. Possible communication problem with IMMOBILIZER for cranking. Possible ECAS suspension levelling operation problem via remote control in cab. Speedometer may stay off.	Possible CAN line problem: CAN line short–circuit to earth or CAN H and CAN L lines reciprocally short–circuiting. Check that all vehicle ECUs are connected.	Check CAN VDB line: 1) Resistance measured with key off directly on EDC ECU between pin B52 (CAN L) and pin B53 (CAN H) must be equal to 120 ohm. 2) Resistance measured with key off on wiring between pin B52 and pin B53 must be equal to 120 ohm. 3) Impedance measured between 30–pin connector pin 21 (CAN H) and pin 22 (CAN L) must be equal to 60 ohm +/–3% (measured with key off and ECUs connected).	
COMMUNICATION LINES – CCVSV: Cruise Control from Vehicle Controller	38	07	VALUE OVER THE NORMAL LIMIT	CAN message appears on Cluster.CAN messages cannot be viewed on Cluster. Possible communication problem with IMMOBILIZER for cranking. Possible ECAS suspension levelling operation problem via remote control in cab. Speedometer may stay off.	Possible CAN line problem: CAN line short–circuit to earth or CAN H and CAN L lines reciprocally short–circuiting. Check that all vehicle ECUs are connected.	Check CAN VDB line: 1) Resistance measured with key off directly on EDC ECU between pin B52 (CAN L) and pin B53 (CAN H) must be equal to 120 ohm. 2) Resistance measured with key off on wiring between pin B52 and pin B53 must be equal to 120 ohm. 3) Impedance measured between 30–pin connector pin 21 (CAN H) and pin 22 (CAN L) must be equal to 60 ohm +/–3% (measured with key off and ECUs connected).	

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Component failure	DTC	FMI	Error type	Visible anomaly	Possible cause	Recommended repairs	Notes
COMMUNICATION LINES – CCVSV: Cruise Control from Vehicle Controller	38	08	VALUE BELOW THE LIMIT	CAN message appears on Cluster.CAN messages cannot be viewed on Cluster. Possible communication problem with IMMOBILIZER for cranking. Possible ECAS suspension levelling operation problem via remote control in cab. Speedometer may stay off.	Possible CAN line problem: CAN line short–circuit to earth or CAN H and CAN L lines reciprocally short–circuiting. Check that all vehicle ECUs are connected.	Check CAN VDB line: 1) Resistance measured with key off directly on EDC ECU between pin B52 (CAN L) and pin B53 (CAN H) must be equal to 120 ohm. 2) Resistance measured with key off on wiring between pin B52 and pin B53 must be equal to 120 ohm. 3) Impedance measured between 30–pin connector pin 21 (CAN H) and pin 22 (CAN L) must be equal to 60 ohm +/–3% (measured with key off and ECUs connected).	
COMMUNICATION LINES – BC2EDC2: Body Computer to EDC #2	38	08	VALUE BELOW THE LIMIT	CAN message appears on Cluster.CAN messages cannot be viewed on Cluster. Possible communication problem with IMMOBILIZER for cranking. Possible ECAS suspension levelling operation problem via remote control in cab. Speedometer may stay off.	Possible CAN line problem: CAN line short–circuit to earth or CAN H and CAN L lines reciprocally short–circuiting. Check that all vehicle ECUs are connected.	Check CAN VDB line: 1) Resistance measured with key off directly on EDC ECU between pin B52 (CAN L) and pin B53 (CAN H) must be equal to 120 ohm. 2) Resistance measured with key off on wiring between pin B52 and pin B53 must be equal to 120 ohm. 3) Impedance measured between 30–pin connector pin 21 (CAN H) and pin 22 (CAN L) must be equal to 60 ohm +/–3% (measured with key off and ECUs connected).	

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Component failure	DTC	FMI	Error type	Visible anomaly	Possible cause	Recommended repairs	Notes
COMMUNICATION LINES – ETC1: Electronic Trasmission Controller	39	00	NO AVAILABLE SYMPTOM	CAN message appears on Cluster.CAN messages cannot be viewed on Cluster. Possible communication problem with IMMOBILIZER for cranking. Possible ECAS suspension levelling operation problem via remote control in cab. Speedometer may stay off.	Possible CAN line problem: CAN line short–circuit to earth or CAN H and CAN L lines reciprocally short–circuiting. Check that all vehicle ECUs are connected.	Check CAN VDB line: 1) Resistance measured with key off directly on EDC ECU between pin B52 (CAN L) and pin B53 (CAN H) must be equal to 120 ohm. 2) Resistance measured with key off on wiring between pin B52 and pin B53 must be equal to 120 ohm. 3) Impedance measured between 30–pin connector pin 21 (CAN H) and pin 22 (CAN L) must be equal to 60 ohm +/–3% (measured with key off and ECUs connected).	
COMMUNICATION LINES – ETC1: Electronic Trasmission Controller	39	01	SHORT CIRCUIT TO POSITIVE	CAN message appears on Cluster.CAN messages cannot be viewed on Cluster. Possible communication problem with IMMOBILIZER for cranking. Possible ECAS suspension levelling operation problem via remote control in cab. Speedometer may stay off.	Possible CAN line problem: CAN line short–circuit to earth or CAN H and CAN L lines reciprocally short–circuiting. Check that all vehicle ECUs are connected.	Check CAN VDB line: 1) Resistance measured with key off directly on EDC ECU between pin B52 (CAN L) and pin B53 (CAN H) must be equal to 120 ohm. 2) Resistance measured with key off on wiring between pin B52 and pin B53 must be equal to 120 ohm. 3) Impedance measured between 30–pin connector pin 21 (CAN H) and pin 22 (CAN L) must be equal to 60 ohm +/–3% (measured with key off and ECUs connected).	

Component failure	DTC	FMI	Error type	Visible anomaly	Possible cause	Recommended repairs	Notes
COMMUNICATION LINES – EBC1: Electronic Brake Controller	39	02	OPEN CIRCUIT OR SHORT CIRCUIT TO GROUND	CAN message appears on Cluster.CAN messages cannot be viewed on Cluster. Possible communication problem with IMMOBILIZER for cranking. Possible ECAS suspension levelling operation problem via remote control in cab. Speedometer may stay off.	Possible CAN line problem: CAN line short–circuit to earth or CAN H and CAN L lines reciprocally short–circuiting. Check that all vehicle ECUs are connected.	Check CAN VDB line: 1) Resistance measured with key off directly on EDC ECU between pin B52 (CAN L) and pin B53 (CAN H) must be equal to 120 ohm. 2) Resistance measured with key off on wiring between pin B52 and pin B53 must be equal to 120 ohm. 3) Impedance measured between 30–pin connector pin 21 (CAN H) and pin 22 (CAN L) must be equal to 60 ohm +/–3% (measured with key off and ECUs connected).	
COMMUNICATION LINES – ETC1: Electronic Trasmission Controller	39	02	OPEN CIRCUIT OR SHORT CIRCUIT TO GROUND	CAN message appears on Cluster.CAN messages cannot be viewed on Cluster. Possible communication problem with IMMOBILIZER for cranking. Possible ECAS suspension levelling operation problem via remote control in cab. Speedometer may stay off.	Possible CAN line problem: CAN line short–circuit to earth or CAN H and CAN L lines reciprocally short–circuiting. Check that all vehicle ECUs are connected.	Check CAN VDB line: 1) Resistance measured with key off directly on EDC ECU between pin B52 (CAN L) and pin B53 (CAN H) must be equal to 120 ohm. 2) Resistance measured with key off on wiring between pin B52 and pin B53 must be equal to 120 ohm. 3) Impedance measured between 30–pin connector pin 21 (CAN H) and pin 22 (CAN L) must be equal to 60 ohm +/–3% (measured with key off and ECUs connected).	

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Component failure	DTC	FMI	Error type	Visible anomaly	Possible cause	Recommended repairs	Notes
COMMUNICATION LINES – EBC1: Electronic Brake Controller	39	03	NO SIGNAL	CAN message appears on Cluster.CAN messages cannot be viewed on Cluster. Possible communication problem with IMMOBILIZER for cranking. Possible ECAS suspension levelling operation problem via remote control in cab. Speedometer may stay off.	Possible CAN line problem: CAN line short–circuit to earth or CAN H and CAN L lines reciprocally short–circuiting. Check that all vehicle ECUs are connected.	Check CAN VDB line: 1) Resistance measured with key off directly on EDC ECU between pin B52 (CAN L) and pin B53 (CAN H) must be equal to 120 ohm. 2) Resistance measured with key off on wiring between pin B52 and pin B53 must be equal to 120 ohm. 3) Impedance measured between 30–pin connector pin 21 (CAN H) and pin 22 (CAN L) must be equal to 60 ohm +/–3% (measured with key off and ECUs connected).	
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Component failure	DTC	FMI	Error type	Visible anomaly	Possible cause	Recommended repairs	Notes
COMMUNICATION LINES – EBC1: Electronic Brake Controller	39	04	SIGNAL NOT PLAUSIBLE	CAN message appears on Cluster.CAN messages cannot be viewed on Cluster. Possible communication problem with IMMOBILIZER for cranking. Possible ECAS suspension levelling operation problem via remote control in cab. Speedometer may stay off.	Possible CAN line problem: CAN line short–circuit to earth or CAN H and CAN L lines reciprocally short–circuiting. Check that all vehicle ECUs are connected.	Check CAN VDB line: 1) Resistance measured with key off directly on EDC ECU between pin B52 (CAN L) and pin B53 (CAN H) must be equal to 120 ohm. 2) Resistance measured with key off on wiring between pin B52 and pin B53 must be equal to 120 ohm. 3) Impedance measured between 30–pin connector pin 21 (CAN H) and pin 22 (CAN L) must be equal to 60 ohm +/–3% (measured with key off and ECUs connected).	
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Component failure	DTC	FMI	Error type	Visible anomaly	Possible cause	Recommended repairs	Notes
COMMUNICATION LINES – EBC1: Electronic Brake Controller	39	05	SUPPLY OVER THE NORMAL RANGE	CAN message appears on Cluster.CAN messages cannot be viewed on Cluster. Possible communication problem with IMMOBILIZER for cranking. Possible ECAS suspension levelling operation problem via remote control in cab. Speedometer may stay off.	Possible CAN line problem: CAN line short–circuit to earth or CAN H and CAN L lines reciprocally short–circuiting. Check that all vehicle ECUs are connected.	Check CAN VDB line: 1) Resistance measured with key off directly on EDC ECU between pin B52 (CAN L) and pin B53 (CAN H) must be equal to 120 ohm. 2) Resistance measured with key off on wiring between pin B52 and pin B53 must be equal to 120 ohm. 3) Impedance measured between 30–pin connector pin 21 (CAN H) and pin 22 (CAN L) must be equal to 60 ohm +/–3% (measured with key off and ECUs connected).	
COMMUNICATION LINES – ETC1: Electronic Trasmission Controller	39	05	SUPPLY OVER THE NORMAL RANGE	CAN message appears on Cluster.CAN messages cannot be viewed on Cluster. Possible communication problem with IMMOBILIZER for cranking. Possible ECAS suspension levelling operation problem via remote control in cab. Speedometer may stay off.	Possible CAN line problem: CAN line short–circuit to earth or CAN H and CAN L lines reciprocally short–circuiting. Check that all vehicle ECUs are connected.	Check CAN VDB line: 1) Resistance measured with key off directly on EDC ECU between pin B52 (CAN L) and pin B53 (CAN H) must be equal to 120 ohm. 2) Resistance measured with key off on wiring between pin B52 and pin B53 must be equal to 120 ohm. 3) Impedance measured between 30–pin connector pin 21 (CAN H) and pin 22 (CAN L) must be equal to 60 ohm +/–3% (measured with key off and ECUs connected).	

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Component failure	DTC	FMI	Error type	Visible anomaly	Possible cause	Recommended repairs	Notes
COMMUNICATION LINES – EBC1: Electronic Brake Controller	39	06	SUPPLY BELOW THE RANGE	CAN message appears on Cluster.CAN messages cannot be viewed on Cluster. Possible communication problem with IMMOBILIZER for cranking. Possible ECAS suspension levelling operation problem via remote control in cab. Speedometer may stay off.	Possible CAN line problem: CAN line short–circuit to earth or CAN H and CAN L lines reciprocally short–circuiting. Check that all vehicle ECUs are connected.	Check CAN VDB line: 1) Resistance measured with key off directly on EDC ECU between pin B52 (CAN L) and pin B53 (CAN H) must be equal to 120 ohm. 2) Resistance measured with key off on wiring between pin B52 and pin B53 must be equal to 120 ohm. 3) Impedance measured between 30–pin connector pin 21 (CAN H) and pin 22 (CAN L) must be equal to 60 ohm +/–3% (measured with key off and ECUs connected).	
COMMUNICATION LINES – ETC1: Electronic Trasmission Controller	39	06	SUPPLY BELOW THE RANGE	CAN message appears on Cluster.CAN messages cannot be viewed on Cluster. Possible communication problem with IMMOBILIZER for cranking. Possible ECAS suspension levelling operation problem via remote control in cab. Speedometer may stay off.	Possible CAN line problem: CAN line short–circuit to earth or CAN H and CAN L lines reciprocally short–circuiting. Check that all vehicle ECUs are connected.	Check CAN VDB line: 1) Resistance measured with key off directly on EDC ECU between pin B52 (CAN L) and pin B53 (CAN H) must be equal to 120 ohm. 2) Resistance measured with key off on wiring between pin B52 and pin B53 must be equal to 120 ohm. 3) Impedance measured between 30–pin connector pin 21 (CAN H) and pin 22 (CAN L) must be equal to 60 ohm +/–3% (measured with key off and ECUs connected).	

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Component failure	DTC	FMI	Error type	Visible anomaly	Possible cause	Recommended repairs	Notes
COMMUNICATION LINES – EBC1: Electronic Brake Controller	39	07	VALUE OVER THE NORMAL LIMIT	CAN message appears on Cluster.CAN messages cannot be viewed on Cluster. Possible communication problem with IMMOBILIZER for cranking. Possible ECAS suspension levelling operation problem via remote control in cab. Speedometer may stay off.	Possible CAN line problem: CAN line short–circuit to earth or CAN H and CAN L lines reciprocally short–circuiting. Check that all vehicle ECUs are connected.	Check CAN VDB line: 1) Resistance measured with key off directly on EDC ECU between pin B52 (CAN L) and pin B53 (CAN H) must be equal to 120 ohm. 2) Resistance measured with key off on wiring between pin B52 and pin B53 must be equal to 120 ohm. 3) Impedance measured between 30–pin connector pin 21 (CAN H) and pin 22 (CAN L) must be equal to 60 ohm +/–3% (measured with key off and ECUs connected).	
COMMUNICATION LINES – ETC1: Electronic Trasmission Controller	39	07	VALUE OVER THE NORMAL LIMIT	CAN message appears on Cluster.CAN messages cannot be viewed on Cluster. Possible communication problem with IMMOBILIZER for cranking. Possible ECAS suspension levelling operation problem via remote control in cab. Speedometer may stay off.	Possible CAN line problem: CAN line short–circuit to earth or CAN H and CAN L lines reciprocally short–circuiting. Check that all vehicle ECUs are connected.	Check CAN VDB line: 1) Resistance measured with key off directly on EDC ECU between pin B52 (CAN L) and pin B53 (CAN H) must be equal to 120 ohm. 2) Resistance measured with key off on wiring between pin B52 and pin B53 must be equal to 120 ohm. 3) Impedance measured between 30–pin connector pin 21 (CAN H) and pin 22 (CAN L) must be equal to 60 ohm +/–3% (measured with key off and ECUs connected).	

Component failure	DTC	FMI	Error type	Visible anomaly	Possible cause	Recommended repairs	Notes
COMMUNICATION LINES – EBC1: Electronic Brake Controller	39	08	VALUE BELOW THE LIMIT	CAN message appears on Cluster.CAN messages cannot be viewed on Cluster. Possible communication problem with IMMOBILIZER for cranking. Possible ECAS suspension levelling operation problem via remote control in cab. Speedometer may stay off.	Possible CAN line problem: CAN line short–circuit to earth or CAN H and CAN L lines reciprocally short–circuiting. Check that all vehicle ECUs are connected.	Check CAN VDB line: 1) Resistance measured with key off directly on EDC ECU between pin B52 (CAN L) and pin B53 (CAN H) must be equal to 120 ohm. 2) Resistance measured with key off on wiring between pin B52 and pin B53 must be equal to 120 ohm. 3) Impedance measured between 30–pin connector pin 21 (CAN H) and pin 22 (CAN L) must be equal to 60 ohm +/–3% (measured with key off and ECUs connected).	
COMMUNICATION LINES – AE: Torque/Speed Control from ATC (Asr) to EDC	3A	00	NO AVAILABLE SYMPTOM	CAN message appears on Cluster.CAN messages cannot be viewed on Cluster. Possible communication problem with IMMOBILIZER for cranking. Possible ECAS suspension levelling operation problem via remote control in cab. Speedometer may stay off.	Possible CAN line problem: CAN line short–circuit to earth or CAN H and CAN L lines reciprocally short–circuiting. Check that all vehicle ECUs are connected.	Check CAN VDB line: 1) Resistance measured with key off directly on EDC ECU between pin B52 (CAN L) and pin B53 (CAN H) must be equal to 120 ohm. 2) Resistance measured with key off on wiring between pin B52 and pin B53 must be equal to 120 ohm. 3) Impedance measured between 30–pin connector pin 21 (CAN H) and pin 22 (CAN L) must be equal to 60 ohm +/–3% (measured with key off and ECUs connected).	

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Component failure	DTC	FMI	Error type	Visible anomaly	Possible cause	Recommended repairs	Notes
COMMUNICATION LINES – DE: Torque/Speed Control from Driveline Retarder to EDC	3A	00	NO AVAILABLE SYMPTOM	CAN message appears on Cluster.CAN messages cannot be viewed on Cluster. Possible communication problem with IMMOBILIZER for cranking. Possible ECAS suspension levelling operation problem via remote control in cab. Speedometer may stay off.	Possible CAN line problem: CAN line short–circuit to earth or CAN H and CAN L lines reciprocally short–circuiting. Check that all vehicle ECUs are connected.	Check CAN VDB line: 1) Resistance measured with key off directly on EDC ECU between pin B52 (CAN L) and pin B53 (CAN H) must be equal to 120 ohm. 2) Resistance measured with key off on wiring between pin B52 and pin B53 must be equal to 120 ohm. 3) Impedance measured between 30–pin connector pin 21 (CAN H) and pin 22 (CAN L) must be equal to 60 ohm +/–3% (measured with key off and ECUs connected).	
COMMUNICATION LINES – DE: Torque/Speed Control from Driveline Retarder to EDC	3A	01	SHORT CIRCUIT TO POSITIVE	CAN message appears on Cluster.CAN messages cannot be viewed on Cluster. Possible communication problem with IMMOBILIZER for cranking. Possible ECAS suspension levelling operation problem via remote control in cab. Speedometer may stay off.	Possible CAN line problem: CAN line short–circuit to earth or CAN H and CAN L lines reciprocally short–circuiting. Check that all vehicle ECUs are connected.	Check CAN VDB line: 1) Resistance measured with key off directly on EDC ECU between pin B52 (CAN L) and pin B53 (CAN H) must be equal to 120 ohm. 2) Resistance measured with key off on wiring between pin B52 and pin B53 must be equal to 120 ohm. 3) Impedance measured between 30–pin connector pin 21 (CAN H) and pin 22 (CAN L) must be equal to 60 ohm +/–3% (measured with key off and ECUs connected).	

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COMMUNICATION LINES – AE: Torque/Speed Control from ATC (Asr) to EDC	3A	01	SHORT CIRCUIT TO POSITIVE	CAN message appears on Cluster.CAN messages cannot be viewed on Cluster. Possible communication problem with IMMOBILIZER for cranking. Possible ECAS suspension levelling operation problem via remote control in cab. Speedometer may stay off.	Possible CAN line problem: CAN line short–circuit to earth or CAN H and CAN L lines reciprocally short–circuiting. Check that all vehicle ECUs are connected.	Check CAN VDB line: 1) Resistance measured with key off directly on EDC ECU between pin B52 (CAN L) and pin B53 (CAN H) must be equal to 120 ohm. 2) Resistance measured with key off on wiring between pin B52 and pin B53 must be equal to 120 ohm. 3) Impedance measured between 30–pin connector pin 21 (CAN H) and pin 22 (CAN L) must be equal to 60 ohm +/–3% (measured with key off and ECUs connected).	
COMMUNICATION LINES – DE: Torque/Speed Control from Driveline Retarder to EDC	3A	02	OPEN CIRCUIT OR SHORT CIRCUIT TO GROUND	CAN message appears on Cluster.CAN messages cannot be viewed on Cluster. Possible communication problem with IMMOBILIZER for cranking. Possible ECAS suspension levelling operation problem via remote control in cab. Speedometer may stay off.	Possible CAN line problem: CAN line short–circuit to earth or CAN H and CAN L lines reciprocally short–circuiting. Check that all vehicle ECUs are connected.	Check CAN VDB line: 1) Resistance measured with key off directly on EDC ECU between pin B52 (CAN L) and pin B53 (CAN H) must be equal to 120 ohm. 2) Resistance measured with key off on wiring between pin B52 and pin B53 must be equal to 120 ohm. 3) Impedance measured between 30–pin connector pin 21 (CAN H) and pin 22 (CAN L) must be equal to 60 ohm +/–3% (measured with key off and ECUs connected).	

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COMMUNICATION LINES – AE: Torque/Speed Control from ATC (Asr) to EDC	3A	02	OPEN CIRCUIT OR SHORT CIRCUIT TO GROUND	CAN message appears on Cluster.CAN messages cannot be viewed on Cluster. Possible communication problem with IMMOBILIZER for cranking. Possible ECAS suspension levelling operation problem via remote control in cab. Speedometer may stay off.	Possible CAN line problem: CAN line short–circuit to earth or CAN H and CAN L lines reciprocally short–circuiting. Check that all vehicle ECUs are connected.	Check CAN VDB line: 1) Resistance measured with key off directly on EDC ECU between pin B52 (CAN L) and pin B53 (CAN H) must be equal to 120 ohm. 2) Resistance measured with key off on wiring between pin B52 and pin B53 must be equal to 120 ohm. 3) Impedance measured between 30–pin connector pin 21 (CAN H) and pin 22 (CAN L) must be equal to 60 ohm +/–3% (measured with key off and ECUs connected).	
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COMMUNICATION LINES – AE: Torque/Speed Control from ATC (Asr) to EDC	3A	04	SIGNAL NOT PLAUSIBLE	CAN message appears on Cluster.CAN messages cannot be viewed on Cluster. Possible communication problem with IMMOBILIZER for cranking. Possible ECAS suspension levelling operation problem via remote control in cab. Speedometer may stay off.	Possible CAN line problem: CAN line short–circuit to earth or CAN H and CAN L lines reciprocally short–circuiting. Check that all vehicle ECUs are connected.	Check CAN VDB line: 1) Resistance measured with key off directly on EDC ECU between pin B52 (CAN L) and pin B53 (CAN H) must be equal to 120 ohm. 2) Resistance measured with key off on wiring between pin B52 and pin B53 must be equal to 120 ohm. 3) Impedance measured between 30–pin connector pin 21 (CAN H) and pin 22 (CAN L) must be equal to 60 ohm +/–3% (measured with key off and ECUs connected).	

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Component failure	DTC	FMI	Error type	Visible anomaly	Possible cause	Recommended repairs	Notes
COMMUNICATION LINES – AE: Torque/Speed Control from ATC (Asr) to EDC	3A	05	SUPPLY OVER THE NORMAL RANGE	CAN message appears on Cluster.CAN messages cannot be viewed on Cluster. Possible communication problem with IMMOBILIZER for cranking. Possible ECAS suspension levelling operation problem via remote control in cab. Speedometer may stay off.	Possible CAN line problem: CAN line short–circuit to earth or CAN H and CAN L lines reciprocally short–circuiting. Check that all vehicle ECUs are connected.	Check CAN VDB line: 1) Resistance measured with key off directly on EDC ECU between pin B52 (CAN L) and pin B53 (CAN H) must be equal to 120 ohm. 2) Resistance measured with key off on wiring between pin B52 and pin B53 must be equal to 120 ohm. 3) Impedance measured between 30–pin connector pin 21 (CAN H) and pin 22 (CAN L) must be equal to 60 ohm +/–3% (measured with key off and ECUs connected).	
COMMUNICATION LINES – AE: Torque/Speed Control from ATC (Asr) to EDC	3A	06	SUPPLY BELOW THE RANGE	CAN message appears on Cluster.CAN messages cannot be viewed on Cluster. Possible communication problem with IMMOBILIZER for cranking. Possible ECAS suspension levelling operation problem via remote control in cab. Speedometer may stay off.	Possible CAN line problem: CAN line short–circuit to earth or CAN H and CAN L lines reciprocally short–circuiting. Check that all vehicle ECUs are connected.	Check CAN VDB line: 1) Resistance measured with key off directly on EDC ECU between pin B52 (CAN L) and pin B53 (CAN H) must be equal to 120 ohm. 2) Resistance measured with key off on wiring between pin B52 and pin B53 must be equal to 120 ohm. 3) Impedance measured between 30–pin connector pin 21 (CAN H) and pin 22 (CAN L) must be equal to 60 ohm +/–3% (measured with key off and ECUs connected).	

Component failure	DTC	FMI	Error type	Visible anomaly	Possible cause	Recommended repairs	Notes
COMMUNICATION LINES – AE: Torque/Speed Control from ATC (Asr) to EDC	3A	07	VALUE OVER THE NORMAL LIMIT	CAN message appears on Cluster.CAN messages cannot be viewed on Cluster. Possible communication problem with IMMOBILIZER for cranking. Possible ECAS suspension levelling operation problem via remote control in cab. Speedometer may stay off.	Possible CAN line problem: CAN line short–circuit to earth or CAN H and CAN L lines reciprocally short–circuiting. Check that all vehicle ECUs are connected.	Check CAN VDB line: 1) Resistance measured with key off directly on EDC ECU between pin B52 (CAN L) and pin B53 (CAN H) must be equal to 120 ohm. 2) Resistance measured with key off on wiring between pin B52 and pin B53 must be equal to 120 ohm. 3) Impedance measured between 30–pin connector pin 21 (CAN H) and pin 22 (CAN L) must be equal to 60 ohm +/–3% (measured with key off and ECUs connected).	
COMMUNICATION LINES – ETC1: Electronic Trasmission Controller	3A	08	VALUE BELOW THE LIMIT	CAN message appears on Cluster.CAN messages cannot be viewed on Cluster. Possible communication problem with IMMOBILIZER for cranking. Possible ECAS suspension levelling operation problem via remote control in cab. Speedometer may stay off.	Possible CAN line problem: CAN line short–circuit to earth or CAN H and CAN L lines reciprocally short–circuiting. Check that all vehicle ECUs are connected.	Check CAN VDB line: 1) Resistance measured with key off directly on EDC ECU between pin B52 (CAN L) and pin B53 (CAN H) must be equal to 120 ohm. 2) Resistance measured with key off on wiring between pin B52 and pin B53 must be equal to 120 ohm. 3) Impedance measured between 30–pin connector pin 21 (CAN H) and pin 22 (CAN L) must be equal to 60 ohm +/–3% (measured with key off and ECUs connected).	

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COMMUNICATION LINES – PE: Torque/Speed Control from PTO to EDC	3B	00	NO AVAILABLE SYMPTOM	CAN message appears on Cluster.CAN messages cannot be viewed on Cluster. Possible communication problem with IMMOBILIZER for cranking. Possible ECAS suspension levelling operation problem via remote control in cab. Speedometer may stay off.	Possible CAN line problem: CAN line short–circuit to earth or CAN H and CAN L lines reciprocally short–circuiting. Check that all vehicle ECUs are connected.	Check CAN VDB line: 1) Resistance measured with key off directly on EDC ECU between pin B52 (CAN L) and pin B53 (CAN H) must be equal to 120 ohm. 2) Resistance measured with key off on wiring between pin B52 and pin B53 must be equal to 120 ohm. 3) Impedance measured between 30–pin connector pin 21 (CAN H) and pin 22 (CAN L) must be equal to 60 ohm +/–3% (measured with key off and ECUs connected).	

