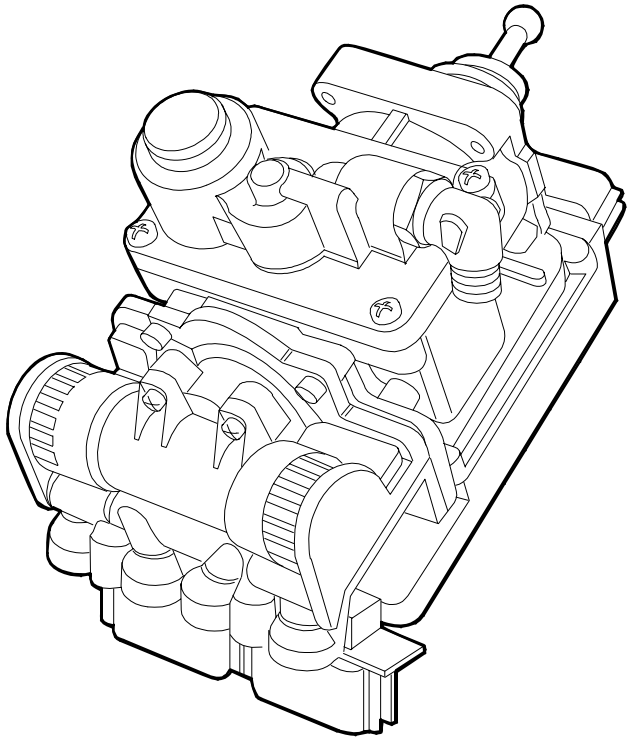
ELECTRONICALLY CONTROLLED BRAKING SYSTEM EBS 2/ESP/EBL



STRALIS AT/AD/AS

"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."

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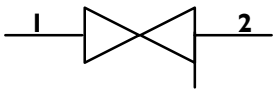
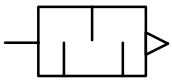
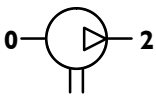
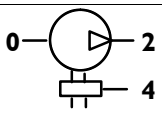
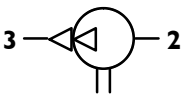
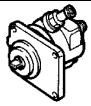
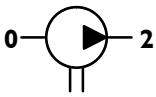
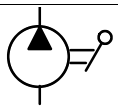
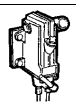
Pneumatic system - EBS 2/ESP/EBL brakes

Page

SYMBOLS FOR AIR/HYDRAULIC SYSTEM CIRCUIT DIAGRAMS (TANKS AND ACCUMULATORS)

DESCRIPTION	SYMBOL	
HYDRAULIC FLOW		
AIR FLOW		
ELECTRICAL LINE		
ABLE TO ROTATE		
CROSSOVER OF CONNECTED LINES		
PRESSURE TEST POINT		
QUICK-CONNECTION COUPLING		
COCK		
COCK WITH OUTLET		
SILENCER		
COMPRESSOR		
ENERGY SAVING COMPRESSOR		
VACUUM PUMP		
HYDRAULIC PUMP		
HYDRAULIC HAND PUMP		

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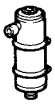
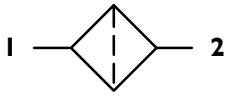
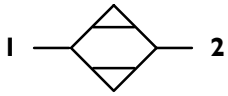
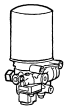
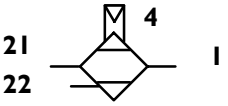
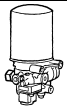
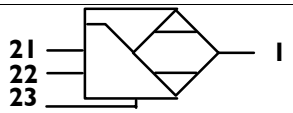
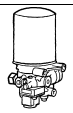
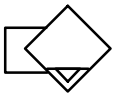
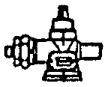
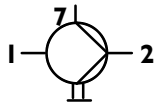
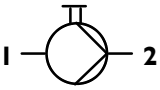
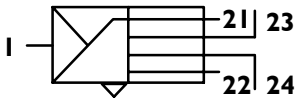
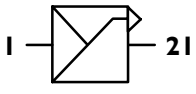
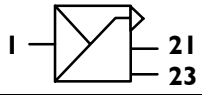
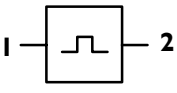
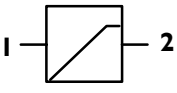
SYMBOLS FOR AIR/HYDRAULIC SYSTEM CIRCUIT DIAGRAMS (VALVES)

DESCRIPTION	SYMBOL	
CONDENSATE SEPARATOR		
FILTER		
DEHUMIDIFIER		
DEHUMIDIFIER		
DEHUMIDIFIER 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 CONTROLLER		
PRESSURE CONTROLLER		
PRESSURE CONTROLLER (GOVERNOR)		
PRESSURE LIMITING VALVE		

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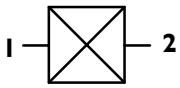
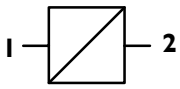
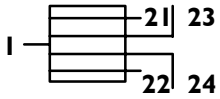
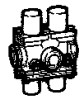
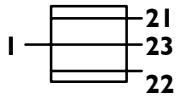
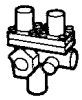
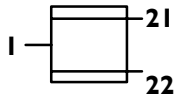
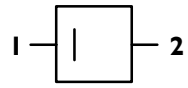
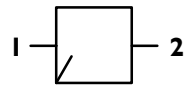
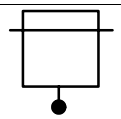
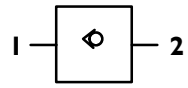
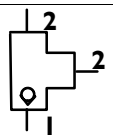
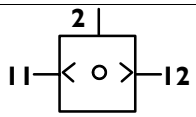
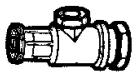
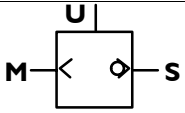
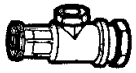
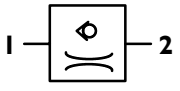
SYMBOLS FOR AIR/HYDRAULIC SYSTEM CIRCUIT DIAGRAMS (VALVES)

DESCRIPTION	SYMBOL	
PROPORTIONAL REDUCING VALVE		
MATCHING VALVE		
FOUR CIRCUIT PROTECTION VALVE		
THREE CIRCUIT PROTECTION VALVE		
TWO 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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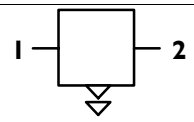
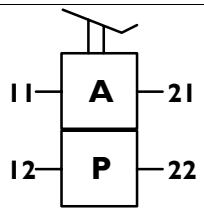
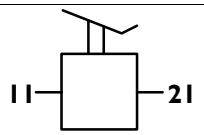
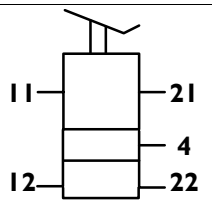
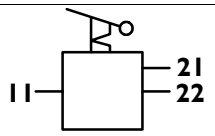
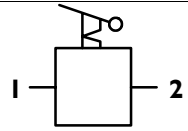
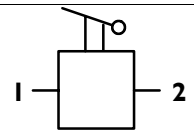
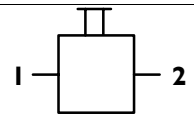
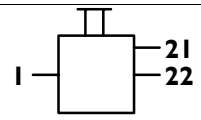
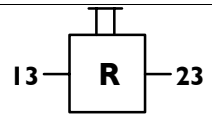
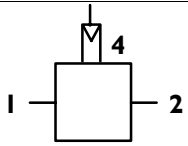
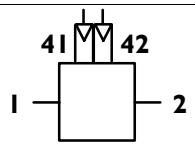
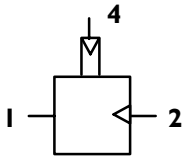
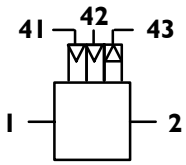
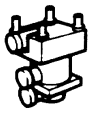
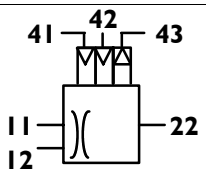
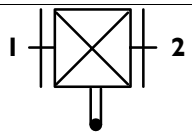
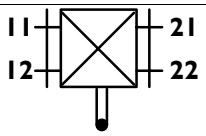
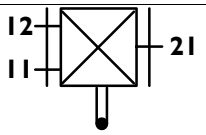
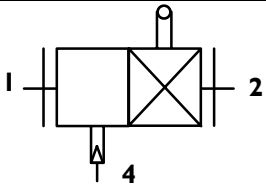
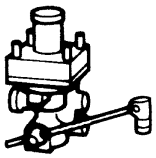
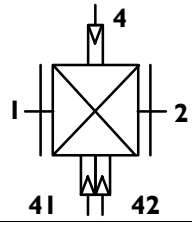
SYMBOLS FOR AIR/HYDRAULIC SYSTEM CIRCUIT DIAGRAMS (VALVES)

DESCRIPTION	SYMBOL	
DUMP VALVE		
BRAKE CONTROL VALVE		
BRAKE CONTROL VALVE		
BRAKE CONTROL VALVE		
PARKING BRAKE CONTROL VALVE		
PARKING BRAKE CONTROL VALVE		
BRAKE VALVE		
CONTROL VALVE		
CONTROL VALVE		
RETARDER CONTROL VALVE		
SERVO CONTROL VALVE		

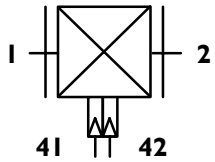
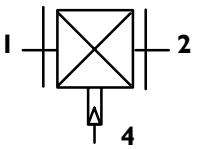
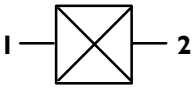
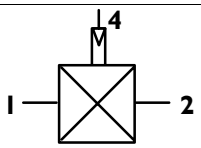
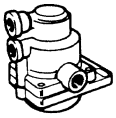
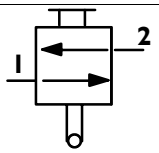
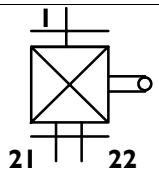
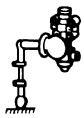
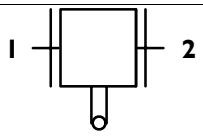
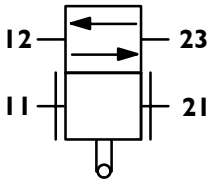
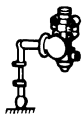
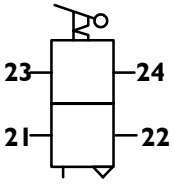
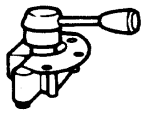
32786

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 PROPORTIONING VALVE		
DUAL LOAD PROPORTIONING VALVE		
LOAD PROPORTIONING VALVE WITH BY-PASS		
LOAD PROPORTIONING VALVE WITH BUILT-IN RELAY		
LOAD PROPORTIONING VALVE WITH BUILT-IN RELAY WITH AIR CONTROL		

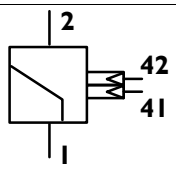
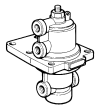
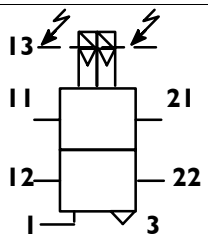
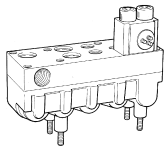
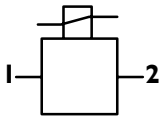
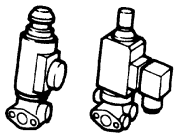
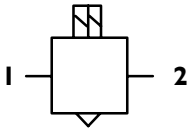
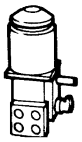
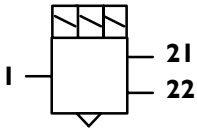
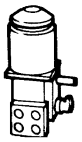
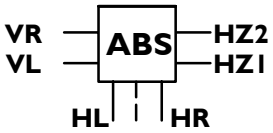
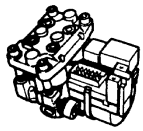
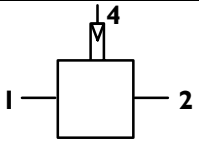
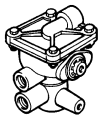
32786 32787

SYMBOLS FOR AIR/HYDRAULIC SYSTEM CIRCUIT DIAGRAMS (VALVES)

DESCRIPTION	SYMBOL	
LOAD PROPORTIONING VALVE WITH AIR CONTROL		
LOAD PROPORTIONING VALVE WITH AIR CONTROL		
PROPORTIONAL REDUCING VALVE		
SLAVED PROPORTIONAL REDUCING VALVE		
STROKE LIMITING VALVE		
LEVELLING VALVE		
LEVELLING VALVE		
LEVELLING VALVE WITH BUILT-IN TRAVEL LIMITER		
HAND OPERATED SUSPENSION RAISING CONTROL VALVE		