Component failure	DTC	FMI	Error type	Visible anomaly	Possible cause	Recommended repairs	Notes
COMMUNICATION LINES – PE: Torque/Speed Control from PTO to EDC	3B	01	SHORT CIRCUIT TO POSITIVE	CAN message appears on Cluster.CAN messages cannot be viewed on Cluster. Possible communication problem with IMMOBILIZER for cranking. Possible ECAS suspension levelling operation problem via remote control in cab. Speedometer may stay off.	Possible CAN line problem: CAN line short–circuit to earth or CAN H and CAN L lines reciprocally short–circuiting. Check that all vehicle ECUs are connected.	Check CAN VDB line: 1) Resistance measured with key off directly on EDC ECU between pin B52 (CAN L) and pin B53 (CAN H) must be equal to 120 ohm. 2) Resistance measured with key off on wiring between pin B52 and pin B53 must be equal to 120 ohm. 3) Impedance measured between 30–pin connector pin 21 (CAN H) and pin 22 (CAN L) must be equal to 60 ohm +/–3% (measured with key off and ECUs connected).	
COMMUNICATION LINES – PE: Torque/Speed Control from PTO to EDC	3B	02	OPEN CIRCUIT OR SHORT CIRCUIT TO GROUND	CAN message appears on Cluster.CAN messages cannot be viewed on Cluster. Possible communication problem with IMMOBILIZER for cranking. Possible ECAS suspension levelling operation problem via remote control in cab. Speedometer may stay off.	Possible CAN line problem: CAN line short–circuit to earth or CAN H and CAN L lines reciprocally short–circuiting. Check that all vehicle ECUs are connected.	Check CAN VDB line: 1) Resistance measured with key off directly on EDC ECU between pin B52 (CAN L) and pin B53 (CAN H) must be equal to 120 ohm. 2) Resistance measured with key off on wiring between pin B52 and pin B53 must be equal to 120 ohm. 3) Impedance measured between 30–pin connector pin 21 (CAN H) and pin 22 (CAN L) must be equal to 60 ohm +/–3% (measured with key off and ECUs connected).	

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Component failure	DTC	FMI	Error type	Visible anomaly	Possible cause	Recommended repairs	Notes
COMMUNICATION LINES – PE: Torque/Speed Control from PTO to EDC	3B	03	NO SIGNAL	CAN message appears on Cluster.CAN messages cannot be viewed on Cluster. Possible communication problem with IMMOBILIZER for cranking. Possible ECAS suspension levelling operation problem via remote control in cab. Speedometer may stay off.	Possible CAN line problem: CAN line short–circuit to earth or CAN H and CAN L lines reciprocally short–circuiting. Check that all vehicle ECUs are connected.	Check CAN VDB line: 1) Resistance measured with key off directly on EDC ECU between pin B52 (CAN L) and pin B53 (CAN H) must be equal to 120 ohm. 2) Resistance measured with key off on wiring between pin B52 and pin B53 must be equal to 120 ohm. 3) Impedance measured between 30–pin connector pin 21 (CAN H) and pin 22 (CAN L) must be equal to 60 ohm +/–3% (measured with key off and ECUs connected).	
COMMUNICATION LINES – DE: Torque/Speed Control from Driveline Retarder to EDC	3B	04	SIGNAL NOT PLAUSIBLE	CAN message appears on Cluster.CAN messages cannot be viewed on Cluster. Possible communication problem with IMMOBILIZER for cranking. Possible ECAS suspension levelling operation problem via remote control in cab. Speedometer may stay off.	Possible CAN line problem: CAN line short–circuit to earth or CAN H and CAN L lines reciprocally short–circuiting. Check that all vehicle ECUs are connected.	Check CAN VDB line: 1) Resistance measured with key off directly on EDC ECU between pin B52 (CAN L) and pin B53 (CAN H) must be equal to 120 ohm. 2) Resistance measured with key off on wiring between pin B52 and pin B53 must be equal to 120 ohm. 3) Impedance measured between 30–pin connector pin 21 (CAN H) and pin 22 (CAN L) must be equal to 60 ohm +/–3% (measured with key off and ECUs connected).	

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Component failure	DTC	FMI	Error type	Visible anomaly	Possible cause	Recommended repairs	Notes
COMMUNICATION LINES – PE: Torque/Speed Control from PTO to EDC	3B	06	SUPPLY BELOW THE RANGE	CAN message appears on Cluster.CAN messages cannot be viewed on Cluster. Possible communication problem with IMMOBILIZER for cranking. Possible ECAS suspension levelling operation problem via remote control in cab. Speedometer may stay off.	Possible CAN line problem: CAN line short–circuit to earth or CAN H and CAN L lines reciprocally short–circuiting. Check that all vehicle ECUs are connected.	Check CAN VDB line: 1) Resistance measured with key off directly on EDC ECU between pin B52 (CAN L) and pin B53 (CAN H) must be equal to 120 ohm. 2) Resistance measured with key off on wiring between pin B52 and pin B53 must be equal to 120 ohm. 3) Impedance measured between 30–pin connector pin 21 (CAN H) and pin 22 (CAN L) must be equal to 60 ohm +/–3% (measured with key off and ECUs connected).	
COMMUNICATION LINES – DE: Torque/Speed Control from Driveline Retarder to EDC	3B	07	VALUE OVER THE NORMAL LIMIT	CAN message appears on Cluster.CAN messages cannot be viewed on Cluster. Possible communication problem with IMMOBILIZER for cranking. Possible ECAS suspension levelling operation problem via remote control in cab. Speedometer may stay off.	Possible CAN line problem: CAN line short–circuit to earth or CAN H and CAN L lines reciprocally short–circuiting. Check that all vehicle ECUs are connected.	Check CAN VDB line: 1) Resistance measured with key off directly on EDC ECU between pin B52 (CAN L) and pin B53 (CAN H) must be equal to 120 ohm. 2) Resistance measured with key off on wiring between pin B52 and pin B53 must be equal to 120 ohm. 3) Impedance measured between 30–pin connector pin 21 (CAN H) and pin 22 (CAN L) must be equal to 60 ohm +/–3% (measured with key off and ECUs connected).	

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Component failure	DTC	FMI	Error type	Visible anomaly	Possible cause	Recommended repairs	Notes
COMMUNICATION LINES – PE: Torque/Speed Control from PTO to EDC	3B	07	VALUE OVER THE NORMAL LIMIT	CAN message appears on Cluster.CAN messages cannot be viewed on Cluster. Possible communication problem with IMMOBILIZER for cranking. Possible ECAS suspension levelling operation problem via remote control in cab. Speedometer may stay off.	Possible CAN line problem: CAN line short–circuit to earth or CAN H and CAN L lines reciprocally short–circuiting. Check that all vehicle ECUs are connected.	Check CAN VDB line: 1) Resistance measured with key off directly on EDC ECU between pin B52 (CAN L) and pin B53 (CAN H) must be equal to 120 ohm. 2) Resistance measured with key off on wiring between pin B52 and pin B53 must be equal to 120 ohm. 3) Impedance measured between 30–pin connector pin 21 (CAN H) and pin 22 (CAN L) must be equal to 60 ohm +/–3% (measured with key off and ECUs connected).	
COMMUNICATION LINES – DE: Torque/Speed Control from Driveline Retarder to EDC	3B	08	VALUE BELOW THE LIMIT	CAN message appears on Cluster.CAN messages cannot be viewed on Cluster. Possible communication problem with IMMOBILIZER for cranking. Possible ECAS suspension levelling operation problem via remote control in cab. Speedometer may stay off.	Possible CAN line problem: CAN line short–circuit to earth or CAN H and CAN L lines reciprocally short–circuiting. Check that all vehicle ECUs are connected.	Check CAN VDB line: 1) Resistance measured with key off directly on EDC ECU between pin B52 (CAN L) and pin B53 (CAN H) must be equal to 120 ohm. 2) Resistance measured with key off on wiring between pin B52 and pin B53 must be equal to 120 ohm. 3) Impedance measured between 30–pin connector pin 21 (CAN H) and pin 22 (CAN L) must be equal to 60 ohm +/–3% (measured with key off and ECUs connected).	

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COMMUNICATION LINES – PE: Torque/Speed Control from PTO to EDC	3B	08	VALUE BELOW THE LIMIT	CAN message appears on Cluster.CAN messages cannot be viewed on Cluster. Possible communication problem with IMMOBILIZER for cranking. Possible ECAS suspension levelling operation problem via remote control in cab. Speedometer may stay off.	Possible CAN line problem: CAN line short–circuit to earth or CAN H and CAN L lines reciprocally short–circuiting. Check that all vehicle ECUs are connected.	Check CAN VDB line: 1) Resistance measured with key off directly on EDC ECU between pin B52 (CAN L) and pin B53 (CAN H) must be equal to 120 ohm. 2) Resistance measured with key off on wiring between pin B52 and pin B53 must be equal to 120 ohm. 3) Impedance measured between 30–pin connector pin 21 (CAN H) and pin 22 (CAN L) must be equal to 60 ohm +/–3% (measured with key off and ECUs connected).	
COMMUNICATION LINES – TE: Torque/Speed Control from ETC to EDC	3C	00	NO AVAILABLE SYMPTOM	CAN message appears on Cluster.CAN messages cannot be viewed on Cluster. Possible communication problem with IMMOBILIZER for cranking. Possible ECAS suspension levelling operation problem via remote control in cab. Speedometer may stay off.	Possible CAN line problem: CAN line short–circuit to earth or CAN H and CAN L lines reciprocally short–circuiting. Check that all vehicle ECUs are connected.	Check CAN VDB line: 1) Resistance measured with key off directly on EDC ECU between pin B52 (CAN L) and pin B53 (CAN H) must be equal to 120 ohm. 2) Resistance measured with key off on wiring between pin B52 and pin B53 must be equal to 120 ohm. 3) Impedance measured between 30–pin connector pin 21 (CAN H) and pin 22 (CAN L) must be equal to 60 ohm +/–3% (measured with key off and ECUs connected).	

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Component failure	DTC	FMI	Error type	Visible anomaly	Possible cause	Recommended repairs	Notes
COMMUNICATION LINES – VE: Torque/Speed Control from Vehicle Management to EDC	3C	00	NO AVAILABLE SYMPTOM	CAN message appears on Cluster.CAN messages cannot be viewed on Cluster. Possible communication problem with IMMOBILIZER for cranking. Possible ECAS suspension levelling operation problem via remote control in cab. Speedometer may stay off.	Possible CAN line problem: CAN line short–circuit to earth or CAN H and CAN L lines reciprocally short–circuiting. Check that all vehicle ECUs are connected.	Check CAN VDB line: 1) Resistance measured with key off directly on EDC ECU between pin B52 (CAN L) and pin B53 (CAN H) must be equal to 120 ohm. 2) Resistance measured with key off on wiring between pin B52 and pin B53 must be equal to 120 ohm. 3) Impedance measured between 30–pin connector pin 21 (CAN H) and pin 22 (CAN L) must be equal to 60 ohm +/–3% (measured with key off and ECUs connected).	
COMMUNICATION LINES – TE: Torque/Speed Control from ETC to EDC	3C	01	SHORT CIRCUIT TO POSITIVE	CAN message appears on Cluster.CAN messages cannot be viewed on Cluster. Possible communication problem with IMMOBILIZER for cranking. Possible ECAS suspension levelling operation problem via remote control in cab. Speedometer may stay off.	Possible CAN line problem: CAN line short–circuit to earth or CAN H and CAN L lines reciprocally short–circuiting. Check that all vehicle ECUs are connected.	Check CAN VDB line: 1) Resistance measured with key off directly on EDC ECU between pin B52 (CAN L) and pin B53 (CAN H) must be equal to 120 ohm. 2) Resistance measured with key off on wiring between pin B52 and pin B53 must be equal to 120 ohm. 3) Impedance measured between 30–pin connector pin 21 (CAN H) and pin 22 (CAN L) must be equal to 60 ohm +/–3% (measured with key off and ECUs connected).	

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COMMUNICATION LINES – TE: Torque/Speed Control from ETC to EDC	3C	02	OPEN CIRCUIT OR SHORT CIRCUIT TO GROUND	CAN message appears on Cluster.CAN messages cannot be viewed on Cluster. Possible communication problem with IMMOBILIZER for cranking. Possible ECAS suspension levelling operation problem via remote control in cab. Speedometer may stay off.	Possible CAN line problem: CAN line short–circuit to earth or CAN H and CAN L lines reciprocally short–circuiting. Check that all vehicle ECUs are connected.	Check CAN VDB line: 1) Resistance measured with key off directly on EDC ECU between pin B52 (CAN L) and pin B53 (CAN H) must be equal to 120 ohm. 2) Resistance measured with key off on wiring between pin B52 and pin B53 must be equal to 120 ohm. 3) Impedance measured between 30–pin connector pin 21 (CAN H) and pin 22 (CAN L) must be equal to 60 ohm +/–3% (measured with key off and ECUs connected).	

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COMMUNICATION LINES – VE: Torque/Speed Control from Vehicle Management to EDC	3C	02	OPEN CIRCUIT OR SHORT CIRCUIT TO GROUND	CAN message appears on Cluster.CAN messages cannot be viewed on Cluster. Possible communication problem with IMMOBILIZER for cranking. Possible ECAS suspension levelling operation problem via remote control in cab. Speedometer may stay off.	Possible CAN line problem: CAN line short–circuit to earth or CAN H and CAN L lines reciprocally short–circuiting. Check that all vehicle ECUs are connected.	Check CAN VDB line: 1) Resistance measured with key off directly on EDC ECU between pin B52 (CAN L) and pin B53 (CAN H) must be equal to 120 ohm. 2) Resistance measured with key off on wiring between pin B52 and pin B53 must be equal to 120 ohm. 3) Impedance measured between 30–pin connector pin 21 (CAN H) and pin 22 (CAN L) must be equal to 60 ohm +/–3% (measured with key off and ECUs connected).	
COMMUNICATION LINES – TE: Torque/Speed Control from ETC to EDC	3C	03	NO SIGNAL	CAN message appears on Cluster.CAN messages cannot be viewed on Cluster. Possible communication problem with IMMOBILIZER for cranking. Possible ECAS suspension levelling operation problem via remote control in cab. Speedometer may stay off.	Possible CAN line problem: CAN line short–circuit to earth or CAN H and CAN L lines reciprocally short–circuiting. Check that all vehicle ECUs are connected.	Check CAN VDB line: 1) Resistance measured with key off directly on EDC ECU between pin B52 (CAN L) and pin B53 (CAN H) must be equal to 120 ohm. 2) Resistance measured with key off on wiring between pin B52 and pin B53 must be equal to 120 ohm. 3) Impedance measured between 30–pin connector pin 21 (CAN H) and pin 22 (CAN L) must be equal to 60 ohm +/–3% (measured with key off and ECUs connected).	

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COMMUNICATION LINES – TE: Torque/Speed Control from ETC to EDC	3C	04	SIGNAL NOT PLAUSIBLE	CAN message appears on Cluster.CAN messages cannot be viewed on Cluster. Possible communication problem with IMMOBILIZER for cranking. Possible ECAS suspension levelling operation problem via remote control in cab. Speedometer may stay off.	Possible CAN line problem: CAN line short–circuit to earth or CAN H and CAN L lines reciprocally short–circuiting. Check that all vehicle ECUs are connected.	Check CAN VDB line: 1) Resistance measured with key off directly on EDC ECU between pin B52 (CAN L) and pin B53 (CAN H) must be equal to 120 ohm. 2) Resistance measured with key off on wiring between pin B52 and pin B53 must be equal to 120 ohm. 3) Impedance measured between 30–pin connector pin 21 (CAN H) and pin 22 (CAN L) must be equal to 60 ohm +/–3% (measured with key off and ECUs connected).	

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Component failure	DTC	FMI	Error type	Visible anomaly	Possible cause	Recommended repairs	Notes
COMMUNICATION LINES – VE: Torque/Speed Control from Vehicle Management to EDC	3C	04	SIGNAL NOT PLAUSIBLE	CAN message appears on Cluster.CAN messages cannot be viewed on Cluster. Possible communication problem with IMMOBILIZER for cranking. Possible ECAS suspension levelling operation problem via remote control in cab. Speedometer may stay off.	Possible CAN line problem: CAN line short–circuit to earth or CAN H and CAN L lines reciprocally short–circuiting. Check that all vehicle ECUs are connected.	Check CAN VDB line: 1) Resistance measured with key off directly on EDC ECU between pin B52 (CAN L) and pin B53 (CAN H) must be equal to 120 ohm. 2) Resistance measured with key off on wiring between pin B52 and pin B53 must be equal to 120 ohm. 3) Impedance measured between 30–pin connector pin 21 (CAN H) and pin 22 (CAN L) must be equal to 60 ohm +/–3% (measured with key off and ECUs connected).	
COMMUNICATION LINES – TE: Torque/Speed Control from ETC to EDC	3C	05	SUPPLY OVER THE NORMAL RANGE	CAN message appears on Cluster.CAN messages cannot be viewed on Cluster. Possible communication problem with IMMOBILIZER for cranking. Possible ECAS suspension levelling operation problem via remote control in cab. Speedometer may stay off.	Possible CAN line problem: CAN line short–circuit to earth or CAN H and CAN L lines reciprocally short–circuiting. Check that all vehicle ECUs are connected.	Check CAN VDB line: 1) Resistance measured with key off directly on EDC ECU between pin B52 (CAN L) and pin B53 (CAN H) must be equal to 120 ohm. 2) Resistance measured with key off on wiring between pin B52 and pin B53 must be equal to 120 ohm. 3) Impedance measured between 30–pin connector pin 21 (CAN H) and pin 22 (CAN L) must be equal to 60 ohm +/–3% (measured with key off and ECUs connected).	

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COMMUNICATION LINES – VE: Torque/Speed Control from Vehicle Management to EDC	3C	05	SUPPLY OVER THE NORMAL RANGE	CAN message appears on Cluster.CAN messages cannot be viewed on Cluster. Possible communication problem with IMMOBILIZER for cranking. Possible ECAS suspension levelling operation problem via remote control in cab. Speedometer may stay off.	Possible CAN line problem: CAN line short–circuit to earth or CAN H and CAN L lines reciprocally short–circuiting. Check that all vehicle ECUs are connected.	Check CAN VDB line: 1) Resistance measured with key off directly on EDC ECU between pin B52 (CAN L) and pin B53 (CAN H) must be equal to 120 ohm. 2) Resistance measured with key off on wiring between pin B52 and pin B53 must be equal to 120 ohm. 3) Impedance measured between 30–pin connector pin 21 (CAN H) and pin 22 (CAN L) must be equal to 60 ohm +/–3% (measured with key off and ECUs connected).	
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Component failure	DTC	FMI	Error type	Visible anomaly	Possible cause	Recommended repairs	Notes
COMMUNICATION LINES – TE: Torque/Speed Control from ETC to EDC	3C	07	VALUE OVER THE NORMAL LIMIT	CAN message appears on Cluster.CAN messages cannot be viewed on Cluster. Possible communication problem with IMMOBILIZER for cranking. Possible ECAS suspension levelling operation problem via remote control in cab. Speedometer may stay off.	Possible CAN line problem: CAN line short–circuit to earth or CAN H and CAN L lines reciprocally short–circuiting. Check that all vehicle ECUs are connected.	Check CAN VDB line: 1) Resistance measured with key off directly on EDC ECU between pin B52 (CAN L) and pin B53 (CAN H) must be equal to 120 ohm. 2) Resistance measured with key off on wiring between pin B52 and pin B53 must be equal to 120 ohm. 3) Impedance measured between 30–pin connector pin 21 (CAN H) and pin 22 (CAN L) must be equal to 60 ohm +/–3% (measured with key off and ECUs connected).	
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Component failure	DTC	FMI	Error type	Visible anomaly	Possible cause	Recommended repairs	Notes
COMMUNICATION LINES – AR: Torque/Speed Control from ATC (Asr) to Engine Brake	3D	00	NO AVAILABLE SYMPTOM	CAN message appears on Cluster.CAN messages cannot be viewed on Cluster. Possible communication problem with IMMOBILIZER for cranking. Possible ECAS suspension levelling operation problem via remote control in cab. Speedometer may stay off.	Possible CAN line problem: CAN line short–circuit to earth or CAN H and CAN L lines reciprocally short–circuiting. Check that all vehicle ECUs are connected.	Check CAN VDB line: 1) Resistance measured with key off directly on EDC ECU between pin B52 (CAN L) and pin B53 (CAN H) must be equal to 120 ohm. 2) Resistance measured with key off on wiring between pin B52 and pin B53 must be equal to 120 ohm. 3) Impedance measured between 30–pin connector pin 21 (CAN H) and pin 22 (CAN L) must be equal to 60 ohm +/–3% (measured with key off and ECUs connected).	
COMMUNICATION LINES – DR: Torque/Speed Control from Driveline Retarder to Engine Brake	3D	00	NO AVAILABLE SYMPTOM	CAN message appears on Cluster.CAN messages cannot be viewed on Cluster. Possible communication problem with IMMOBILIZER for cranking. Possible ECAS suspension levelling operation problem via remote control in cab. Speedometer may stay off.	Possible CAN line problem: CAN line short–circuit to earth or CAN H and CAN L lines reciprocally short–circuiting. Check that all vehicle ECUs are connected.	Check CAN VDB line: 1) Resistance measured with key off directly on EDC ECU between pin B52 (CAN L) and pin B53 (CAN H) must be equal to 120 ohm. 2) Resistance measured with key off on wiring between pin B52 and pin B53 must be equal to 120 ohm. 3) Impedance measured between 30–pin connector pin 21 (CAN H) and pin 22 (CAN L) must be equal to 60 ohm +/–3% (measured with key off and ECUs connected).	

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Component failure	DTC	FMI	Error type	Visible anomaly	Possible cause	Recommended repairs	Notes
COMMUNICATION LINES – AR: Torque/Speed Control from ATC (Asr) to Engine Brake	3D	01	SHORT CIRCUIT TO POSITIVE	CAN message appears on Cluster.CAN messages cannot be viewed on Cluster. Possible communication problem with IMMOBILIZER for cranking. Possible ECAS suspension levelling operation problem via remote control in cab. Speedometer may stay off.	Possible CAN line problem: CAN line short–circuit to earth or CAN H and CAN L lines reciprocally short–circuiting. Check that all vehicle ECUs are connected.	Check CAN VDB line: 1) Resistance measured with key off directly on EDC ECU between pin B52 (CAN L) and pin B53 (CAN H) must be equal to 120 ohm. 2) Resistance measured with key off on wiring between pin B52 and pin B53 must be equal to 120 ohm. 3) Impedance measured between 30–pin connector pin 21 (CAN H) and pin 22 (CAN L) must be equal to 60 ohm +/–3% (measured with key off and ECUs connected).	
COMMUNICATION LINES – DR: Torque/Speed Control from Driveline Retarder to Engine Brake	3D	01	SHORT CIRCUIT TO POSITIVE	CAN message appears on Cluster.CAN messages cannot be viewed on Cluster. Possible communication problem with IMMOBILIZER for cranking. Possible ECAS suspension levelling operation problem via remote control in cab. Speedometer may stay off.	Possible CAN line problem: CAN line short–circuit to earth or CAN H and CAN L lines reciprocally short–circuiting. Check that all vehicle ECUs are connected.	Check CAN VDB line: 1) Resistance measured with key off directly on EDC ECU between pin B52 (CAN L) and pin B53 (CAN H) must be equal to 120 ohm. 2) Resistance measured with key off on wiring between pin B52 and pin B53 must be equal to 120 ohm. 3) Impedance measured between 30–pin connector pin 21 (CAN H) and pin 22 (CAN L) must be equal to 60 ohm +/–3% (measured with key off and ECUs connected).	

Component failure	DTC	FMI	Error type	Visible anomaly	Possible cause	Recommended repairs	Notes
COMMUNICATION LINES – AR: Torque/Speed Control from ATC (Asr) to Engine Brake	3D	02	OPEN CIRCUIT OR SHORT CIRCUIT TO GROUND	CAN message appears on Cluster.CAN messages cannot be viewed on Cluster. Possible communication problem with IMMOBILIZER for cranking. Possible ECAS suspension levelling operation problem via remote control in cab. Speedometer may stay off.	Possible CAN line problem: CAN line short–circuit to earth or CAN H and CAN L lines reciprocally short–circuiting. Check that all vehicle ECUs are connected.	Check CAN VDB line: 1) Resistance measured with key off directly on EDC ECU between pin B52 (CAN L) and pin B53 (CAN H) must be equal to 120 ohm. 2) Resistance measured with key off on wiring between pin B52 and pin B53 must be equal to 120 ohm. 3) Impedance measured between 30–pin connector pin 21 (CAN H) and pin 22 (CAN L) must be equal to 60 ohm +/–3% (measured with key off and ECUs connected).	
COMMUNICATION LINES – AR: Torque/Speed Control from ATC (Asr) to Engine Brake	3D	03	NO SIGNAL	CAN message appears on Cluster.CAN messages cannot be viewed on Cluster. Possible communication problem with IMMOBILIZER for cranking. Possible ECAS suspension levelling operation problem via remote control in cab. Speedometer may stay off.	Possible CAN line problem: CAN line short–circuit to earth or CAN H and CAN L lines reciprocally short–circuiting. Check that all vehicle ECUs are connected.	Check CAN VDB line: 1) Resistance measured with key off directly on EDC ECU between pin B52 (CAN L) and pin B53 (CAN H) must be equal to 120 ohm. 2) Resistance measured with key off on wiring between pin B52 and pin B53 must be equal to 120 ohm. 3) Impedance measured between 30–pin connector pin 21 (CAN H) and pin 22 (CAN L) must be equal to 60 ohm +/–3% (measured with key off and ECUs connected).	

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Component failure	DTC	FMI	Error type	Visible anomaly	Possible cause	Recommended repairs	Notes
COMMUNICATION LINES – AR: Torque/Speed Control from ATC (Asr) to Engine Brake	3D	04	SIGNAL NOT PLAUSIBLE	CAN message appears on Cluster.CAN messages cannot be viewed on Cluster. Possible communication problem with IMMOBILIZER for cranking. Possible ECAS suspension levelling operation problem via remote control in cab. Speedometer may stay off.	Possible CAN line problem: CAN line short–circuit to earth or CAN H and CAN L lines reciprocally short–circuiting. Check that all vehicle ECUs are connected.	Check CAN VDB line: 1) Resistance measured with key off directly on EDC ECU between pin B52 (CAN L) and pin B53 (CAN H) must be equal to 120 ohm. 2) Resistance measured with key off on wiring between pin B52 and pin B53 must be equal to 120 ohm. 3) Impedance measured between 30–pin connector pin 21 (CAN H) and pin 22 (CAN L) must be equal to 60 ohm +/–3% (measured with key off and ECUs connected).	
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COMMUNICATION LINES – VE: Torque/Speed Control from Vehicle Management to EDC	3D	06	SUPPLY BELOW THE RANGE	CAN message appears on Cluster.CAN messages cannot be viewed on Cluster. Possible communication problem with IMMOBILIZER for cranking. Possible ECAS suspension levelling operation problem via remote control in cab. Speedometer may stay off.	Possible CAN line problem: CAN line short–circuit to earth or CAN H and CAN L lines reciprocally short–circuiting. Check that all vehicle ECUs are connected.	Check CAN VDB line: 1) Resistance measured with key off directly on EDC ECU between pin B52 (CAN L) and pin B53 (CAN H) must be equal to 120 ohm. 2) Resistance measured with key off on wiring between pin B52 and pin B53 must be equal to 120 ohm. 3) Impedance measured between 30–pin connector pin 21 (CAN H) and pin 22 (CAN L) must be equal to 60 ohm +/–3% (measured with key off and ECUs connected).	

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Component failure	DTC	FMI	Error type	Visible anomaly	Possible cause	Recommended repairs	Notes
COMMUNICATION LINES – AR: Torque/Speed Control from ATC (Asr) to Engine Brake	3D	07	VALUE OVER THE NORMAL LIMIT	CAN message appears on Cluster.CAN messages cannot be viewed on Cluster. Possible communication problem with IMMOBILIZER for cranking. Possible ECAS suspension levelling operation problem via remote control in cab. Speedometer may stay off.	Possible CAN line problem: CAN line short–circuit to earth or CAN H and CAN L lines reciprocally short–circuiting. Check that all vehicle ECUs are connected.	Check CAN VDB line: 1) Resistance measured with key off directly on EDC ECU between pin B52 (CAN L) and pin B53 (CAN H) must be equal to 120 ohm. 2) Resistance measured with key off on wiring between pin B52 and pin B53 must be equal to 120 ohm. 3) Impedance measured between 30–pin connector pin 21 (CAN H) and pin 22 (CAN L) must be equal to 60 ohm +/–3% (measured with key off and ECUs connected).	
COMMUNICATION LINES – VE: Torque/Speed Control from Vehicle Management to EDC	3D	07	VALUE OVER THE NORMAL LIMIT	CAN message appears on Cluster.CAN messages cannot be viewed on Cluster. Possible communication problem with IMMOBILIZER for cranking. Possible ECAS suspension levelling operation problem via remote control in cab. Speedometer may stay off.	Possible CAN line problem: CAN line short–circuit to earth or CAN H and CAN L lines reciprocally short–circuiting. Check that all vehicle ECUs are connected.	Check CAN VDB line: 1) Resistance measured with key off directly on EDC ECU between pin B52 (CAN L) and pin B53 (CAN H) must be equal to 120 ohm. 2) Resistance measured with key off on wiring between pin B52 and pin B53 must be equal to 120 ohm. 3) Impedance measured between 30–pin connector pin 21 (CAN H) and pin 22 (CAN L) must be equal to 60 ohm +/–3% (measured with key off and ECUs connected).	