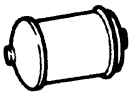
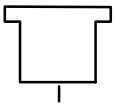
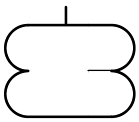
32787 32788

SYMBOLS FOR AIR/HYDRAULIC SYSTEM CIRCUIT DIAGRAMS (VALVES)

DESCRIPTION	SYMBOL	
PROPORTIONAL CONTROL VALVE		
HAND OPERATED SUSPENSION CONTROL VALVE WITH ELECTRICAL MONITORING		
ELECTROPNEUMATIC VALVE		
ELECTROPNEUMATIC VALVE		
ELECTROPNEUMATIC VALVE		
HYDRAULIC MODULATOR FOR ABS		
AUGMENTER VALVE		

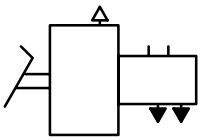
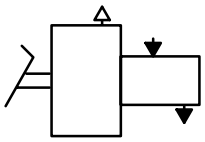
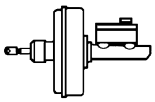
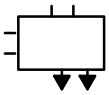
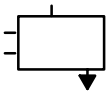
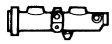
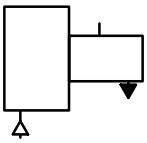
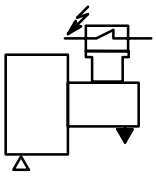
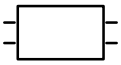
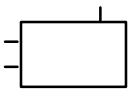
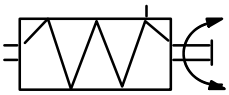
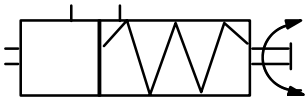
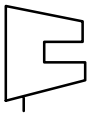
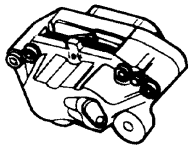
32788

SYMBOLS FOR AIR-HYDRAULIC SYSTEM DIAGRAMS (TANKS AND ACCUMULATORS)

DESCRIPTION	SYMBOL	
COMPRESSED AIR TANK		
BRAKE FLUID RESERVOIR		
AIR SPRING		

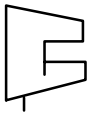
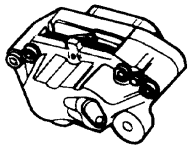
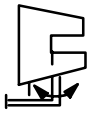
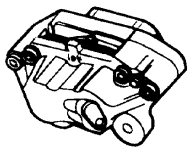
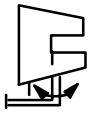
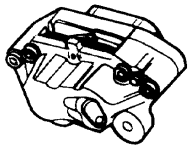
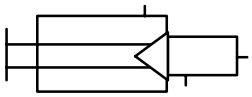
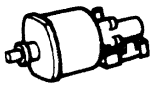
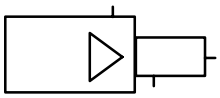
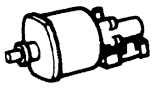
32789

SYMBOLS FOR AIR/HYDRAULIC SYSTEM CIRCUIT DIAGRAMS (CONVERTERS, CYLINDERS AND CALLIPERS)

DESCRIPTION	SYMBOL	
VACUUM BRAKE SERVO		
VACUUM BRAKE SERVO		
DUAL CIRCUIT MASTER CYLINDER		
SINGLE CIRCUIT MASTER CYLINDER		
AIR/HYDRAULIC CONVERTER		
AIR/HYDRAULIC CONVERTER		
HYDRAULIC BRAKE CYLINDER		
SLAVE CYLINDER		
BRAKE CYLINDER		
SPRING CYLINDER		
COMBINED BRAKE CYLINDER		
FIXED DISC BRAKE CALLIPER		

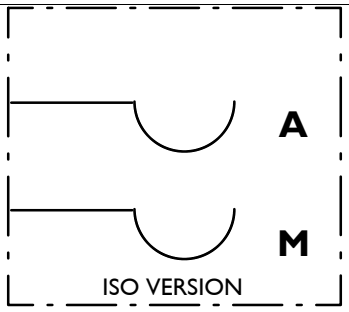
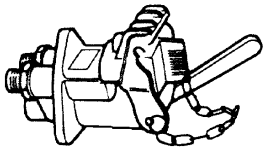
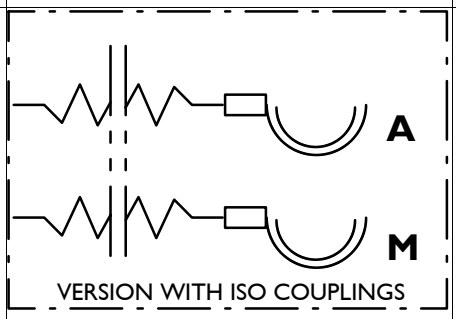
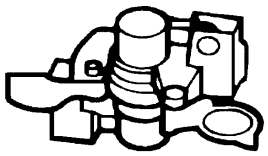
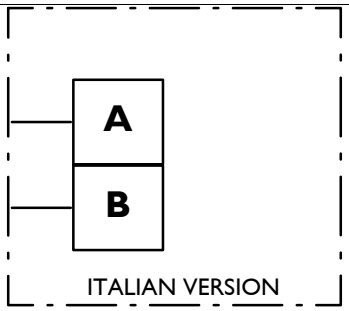
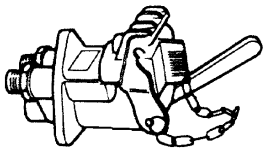
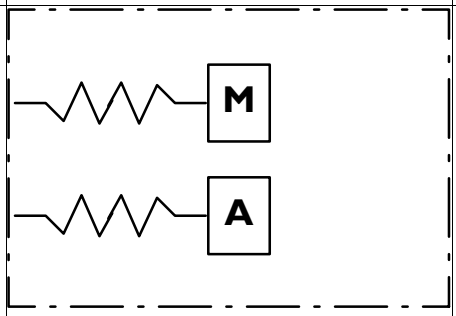
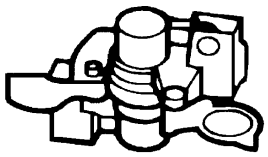
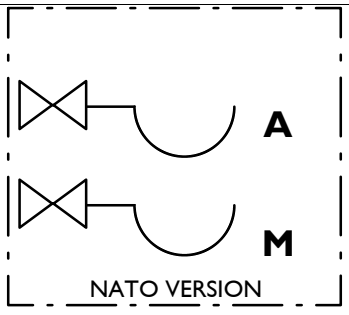
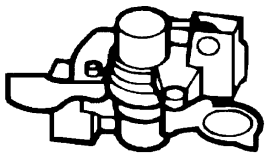
32790 32791

SYMBOLS FOR AIR/HYDRAULIC SYSTEM CIRCUIT DIAGRAMS (CALLIPERS AND CYLINDERS)

DESCRIPTION	SYMBOL	
FLOATING DISC BRAKE CALLIPER		
FLOATING DISC BRAKE CALLIPER WITH PARKING		
MECHANICAL FLOATING DISC BRAKE CALLIPER		
SERVO CLUTCH		
SERVO CLUTCH		

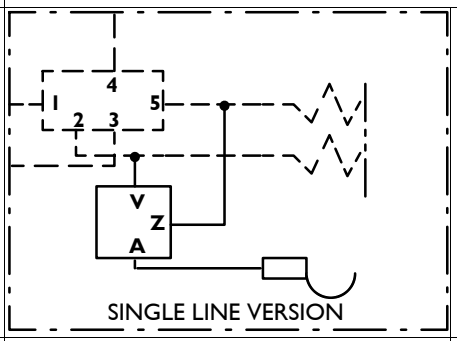
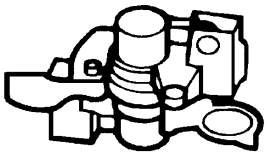
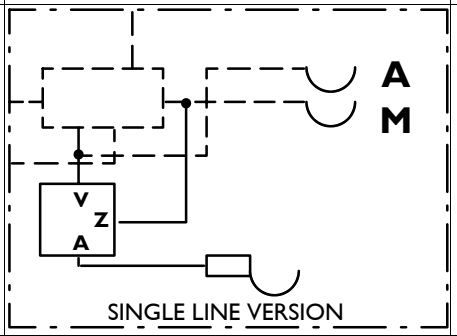
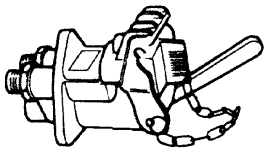
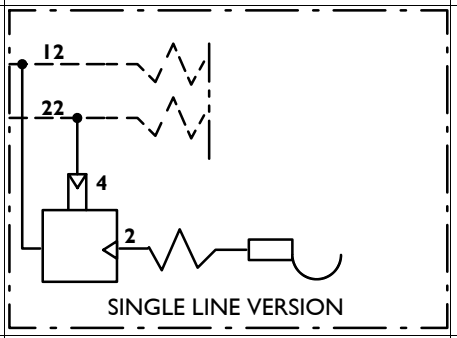
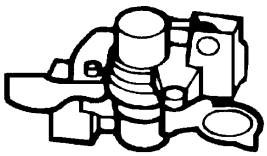
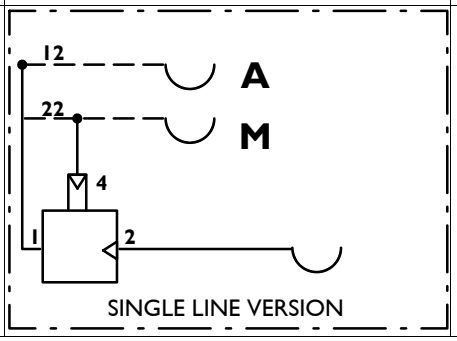
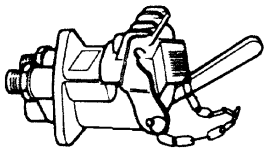
32791

SYMBOLS FOR AIR/HYDRAULIC SYSTEM CIRCUIT DIAGRAMS (SEMI-COUPLINGS AND COUPLING CONNECTORS)

DESCRIPTION	SYMBOL	
"ISO" SEMI-COUPLING		
"ISO" SEMI-COUPLING		
"CUNA" SEMI-COUPLING		
"CUNA" SEMI-COUPLING		
"NATO" SEMI-COUPLING		

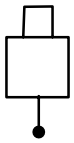
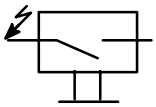
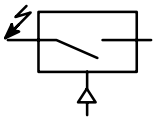
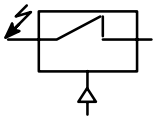
32792 32793

SYMBOLS FOR AIR/HYDRAULIC SYSTEM CIRCUIT DIAGRAMS (SEMI-COUPLINGS AND COUPLING CONNECTORS)

DESCRIPTION	SYMBOL	
		
SEMI-COUPLING		
SEMI-COUPLING		
SEMI-COUPLING		

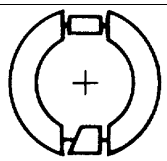
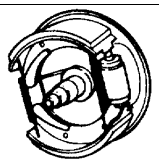
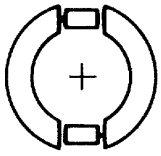
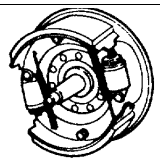
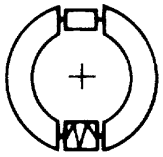
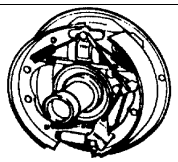
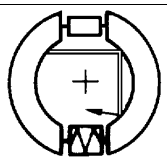
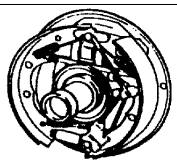
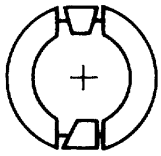
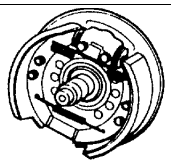
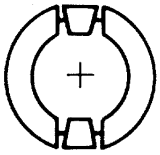
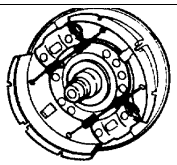
32793

SYMBOLS FOR AIR/HYDRAULIC SYSTEM CIRCUIT DIAGRAMS (INDICATORS AND SWITCHES)

DESCRIPTION	SYMBOL	
PRESSURE GAUGE		
PRESSURE GAUGE		
PRESSURE SENDING UNIT		
LAMP		
MECHANICAL SWITCH		
PRESSURE SWITCH		
LOW PRESSURE SWITCH		
AUDIBLE WARNING		
SENSOR		

32794

SYMBOLS FOR AIR/HYDRAULIC SYSTEM CIRCUIT DIAGRAMS (BRAKES)

DESCRIPTION	SYMBOL	
SINGLE CYLINDER HYDRAULIC BRAKE		
TWIN CYLINDER HYDRAULIC BRAKE		
DUAL SERVO HYDRAULIC BRAKE		
DUAL SERVO HYDRAULIC BRAKE WITH PARKING BRAKE		
SINGLE CAM OPERATED BRAKE		
TWIN DUAL CAM OPERATED BRAKE		

32795

799512 PIPINGS AND FITTINGS

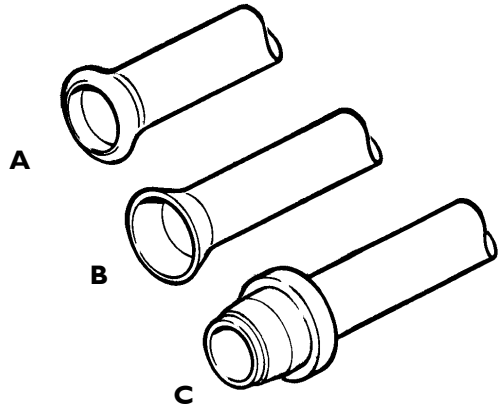
In general

Hydraulic system pipings for industrial vehicles are currently of two types:

- Flexible ones made of polyamide with single-layered or double-layered structure and in the following diameters (∅ 6-8-10-12-16 mm) equipped with spares in meters.
- Rigid metal pipings in the following diameters (∅ 4.75-6.35-8-10-12 mm). Pipings from ∅ 4.75 to ∅ 10 mm are supplied as spares in straight 4-5-6 m crop ends, while those exceeding 10 mm are supplied as spares already cut, bent and reflanged.

Rigid pipings reflanging

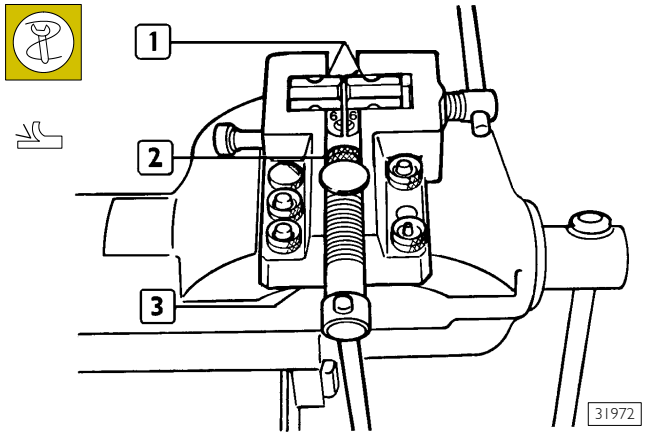
Figure 1



RIGID PIPINGS REFLANGING REPRESENTATION

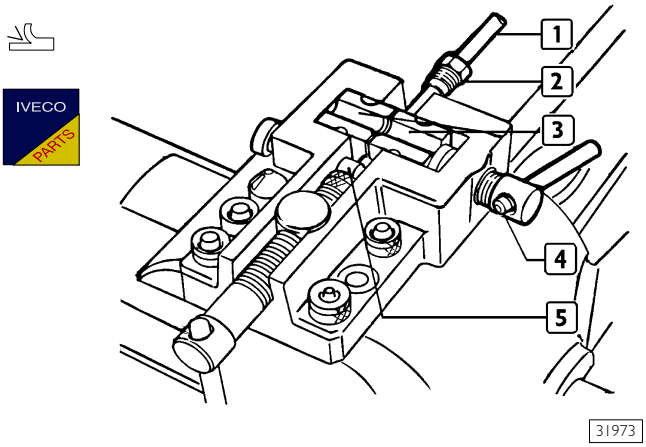
Reflanging type A

Figure 2



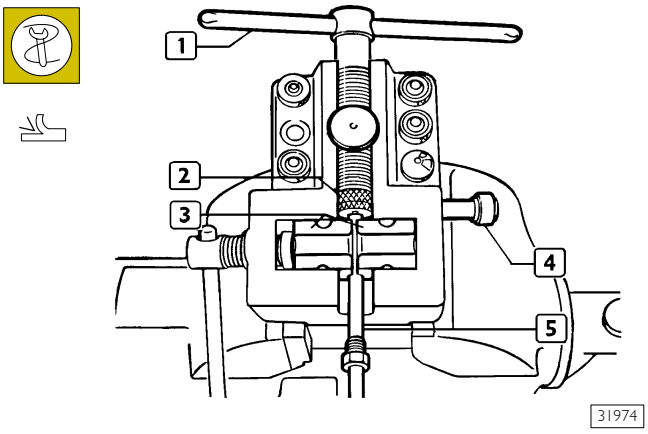
Arrange on a press 99386523 (3) small blocks (1) so that the punched numbers, showing the piping number to be worked, are facing the matrix die (2). The choice of the matrix die (2) depends on the diameter of the piping to be reflanged. Moreover, on every matrix die (2) the diameter of the piping is punched for which the same one can be used.

Figure 3



Burr piping (1), insert union (2) and place it between small blocks (3) abutting pin (5). Lock piping (1) with screw (4).

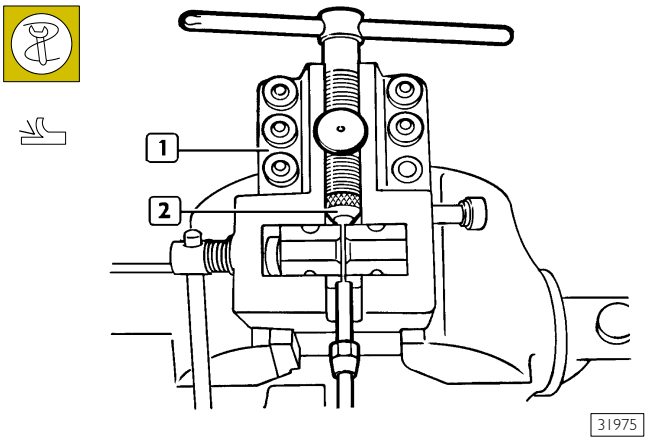
Figure 4



Take back pin (4) to its neutral position. Screw screw (1) till matrix die (2) comes to abut against small blocks (3) thereby shaping the piping (5) end.

Reflanging type B

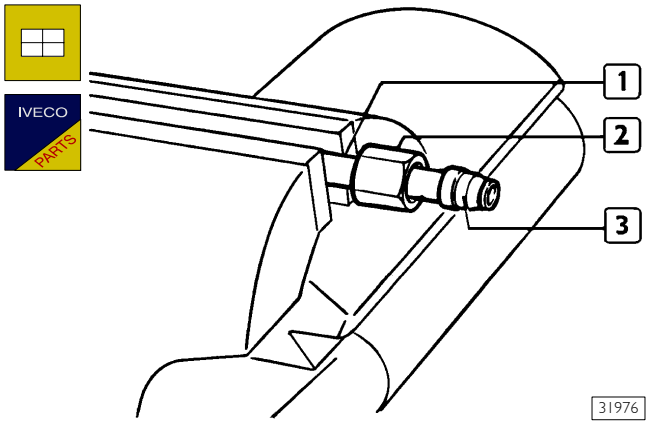
Figure 5



Assemble matrix die (2) on press 99386523 (1).
For the reflanging process comply with what has been stated above for reflanging type A.

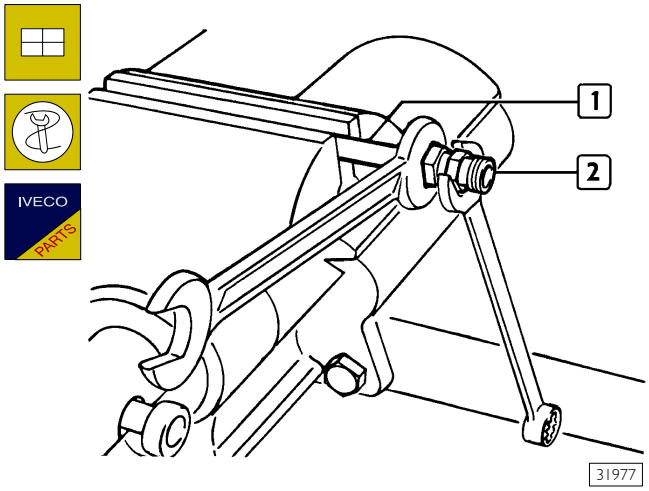
Reflanging type C

Figure 6



Key on piping (1) nut (2) and ring (3).

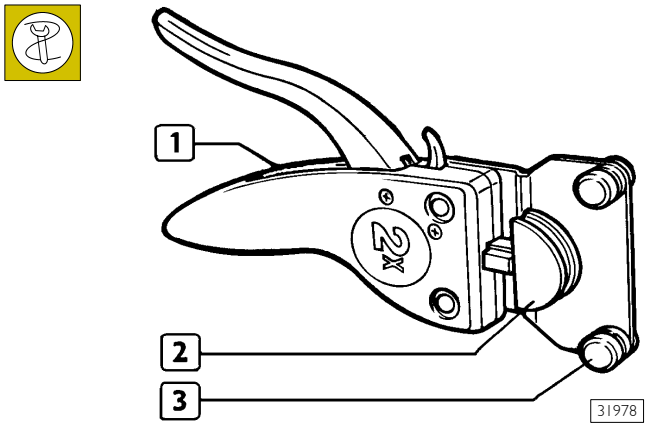
Figure 7



Assemble union (2) and tighten so that ring (3, Figure 6) is locked on piping (1).

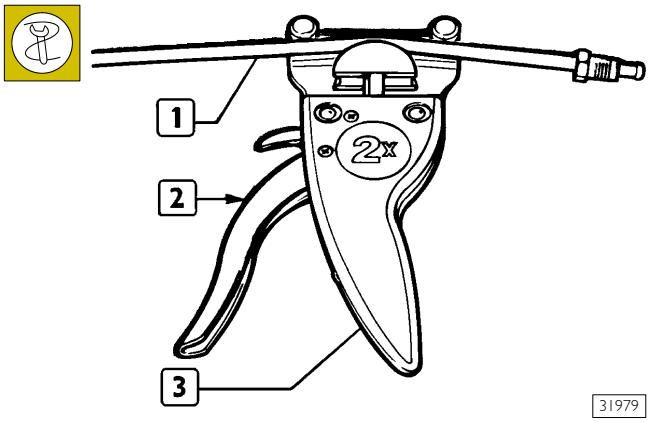
Rigid pipings bending

Figure 8



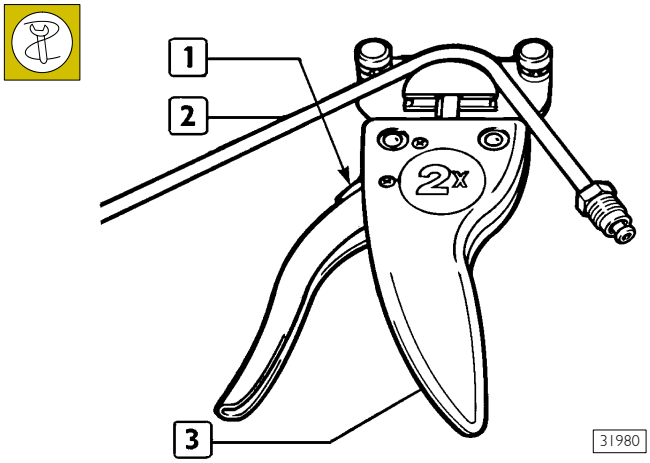
Assemble tool (1) 99386523 choosing parts (2) and (3) depending on the diameter of pipings to be bent.

Figure 9



Place piping (1) into tool (3) and operating on lever (2) bend the piping.

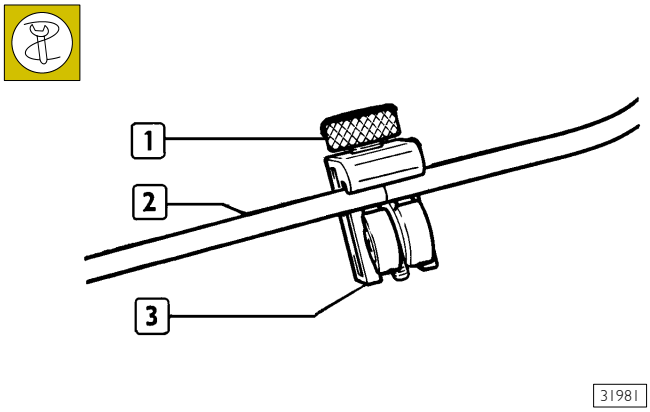
Figure 10



In order to free piping (2) from tool (3), operate on lever (1).

Rigid pipings cutting

Figure 11



Place piping (2) into tool (3) 99386523 and tighten screw (1). Keeping piping (2) still, rotate tool (3) till the piping is completely cut.

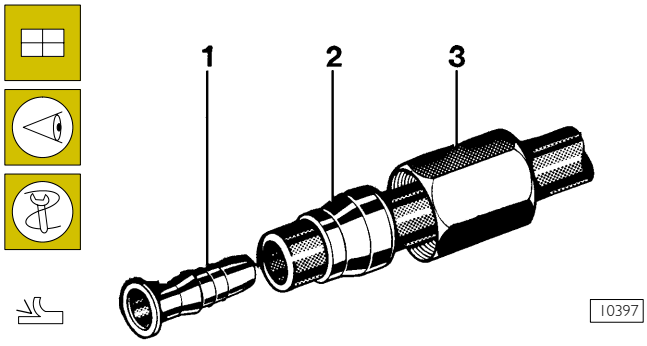
After having cut the piping, burr and shape the end as previously described.