Component failure	DTC	FMI	Error type	Visible anomaly	Possible cause	Recommended repairs	Notes
COMMUNICATION LINES – VE: Torque/Speed Control from Vehicle Management to EDC	3D	08	VALUE BELOW THE LIMIT	CAN message appears on Cluster.CAN messages cannot be viewed on Cluster. Possible communication problem with IMMOBILIZER for cranking. Possible ECAS suspension levelling operation problem via remote control in cab. Speedometer may stay off.	Possible CAN line problem: CAN line short–circuit to earth or CAN H and CAN L lines reciprocally short–circuiting. Check that all vehicle ECUs are connected.	Check CAN VDB line: 1) Resistance measured with key off directly on EDC ECU between pin B52 (CAN L) and pin B53 (CAN H) must be equal to 120 ohm. 2) Resistance measured with key off on wiring between pin B52 and pin B53 must be equal to 120 ohm. 3) Impedance measured between 30–pin connector pin 21 (CAN H) and pin 22 (CAN L) must be equal to 60 ohm +/–3% (measured with key off and ECUs connected).	
COMMUNICATION LINES – AR: Torque/Speed Control from ATC (Asr) to Engine Brake	3D	08	VALUE BELOW THE LIMIT	CAN message appears on Cluster.CAN messages cannot be viewed on Cluster. Possible communication problem with IMMOBILIZER for cranking. Possible ECAS suspension levelling operation problem via remote control in cab. Speedometer may stay off.	Possible CAN line problem: CAN line short–circuit to earth or CAN H and CAN L lines reciprocally short–circuiting. Check that all vehicle ECUs are connected.	Check CAN VDB line: 1) Resistance measured with key off directly on EDC ECU between pin B52 (CAN L) and pin B53 (CAN H) must be equal to 120 ohm. 2) Resistance measured with key off on wiring between pin B52 and pin B53 must be equal to 120 ohm. 3) Impedance measured between 30–pin connector pin 21 (CAN H) and pin 22 (CAN L) must be equal to 60 ohm +/–3% (measured with key off and ECUs connected).	

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Component failure	DTC	FMI	Error type	Visible anomaly	Possible cause	Recommended repairs	Notes
COMMUNICATION LINES – TR: Torque/Speed Control from ETC to Engine Brake	3E	00	NO AVAILABLE SYMPTOM	CAN message appears on Cluster.CAN messages cannot be viewed on Cluster. Possible communication problem with IMMOBILIZER for cranking. Possible ECAS suspension levelling operation problem via remote control in cab. Speedometer may stay off.	Possible CAN line problem: CAN line short–circuit to earth or CAN H and CAN L lines reciprocally short–circuiting. Check that all vehicle ECUs are connected.	Check CAN VDB line: 1) Resistance measured with key off directly on EDC ECU between pin B52 (CAN L) and pin B53 (CAN H) must be equal to 120 ohm. 2) Resistance measured with key off on wiring between pin B52 and pin B53 must be equal to 120 ohm. 3) Impedance measured between 30–pin connector pin 21 (CAN H) and pin 22 (CAN L) must be equal to 60 ohm +/–3% (measured with key off and ECUs connected).	
COMMUNICATION LINES – TR: Torque/Speed Control from ETC to Engine Brake	3E	01	SHORT CIRCUIT TO POSITIVE	CAN message appears on Cluster.CAN messages cannot be viewed on Cluster. Possible communication problem with IMMOBILIZER for cranking. Possible ECAS suspension levelling operation problem via remote control in cab. Speedometer may stay off.	Possible CAN line problem: CAN line short–circuit to earth or CAN H and CAN L lines reciprocally short–circuiting. Check that all vehicle ECUs are connected.	Check CAN VDB line: 1) Resistance measured with key off directly on EDC ECU between pin B52 (CAN L) and pin B53 (CAN H) must be equal to 120 ohm. 2) Resistance measured with key off on wiring between pin B52 and pin B53 must be equal to 120 ohm. 3) Impedance measured between 30–pin connector pin 21 (CAN H) and pin 22 (CAN L) must be equal to 60 ohm +/–3% (measured with key off and ECUs connected).	

Component failure	DTC	FMI	Error type	Visible anomaly	Possible cause	Recommended repairs	Notes
COMMUNICATION LINES – DR: Torque/Speed Control from Driveline Retarder to Engine Brake	3E	02	OPEN CIRCUIT OR SHORT CIRCUIT TO GROUND	CAN message appears on Cluster.CAN messages cannot be viewed on Cluster. Possible communication problem with IMMOBILIZER for cranking. Possible ECAS suspension levelling operation problem via remote control in cab. Speedometer may stay off.	Possible CAN line problem: CAN line short–circuit to earth or CAN H and CAN L lines reciprocally short–circuiting. Check that all vehicle ECUs are connected.	Check CAN VDB line: 1) Resistance measured with key off directly on EDC ECU between pin B52 (CAN L) and pin B53 (CAN H) must be equal to 120 ohm. 2) Resistance measured with key off on wiring between pin B52 and pin B53 must be equal to 120 ohm. 3) Impedance measured between 30–pin connector pin 21 (CAN H) and pin 22 (CAN L) must be equal to 60 ohm +/–3% (measured with key off and ECUs connected).	
COMMUNICATION LINES – TR: Torque/Speed Control from ETC to Engine Brake	3E	02	OPEN CIRCUIT OR SHORT CIRCUIT TO GROUND	CAN message appears on Cluster.CAN messages cannot be viewed on Cluster. Possible communication problem with IMMOBILIZER for cranking. Possible ECAS suspension levelling operation problem via remote control in cab. Speedometer may stay off.	Possible CAN line problem: CAN line short–circuit to earth or CAN H and CAN L lines reciprocally short–circuiting. Check that all vehicle ECUs are connected.	Check CAN VDB line: 1) Resistance measured with key off directly on EDC ECU between pin B52 (CAN L) and pin B53 (CAN H) must be equal to 120 ohm. 2) Resistance measured with key off on wiring between pin B52 and pin B53 must be equal to 120 ohm. 3) Impedance measured between 30–pin connector pin 21 (CAN H) and pin 22 (CAN L) must be equal to 60 ohm +/–3% (measured with key off and ECUs connected).	

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Component failure	DTC	FMI	Error type	Visible anomaly	Possible cause	Recommended repairs	Notes
COMMUNICATION LINES – DR: Torque/Speed Control from Driveline Retarder to Engine Brake	3E	03	NO SIGNAL	CAN message appears on Cluster.CAN messages cannot be viewed on Cluster. Possible communication problem with IMMOBILIZER for cranking. Possible ECAS suspension levelling operation problem via remote control in cab. Speedometer may stay off.	Possible CAN line problem: CAN line short–circuit to earth or CAN H and CAN L lines reciprocally short–circuiting. Check that all vehicle ECUs are connected.	Check CAN VDB line: 1) Resistance measured with key off directly on EDC ECU between pin B52 (CAN L) and pin B53 (CAN H) must be equal to 120 ohm. 2) Resistance measured with key off on wiring between pin B52 and pin B53 must be equal to 120 ohm. 3) Impedance measured between 30–pin connector pin 21 (CAN H) and pin 22 (CAN L) must be equal to 60 ohm +/–3% (measured with key off and ECUs connected).	
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COMMUNICATION LINES – DR: Torque/Speed Control from Driveline Retarder to Engine Brake	3E	04	SIGNAL NOT PLAUSIBLE	CAN message appears on Cluster.CAN messages cannot be viewed on Cluster. Possible communication problem with IMMOBILIZER for cranking. Possible ECAS suspension levelling operation problem via remote control in cab. Speedometer may stay off.	Possible CAN line problem: CAN line short–circuit to earth or CAN H and CAN L lines reciprocally short–circuiting. Check that all vehicle ECUs are connected.	Check CAN VDB line: 1) Resistance measured with key off directly on EDC ECU between pin B52 (CAN L) and pin B53 (CAN H) must be equal to 120 ohm. 2) Resistance measured with key off on wiring between pin B52 and pin B53 must be equal to 120 ohm. 3) Impedance measured between 30–pin connector pin 21 (CAN H) and pin 22 (CAN L) must be equal to 60 ohm +/–3% (measured with key off and ECUs connected).	
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Component failure	DTC	FMI	Error type	Visible anomaly	Possible cause	Recommended repairs	Notes
COMMUNICATION LINES – DR: Torque/Speed Control from Driveline Retarder to Engine Brake	3E	05	SUPPLY OVER THE NORMAL RANGE	CAN message appears on Cluster.CAN messages cannot be viewed on Cluster. Possible communication problem with IMMOBILIZER for cranking. Possible ECAS suspension levelling operation problem via remote control in cab. Speedometer may stay off.	Possible CAN line problem: CAN line short–circuit to earth or CAN H and CAN L lines reciprocally short–circuiting. Check that all vehicle ECUs are connected.	Check CAN VDB line: 1) Resistance measured with key off directly on EDC ECU between pin B52 (CAN L) and pin B53 (CAN H) must be equal to 120 ohm. 2) Resistance measured with key off on wiring between pin B52 and pin B53 must be equal to 120 ohm. 3) Impedance measured between 30–pin connector pin 21 (CAN H) and pin 22 (CAN L) must be equal to 60 ohm +/–3% (measured with key off and ECUs connected).	
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COMMUNICATION LINES – DR: Torque/Speed Control from Driveline Retarder to Engine Brake	3E	06	SUPPLY BELOW THE RANGE	CAN message appears on Cluster.CAN messages cannot be viewed on Cluster. Possible communication problem with IMMOBILIZER for cranking. Possible ECAS suspension levelling operation problem via remote control in cab. Speedometer may stay off.	Possible CAN line problem: CAN line short–circuit to earth or CAN H and CAN L lines reciprocally short–circuiting. Check that all vehicle ECUs are connected.	Check CAN VDB line: 1) Resistance measured with key off directly on EDC ECU between pin B52 (CAN L) and pin B53 (CAN H) must be equal to 120 ohm. 2) Resistance measured with key off on wiring between pin B52 and pin B53 must be equal to 120 ohm. 3) Impedance measured between 30–pin connector pin 21 (CAN H) and pin 22 (CAN L) must be equal to 60 ohm +/–3% (measured with key off and ECUs connected).	
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COMMUNICATION LINES – DR: Torque/Speed Control from Driveline Retarder to Engine Brake	3E	07	VALUE OVER THE NORMAL LIMIT	CAN message appears on Cluster.CAN messages cannot be viewed on Cluster. Possible communication problem with IMMOBILIZER for cranking. Possible ECAS suspension levelling operation problem via remote control in cab. Speedometer may stay off.	Possible CAN line problem: CAN line short–circuit to earth or CAN H and CAN L lines reciprocally short–circuiting. Check that all vehicle ECUs are connected.	Check CAN VDB line: 1) Resistance measured with key off directly on EDC ECU between pin B52 (CAN L) and pin B53 (CAN H) must be equal to 120 ohm. 2) Resistance measured with key off on wiring between pin B52 and pin B53 must be equal to 120 ohm. 3) Impedance measured between 30–pin connector pin 21 (CAN H) and pin 22 (CAN L) must be equal to 60 ohm +/–3% (measured with key off and ECUs connected).	
COMMUNICATION LINES – TR: Torque/Speed Control from ETC to Engine Brake	3E	07	VALUE OVER THE NORMAL LIMIT	CAN message appears on Cluster.CAN messages cannot be viewed on Cluster. Possible communication problem with IMMOBILIZER for cranking. Possible ECAS suspension levelling operation problem via remote control in cab. Speedometer may stay off.	Possible CAN line problem: CAN line short–circuit to earth or CAN H and CAN L lines reciprocally short–circuiting. Check that all vehicle ECUs are connected.	Check CAN VDB line: 1) Resistance measured with key off directly on EDC ECU between pin B52 (CAN L) and pin B53 (CAN H) must be equal to 120 ohm. 2) Resistance measured with key off on wiring between pin B52 and pin B53 must be equal to 120 ohm. 3) Impedance measured between 30–pin connector pin 21 (CAN H) and pin 22 (CAN L) must be equal to 60 ohm +/–3% (measured with key off and ECUs connected).	

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Component failure	DTC	FMI	Error type	Visible anomaly	Possible cause	Recommended repairs	Notes
COMMUNICATION LINES – DR: Torque/Speed Control from Driveline Retarder to Engine Brake	3E	08	VALUE BELOW THE LIMIT	CAN message appears on Cluster.CAN messages cannot be viewed on Cluster. Possible communication problem with IMMOBILIZER for cranking. Possible ECAS suspension levelling operation problem via remote control in cab. Speedometer may stay off.	Possible CAN line problem: CAN line short–circuit to earth or CAN H and CAN L lines reciprocally short–circuiting. Check that all vehicle ECUs are connected.	Check CAN VDB line: 1) Resistance measured with key off directly on EDC ECU between pin B52 (CAN L) and pin B53 (CAN H) must be equal to 120 ohm. 2) Resistance measured with key off on wiring between pin B52 and pin B53 must be equal to 120 ohm. 3) Impedance measured between 30–pin connector pin 21 (CAN H) and pin 22 (CAN L) must be equal to 60 ohm +/–3% (measured with key off and ECUs connected).	
COMMUNICATION LINES – VR: Torque/Speed Control from Vehicle Management to Engine Brake	3F	00	NO AVAILABLE SYMPTOM	CAN message appears on Cluster.CAN messages cannot be viewed on Cluster. Possible communication problem with IMMOBILIZER for cranking. Possible ECAS suspension levelling operation problem via remote control in cab. Speedometer may stay off.	Possible CAN line problem: CAN line short–circuit to earth or CAN H and CAN L lines reciprocally short–circuiting. Check that all vehicle ECUs are connected.	Check CAN VDB line: 1) Resistance measured with key off directly on EDC ECU between pin B52 (CAN L) and pin B53 (CAN H) must be equal to 120 ohm. 2) Resistance measured with key off on wiring between pin B52 and pin B53 must be equal to 120 ohm. 3) Impedance measured between 30–pin connector pin 21 (CAN H) and pin 22 (CAN L) must be equal to 60 ohm +/–3% (measured with key off and ECUs connected).	

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Component failure	DTC	FMI	Error type	Visible anomaly	Possible cause	Recommended repairs	Notes
COMMUNICATION LINES – VM2EDC2: Vehicle Management to EDC #2	3F	00	NO AVAILABLE SYMPTOM	CAN message appears on Cluster.CAN messages cannot be viewed on Cluster. Possible communication problem with IMMOBILIZER for cranking. Possible ECAS suspension levelling operation problem via remote control in cab. Speedometer may stay off.	Possible CAN line problem: CAN line short–circuit to earth or CAN H and CAN L lines reciprocally short–circuiting. Check that all vehicle ECUs are connected.	Check CAN VDB line: 1) Resistance measured with key off directly on EDC ECU between pin B52 (CAN L) and pin B53 (CAN H) must be equal to 120 ohm. 2) Resistance measured with key off on wiring between pin B52 and pin B53 must be equal to 120 ohm. 3) Impedance measured between 30–pin connector pin 21 (CAN H) and pin 22 (CAN L) must be equal to 60 ohm +/–3% (measured with key off and ECUs connected).	
COMMUNICATION LINES – VR: Torque/Speed Control from Vehicle Management to Engine Brake	3F	01	SHORT CIRCUIT TO POSITIVE	CAN message appears on Cluster.CAN messages cannot be viewed on Cluster. Possible communication problem with IMMOBILIZER for cranking. Possible ECAS suspension levelling operation problem via remote control in cab. Speedometer may stay off.	Possible CAN line problem: CAN line short–circuit to earth or CAN H and CAN L lines reciprocally short–circuiting. Check that all vehicle ECUs are connected.	Check CAN VDB line: 1) Resistance measured with key off directly on EDC ECU between pin B52 (CAN L) and pin B53 (CAN H) must be equal to 120 ohm. 2) Resistance measured with key off on wiring between pin B52 and pin B53 must be equal to 120 ohm. 3) Impedance measured between 30–pin connector pin 21 (CAN H) and pin 22 (CAN L) must be equal to 60 ohm +/–3% (measured with key off and ECUs connected).	

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Component failure	DTC	FMI	Error type	Visible anomaly	Possible cause	Recommended repairs	Notes
COMMUNICATION LINES – VM2EDC2: Vehicle Management to EDC #2	3F	01	SHORT CIRCUIT TO POSITIVE	CAN message appears on Cluster.CAN messages cannot be viewed on Cluster. Possible communication problem with IMMOBILIZER for cranking. Possible ECAS suspension levelling operation problem via remote control in cab. Speedometer may stay off.	Possible CAN line problem: CAN line short–circuit to earth or CAN H and CAN L lines reciprocally short–circuiting. Check that all vehicle ECUs are connected.	Check CAN VDB line: 1) Resistance measured with key off directly on EDC ECU between pin B52 (CAN L) and pin B53 (CAN H) must be equal to 120 ohm. 2) Resistance measured with key off on wiring between pin B52 and pin B53 must be equal to 120 ohm. 3) Impedance measured between 30–pin connector pin 21 (CAN H) and pin 22 (CAN L) must be equal to 60 ohm +/–3% (measured with key off and ECUs connected).	
COMMUNICATION LINES – VR: Torque/Speed Control from Vehicle Management to Engine Brake	3F	02	OPEN CIRCUIT OR SHORT CIRCUIT TO GROUND	CAN message appears on Cluster.CAN messages cannot be viewed on Cluster. Possible communication problem with IMMOBILIZER for cranking. Possible ECAS suspension levelling operation problem via remote control in cab. Speedometer may stay off.	Possible CAN line problem: CAN line short–circuit to earth or CAN H and CAN L lines reciprocally short–circuiting. Check that all vehicle ECUs are connected.	Check CAN VDB line: 1) Resistance measured with key off directly on EDC ECU between pin B52 (CAN L) and pin B53 (CAN H) must be equal to 120 ohm. 2) Resistance measured with key off on wiring between pin B52 and pin B53 must be equal to 120 ohm. 3) Impedance measured between 30–pin connector pin 21 (CAN H) and pin 22 (CAN L) must be equal to 60 ohm +/–3% (measured with key off and ECUs connected).	

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Component failure	DTC	FMI	Error type	Visible anomaly	Possible cause	Recommended repairs	Notes
COMMUNICATION LINES – VM2EDC2: Vehicle Management to EDC #2	3F	02	OPEN CIRCUIT OR SHORT CIRCUIT TO GROUND	CAN message appears on Cluster.CAN messages cannot be viewed on Cluster. Possible communication problem with IMMOBILIZER for cranking. Possible ECAS suspension levelling operation problem via remote control in cab. Speedometer may stay off.	Possible CAN line problem: CAN line short–circuit to earth or CAN H and CAN L lines reciprocally short–circuiting. Check that all vehicle ECUs are connected.	Check CAN VDB line: 1) Resistance measured with key off directly on EDC ECU between pin B52 (CAN L) and pin B53 (CAN H) must be equal to 120 ohm. 2) Resistance measured with key off on wiring between pin B52 and pin B53 must be equal to 120 ohm. 3) Impedance measured between 30–pin connector pin 21 (CAN H) and pin 22 (CAN L) must be equal to 60 ohm +/–3% (measured with key off and ECUs connected).	
COMMUNICATION LINES – VR: Torque/Speed Control from Vehicle Management to Engine Brake	3F	03	NO SIGNAL	CAN message appears on Cluster.CAN messages cannot be viewed on Cluster. Possible communication problem with IMMOBILIZER for cranking. Possible ECAS suspension levelling operation problem via remote control in cab. Speedometer may stay off.	Possible CAN line problem: CAN line short–circuit to earth or CAN H and CAN L lines reciprocally short–circuiting. Check that all vehicle ECUs are connected.	Check CAN VDB line: 1) Resistance measured with key off directly on EDC ECU between pin B52 (CAN L) and pin B53 (CAN H) must be equal to 120 ohm. 2) Resistance measured with key off on wiring between pin B52 and pin B53 must be equal to 120 ohm. 3) Impedance measured between 30–pin connector pin 21 (CAN H) and pin 22 (CAN L) must be equal to 60 ohm +/–3% (measured with key off and ECUs connected).	

Component failure	DTC	FMI	Error type	Visible anomaly	Possible cause	Recommended repairs	Notes
COMMUNICATION LINES – VM2EDC2: Vehicle Management to EDC #2	3F	03	NO SIGNAL	CAN message appears on Cluster.CAN messages cannot be viewed on Cluster. Possible communication problem with IMMOBILIZER for cranking. Possible ECAS suspension levelling operation problem via remote control in cab. Speedometer may stay off.	Possible CAN line problem: CAN line short–circuit to earth or CAN H and CAN L lines reciprocally short–circuiting. Check that all vehicle ECUs are connected.	Check CAN VDB line: 1) Resistance measured with key off directly on EDC ECU between pin B52 (CAN L) and pin B53 (CAN H) must be equal to 120 ohm. 2) Resistance measured with key off on wiring between pin B52 and pin B53 must be equal to 120 ohm. 3) Impedance measured between 30–pin connector pin 21 (CAN H) and pin 22 (CAN L) must be equal to 60 ohm +/–3% (measured with key off and ECUs connected).	
COMMUNICATION LINES – VR: Torque/Speed Control from Vehicle Management to Engine Brake	3F	04	SIGNAL NOT PLAUSIBLE	CAN message appears on Cluster.CAN messages cannot be viewed on Cluster. Possible communication problem with IMMOBILIZER for cranking. Possible ECAS suspension levelling operation problem via remote control in cab. Speedometer may stay off.	Possible CAN line problem: CAN line short–circuit to earth or CAN H and CAN L lines reciprocally short–circuiting. Check that all vehicle ECUs are connected.	Check CAN VDB line: 1) Resistance measured with key off directly on EDC ECU between pin B52 (CAN L) and pin B53 (CAN H) must be equal to 120 ohm. 2) Resistance measured with key off on wiring between pin B52 and pin B53 must be equal to 120 ohm. 3) Impedance measured between 30–pin connector pin 21 (CAN H) and pin 22 (CAN L) must be equal to 60 ohm +/–3% (measured with key off and ECUs connected).	

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Component failure	DTC	FMI	Error type	Visible anomaly	Possible cause	Recommended repairs	Notes
COMMUNICATION LINES – VR: Torque/Speed Control from Vehicle Management to Engine Brake	3F	07	VALUE OVER THE NORMAL LIMIT	CAN message appears on Cluster.CAN messages cannot be viewed on Cluster. Possible communication problem with IMMOBILIZER for cranking. Possible ECAS suspension levelling operation problem via remote control in cab. Speedometer may stay off.	Possible CAN line problem: CAN line short–circuit to earth or CAN H and CAN L lines reciprocally short–circuiting. Check that all vehicle ECUs are connected.	Check CAN VDB line: 1) Resistance measured with key off directly on EDC ECU between pin B52 (CAN L) and pin B53 (CAN H) must be equal to 120 ohm. 2) Resistance measured with key off on wiring between pin B52 and pin B53 must be equal to 120 ohm. 3) Impedance measured between 30–pin connector pin 21 (CAN H) and pin 22 (CAN L) must be equal to 60 ohm +/–3% (measured with key off and ECUs connected).	
COMMUNICATION LINES – TR: Torque/Speed Control from ETC to Engine Brake	3F	08	VALUE BELOW THE LIMIT	CAN message appears on Cluster.CAN messages cannot be viewed on Cluster. Possible communication problem with IMMOBILIZER for cranking. Possible ECAS suspension levelling operation problem via remote control in cab. Speedometer may stay off.	Possible CAN line problem: CAN line short–circuit to earth or CAN H and CAN L lines reciprocally short–circuiting. Check that all vehicle ECUs are connected.	Check CAN VDB line: 1) Resistance measured with key off directly on EDC ECU between pin B52 (CAN L) and pin B53 (CAN H) must be equal to 120 ohm. 2) Resistance measured with key off on wiring between pin B52 and pin B53 must be equal to 120 ohm. 3) Impedance measured between 30–pin connector pin 21 (CAN H) and pin 22 (CAN L) must be equal to 60 ohm +/–3% (measured with key off and ECUs connected).	

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Component failure	DTC	FMI	Error type	Visible anomaly	Possible cause	Recommended repairs	Notes
COMMUNICATION LINES – VR: Torque/Speed Control from Vehicle Management to Engine Brake	3F	08	VALUE BELOW THE LIMIT	CAN message appears on Cluster.CAN messages cannot be viewed on Cluster. Possible communication problem with IMMOBILIZER for cranking. Possible ECAS suspension levelling operation problem via remote control in cab. Speedometer may stay off.	Possible CAN line problem: CAN line short–circuit to earth or CAN H and CAN L lines reciprocally short–circuiting. Check that all vehicle ECUs are connected.	Check CAN VDB line: 1) Resistance measured with key off directly on EDC ECU between pin B52 (CAN L) and pin B53 (CAN H) must be equal to 120 ohm. 2) Resistance measured with key off on wiring between pin B52 and pin B53 must be equal to 120 ohm. 3) Impedance measured between 30–pin connector pin 21 (CAN H) and pin 22 (CAN L) must be equal to 60 ohm +/–3% (measured with key off and ECUs connected).	
COMMUNICATION LINES – WSI: Wheel Speed Information	40	00	NO AVAILABLE SYMPTOM	CAN message appears on Cluster.CAN messages cannot be viewed on Cluster. Possible communication problem with IMMOBILIZER for cranking. Possible ECAS suspension levelling operation problem via remote control in cab. Speedometer may stay off.	Possible CAN line problem: CAN line short–circuit to earth or CAN H and CAN L lines reciprocally short–circuiting. Check that all vehicle ECUs are connected.	Check CAN VDB line: 1) Resistance measured with key off directly on EDC ECU between pin B52 (CAN L) and pin B53 (CAN H) must be equal to 120 ohm. 2) Resistance measured with key off on wiring between pin B52 and pin B53 must be equal to 120 ohm. 3) Impedance measured between 30–pin connector pin 21 (CAN H) and pin 22 (CAN L) must be equal to 60 ohm +/–3% (measured with key off and ECUs connected).	

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Component failure	DTC	FMI	Error type	Visible anomaly	Possible cause	Recommended repairs	Notes
COMMUNICATION LINES – WSI: Wheel Speed Information	40	01	SHORT CIRCUIT TO POSITIVE	CAN message appears on Cluster.CAN messages cannot be viewed on Cluster. Possible communication problem with IMMOBILIZER for cranking. Possible ECAS suspension levelling operation problem via remote control in cab. Speedometer may stay off.	Possible CAN line problem: CAN line short–circuit to earth or CAN H and CAN L lines reciprocally short–circuiting. Check that all vehicle ECUs are connected.	Check CAN VDB line: 1) Resistance measured with key off directly on EDC ECU between pin B52 (CAN L) and pin B53 (CAN H) must be equal to 120 ohm. 2) Resistance measured with key off on wiring between pin B52 and pin B53 must be equal to 120 ohm. 3) Impedance measured between 30–pin connector pin 21 (CAN H) and pin 22 (CAN L) must be equal to 60 ohm +/–3% (measured with key off and ECUs connected).	
COMMUNICATION LINES – WSI: Wheel Speed Information	40	02	OPEN CIRCUIT OR SHORT CIRCUIT TO GROUND	CAN message appears on Cluster.CAN messages cannot be viewed on Cluster. Possible communication problem with IMMOBILIZER for cranking. Possible ECAS suspension levelling operation problem via remote control in cab. Speedometer may stay off.	Possible CAN line problem: CAN line short–circuit to earth or CAN H and CAN L lines reciprocally short–circuiting. Check that all vehicle ECUs are connected.	Check CAN VDB line: 1) Resistance measured with key off directly on EDC ECU between pin B52 (CAN L) and pin B53 (CAN H) must be equal to 120 ohm. 2) Resistance measured with key off on wiring between pin B52 and pin B53 must be equal to 120 ohm. 3) Impedance measured between 30–pin connector pin 21 (CAN H) and pin 22 (CAN L) must be equal to 60 ohm +/–3% (measured with key off and ECUs connected).	

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Component failure	DTC	FMI	Error type	Visible anomaly	Possible cause	Recommended repairs	Notes
COMMUNICATION LINES – WSI: Wheel Speed Information	40	03	NO SIGNAL	CAN message appears on Cluster.CAN messages cannot be viewed on Cluster. Possible communication problem with IMMOBILIZER for cranking. Possible ECAS suspension levelling operation problem via remote control in cab. Speedometer may stay off.	Possible CAN line problem: CAN line short–circuit to earth or CAN H and CAN L lines reciprocally short–circuiting. Check that all vehicle ECUs are connected.	Check CAN VDB line: 1) Resistance measured with key off directly on EDC ECU between pin B52 (CAN L) and pin B53 (CAN H) must be equal to 120 ohm. 2) Resistance measured with key off on wiring between pin B52 and pin B53 must be equal to 120 ohm. 3) Impedance measured between 30–pin connector pin 21 (CAN H) and pin 22 (CAN L) must be equal to 60 ohm +/–3% (measured with key off and ECUs connected).	
COMMUNICATION LINES – VM2EDC2: Vehicle Management to EDC #2	40	04	SIGNAL NOT PLAUSIBLE	CAN message appears on Cluster.CAN messages cannot be viewed on Cluster. Possible communication problem with IMMOBILIZER for cranking. Possible ECAS suspension levelling operation problem via remote control in cab. Speedometer may stay off.	Possible CAN line problem: CAN line short–circuit to earth or CAN H and CAN L lines reciprocally short–circuiting. Check that all vehicle ECUs are connected.	Check CAN VDB line: 1) Resistance measured with key off directly on EDC ECU between pin B52 (CAN L) and pin B53 (CAN H) must be equal to 120 ohm. 2) Resistance measured with key off on wiring between pin B52 and pin B53 must be equal to 120 ohm. 3) Impedance measured between 30–pin connector pin 21 (CAN H) and pin 22 (CAN L) must be equal to 60 ohm +/–3% (measured with key off and ECUs connected).	

Component failure	DTC	FMI	Error type	Visible anomaly	Possible cause	Recommended repairs	Notes
COMMUNICATION LINES – WSI: Wheel Speed Information	40	04	SIGNAL NOT PLAUSIBLE	CAN message appears on Cluster.CAN messages cannot be viewed on Cluster. Possible communication problem with IMMOBILIZER for cranking. Possible ECAS suspension levelling operation problem via remote control in cab. Speedometer may stay off.	Possible CAN line problem: CAN line short–circuit to earth or CAN H and CAN L lines reciprocally short–circuiting. Check that all vehicle ECUs are connected.	Check CAN VDB line: 1) Resistance measured with key off directly on EDC ECU between pin B52 (CAN L) and pin B53 (CAN H) must be equal to 120 ohm. 2) Resistance measured with key off on wiring between pin B52 and pin B53 must be equal to 120 ohm. 3) Impedance measured between 30–pin connector pin 21 (CAN H) and pin 22 (CAN L) must be equal to 60 ohm +/–3% (measured with key off and ECUs connected).	
COMMUNICATION LINES – VM2EDC2: Vehicle Management to EDC #2	40	05	SUPPLY OVER THE NORMAL RANGE	CAN message appears on Cluster.CAN messages cannot be viewed on Cluster. Possible communication problem with IMMOBILIZER for cranking. Possible ECAS suspension levelling operation problem via remote control in cab. Speedometer may stay off.	Possible CAN line problem: CAN line short–circuit to earth or CAN H and CAN L lines reciprocally short–circuiting. Check that all vehicle ECUs are connected.	Check CAN VDB line: 1) Resistance measured with key off directly on EDC ECU between pin B52 (CAN L) and pin B53 (CAN H) must be equal to 120 ohm. 2) Resistance measured with key off on wiring between pin B52 and pin B53 must be equal to 120 ohm. 3) Impedance measured between 30–pin connector pin 21 (CAN H) and pin 22 (CAN L) must be equal to 60 ohm +/–3% (measured with key off and ECUs connected).	

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Component failure	DTC	FMI	Error type	Visible anomaly	Possible cause	Recommended repairs	Notes
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COMMUNICATION LINES – VM2EDC2: Vehicle Management to EDC #2	40	06	SUPPLY BELOW THE RANGE	CAN message appears on Cluster.CAN messages cannot be viewed on Cluster. Possible communication problem with IMMOBILIZER for cranking. Possible ECAS suspension levelling operation problem via remote control in cab. Speedometer may stay off.	Possible CAN line problem: CAN line short–circuit to earth or CAN H and CAN L lines reciprocally short–circuiting. Check that all vehicle ECUs are connected.	Check CAN VDB line: 1) Resistance measured with key off directly on EDC ECU between pin B52 (CAN L) and pin B53 (CAN H) must be equal to 120 ohm. 2) Resistance measured with key off on wiring between pin B52 and pin B53 must be equal to 120 ohm. 3) Impedance measured between 30–pin connector pin 21 (CAN H) and pin 22 (CAN L) must be equal to 60 ohm +/–3% (measured with key off and ECUs connected).	

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COMMUNICATION LINES – WSI: Wheel Speed Information	40	06	SUPPLY BELOW THE RANGE	CAN message appears on Cluster.CAN messages cannot be viewed on Cluster. Possible communication problem with IMMOBILIZER for cranking. Possible ECAS suspension levelling operation problem via remote control in cab. Speedometer may stay off.	Possible CAN line problem: CAN line short–circuit to earth or CAN H and CAN L lines reciprocally short–circuiting. Check that all vehicle ECUs are connected.	Check CAN VDB line: 1) Resistance measured with key off directly on EDC ECU between pin B52 (CAN L) and pin B53 (CAN H) must be equal to 120 ohm. 2) Resistance measured with key off on wiring between pin B52 and pin B53 must be equal to 120 ohm. 3) Impedance measured between 30–pin connector pin 21 (CAN H) and pin 22 (CAN L) must be equal to 60 ohm +/–3% (measured with key off and ECUs connected).	
COMMUNICATION LINES – VM2EDC2: Vehicle Management to EDC #2	40	07	VALUE OVER THE NORMAL LIMIT	CAN message appears on Cluster.CAN messages cannot be viewed on Cluster. Possible communication problem with IMMOBILIZER for cranking. Possible ECAS suspension levelling operation problem via remote control in cab. Speedometer may stay off.	Possible CAN line problem: CAN line short–circuit to earth or CAN H and CAN L lines reciprocally short–circuiting. Check that all vehicle ECUs are connected.	Check CAN VDB line: 1) Resistance measured with key off directly on EDC ECU between pin B52 (CAN L) and pin B53 (CAN H) must be equal to 120 ohm. 2) Resistance measured with key off on wiring between pin B52 and pin B53 must be equal to 120 ohm. 3) Impedance measured between 30–pin connector pin 21 (CAN H) and pin 22 (CAN L) must be equal to 60 ohm +/–3% (measured with key off and ECUs connected).	

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COMMUNICATION LINES – VM2EDC2: Vehicle Management to EDC #2	40	08	VALUE BELOW THE LIMIT	CAN message appears on Cluster.CAN messages cannot be viewed on Cluster. Possible communication problem with IMMOBILIZER for cranking. Possible ECAS suspension levelling operation problem via remote control in cab. Speedometer may stay off.	Possible CAN line problem: CAN line short–circuit to earth or CAN H and CAN L lines reciprocally short–circuiting. Check that all vehicle ECUs are connected.	Check CAN VDB line: 1) Resistance measured with key off directly on EDC ECU between pin B52 (CAN L) and pin B53 (CAN H) must be equal to 120 ohm. 2) Resistance measured with key off on wiring between pin B52 and pin B53 must be equal to 120 ohm. 3) Impedance measured between 30–pin connector pin 21 (CAN H) and pin 22 (CAN L) must be equal to 60 ohm +/–3% (measured with key off and ECUs connected).	

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Component failure	DTC	FMI	Error type	Visible anomaly	Possible cause	Recommended repairs	Notes
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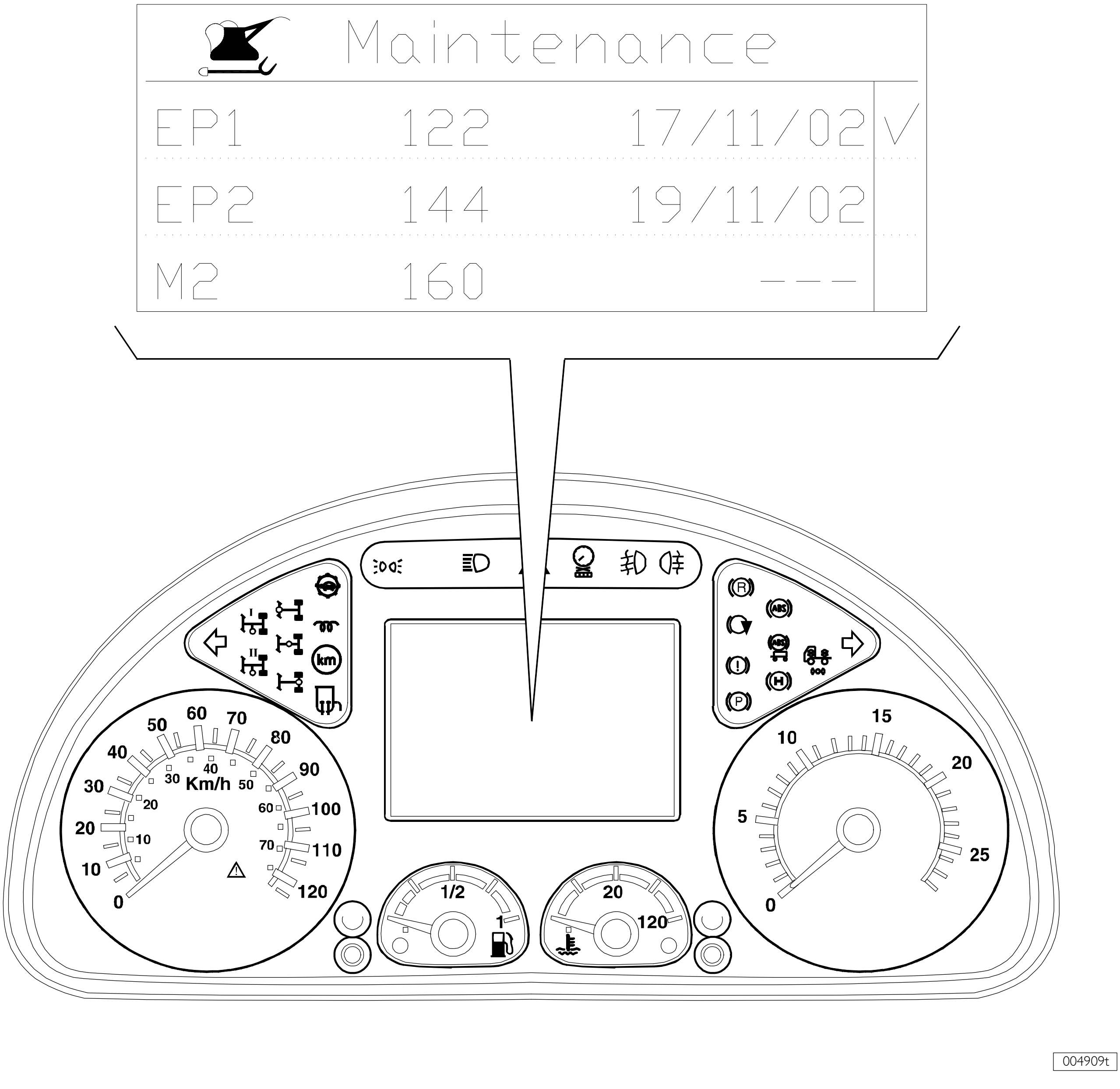
MAINTENANCE SCHEDULE

One important functional character is the ELECTRONIC MAINTENANCE SCHEDULE which can, with the latest Modus and IT2000 release, be managed and programmed very easily.
The workshop service slip will be quickly registered directly on the vehicle, and the recorded maintenance history will be able to be displayed.
The Dealerhsip Workshop shall, prior to delivering the vehicle, program the maintenance schedule (from among those established by Iveco) into the on–board panel control unit by means of the diagnosis station.
According to the vehicle's mission, a km– or hour–based maintenance schedule can be chosen.
The single workshop can subsequently modify the maintenance schedule according to the vehicle requirements.
After the vehicle has been delivered, the driver will be able to refer to their own maintenance schedule through the owner handbook and also by means of their own Cluster, where a screen dedicated to this function will be available.
The customer can neither cancel or modify the program; they will have to contact an authorized Iveco service center.

Figure 224



Shortly before the vehicle has reached the distance in kilometres at which the service slip is to be made, an alarm warning light will illuminate on the Cluster, to inform the driver that the vehicle has to be serviced at an authorized workshop.

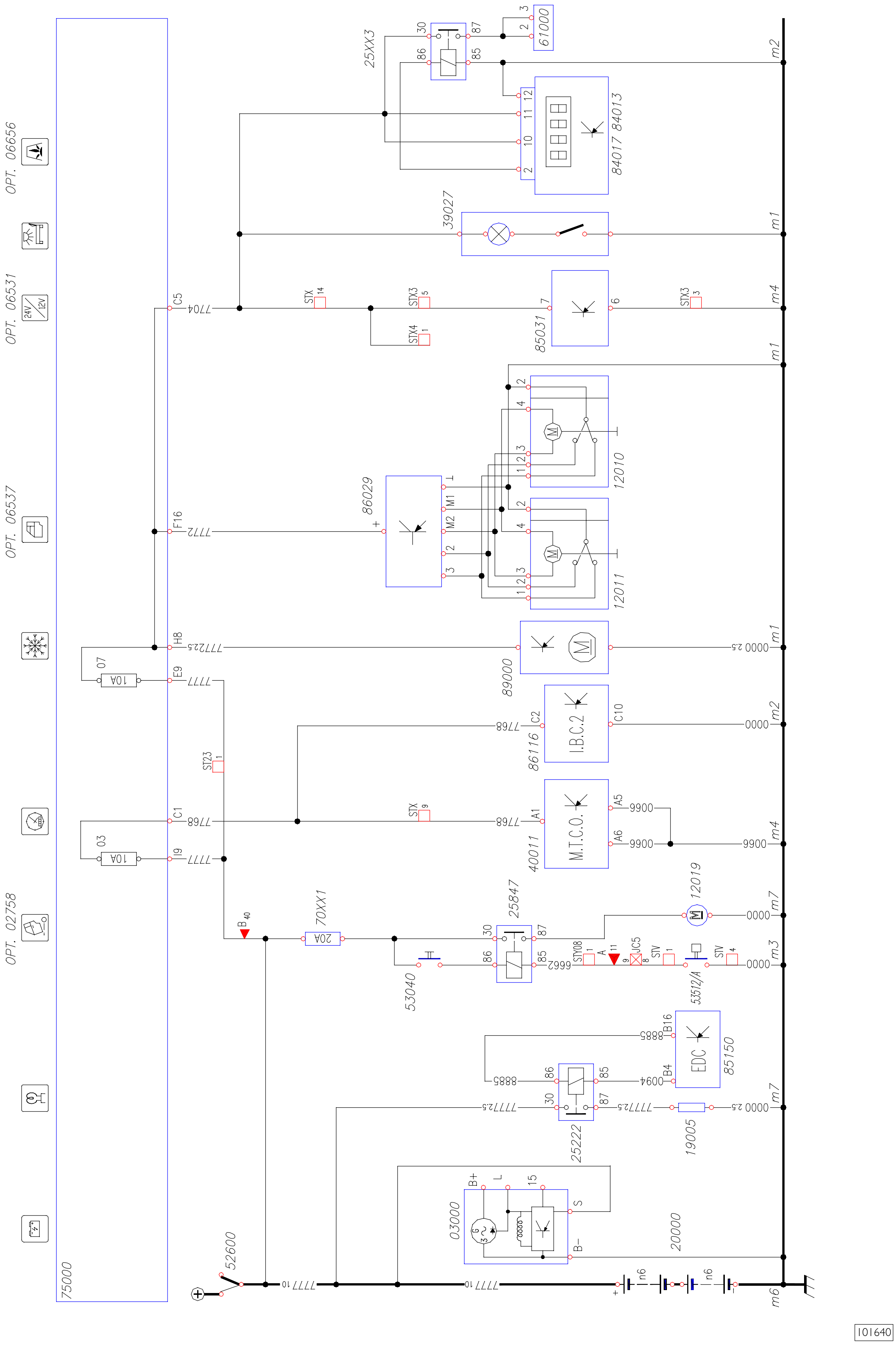
Figure 225

Alarm warning light on Cluster

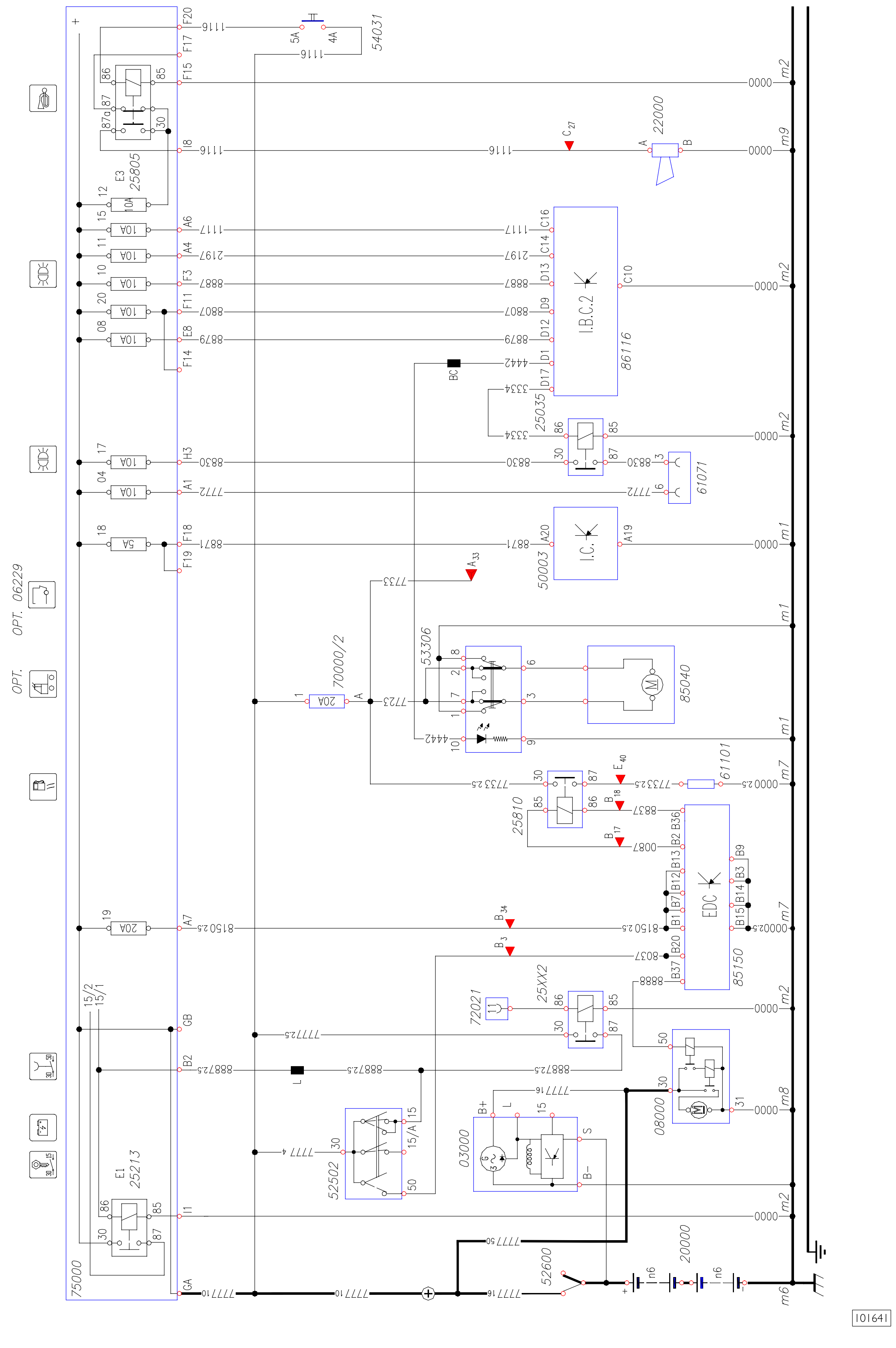
If the vehicle is serviced at a workshop where a diagnosis instrument is available, the instrument will, after maintenance has been completed, have to be connected: it will store both the date and the type of slip into the Cluster memory, and then will cause the alarm warning light to go out.
In the event that operational maintenance is not carried out at a service centre where a diagnosis instrument is available, the warning light on the dashboard cannot be turned off.
At the root of this choice is a strategy aimed at making the customer more and more loyal to the brand–name through the competence of our Dealerships, so as to induce the customer to go to an authorized workshop and have any type of maintenance work (including operational maintenance) performed on the vehicle by qualified engineers.
This system, introduced into the latest EuroCargo, obviously gives new advantages to the customer too, who will therefore be able to better plan their vehicle's maintenance schedule (and will always remember to have it done). Thus, they will always be able to rely on vehicles in perfect working order and ensuring top performance levels.
This functional character is possible provided that the vehicle is equipped with a HighLine–type Cluster. It is not available on BaseLine–type Clusters.

Circuit cards

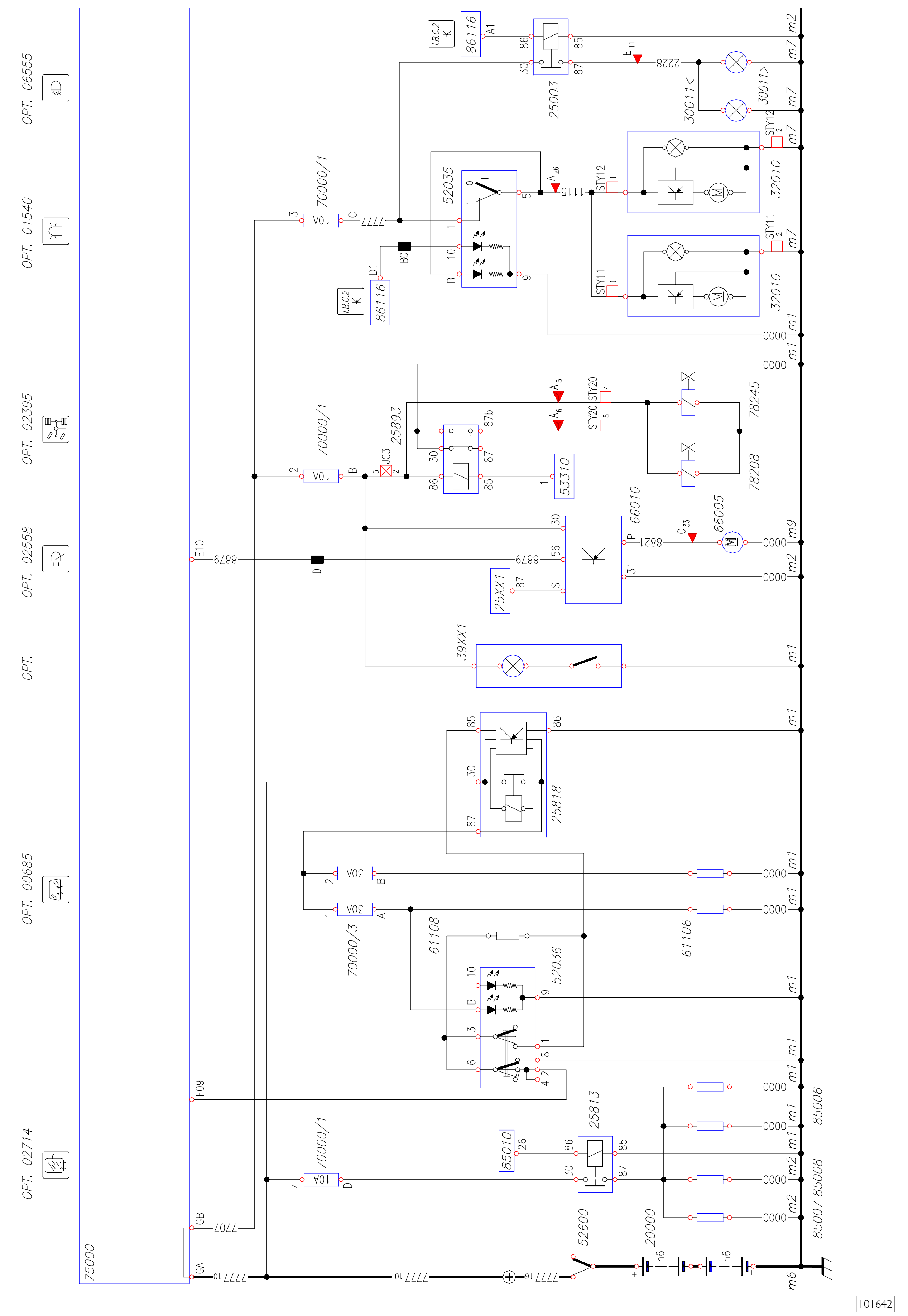
Card 1: Positive direct to the batteries



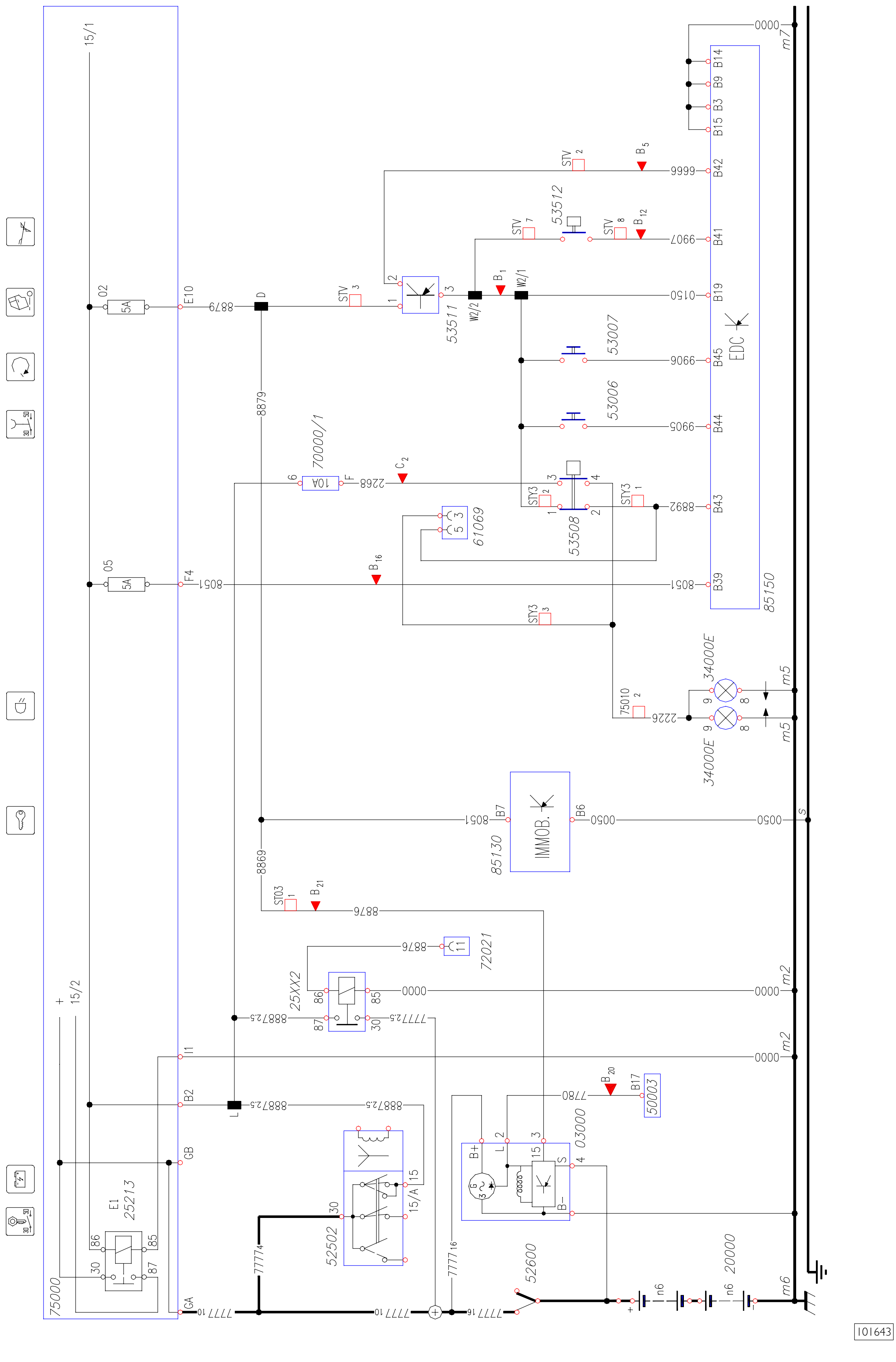
Card 2: Positive after main current switch