Rotating tool (3) around piping (2), screw (1) is loosened. In order to completely cut the piping, it is then necessary to tighten screw (1) when it loosening.

Flexible pipings replacement with traditional fittings

Strictly comply with the following instructions:

Figure 12

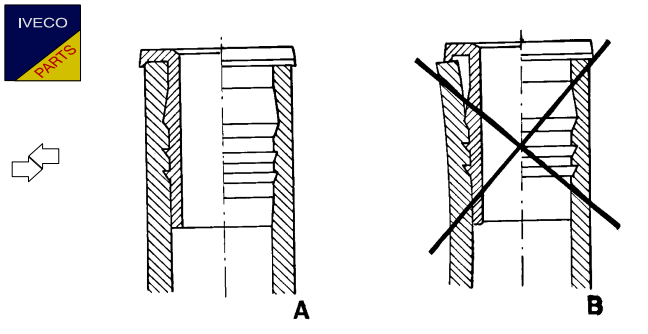


- ❑ Use homologated pipes only;
- ❑ Check the spare pipe status, on which no cracks, cuts or nickings must be detected;
- ❑ Cut the pipe at 90° with respect to the axis through a suitable pipe-cutting pliers 99387050 at the necessary length;

Insert on the pipe in the following order:

- ❑ nut (3), pressure ring (2) (its greater thickness must be facing nut (3) and reinforcement bush (1));
- ❑ the bush must be in perfect conditions (it must not have either distortions or hammering traces).

Figure 13



REINFORCEMENT BUSH ASSEMBLY
A = CORRECT ASSEMBLY
B = WRONG ASSEMBLY

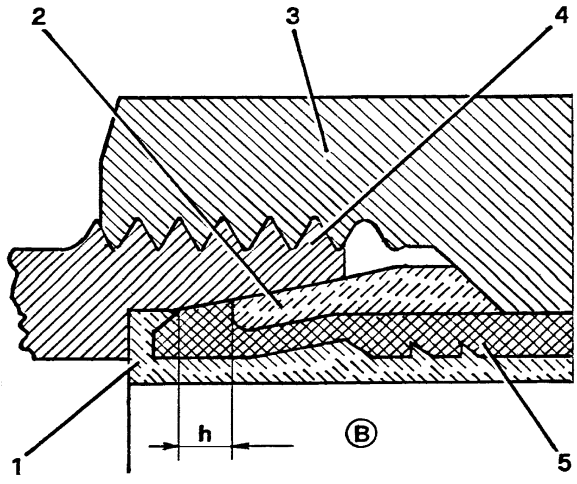
- ❑ Key the reinforcement bush with tool 99372219 guaranteeing the contact between its flange and the pipe end;
- ❑ make sure that the pipe end penetrates into the suitable rake groove obtained in the flange.
- ❑ Carry out abutment ring reflanging upon assembly on the vehicle or work bench on a fitting.
- ❑ The exerted pressure and the final distance from front pressure ring edge to reinforcement bush edge must be those mentioned in the table below.

In case of a bad assembly, never use the pipe after having extracted bush and abutment ring.

	Pipe mm	Distance between bush edge and ring mm (*)	Assembling pressure N/mm²
Double-layered	6 x 1	from 1 to 1.5	0.040
	8 x 1	from 2 to 2.5	0.050
Single-layered	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. Reinforcement bush - 2. Pressure ring -
3. Nut - 4. Fitting - 5. Pipe -
h. Distance between bush edge and ring edge (see table).

Insert the thereby-prepared piping end into the fitting body till the reinforcement bush flange rests within the suitable seat:

- ❑ For closing the nut on the fitting, initially screw it manually and then complete the tightening with a suitable box wrench (complete series 99372221) inserted into the dynamometric wrench, to be calibrated according to the required tightening torque.

Assembly of piping on vehicle is carried out by taking into account some important solutions:

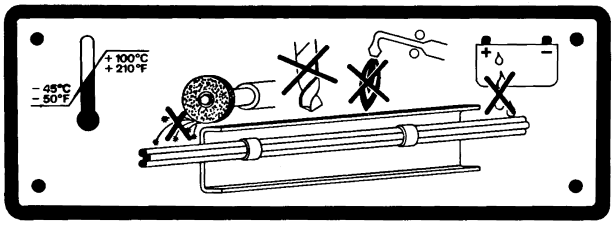
- Bendings must comply with minimum radiusses, in order to avoid throttlings.

Pipings diameter mm	Minimum bending radius mm
6 x 1	approx. 40
8 x 1	approx. 50
10 x 1.5	approx. 60
12 x 1.6	approx. 75
16 x 2.34	approx. 100

Make sure that pipings are not in contact with sharp edges or with cutting metallic parts or with heat sources, but that are distant therefrom by a minimum safety distance of 15 mm.

- Moreover, when crossing chassis longitudinal members or metallic parts, check that passage holes are coated with rubber fairlead rings and that these latter ones are in good conditions;
- Avoid that the pipe slides along cutting edges that would risk to create nickings;
- Having to fix the piping onto already existing ducts, take into account the supplementary heat to which it can be subjected (hydraulic power steering duct): in such case, the piping must be protected with guards;
- At the end of the connection, verify that the piping, between keying and securing, is not stretched, but must be slightly loosened to recover higher temperature variations, particularly for short lengths;
- Before assembling, accurately clean the pipings by blowing compressed air in order to guarantee system operation.

Figure 15



13132

- Protect the pipes in case of grinding or welding operations on the vehicle; for such purpose, an adhesive plate is applied in the cabin and shows the precautions to be observed with utmost care to avoid damages.

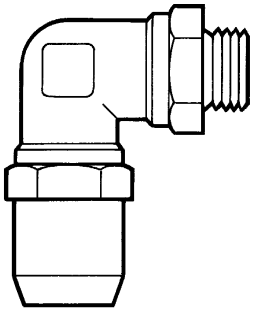
For better safety and work comfortability, it is advisable to detach the pipings during such operations.

At the end of the assembly, check the perfect seal of all gaskets (unions, fittings, etc.).

Flexible pipings replacement with quick connection fittings

Rotating fittings

Figure 16

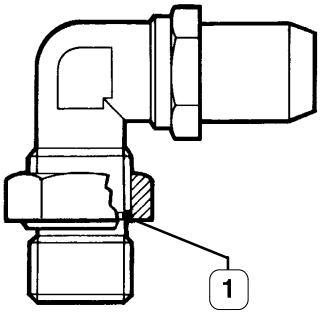


39306

Screw the fitting in the threaded seat provided on the pneumatic valve and lock it at the tightening torque shown in the table.

Swinging fittings

Figure 17



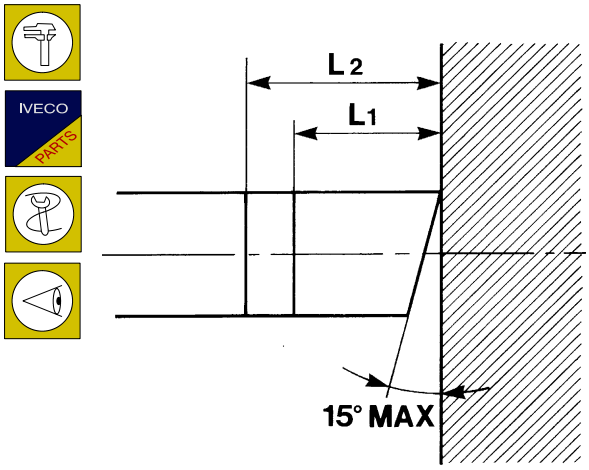
39307

- Check that the sealing ring (1) is into its suitable seat;
- screw the fitting till it is felt that the sealing gasket abuts onto the valve;
- adequately swing the fitting and keeping the swingable part still, lock the hexagonal nut at the tightening torque mentioned in the table.

Rotating and swinging fittings

FITTING THREADING	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

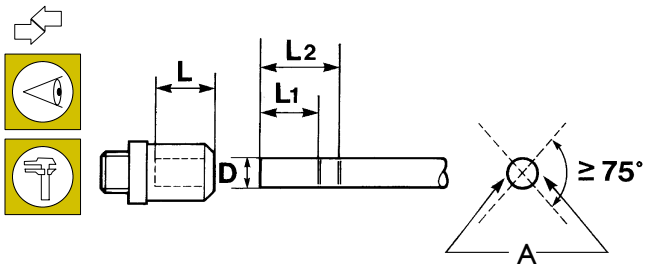
Figure 18



33977

- ❑ Use homogated pipes only;
- ❑ Check the spare pipe status, on which no cracks, cuts or nicking must be detected;
- ❑ Cut the pipe at 90° with a max 15° error with respect to the axis through the suitable pipe-cutting pliers 99387050 at the necessary length;

Figure 19



33976

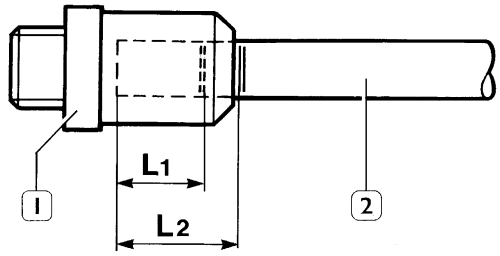
A = Marking to identify pipe end-of-stroke

- ❑ Strongly and indelibly mark with ink two reference notches on both diametrically-opposed pipe faces for an angle ≥ 75°, placed at the distances of L_1 and L_2 to guarantee a correct assembly.

Dimensions L_1 and L_2 change depending on the pipe diameter and must be measured from the longest pipe part (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

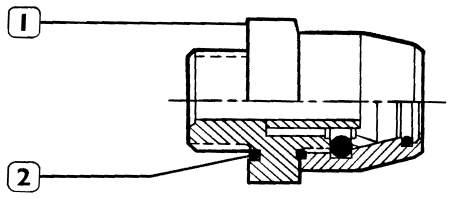
Figure 20



39308

- ❑ Manually insert pipe (2) into fitting (1), with a force varying from 30 to 120 N depending on pipe diameter, so that the notch L_1 is placed inside the fitting while the notch L_2 is visible.

Figure 21



33978

In case of disassembling of fittings (1) from pneumatic components, check the sealing ring (2) status, and if necessary replace it.

FITTING THREADING	SEALING RINGS 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	-

Every time a piping is detached from a quick connection fitting, it is necessary to replace the fitting itself. Quick connection fittings are supplied complete as spares.

Quick connection and threaded fittings, as well as flexible pipings used with quick connection fittings and flexible pipings used with threaded fittings, are not interchangeable.

EBS 2 (ELECTRONIC BRAKE SYSTEM)

The increase in competition in the transport sector has had the effect, among others, of constantly increasing the basic requirements of braking systems.

The introduction of the EBS electronic brake system is the logical answer to these new needs.

It is an integrated and permanent electronic control system for the brake system of the tractor and trailer.

It supplements the ABS, ASR and EBL functions.

The system is made up of a pneumatic system and an electric system. In the system there is inserted the CBU (central brake unit), component integrating:

- ❑ Duplex distributor, which generates electric and pneumatic signals to increase or decrease pressure in the braking system;
- ❑ electronic central unit, which has the task of managing the braking system determining deceleration values as a function of parameters detected from various components;
- ❑ proportional relay valve, which modulates pressure at front axle.

The EBS system dialogues with the control units of the other assemblies:

Engine, Ecas, retarder and gearbox via the CAN line (VDB, Vehicle Data Bus).

EBS Benefits

Lower servicing costs.

The EBS combines many functions. The aim is to cut maintenance costs while maximizing braking safety – that is minimizing brake lining wear.

An individual control according to the lining wear parameters on both the front and rear axles harmonizes lining wear. Distributing the load homogeneously between all the brakes of the wheels reduces total consumption. In addition, the frequency of servicing and changing the linings coincide. The costs of inactivity are drastically reduced.

Depending on the servicing a vehicle needs along with other factors, the owner may be able to make considerable savings. A comparison of the maintenance costs, for the brake system, of a vehicle with EBS and one with a conventional brake system highlights significant savings.

Tractor and trailer compatibility at any time

Harmonizing the braking processes of the entire tractor-trailer combination, especially if the combinations are frequently changed, often with conventional means, is not satisfactory.

An inadequate balance, such as with a trailer whose braking is not sufficiently effective, will cause uneven wear of the brake linings.

The EBS will recognize all the incompatibilities between tractor and trailer, harmonizing braking automatically. When the brakes work in the best conditions, not only are brake maintenance costs optimized, but safety and comfort are optimum too.