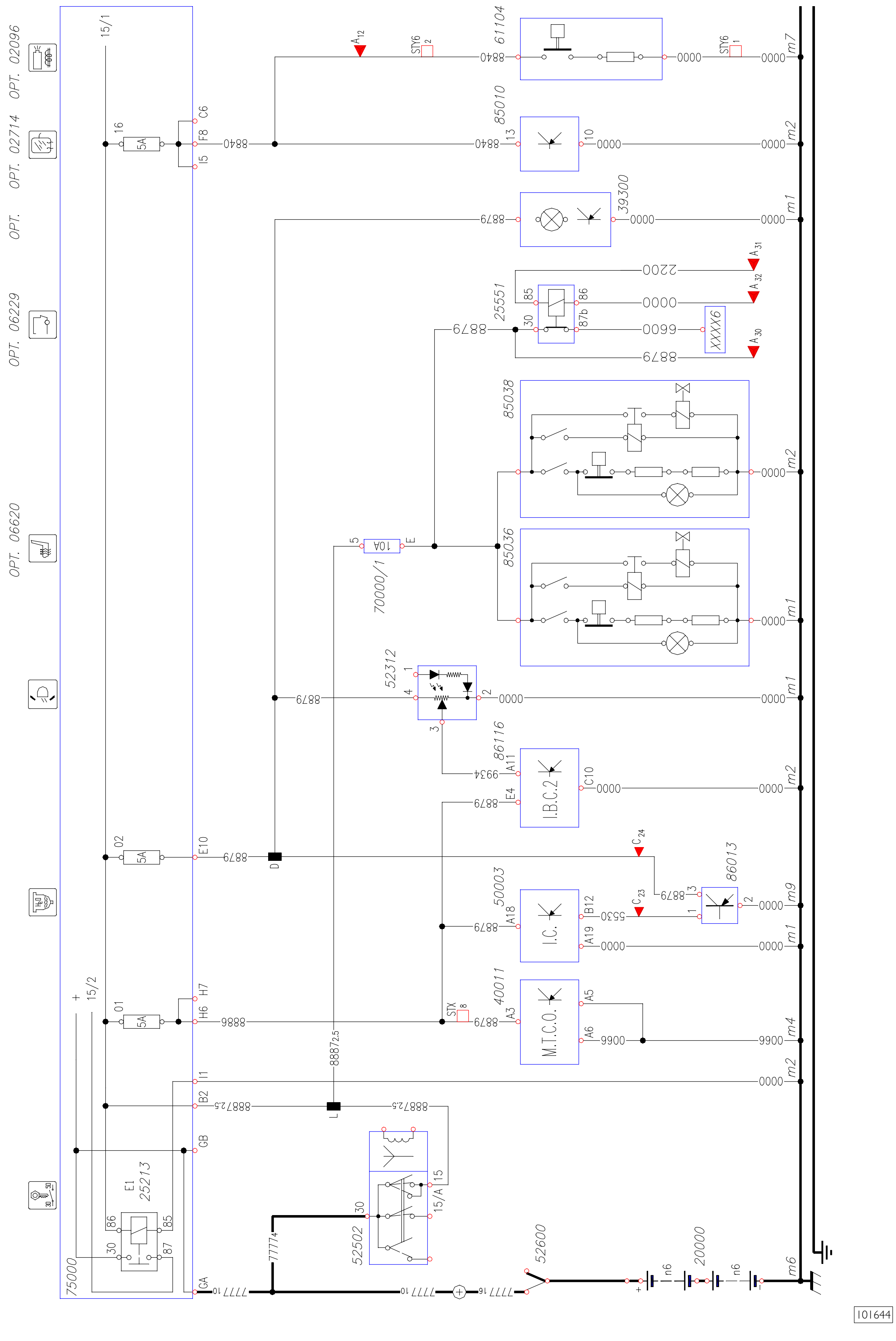
Card 3: Positive after main current switch



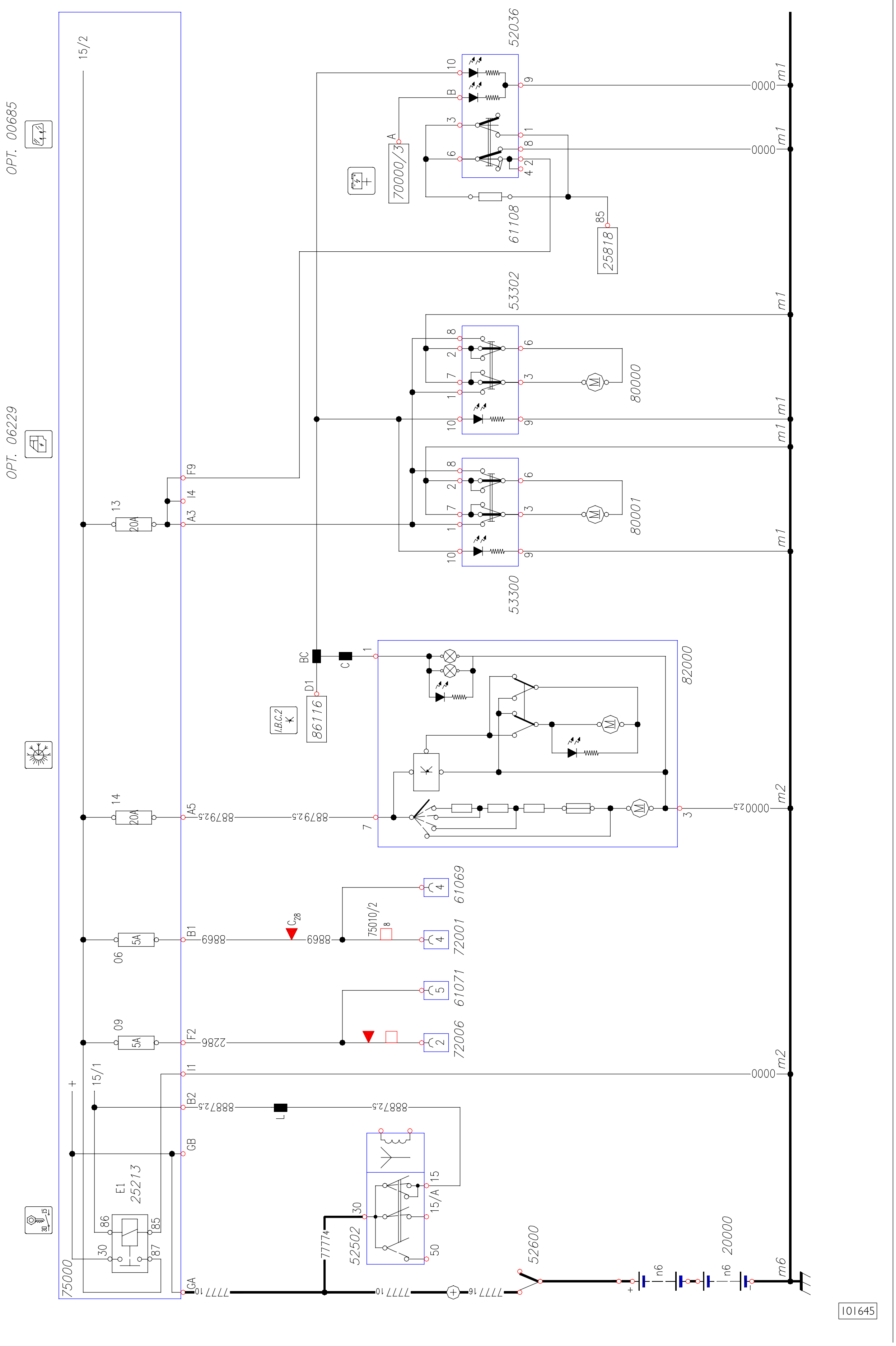
Card 4: Service power supply (+15/1)



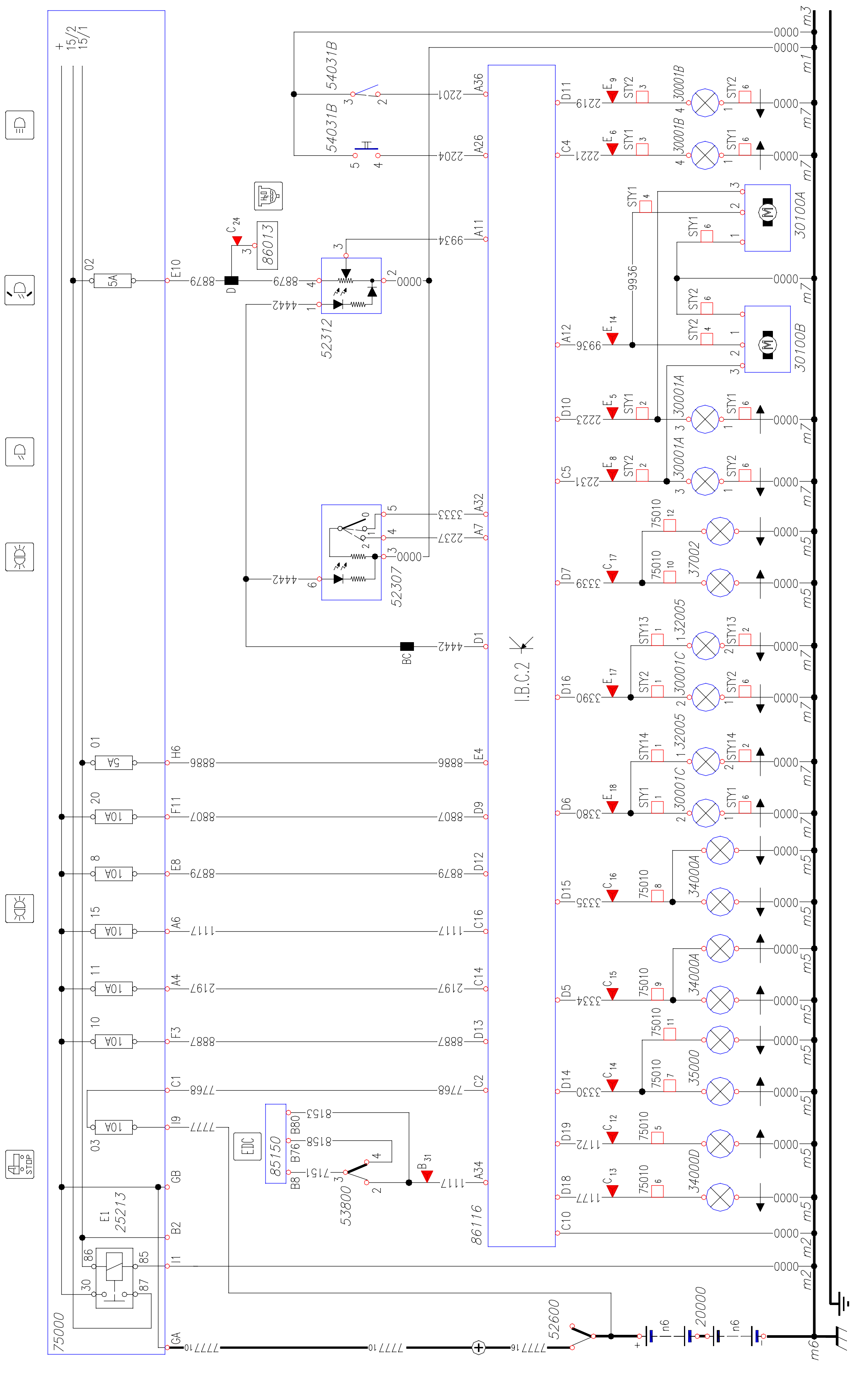
Card 5: Service power supply (+15/1)



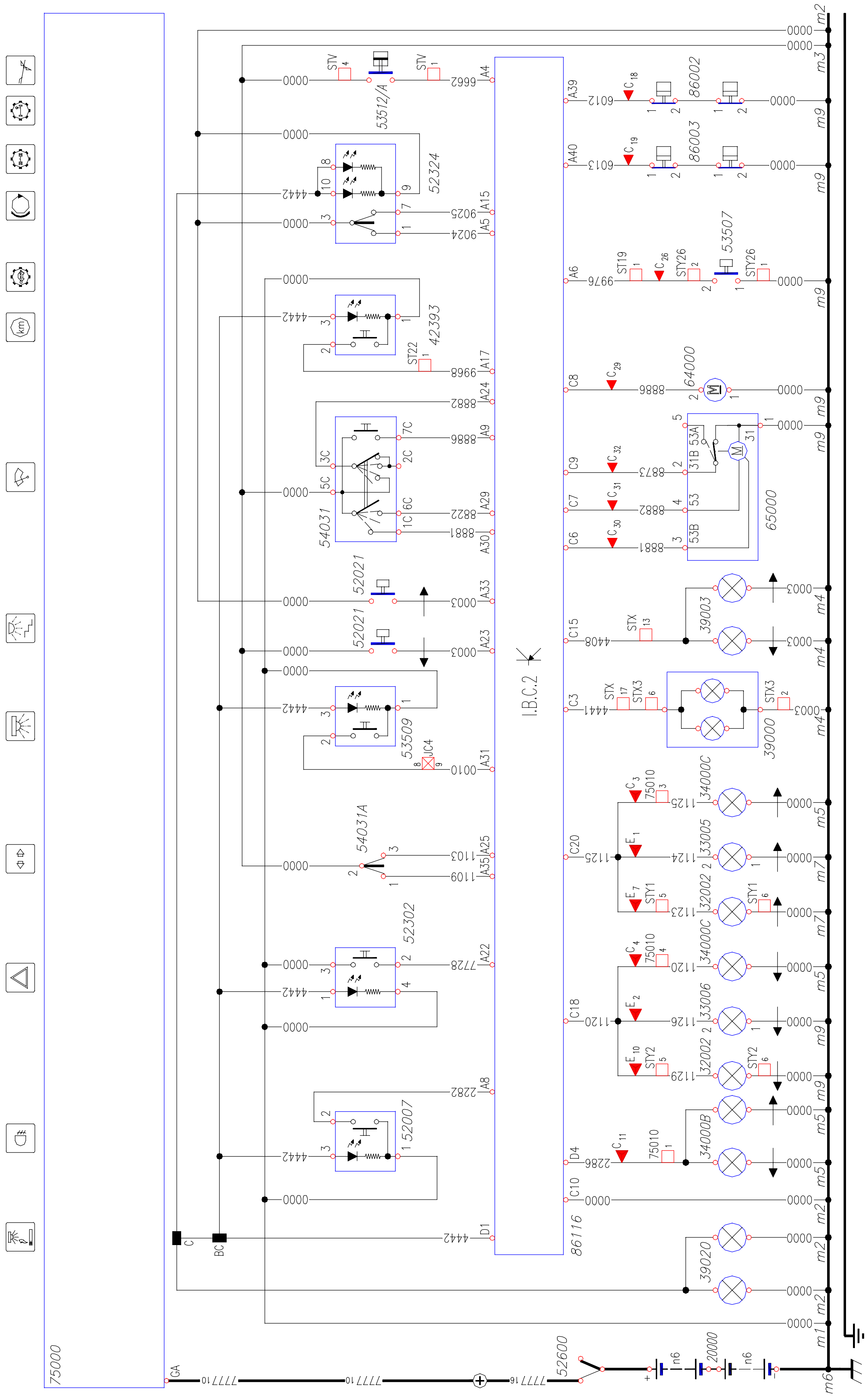
Card 6: Service power supply (+15/2)



Card 7: Body Controller



Card 8: Body Controller



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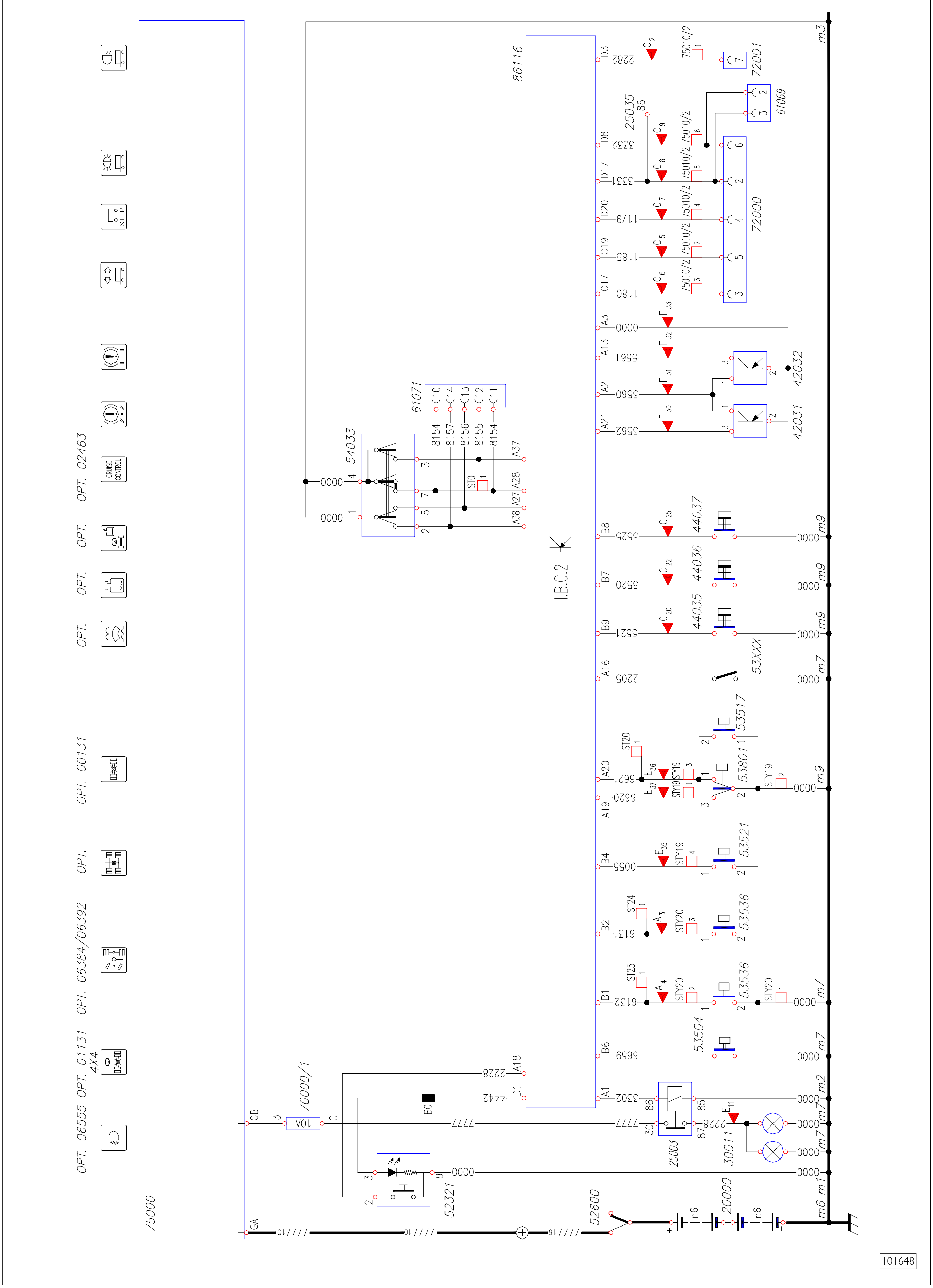
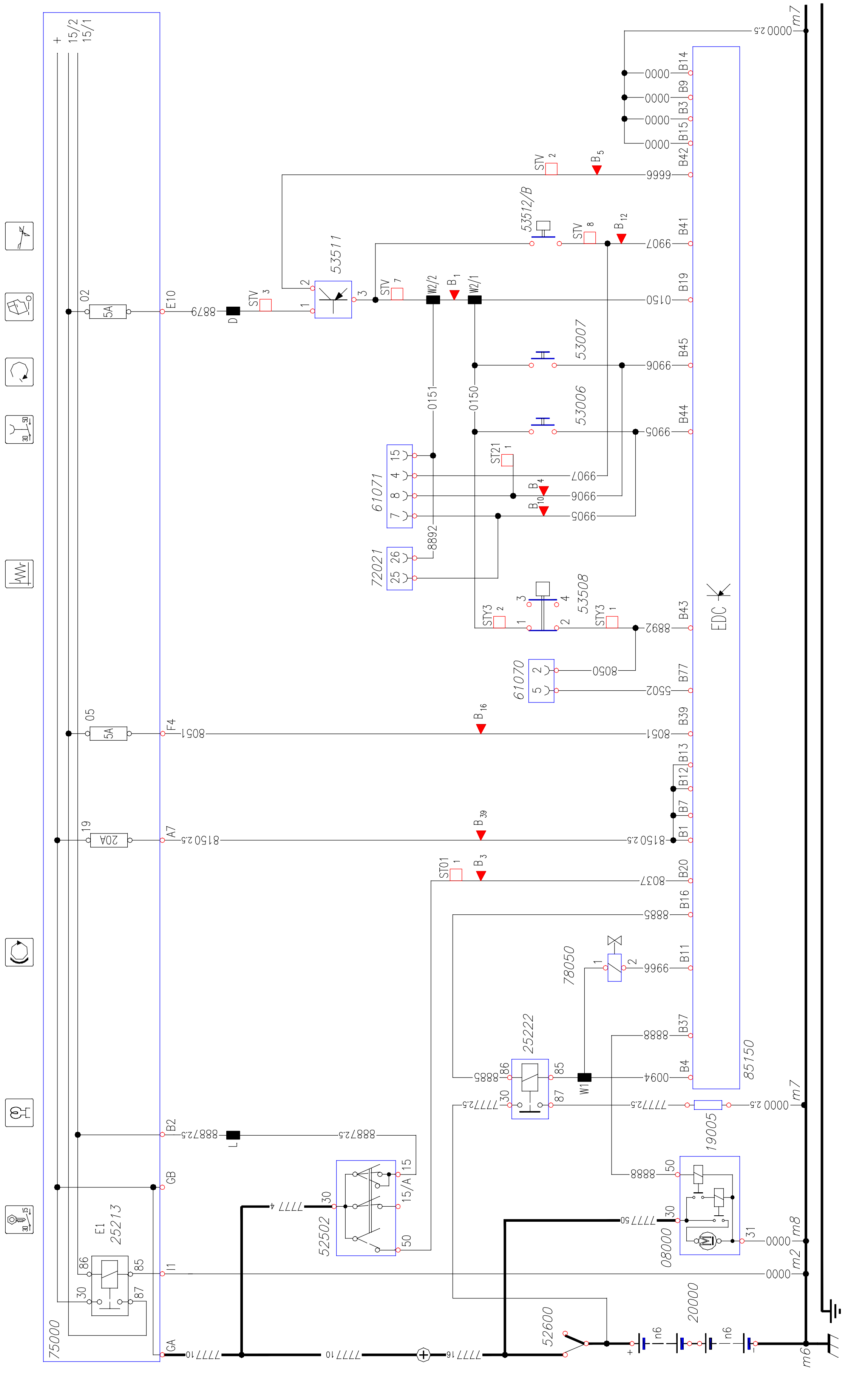
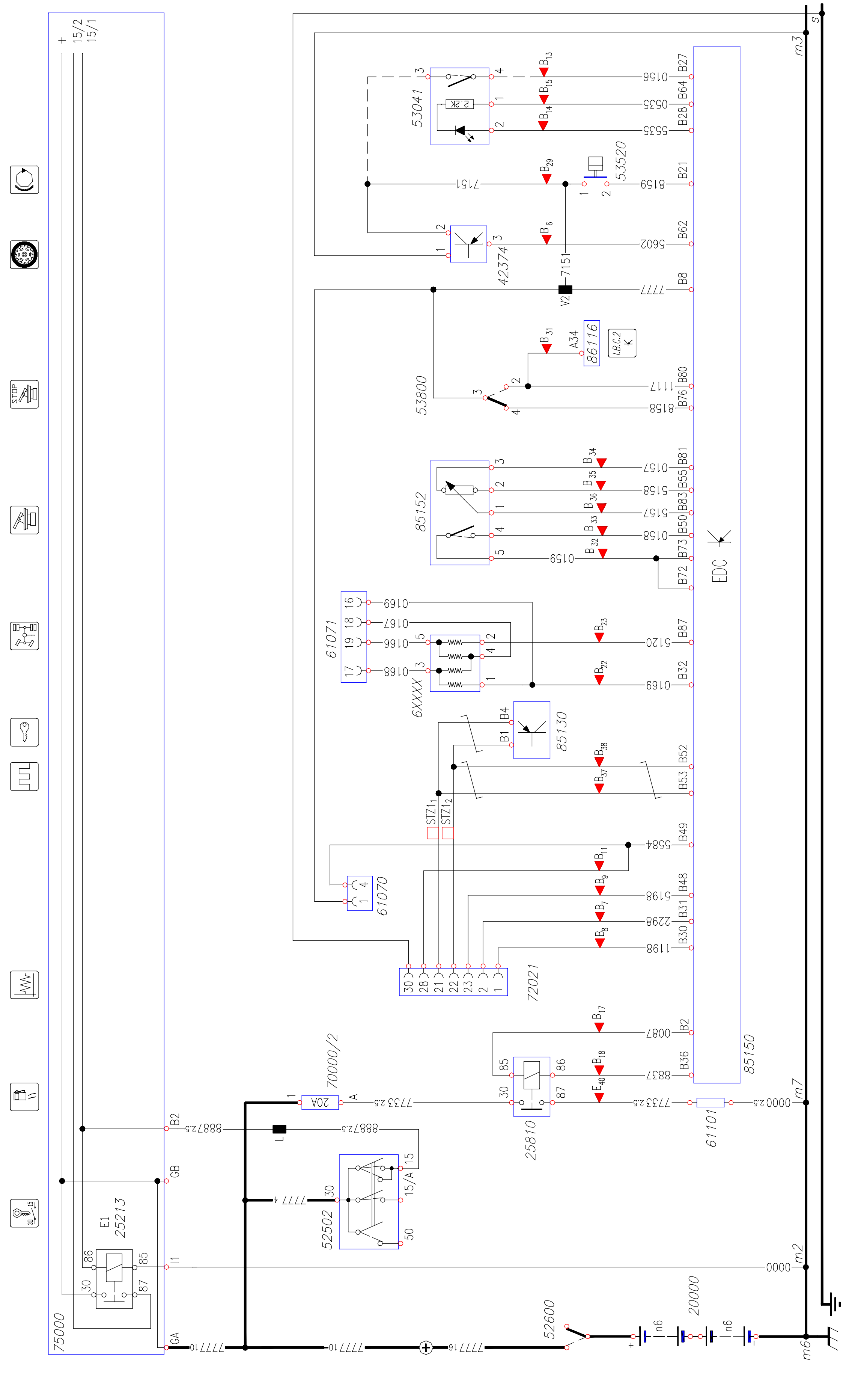
Card 9: Body Controller



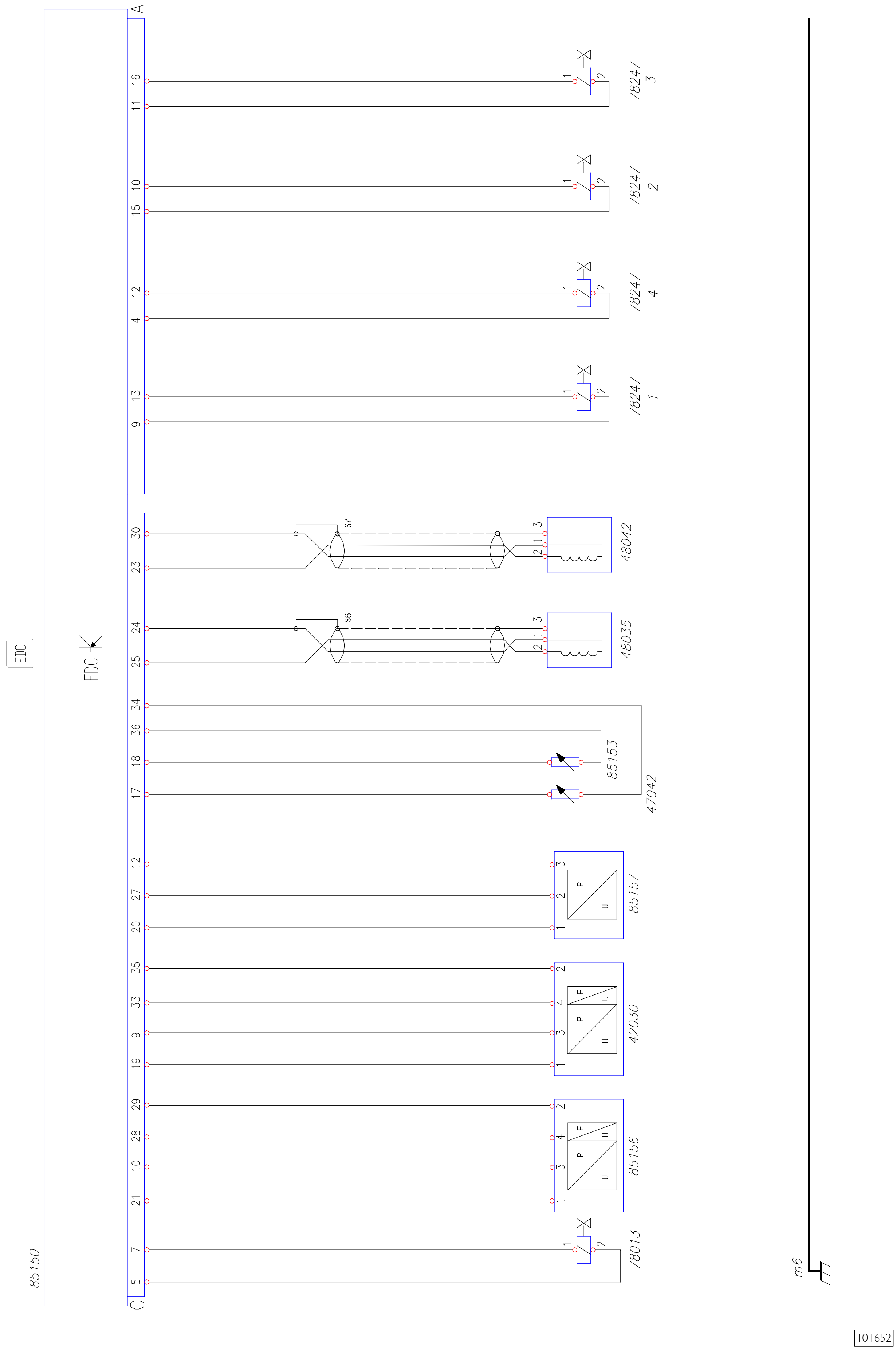
Card 10: EDC (Connector B)