Complete fault-diagnosis structures

The EBS provides the owner of the vehicle with constantly updated information on the state of the brake system and the basic brakes. This makes it possible to schedule servicing in advance. The EBS monitors all the fundamental components and functions of the brake system.

Any defect recognized by the system is accurately highlighted. The maintenance specialist can therefore rectify the error at issue.

The high degree of safety ensured by the EBS is due to several factors:

- ❑ Lower pressure accumulation and response times for the brakes on the front, rear and trailer axles.
- ❑ Better ABS function.
- ❑ Tractor/trailer always balanced in every moment.
- ❑ Constant monitoring of the service brake system. In the event of reduced brake performance, the EBS will be able to warn the driver.
- ❑ The integrated ASR function permits optimum vehicle stability and drive optimization.

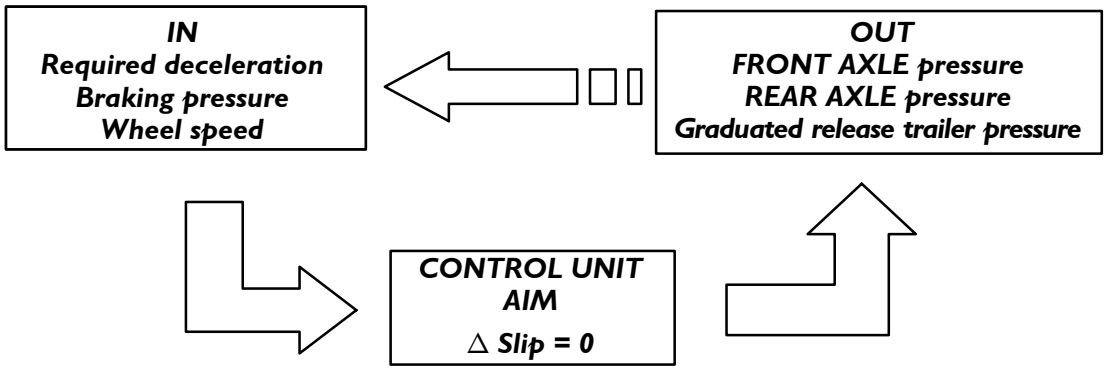
OPERATING LOGIC

The purpose of the electronic control unit is to slow down the vehicle as quickly as possible, ensuring its stability and avoiding the tendency for the wheels to lock.

To achieve this aim, while braking, the electronic control unit will be informed of the:

- ❑ required deceleration via the sensors inside the duplex control valve;
- ❑ pressures made available via the pressure sensors in the components;
- ❑ reaction on slowing down due to the pressures made available via the speed sensor signals.

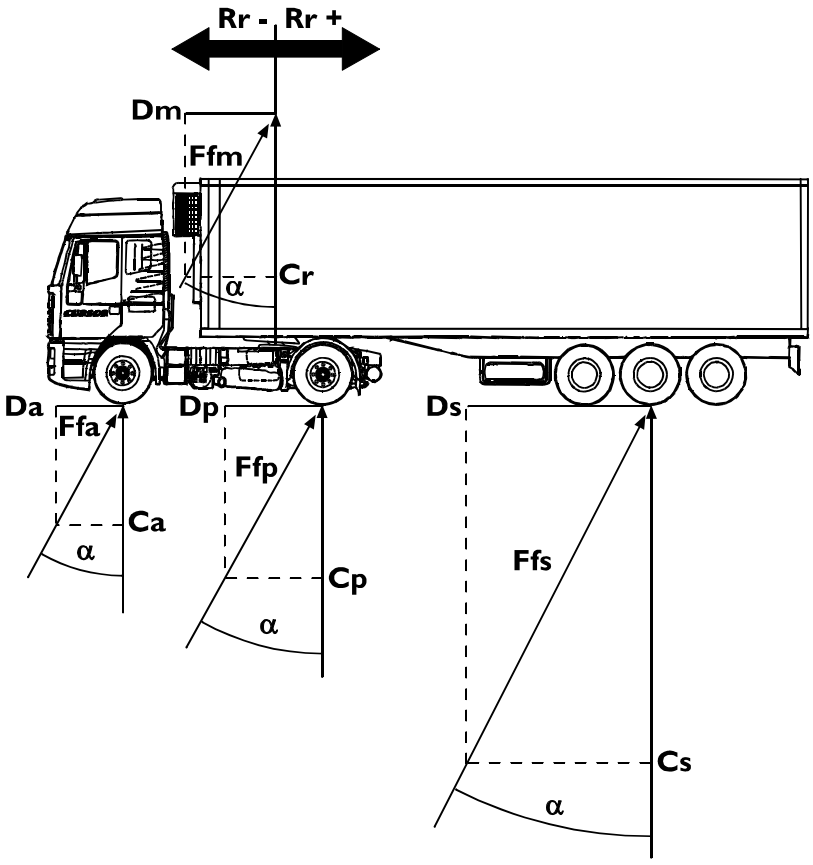
The continuous monitoring and processing of this information, in relation to the set aim, will cause the modulating valves to activate appropriately and optimize the braking action accordingly.



BRAKE SYSTEM

In a dynamic situation the effect on the vehicle will be managed in this way:

Figure 22



Ca. Front axle load - Cp. Rear axle load - Cr. Load on fifth wheel - Da. Front axle braking force - Dp. Rear axle braking force - Dm. Braking force at graduated release - Ds. Semitrailer braking force - Ffa. Resultant of braking/front axle load - Ffp. Resultant of braking/rear axle load - Ffm. Resultant of braking/load at graduated release - Ffs. Resultant of braking/semitrailer load - a. Braking angle - Rr. Reaction on the fifth wheel - Dec. Required deceleration - g. Acceleration due to gravity - z. Braking ratio

Generally, the EBS will tend to apply a braking force in proportion to the load on the axles, that is to maintain the same angle "α" for all the axles:

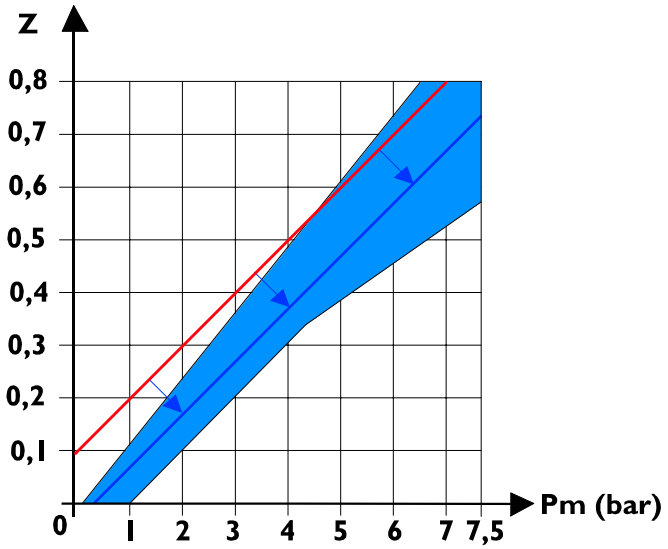
$$\frac{Da}{Ca} = \frac{Dp}{Cp} = \frac{Ds\ (Dm)}{Cs\ (Cr)} = Tag\ \alpha \cong \alpha = \frac{dec}{g} = z$$

Therefore, such force will be larger as compared to required deceleration.

This, as may be seen, also holds for the semitrailer control.

If the reaction on the fifth wheel "Rr" is not as expected, the system automatically increases or decreases the predominance at the graduated release and "Ffm" accordingly so as to ensure the best compatibility between the tractor and semitrailer in compliance with current type-approval standards, as may be seen in the following compatibility diagram.

Figure 23



000987t

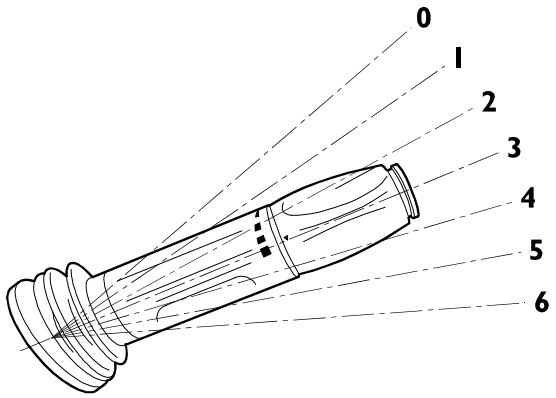
AUXILIARY BRAKE INTEGRATION

Commercial vehicles are normally fitted with auxiliary brakes for slowing down without causing wear, such as the exhaust brake and intarder.

On vehicles equipped with the EBS, these devices can be integrated to ensure the vehicle slows down sooner and more effectively. The exhaust brake/intarder action percentage is set by the driver with the lever.

The exhaust brake will be applied up to a speed of 1000 rpm, while the action of the retarder will cause the following action depending on the position of the lever:

Figure 24



001685t

Position 0 – disengaged

Position 1 – E.B. 100%

Position 2 – E.B. 100% + Intarder 25% (20% *)

Position 3 – E.B. 100% + Intarder 50% (40% *)

Position 4 – E.B. 100% + Intarder 75% (60% *)

Position 5 – E.B. 100% + Intarder 100% (80% *)

Position 6 – E.B. 100% + Intarder 100%

These applications, always possible, will be signalled to the driver by the relevant indicator lights coming on.
* Vehicles with mechanic gearbox.

On vehicles without the optional Intarder, the auxiliary brake lever has just three positions: off, E.B. 50%, E.B. 100%.

On vehicles fitted with a EuroTronic gearbox, with the auxiliary brake lever on position 6, slowing down will be more effective with the automatic gear shift down.

Switching the engine off for longer than one minute involving a change in load, tyres or ratios at the rear axle causes the adjustment data to be lost and so a fresh period of data acquisition will be necessary for the system to be able to reactivate auxiliary brake integration if no vehicle parameter is changed the integration will be immediately available.

If manually activating the auxiliary brakes, the next time the brake pedal is pressed will implement integration.

On releasing the brake pedal, if the manual action is compatible with the calculated action it will be kept active.

If activating the auxiliary brakes, both manual and integrated, causes the rear axle to slow down too much and a tendency for it to lock, the EBS control unit, on detecting this situation via the speed sensors, will immediately disengage them or turn on the auxiliary brake Slip Control.

ESP (Electronic Stability Program)

ESP function, joined to EBS abilities, controls vehicle lateral dynamics.

The main objectives of this function are:

- ❑ Improving stability, most of all in both understeering and oversteering conditions
- ❑ Reducing braking spaces in change of line conditions on slippery roads

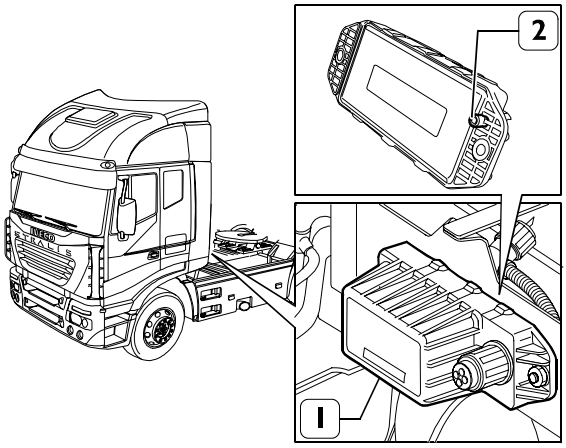
Main central unit input data in order to achieve following objectives, are:

- ❑ signal from steering angle sensor (mounted on the steering wheel)
- ❑ signals from yaw speed and lateral acceleration sensors (integrated into the ESP module, that is mounted on the chassis and also contains a part of ESP software).

In order to avoid control loss, the ESP will automatically activate the brakes of one wheel per axle only trying to take the vehicle back to correct direction. In this case, the ESP controls towing body skidding angle and slant, as well as the shift between driver's request and actual vehicle yaw speed. To the purpose of withstanding vehicle deceleration, the driving torque will be decreased. In yaw control mode, the ESP very carefully controls driver's reactions and always tries to provide relevant support.

Note: ESP function is optionally available on tractors only.

Figure 25



89009

1. ESP module - 2. Reference pin for mounting to support bracket.

"ABS-EBL" SYSTEM (ANTI-LOCK BRAKE SYSTEM – ELECTRONIC BRAKE LIMITER)

EBL function controls rear axle wheel "skidding" by comparing it to front axle wheel speed.
On the basis of wheel r.p.m.'s and braking pressure (detected by the sensor upstream from rear axle ABS modulators), the central unit calculates vehicle speed, rear axle wheel "skidding" and minimum acceleration expected.

"ABS" (Anti-Lock Brake System)

The braking of a moving vehicle and the according deceleration and stopping distances depend above all on the grip between the surfaces of the tyres and the road.

With a fully efficient braking system, a further improvement in braking can only be achieved by acting on the friction of the tyres or on the grade of the road surface.

Even in these optimum conditions, absolute braking safety is anyhow not guaranteed when faced with especially tricky situations, such as poor grip due to a wet or icy road surface: the driver is forced to moderate use of the brakes in order to avoid partially locking one or more wheels, with the risk of skidding dangerously.

The function of the "ABS" is therefore to ensure vehicle stability (in all braking conditions), preventing the wheels from locking irrespective of the state of the road surface, so as to ensure the available grip is made full use of.

Even in the case of emergency braking, the system makes it possible to keep direction, that is to turn the steering wheel to avoid obstacles with no risk of skidding.

In short, the anti-lock brake system (ABS):

- ❑ Prevents the wheels locking when the vehicle is braking, no matter what grip is available on the road.
- ❑ Shortens stopping distances.
- ❑ Provides safety for the driver who can keep the vehicle's stability and direction.

EBL (Electronic Brakes Limiter)

The EBL function checks the rear axle wheel "slip", comparing it with the speed of the wheels of the front axle.

The control unit input data are the wheel speed and braking pressure measured by the pressure sensor installed upstream from the rear axle ABS modulators.

On the basis of these values, the control unit calculates the speed of the vehicle, the vehicle's deceleration, the rear axle wheel "slip" and the minimum deceleration contemplated.

The EBL function is activated (the rear ABS modulators maintain the set pressure) when the driver applies an excessive braking force for the conditions of load on the vehicle, in short when the rear axle slip and vehicle deceleration thresholds are exceeded.

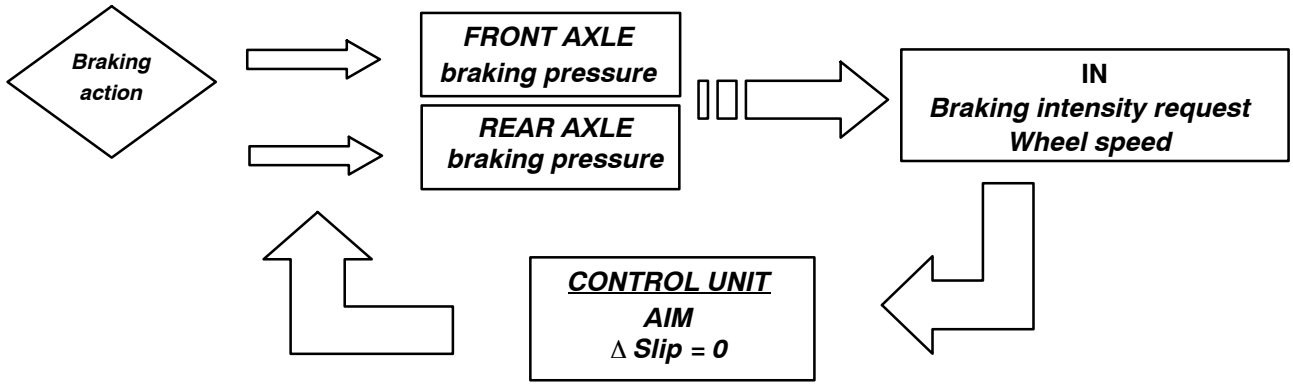
Operating Logic

The purpose of the electronic control unit is to slow down the vehicle as quickly as possible, ensuring its stability and avoiding the tendency for the wheels to lock.
To achieve this aim, while braking, the electronic control unit will be informed of the:

- braking intensity required by the driver via the rear axle pressure sensor,
- reaction on slowing down due to the pressures made available via the speed sensor signals.

The continuous monitoring and processing of this information, in relation to the set aim, will cause the rear axle modulating valves to activate appropriately and optimize the braking action accordingly.

Figure 26



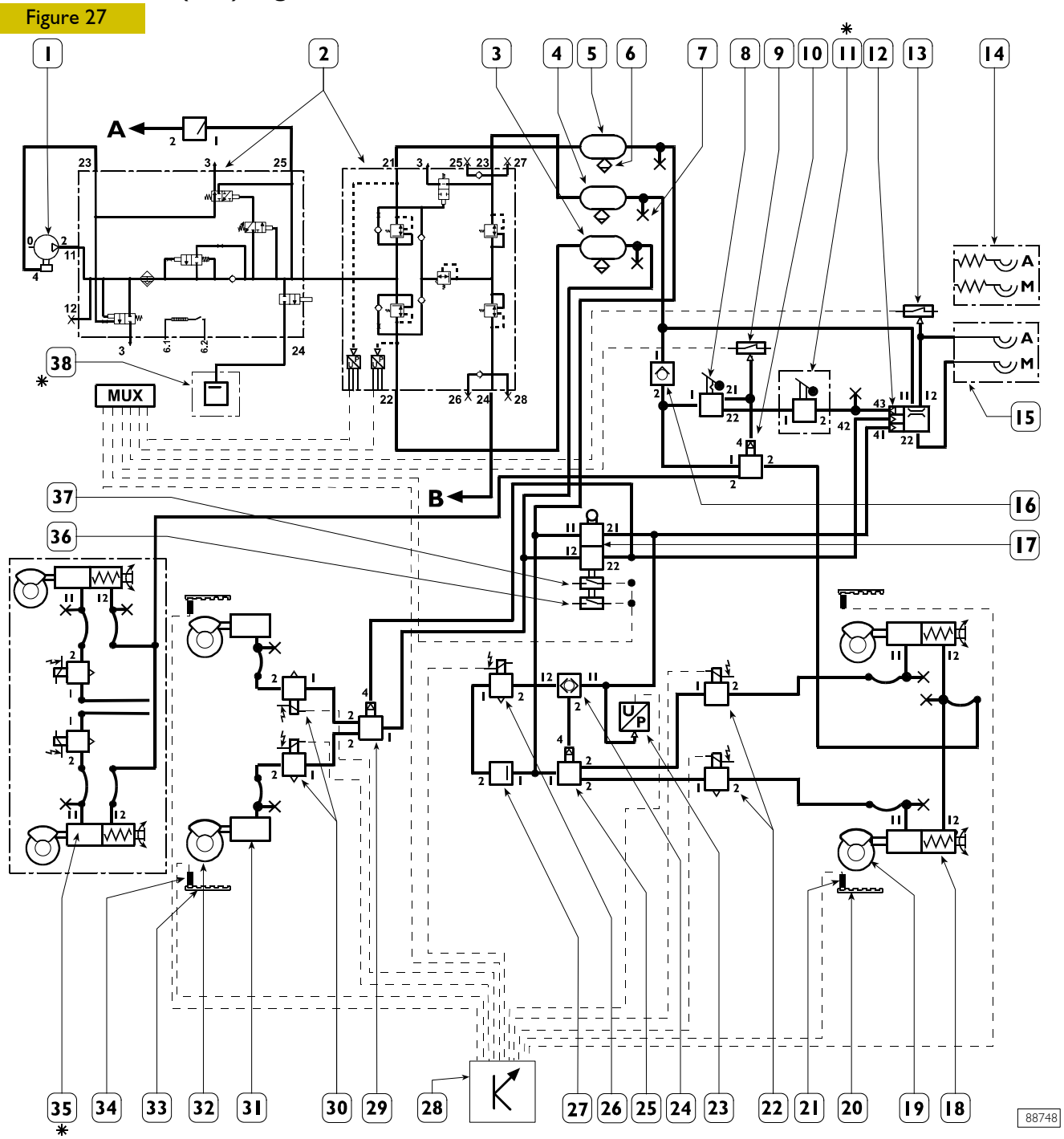
Braking system evolution

Vehicle	Engine	Type of system	Type of brakes
AT/AD/AS - HR	cursor 8/10/13	EBL	Disc/Drum
AT/AD/AS - 6x4	cursor 10/13	EBL	Disc/Drum
AT/AD (no HR)	cursor 8	EBL	Disc/Disc
AT/AD mechanical suspensions	cursor 10	EBL	Disc/Disc
AT/AD/AS	cursor 10	EBS	Disc/Disc
AS	cursor 13	EBS	Disc/Disc

BRAKING SYSTEMS

ABS-EBL working diagram for 4x2 vehicles (trucks and tractors, not including HR) with CURSOR 8 (F2B) engine

Figure 27



1. Compressor - 2. Air processing unit - 10.5 bars - 3. Front axle air tank - 20 l. - 4. Parking air tank - 20 l. - 5. Rear axle air tank - 30 l. - 6. Manual discharge valve - 7. Air test point - 8. Parking manual control valve - 9. Handbrake low pressure switch turned on – 6.4 bars - 10. Parking control relay valve - 11. Trailer slowing manual control valve - 12. Trailer brake servo control valve - 13. Trailer system low pressure switch – 6.4 bars - 14. Trailer half couplings for tractors - 15. Trailer coupling half joints for FP-CT carts and tractors - 16. Parking system one-way valve - 17. Duplex control valve - 18. Rear axle combined cylinder - 19. Rear axle disk brake assembly - 20. Rear axle phonic wheel - 21. Rear axle speed sensor - 22. Rear axle ABS solenoid valves - 23. EBL pressure sensor - 24. Dual stop valve - 25. Rear axle brake control relay valve - 26. ASR control solenoid valve - 27. Controlled pressure valve with no return for ASR – 7.5 bars - 28. ABS electronic control unit - 29. Front axle brake control relay valve - 30. Front axle ABS solenoid valve - 31. Front axle diaphragm brake cylinder - 32. Front axle disc brake assembly - 33. Front axle phonic wheel - 34. Front axle speed sensor - 35. Front axle parking brake - 36. Brake light control microswitch - 37. Microswitch for EDC control unit - 38. 14 bar safety valve - A. To the air suspension system - B. To the service system - * Optional.

Working diagram for 6x2 vehicles (tractors) with CURSOR 8 (F2B) engine

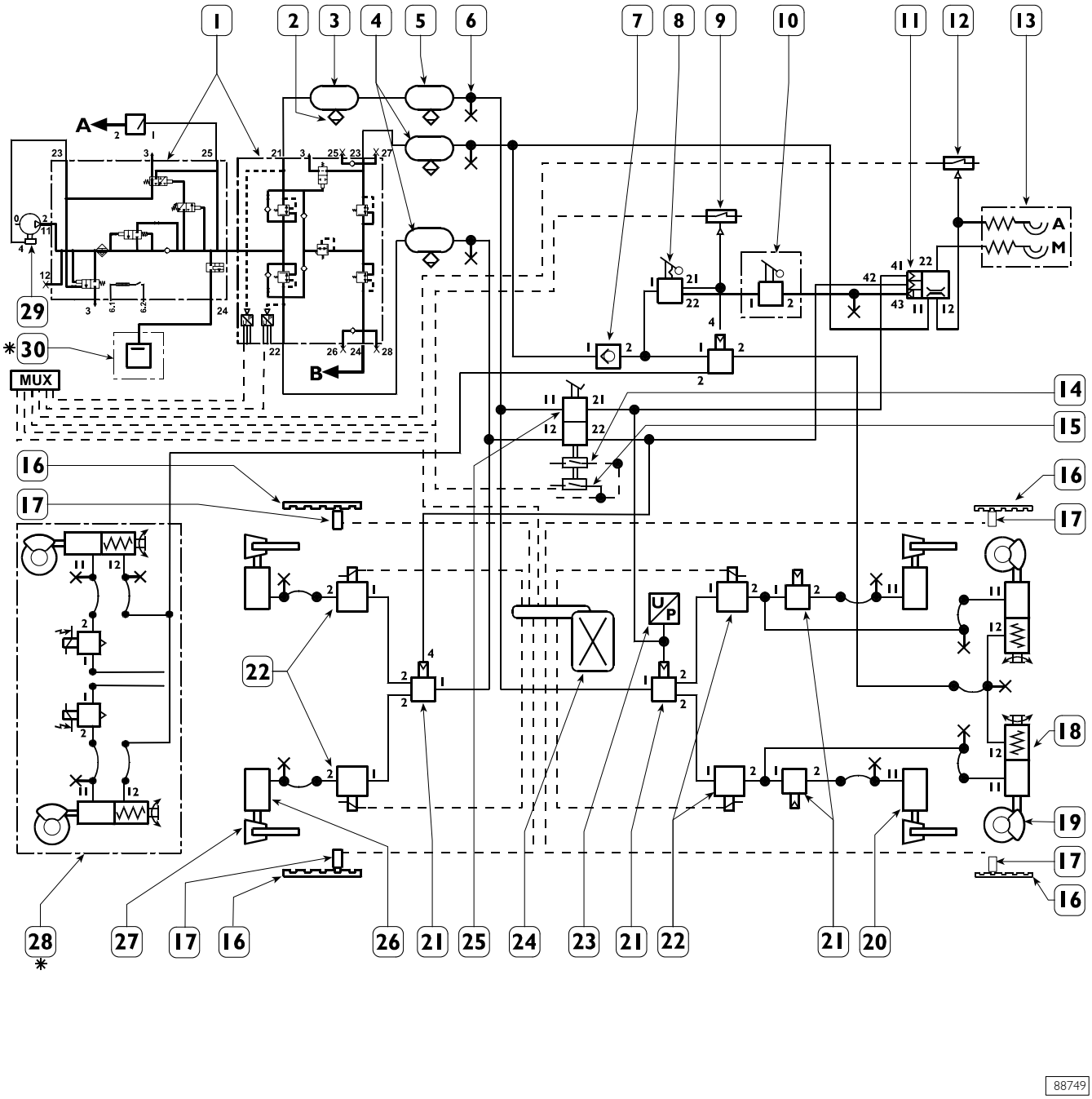
Legend

1. A.P.U. unit
2. Manual condensate bleeding valve
3. 30-litre air reservoir
4. 20 -litre air reservoir
5. 15-litre air reservoir
6. Pressure check socket
7. Retaining valve
8. Manual control distributor for parking brake
9. Low pressure switch
10. Manual control distributor for trailer brake (optional)
11. Three-control servo-distributor
12. Low pressure switch
13. Half-coupling "ISO"
14. Stop light control microswitch
15. EDC control unit microswitch
16. Phonic wheel
17. Rev sensor
18. Combined brake cylinder
19. Rear disk brake assembly
20. Membrane brake cylinder
21. Relay valve
22. ABS solenoid valve
23. Pressure sensor
24. Electronic control unit
25. Duplex distributor
26. Membrane cylinder
27. Disc brake assembly
28. Axle emergency brake
29. Compressor
30. 14 bar safety valve (optional)