Card 11: EDC (Connector B)



Card 12: EDC (Connector A/C – 4 cylinders)



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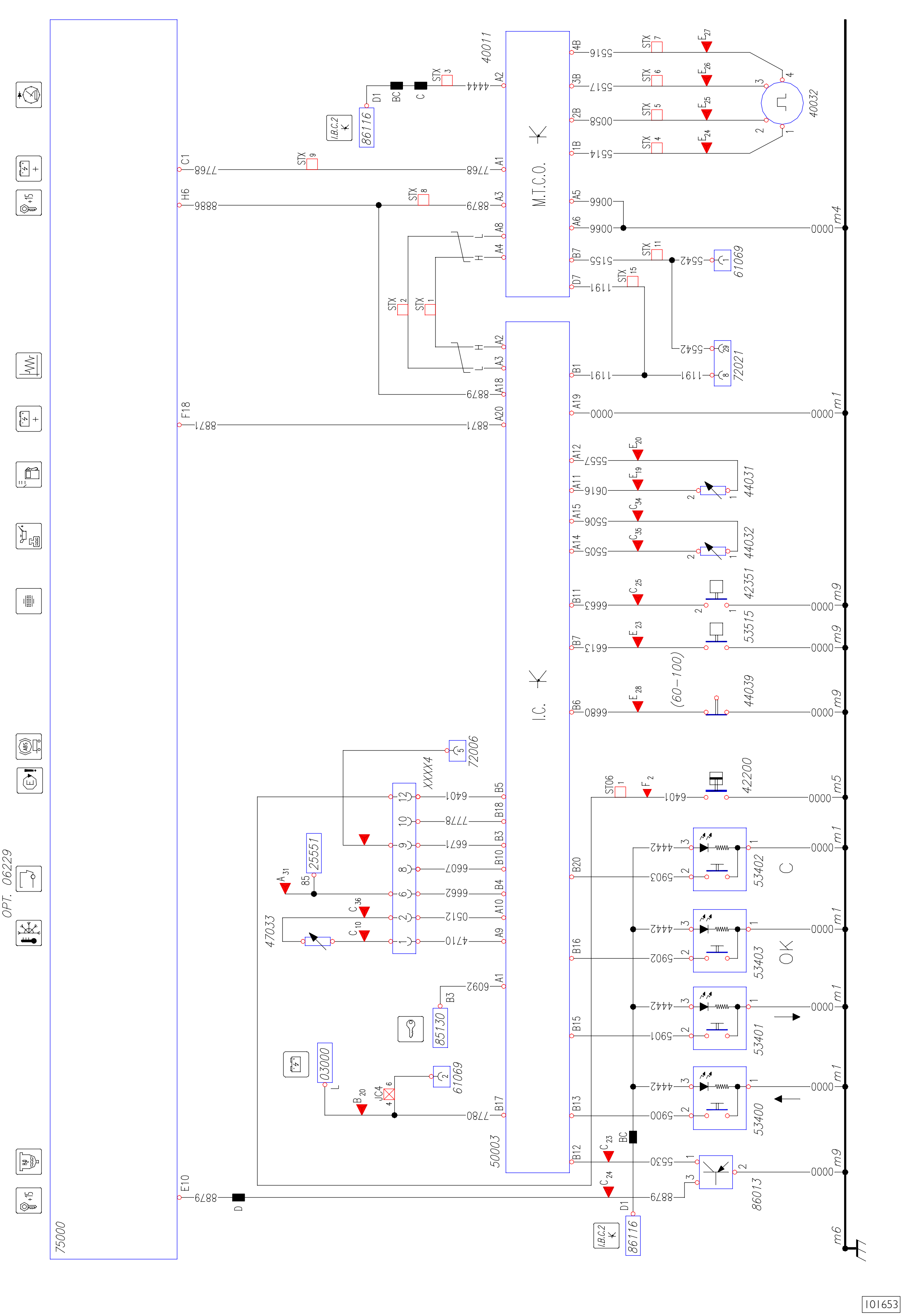
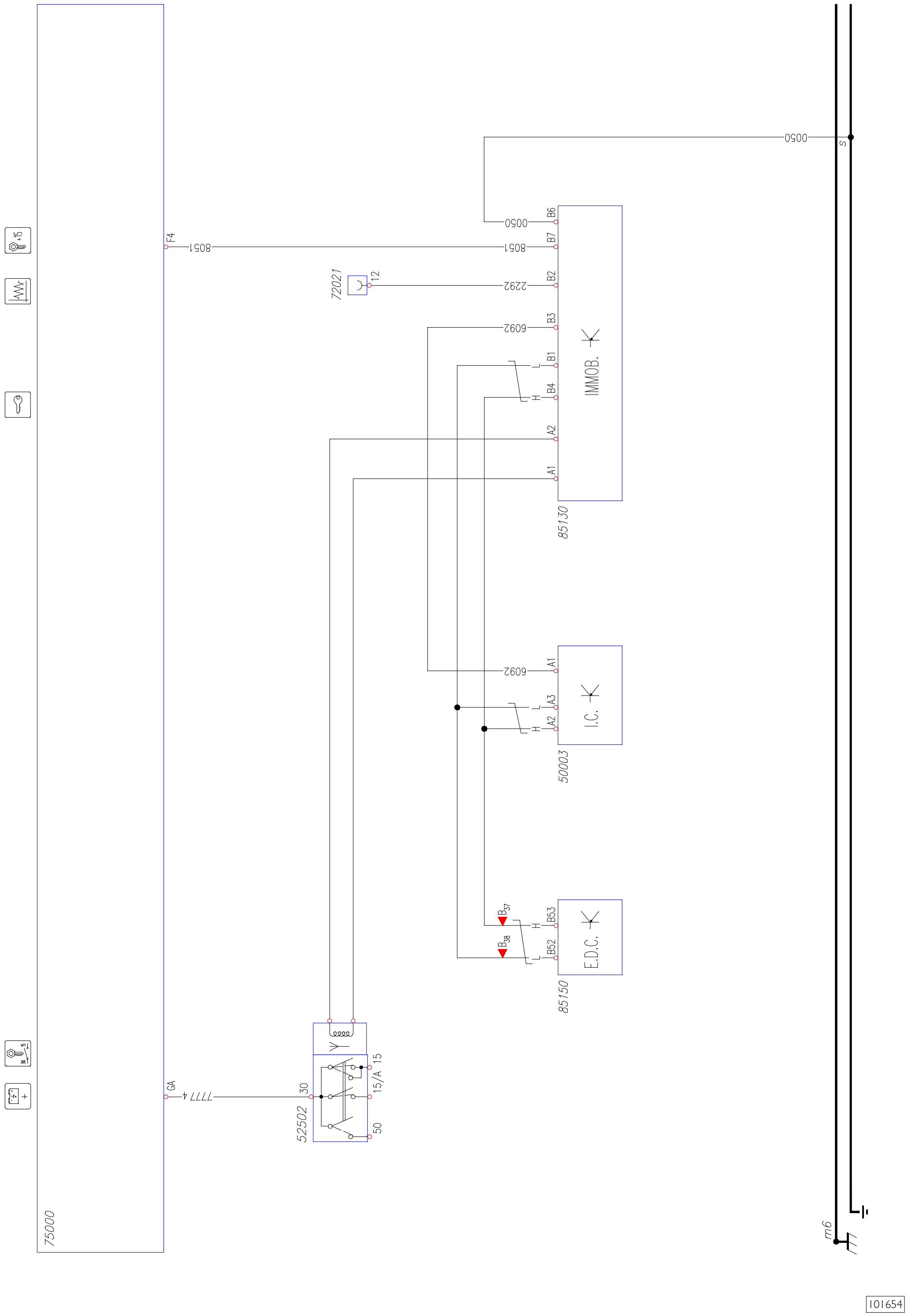
Card 13: Instrument Cluster / Tachograph



Card 14: Immobilizer



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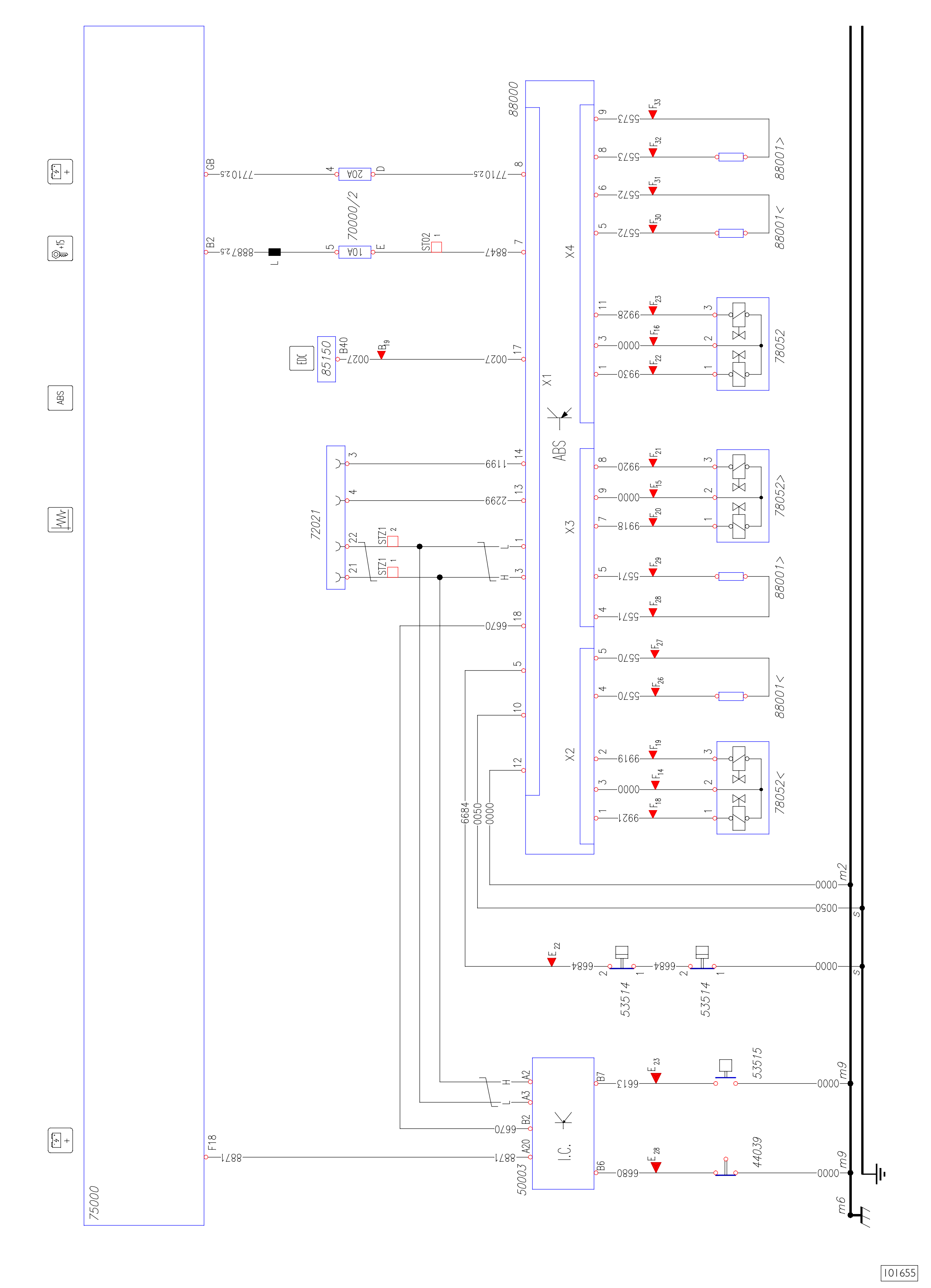
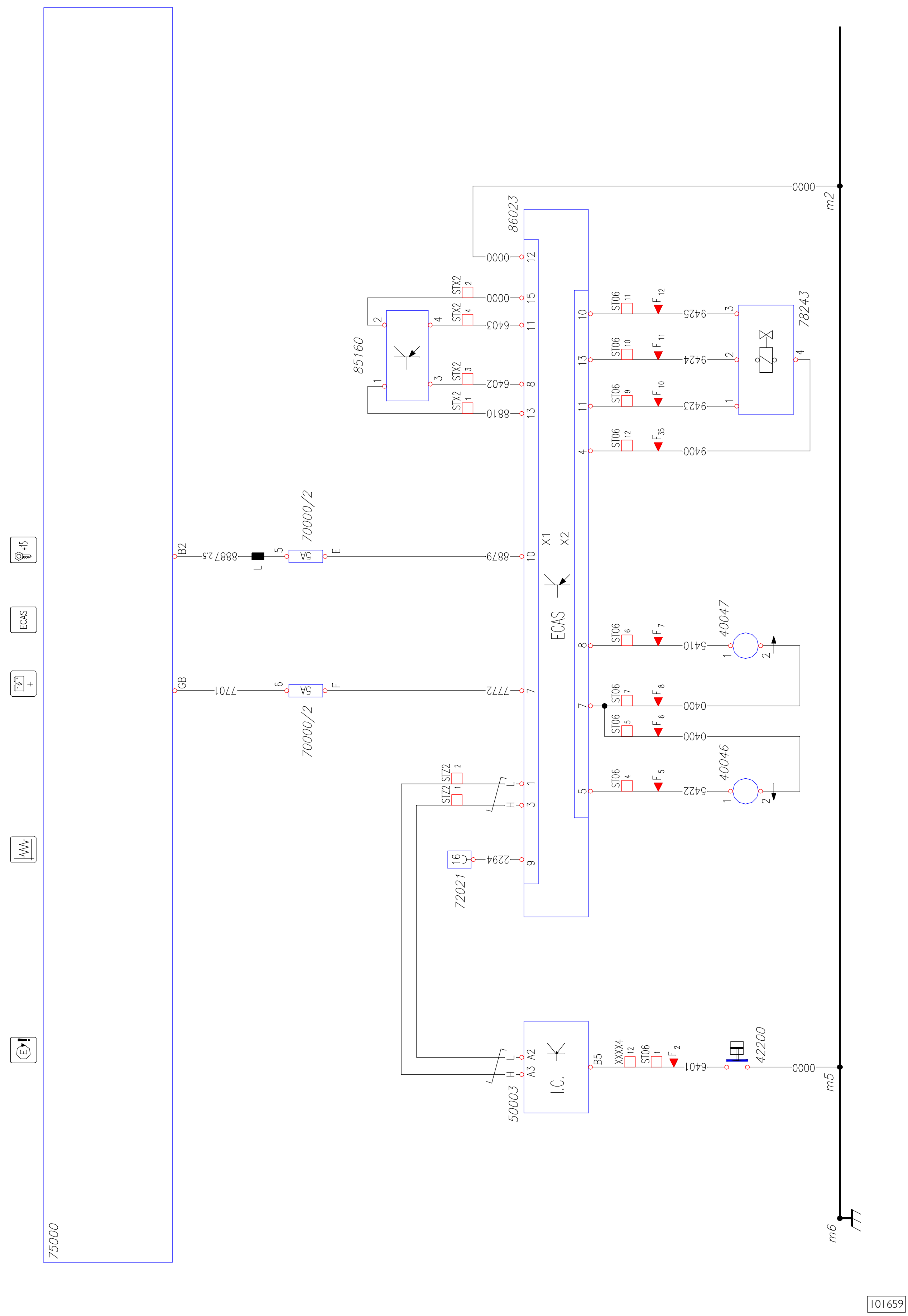
Card 15: ABS


75000
88000
X1
X2
X3
X4
ABS
70000/2
20A
10A
EDC
85150
72021
78052
78052>
78052<
88001>
88001<
53514
53515
44039
50003
I.C.
101655

Card 16: ECAS P



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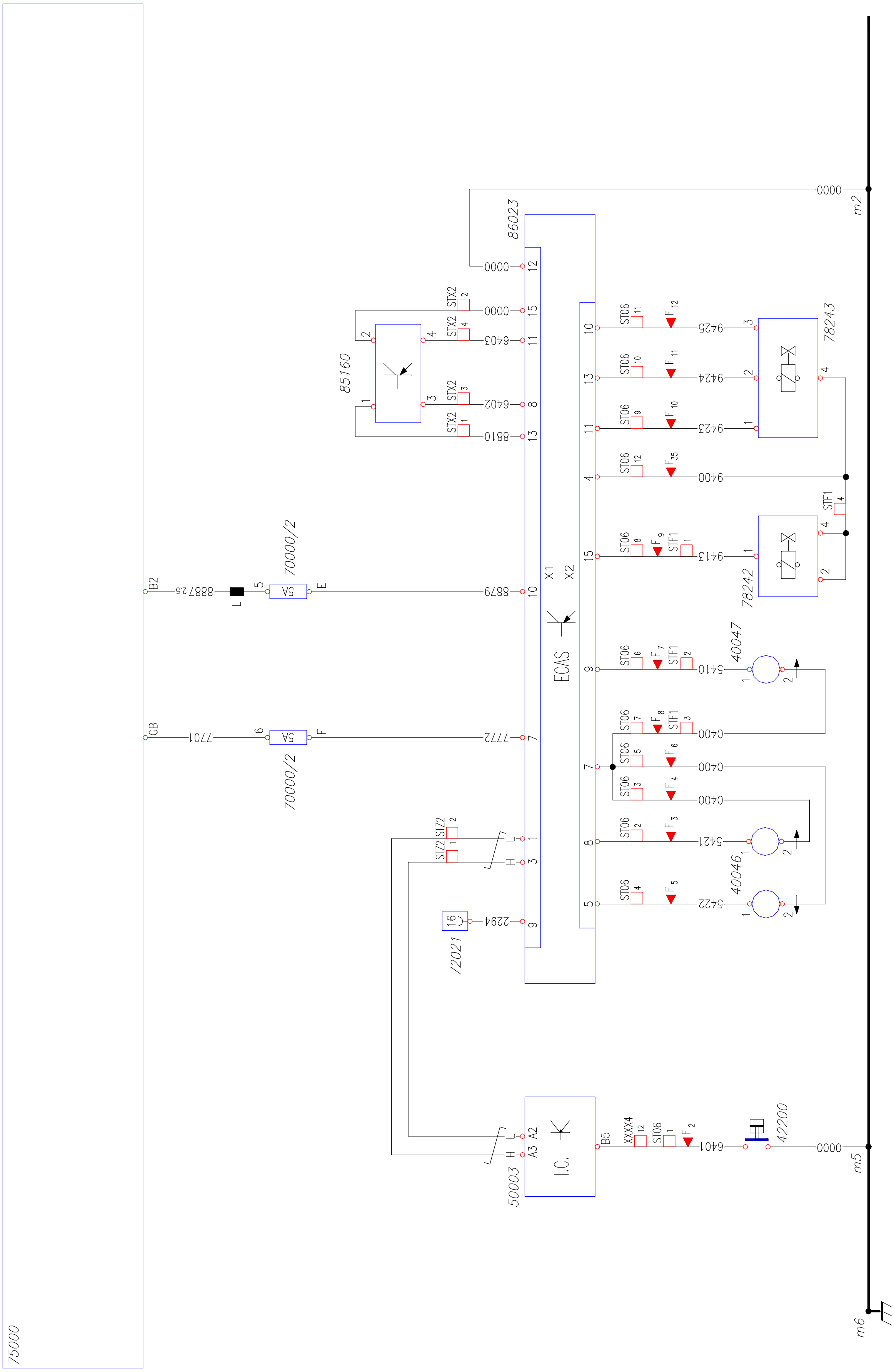
Card 17: ECAS FP



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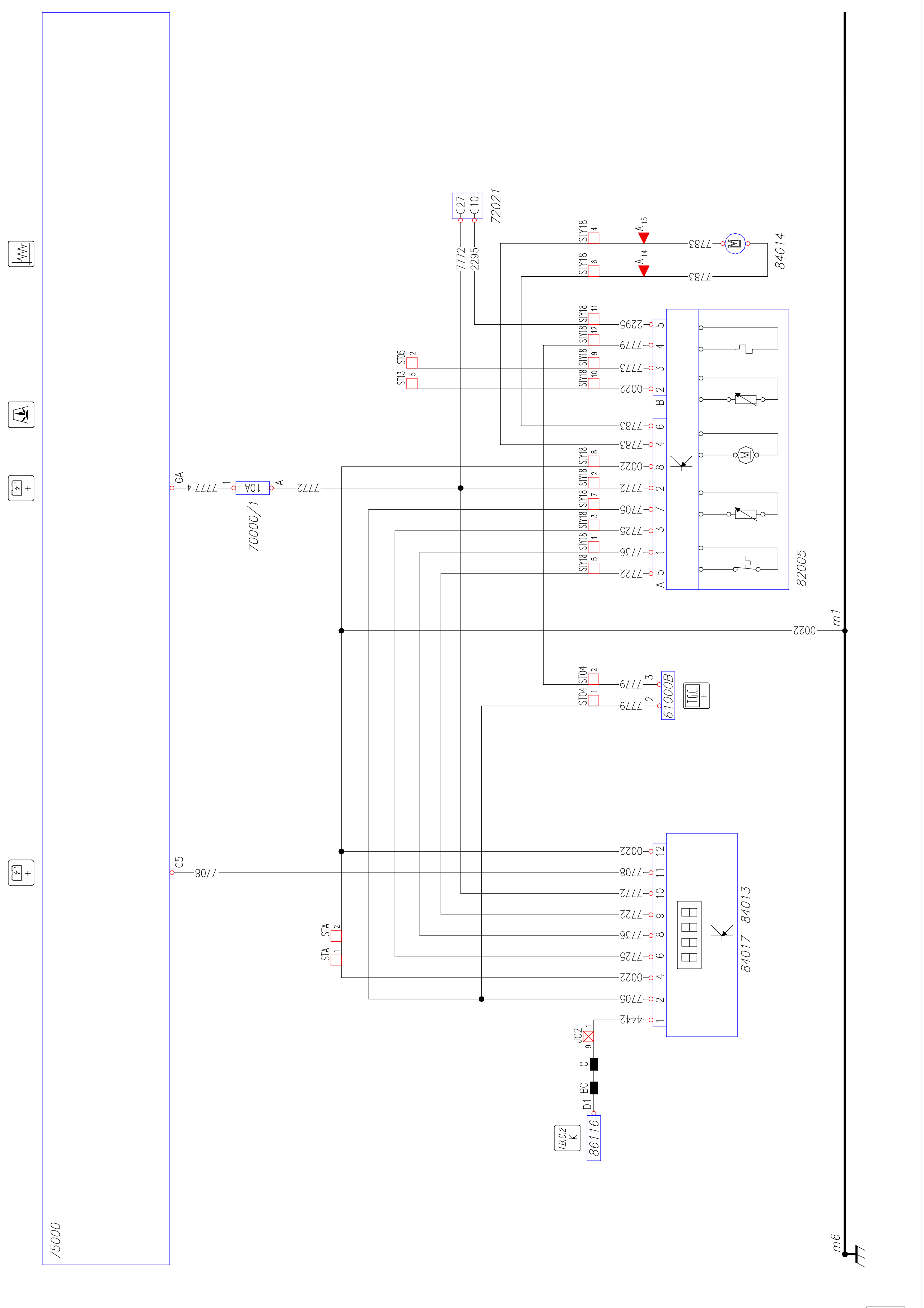
Card 18: Additional heater prearrangement AIRTOP2000



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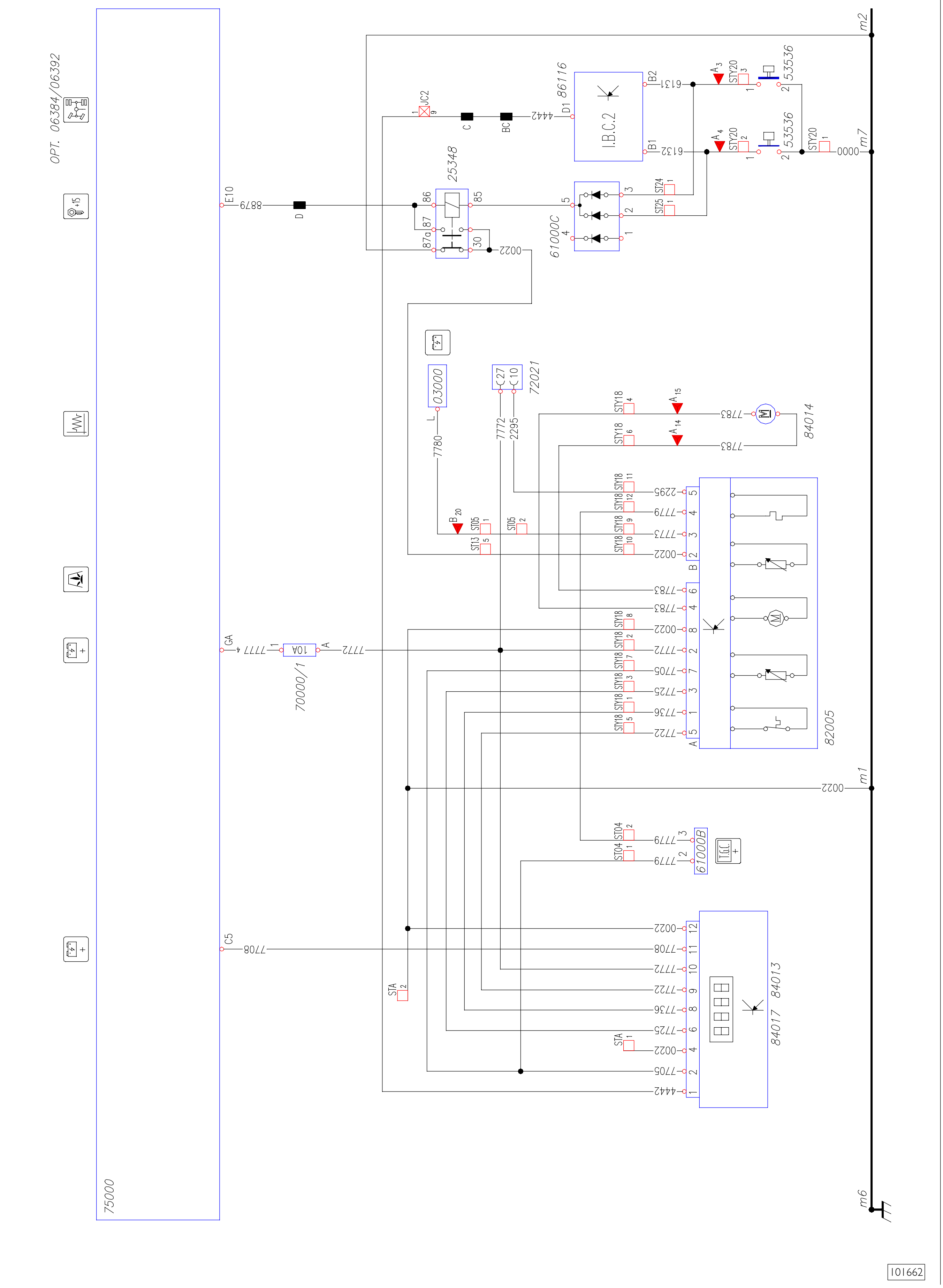
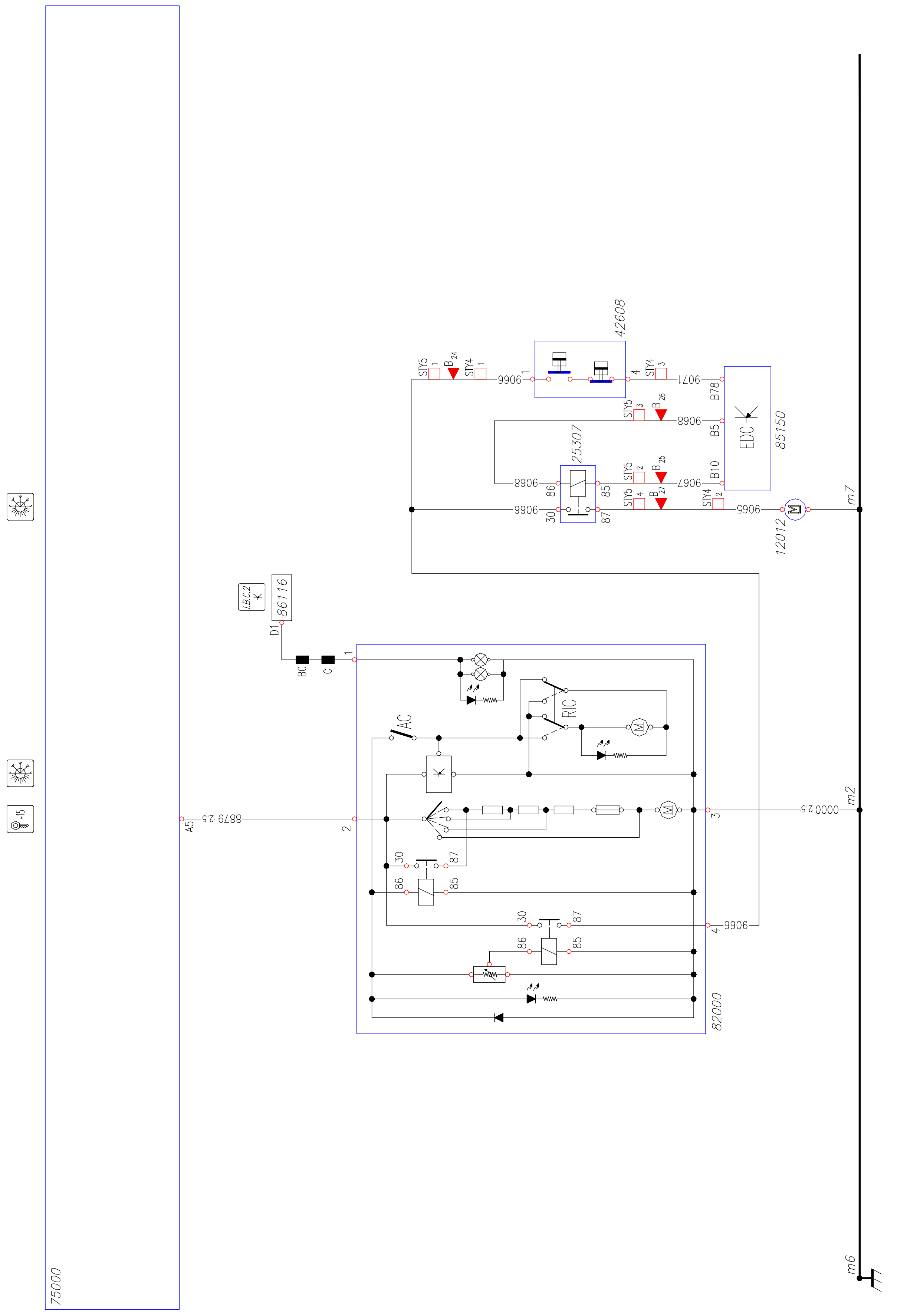
Card 19: Additional heater prearrangement AIRTOP2000 with ADR