A. To air suspensions
B. To services
* Optional

ABS-EBL working diagram for 6x2 vehicles (tractors) with CURSOR 8 (F2B) engine

Figure 28



Working diagram for 6x2 vehicles (trucks) with CURSOR 8 (F2B) engine and with CURSOR 10 engine (F3A with mechanical suspensions)

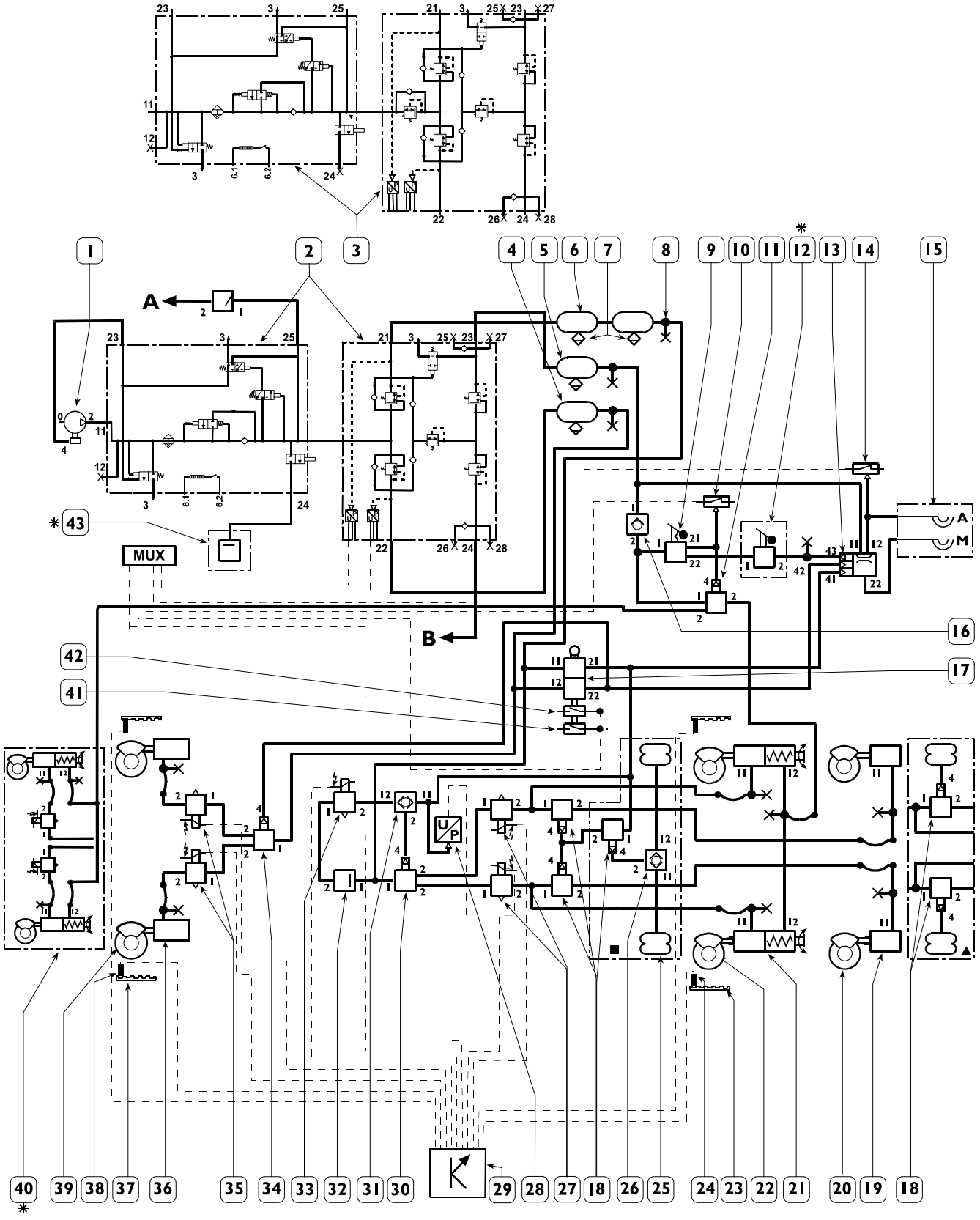
Legend

1. Compressor
2. Air processing unit - 10.5 bars
3. Air processing unit - 12.5 bars
4. Front axle air tank - 20 l.
5. Parking air tank - 20 l.
6. Rear axle air tank – 30 l. + 20 l.
7. Manual discharge valve
8. Air test point
9. Parking manual control valve
10. Handbrake low pressure switch turned on – 6.4 bars
11. Parking control relay valve
12. Trailer slowing manual control valve
13. Trailer brake servo control valve
14. Trailer system low pressure switch – 6.4 bars
15. Trailer half-couplings
16. Parking system one-way valve
17. Duplex control valve
18. Load ratio relay valve for added axle braking
19. Diaphragm cylinder
20. Additional axle disk brake assembly
21. Rear axle combined cylinder
22. Rear axle disk brake assembly
23. Rear axle phonic wheel
24. Rear axle speed sensor
25. Added axle suspension air springs
26. Added axle load ratio dual stop valve
27. Rear axle ABS solenoid valves
28. EBL pressure sensor
29. ABS electronic control unit
30. Rear axle brake control relay valve
31. Dual stop valve
32. Controlled pressure valve with no return for ASR – 7 bars
33. ASR control solenoid valve
34. Front axle brake control relay valve
35. Front axle ABS solenoid valve
36. Front axle diaphragm brake cylinder
37. Front axle phonic wheel
38. Front axle speed sensor
39. Front axle disc brake assembly
40. Axle emergency brake
41. Brake light control microswitch
42. Microswitch for EDC control unit
43. 14 bar safety valve (optional)

A. To the air suspension system
B. To the service system
* Optional
• For CM vehicles only
■ Version with ASR
▲ Version without ASR

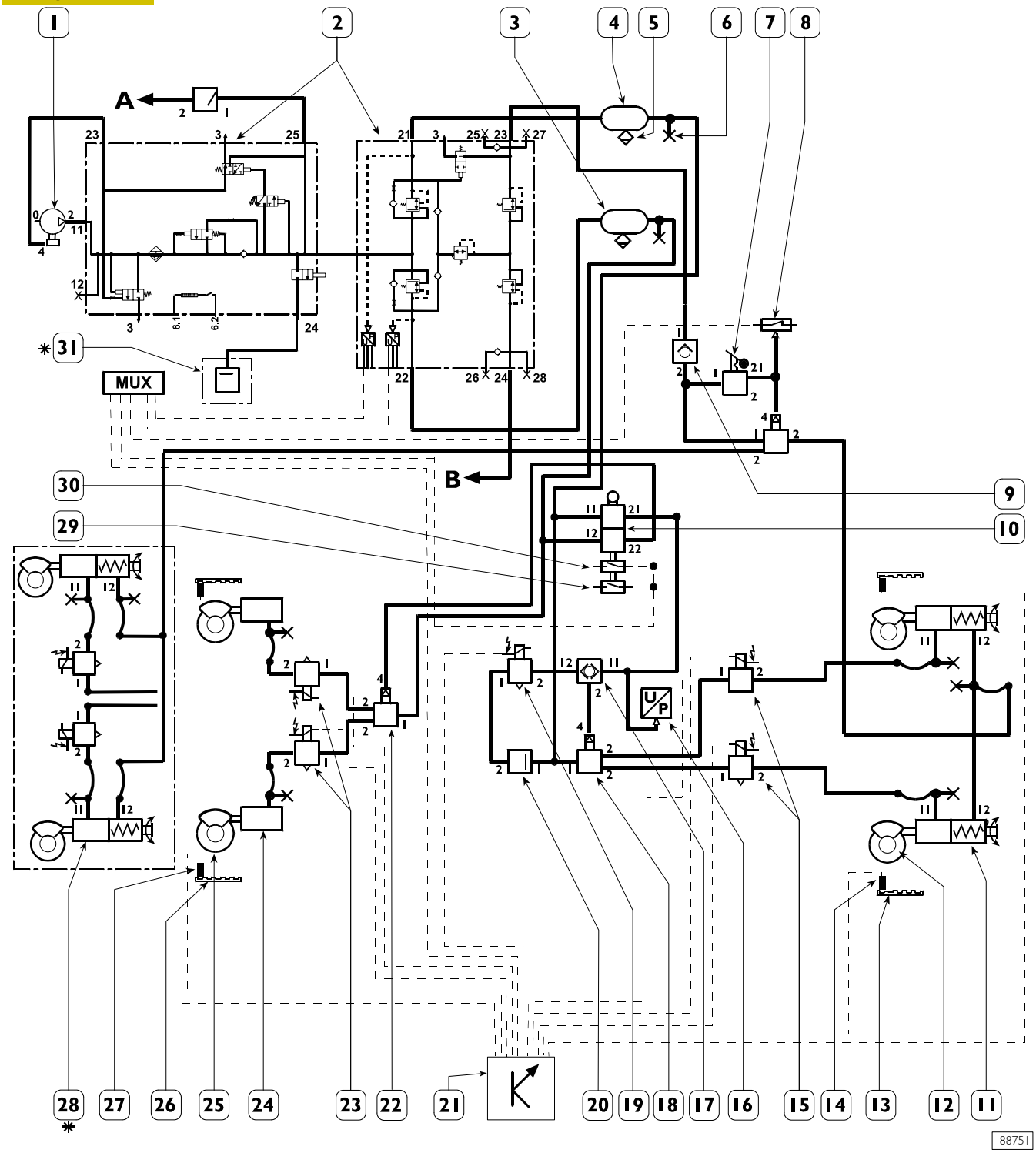
ABS-EBL working diagram for 6x2 vehicles (trucks) with CURSOR 8 (F2B) engine and with CURSOR 10 engine (F3A with mechanical suspensions)

Figure 29



ABS-EBL working diagram for stand alone 4x2 vehicles (trucks) with CURSOR 8 (F2B) engine