Card 20: Manual–control air–conditioning



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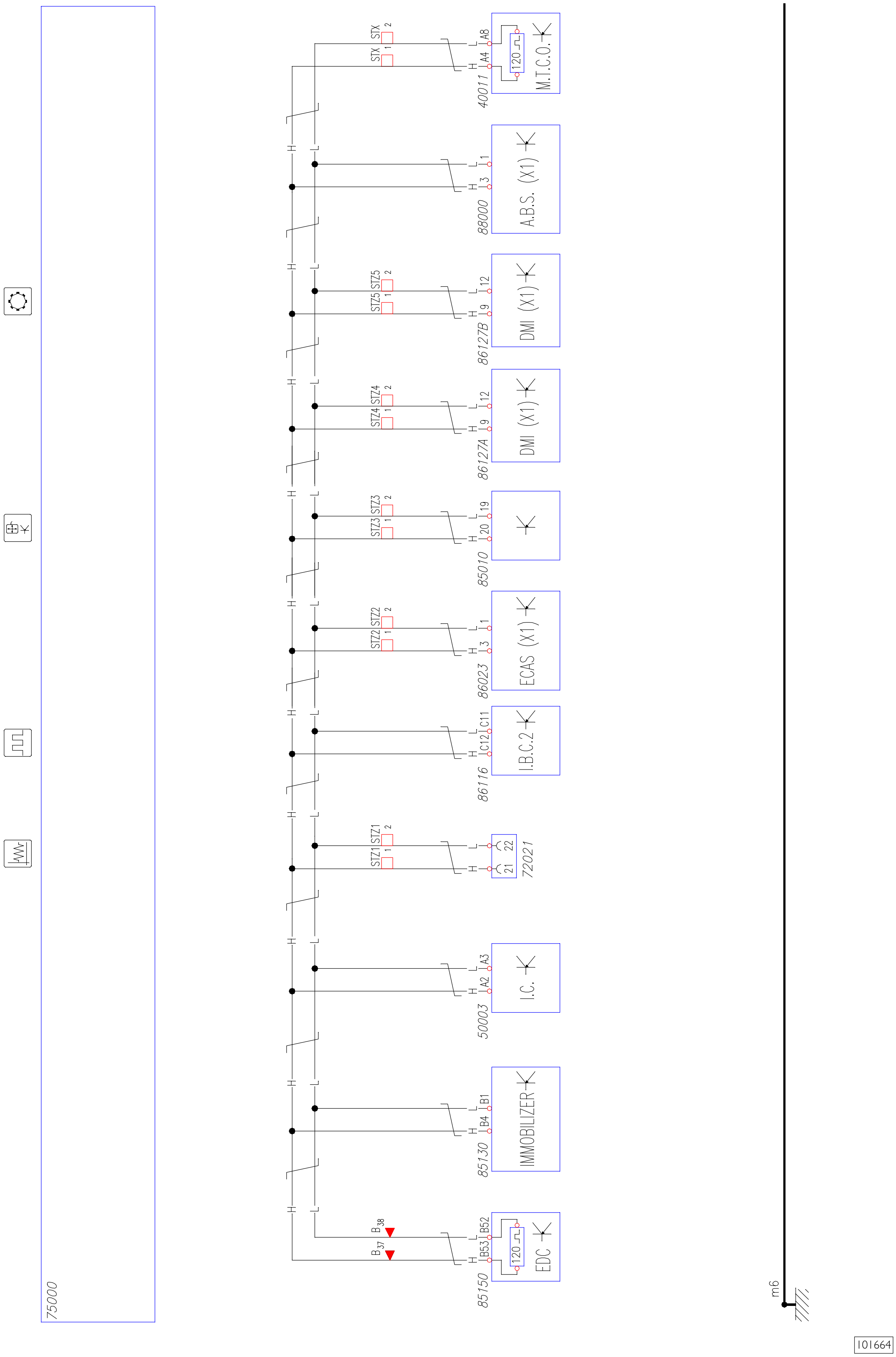
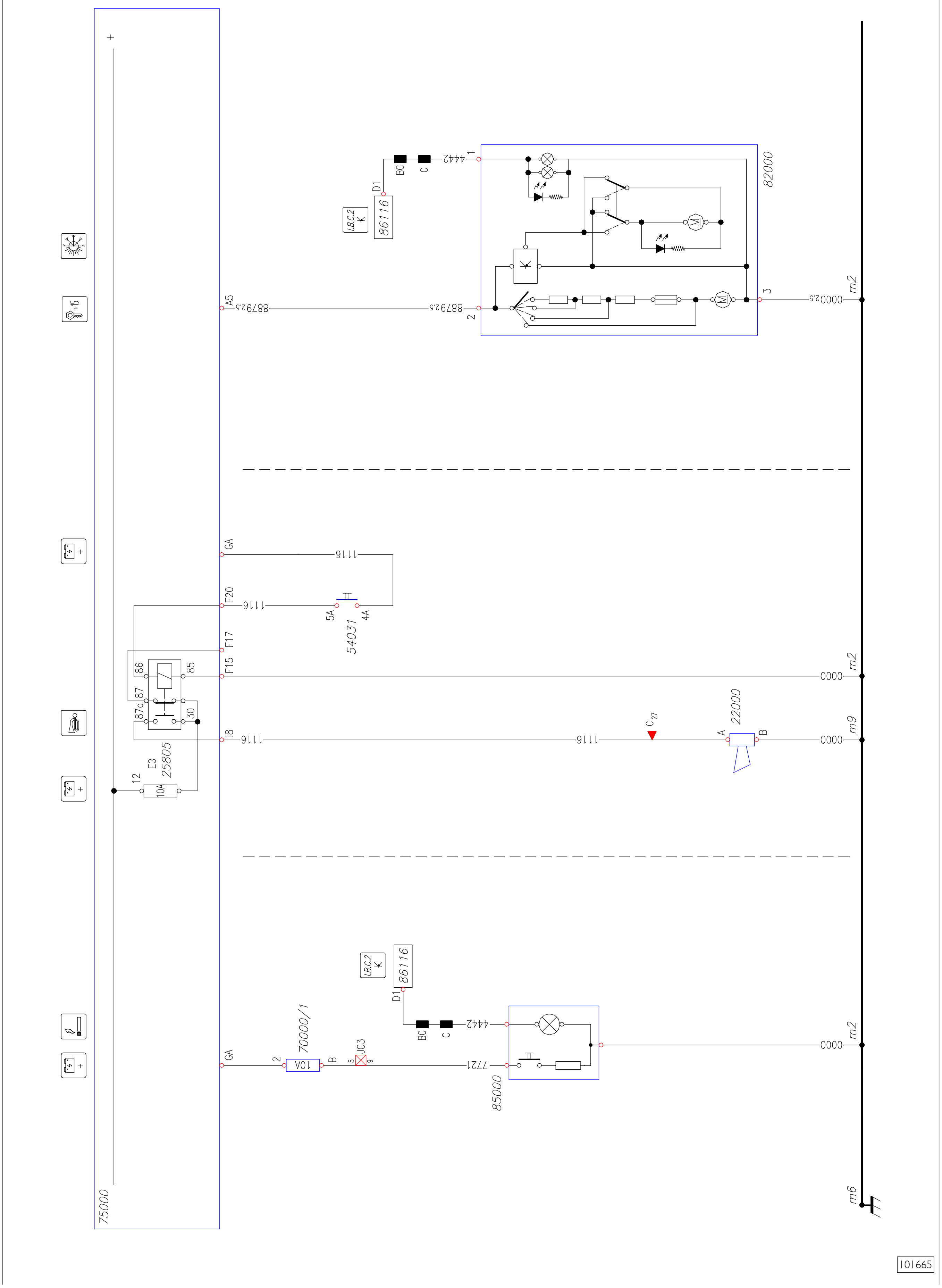
Card 21: CAN line



Card 22: Cigar lighter/Horns/Electric heater



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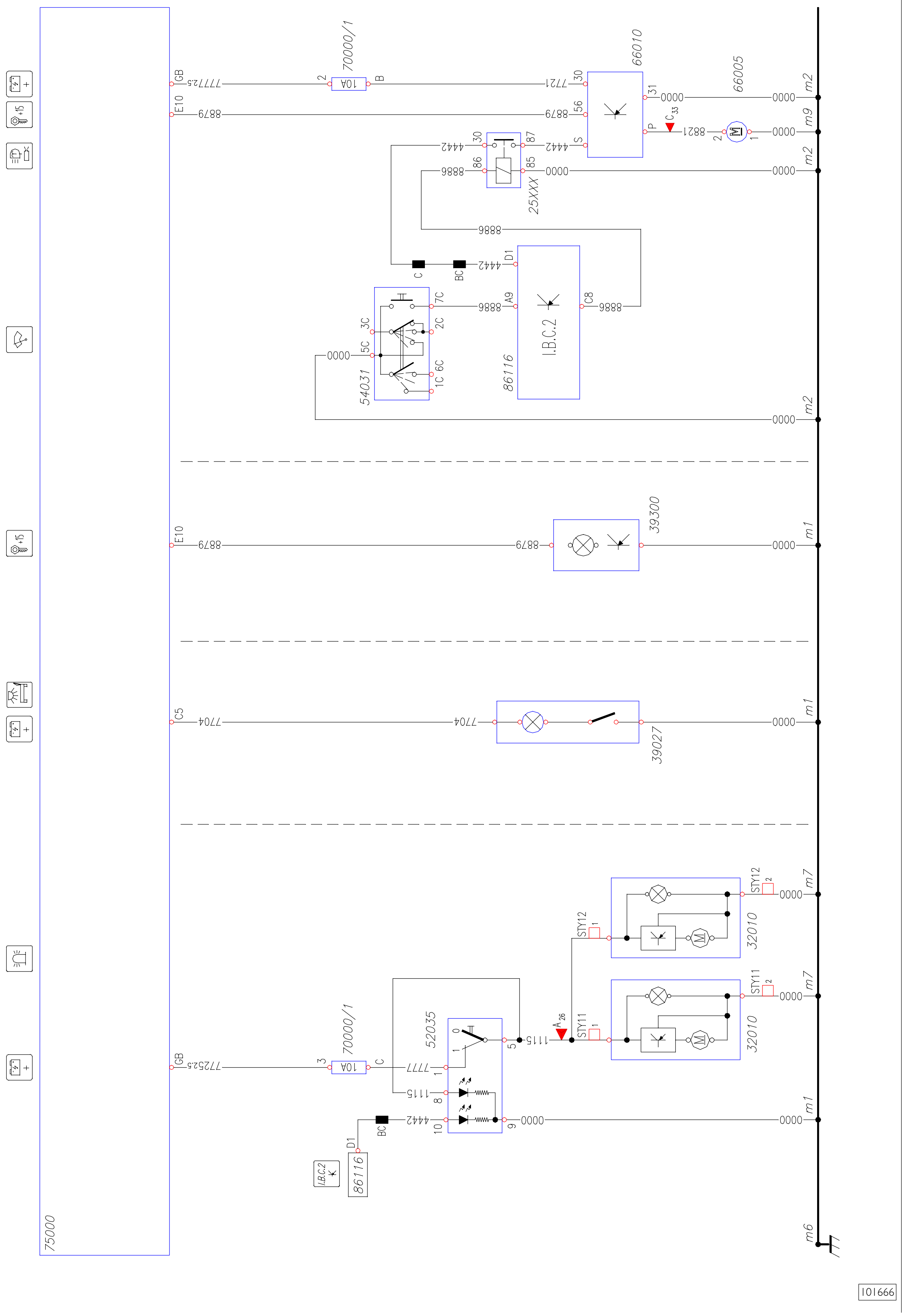
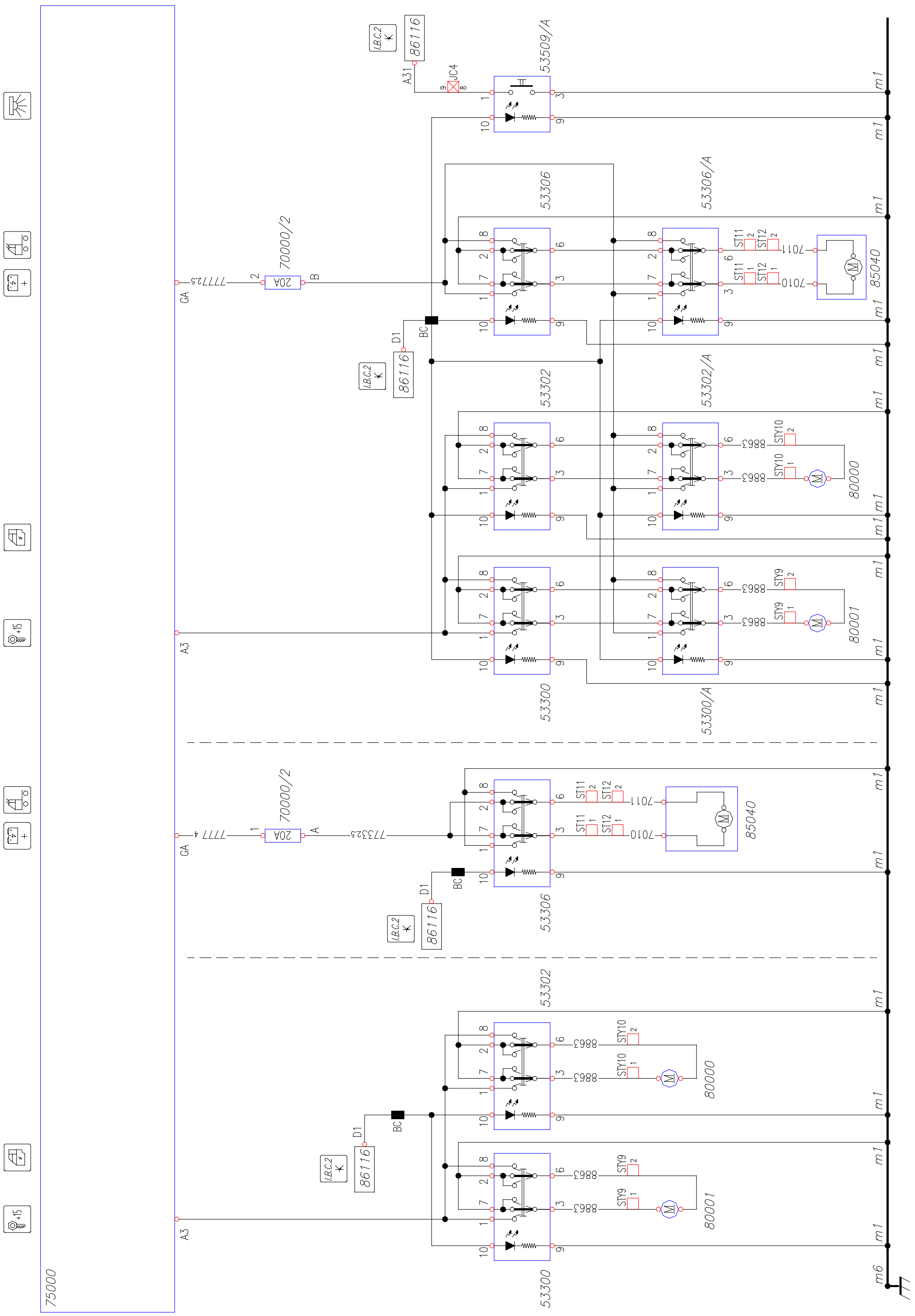
Card 23: Rotating lamps/Bed lights/ Emergency light/Headlamp washer



Card 24: Electric window regulator/Sunroof (with and without the Bed Module)



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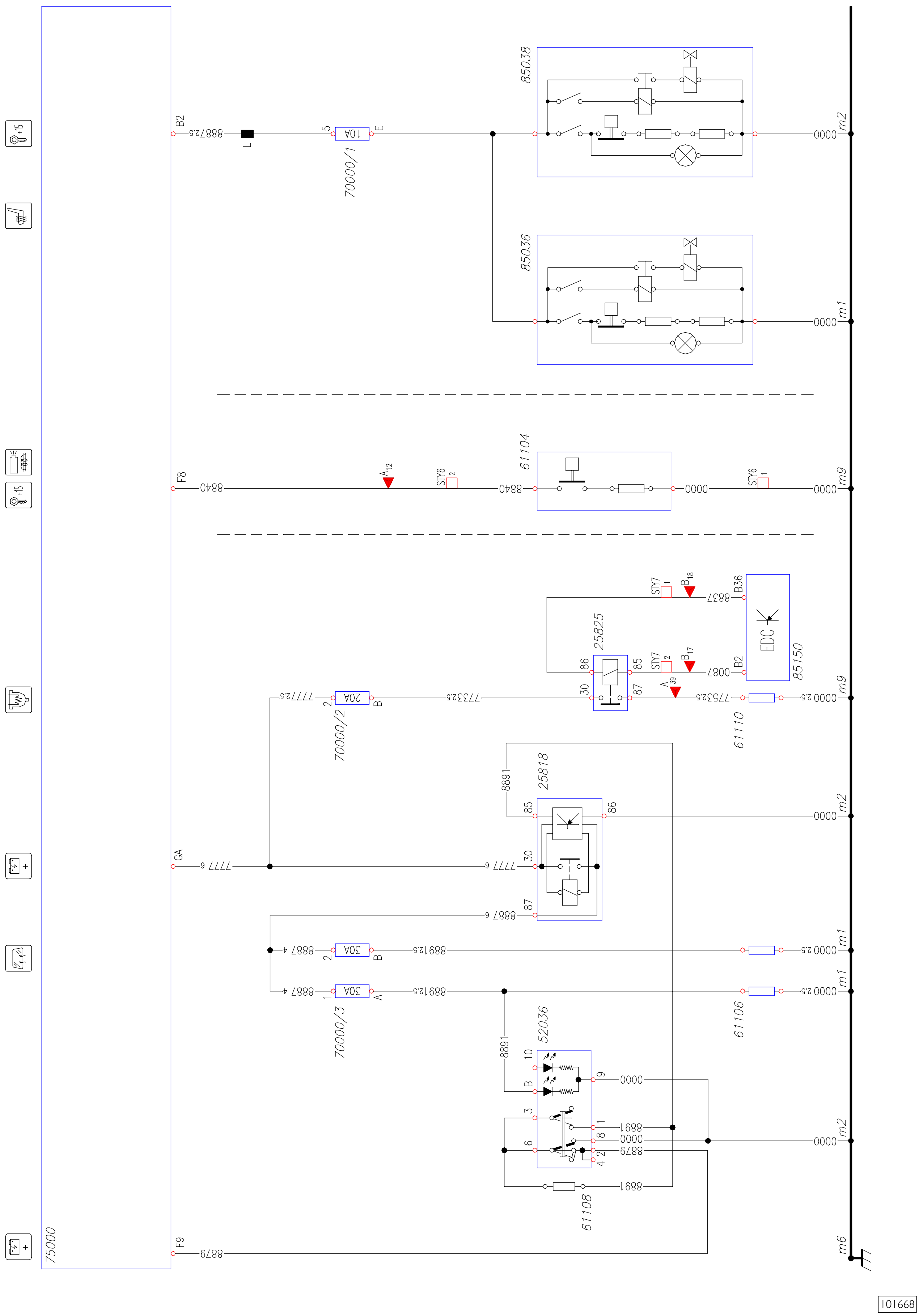
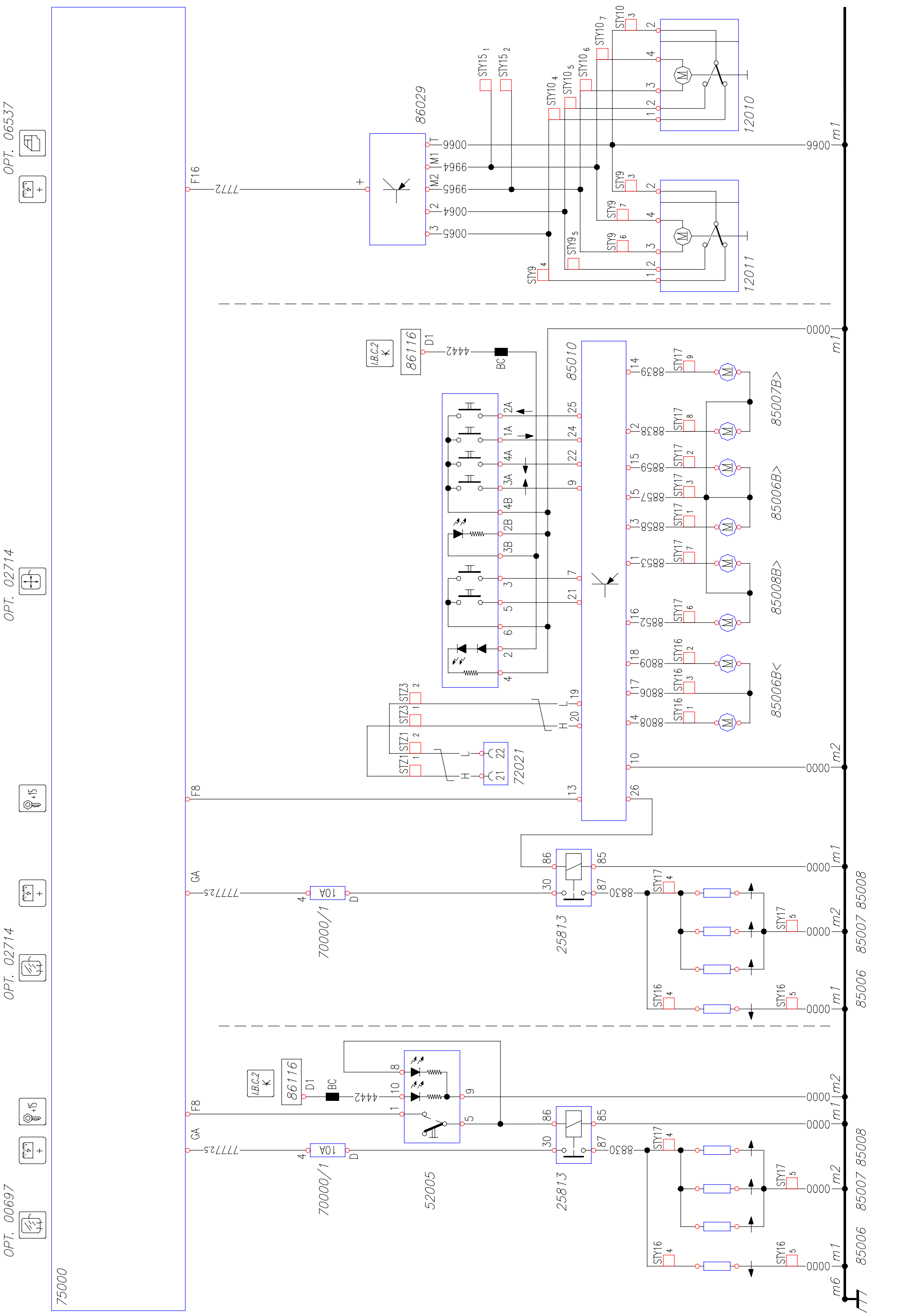
Card 25: Heated windscreen/Heated prefilter/Brake air drier/Pneumatic, heated seats



Card 26: Central closing prearrangement/Adjustable, heated rearview mirrors



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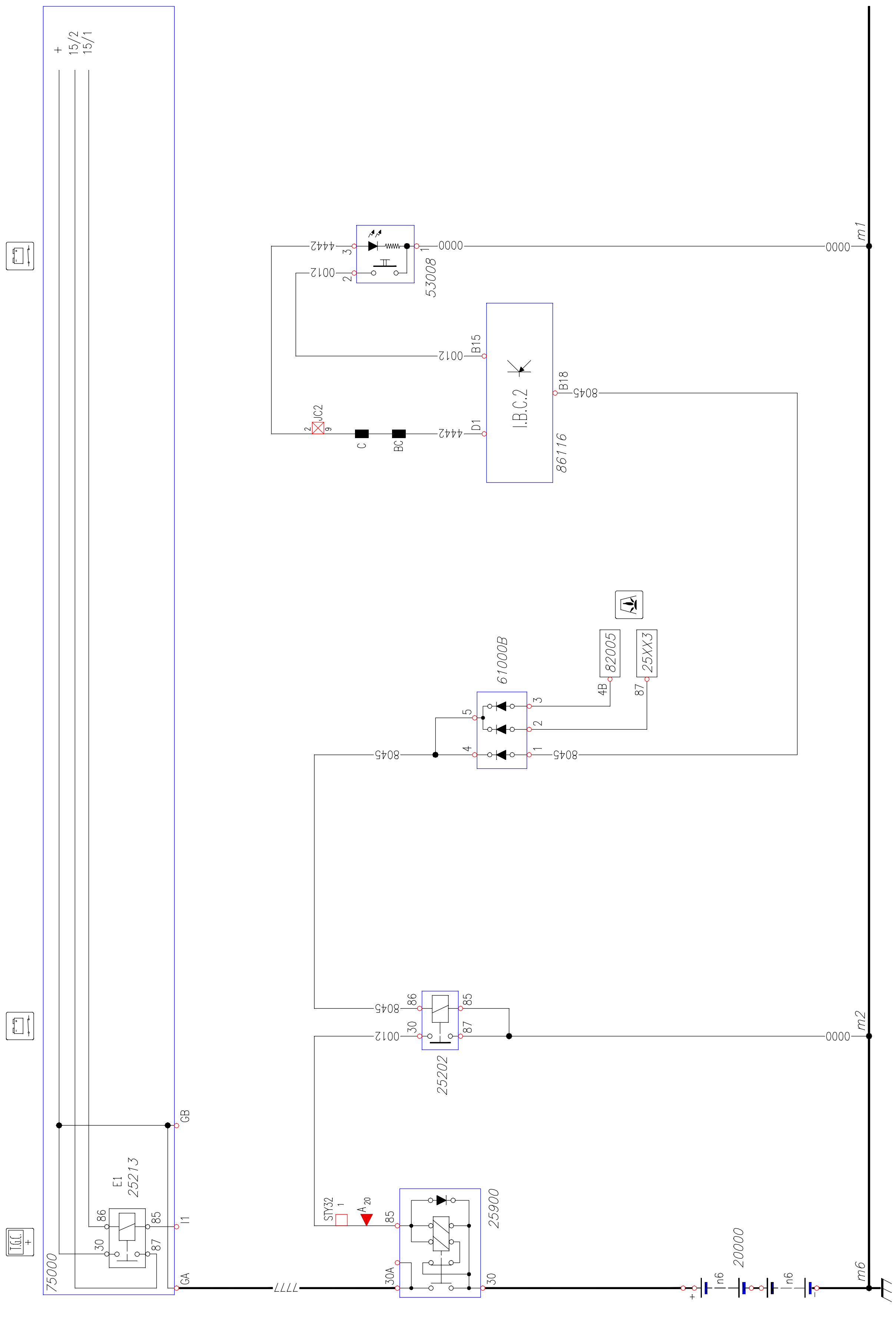
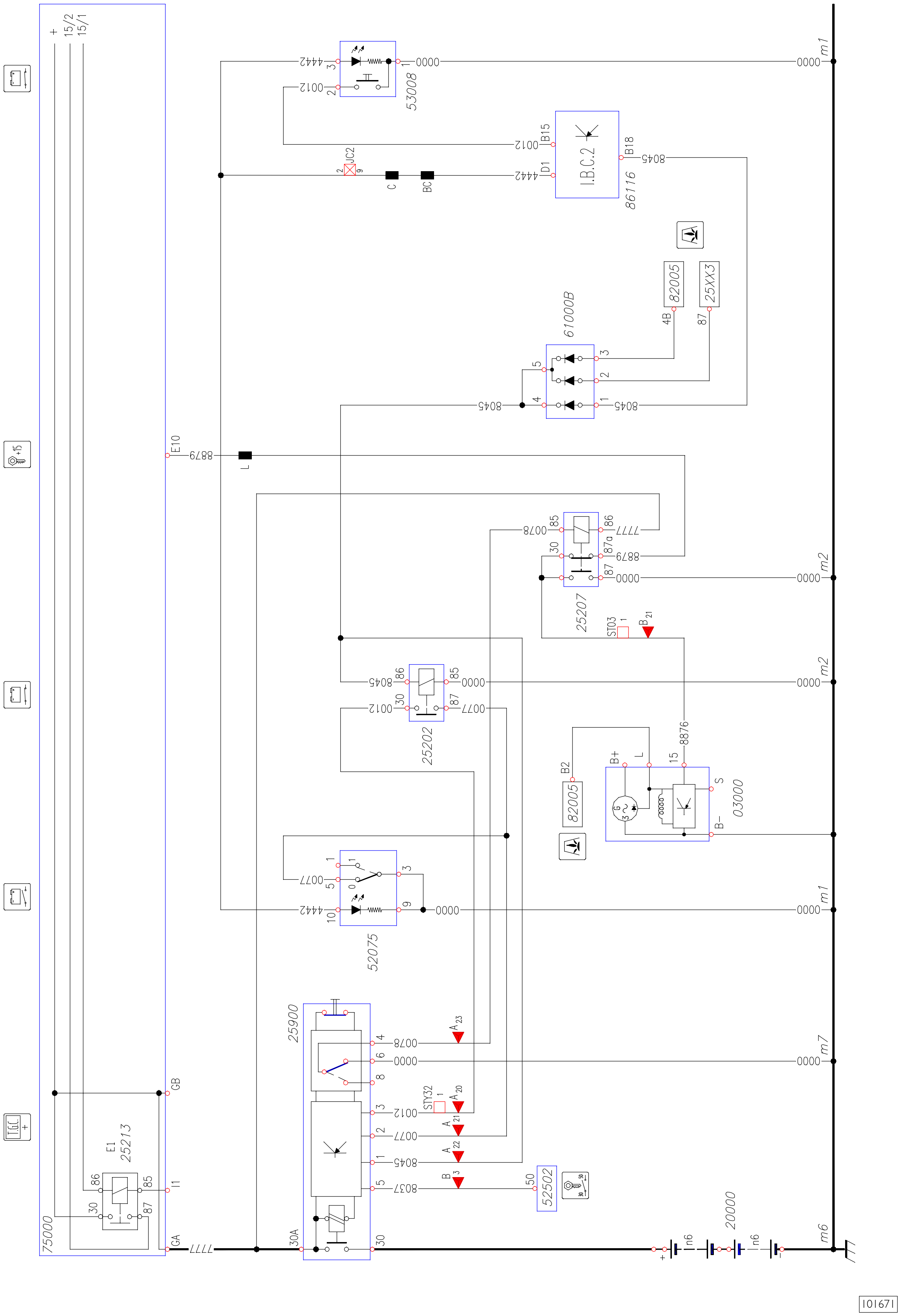
Card 27: Main current remote–control switch (TGC)

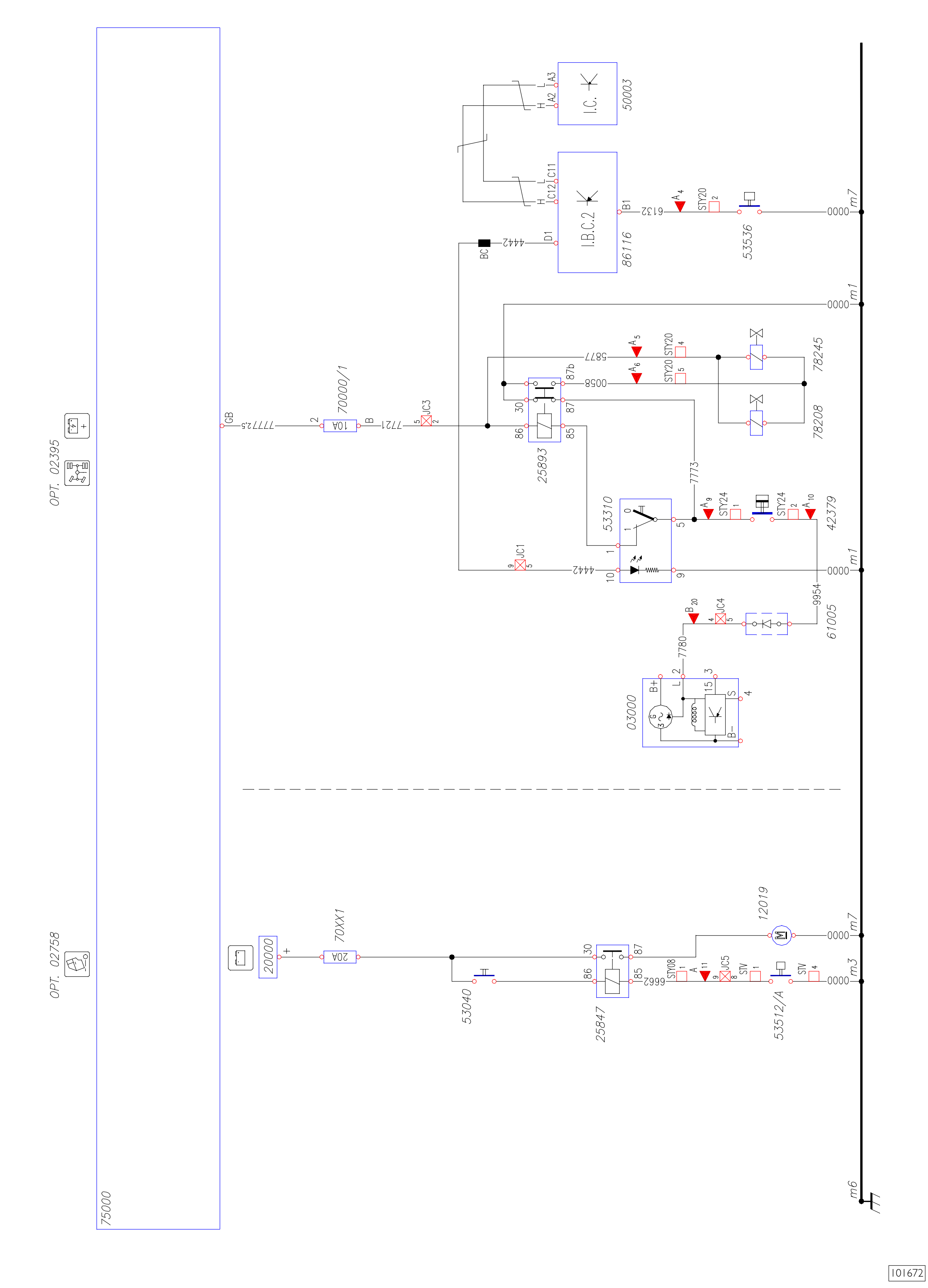


101670

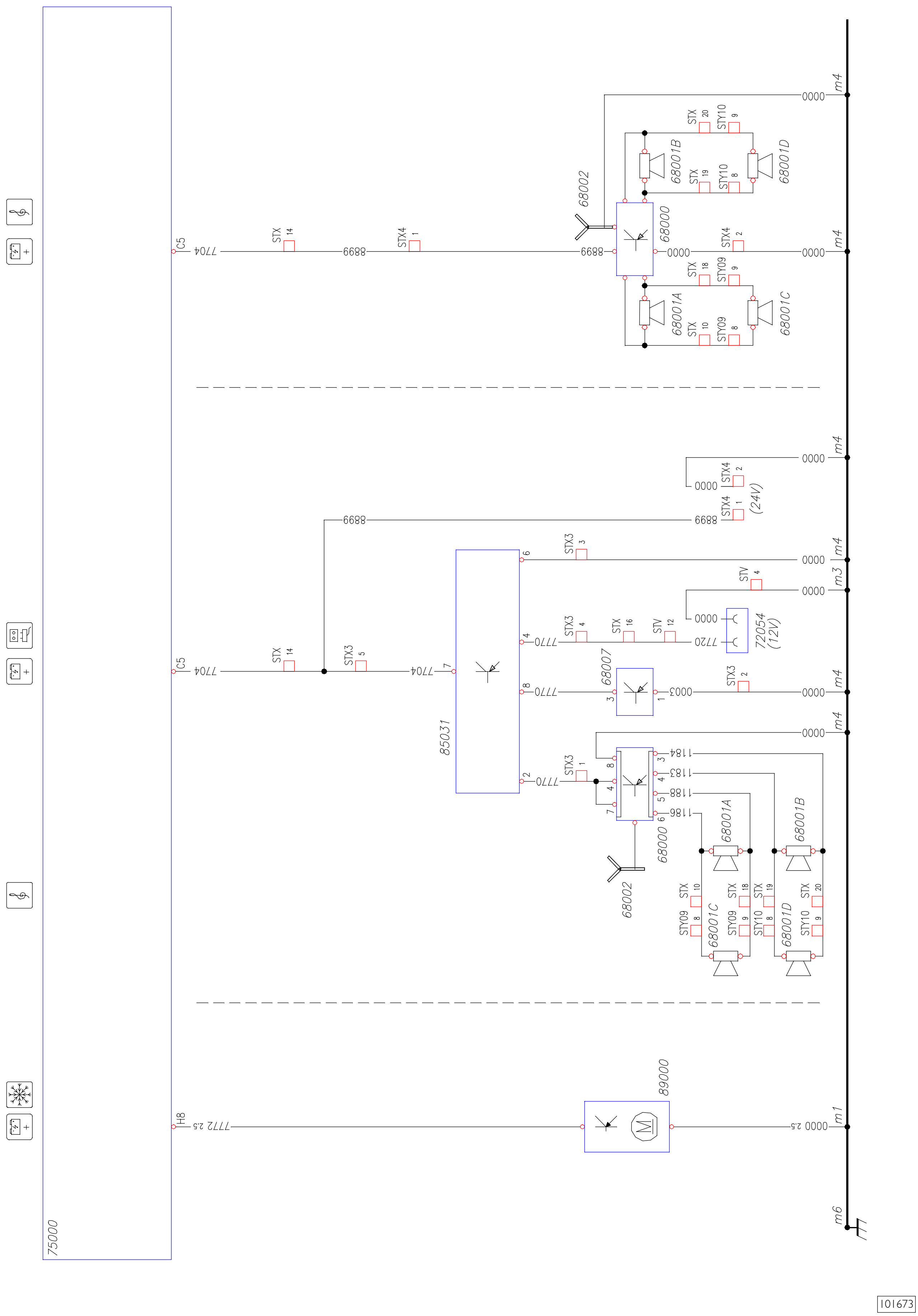
Card 28: Current Main Remote Control Switch (TGC) prearrangement (TGC)/ Compliance to rules ADR (TMP)



Card 29: Cab tipping/Overall power takeoff



Card 30: Fridge/Voltage reducer/Car radio



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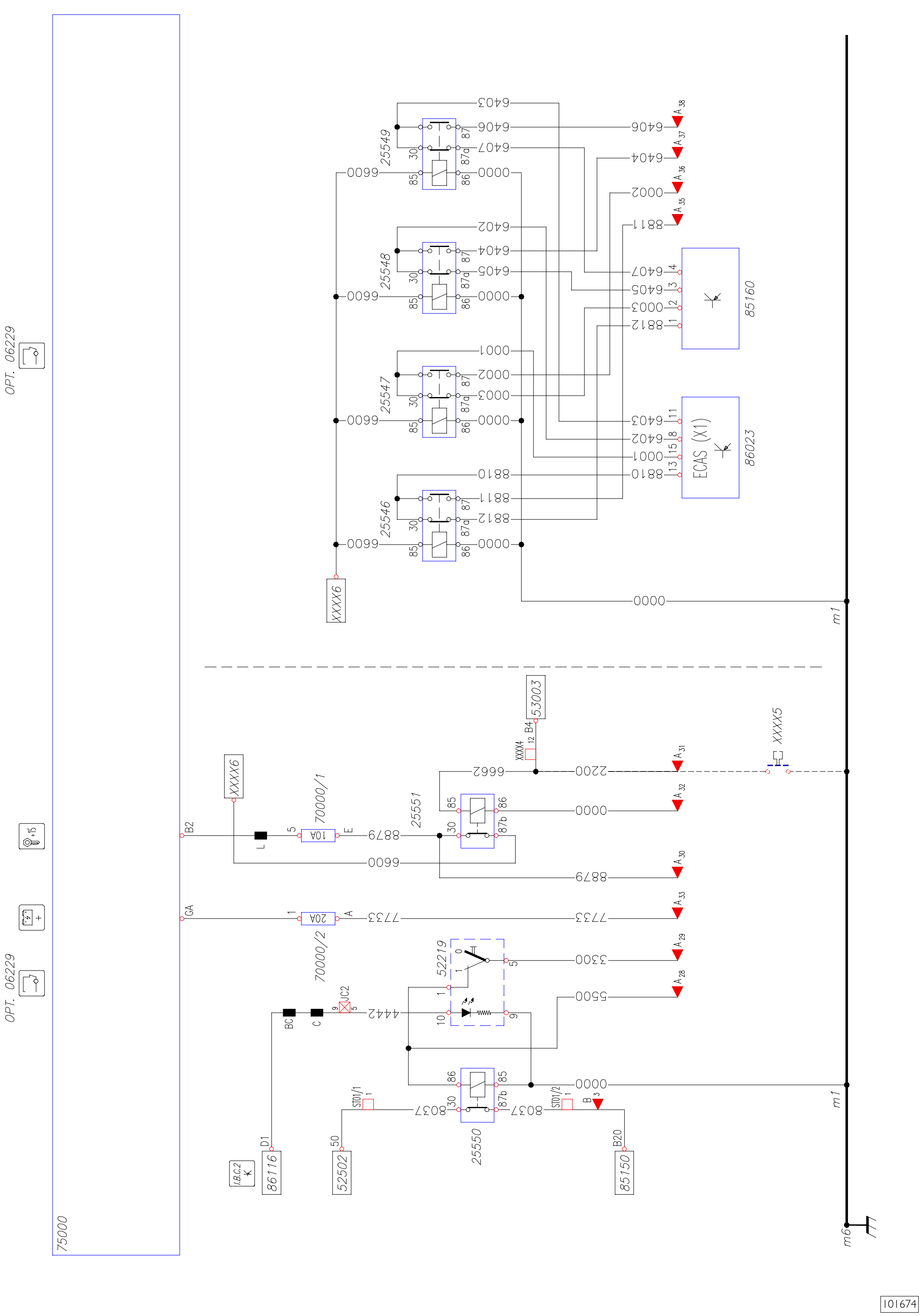
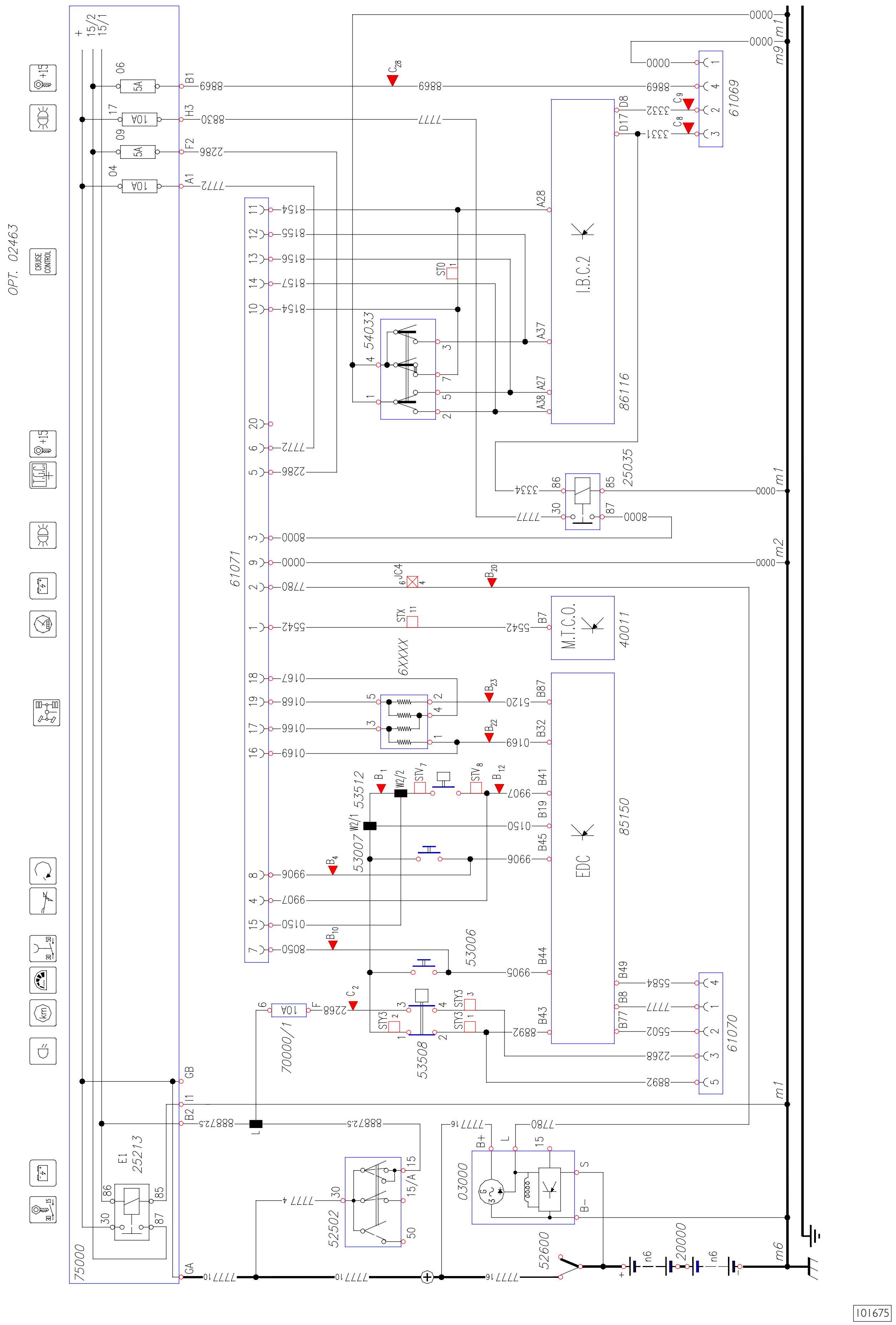
Card 31: Loading board preset



Card 32: Body builder connectors



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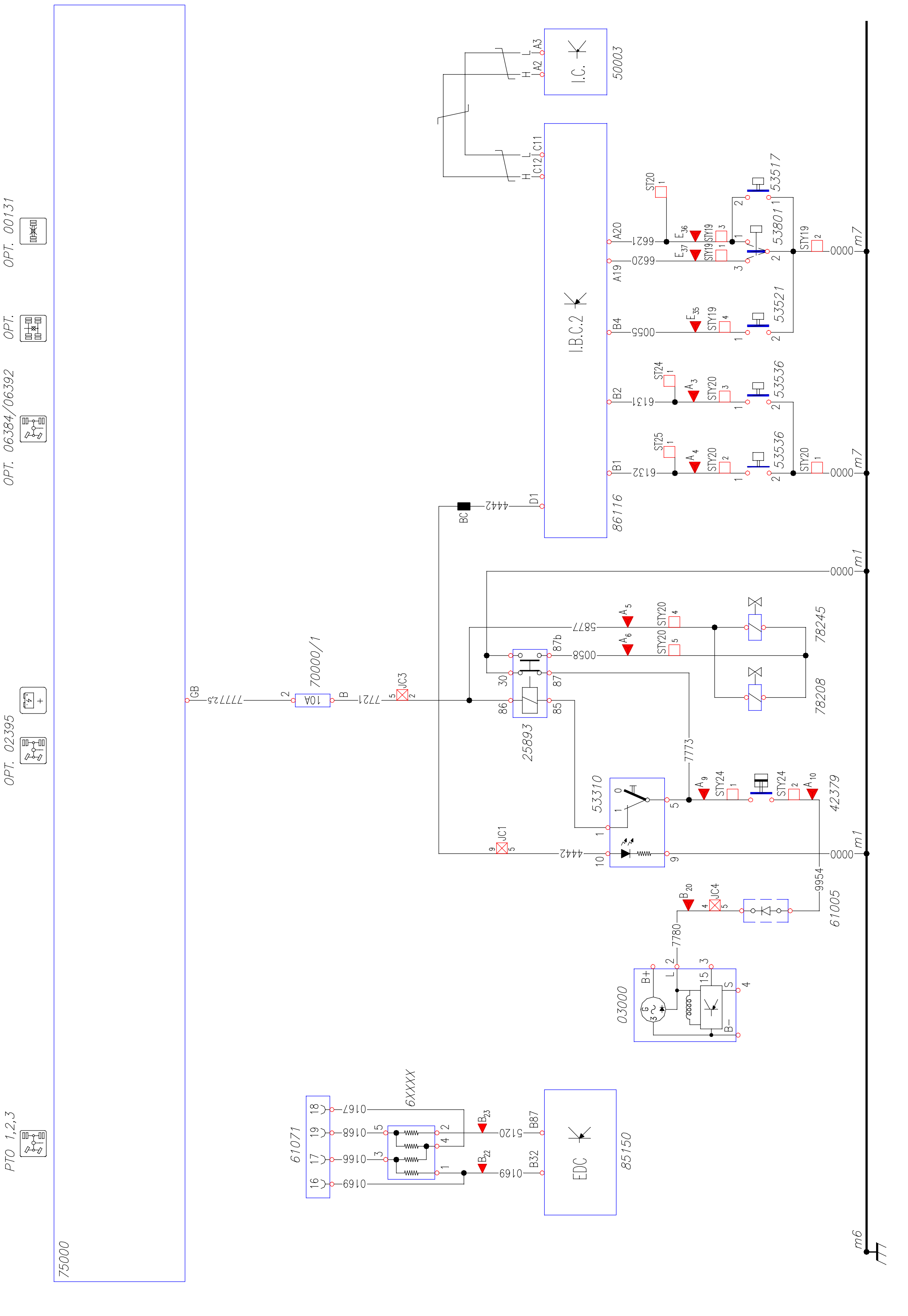
Card 33: PTO lateral – trasero – total /Bloqueo diferencial transversal y longitudinal



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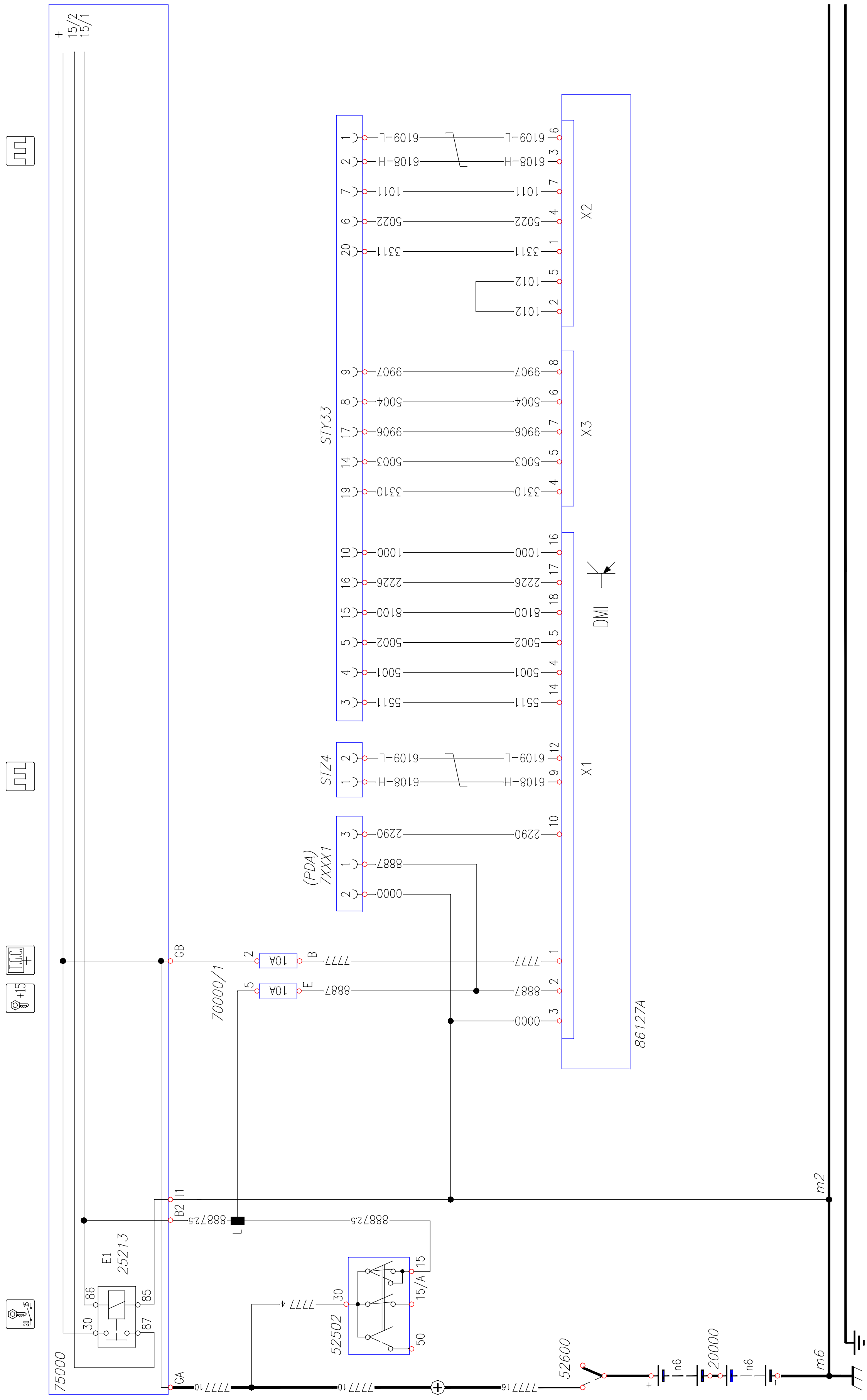
Card 34: Central unit (DMI) (opt. 5626)



Print 603.93.381