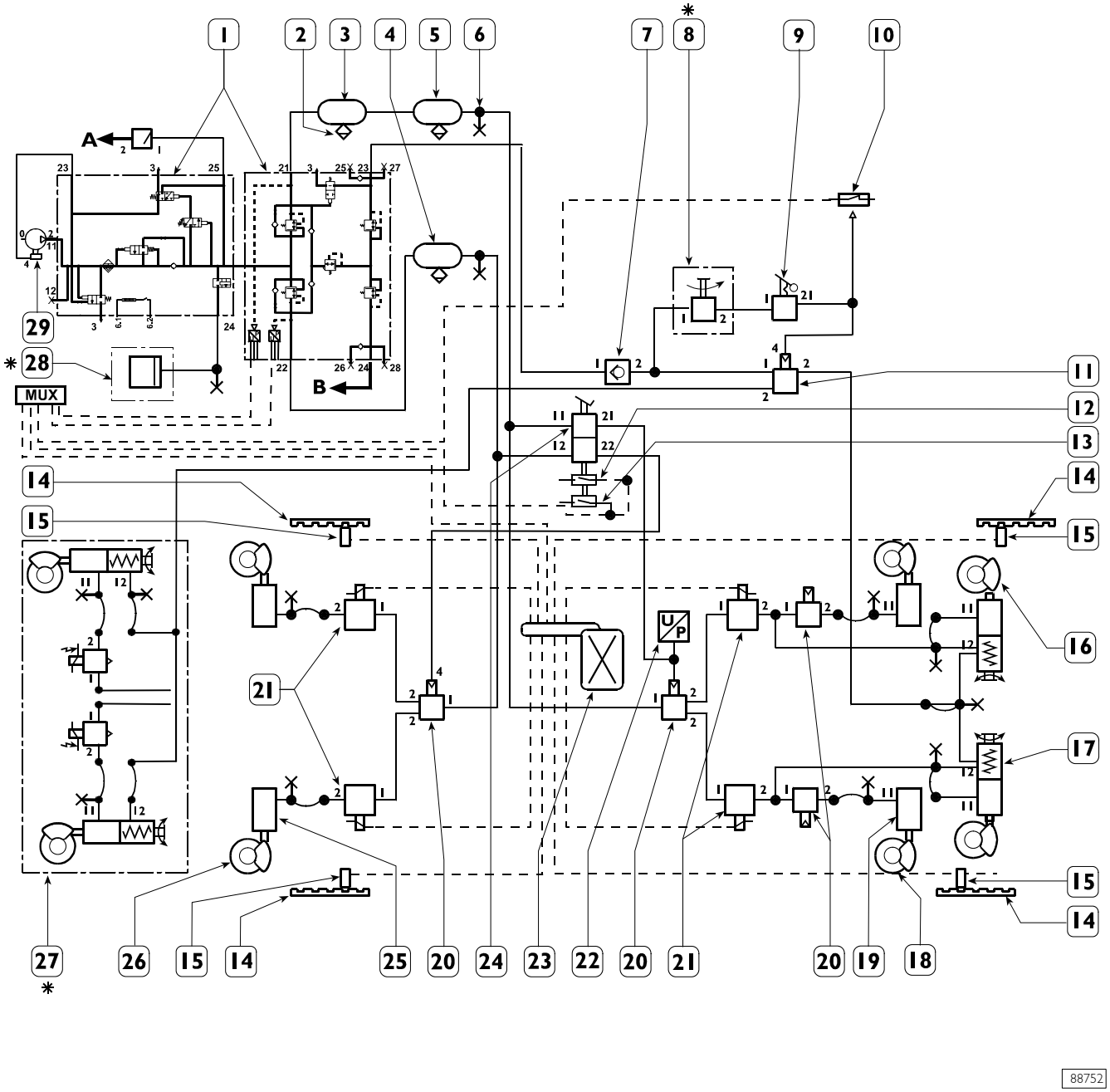
Figure 30



1. Compressor - 2. Air processing unit - 10.5 bars - 3. Air tank - 20 l. - 4. Air tank - 30 l. - 5. Manual discharge valve - 6. Air test point - 7. Parking manual control valve - 8. Handbrake low pressure switch turned on – 6.4 bars - 9. Parking system one-way valve - 10. Duplex control valve - 11. Rear axle combined cylinder - 12. Rear axle disc brake assembly - 13. Rear axle phonic wheel - 14. Rear axle speed sensor - 15. Rear axle ABS solenoid valves - 16. EBL pressure sensor - 17. Dual stop valve - 18. Rear axle brake control relay valve - 19. ASR control solenoid valve - 20. Controlled pressure valve with no return for ASR – 7.5 bars - 21. ABS electronic control unit - 22. Front axle brake control relay valve - 23. Front axle ABS solenoid valve - 24. Front axle diaphragm brake cylinder - 25. Front axle disc brake assembly - 26. Front axle phonic wheel - 27. Front axle speed sensor - 28. Front axle parking brake - 29. Brake light control microswitch - 30. Microswitch for EDC control unit - 31. 14 bar safety valve - A. To the air suspension system - B. To the service system - * Optional.

ABS-EBL working diagram for 6x2C vehicles (trucks) with CURSOR 8 (F2B) engine

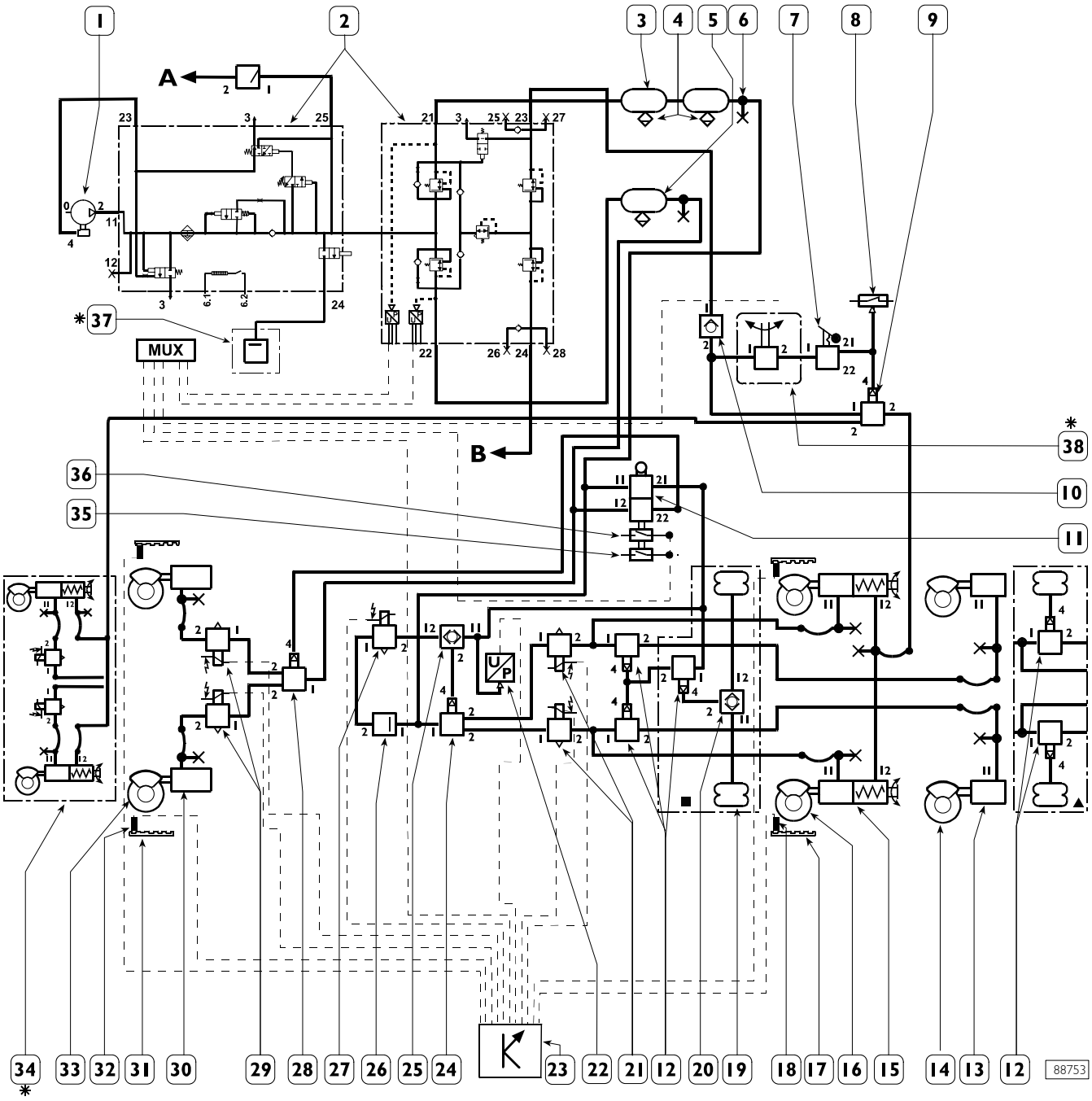
Figure 31



1. A.P.U. unit - 2. Manual condensate bleeding valve - 3. 20-litre air reservoir - 4. 20 -litre air reservoir - 5. 30-litre air reservoir - 6. Pressure check socket - 7. Retaining valve - 8. Cutoff valve - 9. Manual control distributor for parking brake - 10. Low pressure switch - 11. Parking control relay valve - 12. Stop light control microswitch - 13. EDC control unit microswitch - 14. Phonic wheel - 15. Rev sensor - 16. Disc brake assembly - 17. Combined brake cylinder - 18. Disc brake assembly - 19. Membrane brake cylinder - 20. Relay valve - 21. ABS solenoid valve - 22. Pressure sensor - 23. Electronic control unit - 24. Duplex distributor - 25. Membrane cylinder - 26. Disc brake assembly - 27. Axle parking brake - 28. 14 bar safety valve - 29. Compressor - A. To air suspensions - B. To services - * Optional.

ABS-EBL working diagram for stand alone 6x2 vehicles (trucks) with CURSOR 8 (F2B) engine

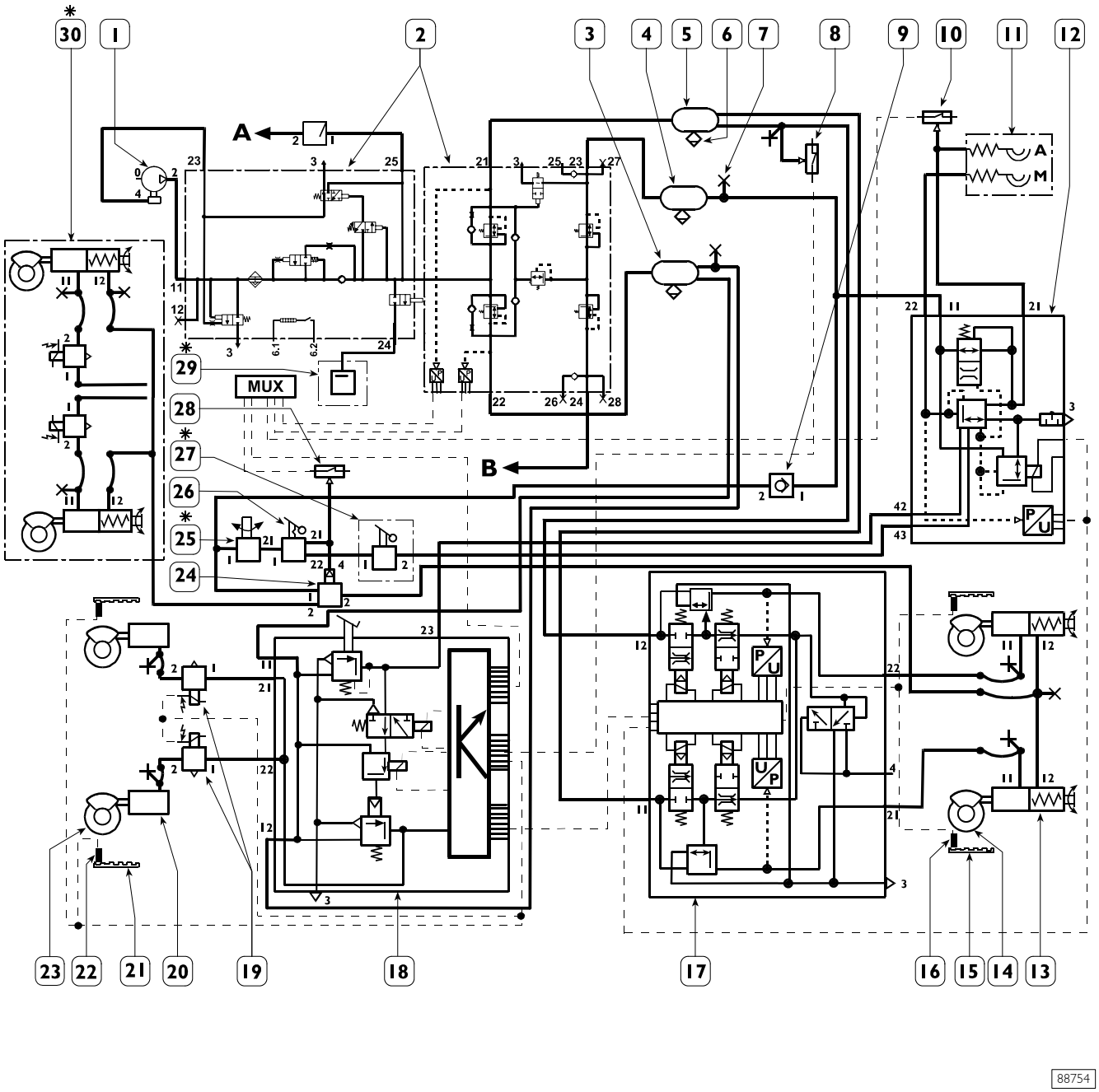
Figure 32



1. Compressor - 2. Air processing unit - 10.5 bars - 3. Air tank - 30 l. - 4. Manual discharge valve - 5. Air tank - 20 l. - 6. Air test point - 7. Parking manual control valve - 8. Handbrake low pressure switch turned on - 9. Parking control relay valve - 10. Parking system one-way valve - 11. Duplex control valve - 12. Load ratio relay valve for added axle braking- 13. Diaphragm cylinder - 14. Added axle drum brake assembly - 15. Rear axle combined cylinder - 16. Rear axle disc brake assembly - 17. Rear axle phonic wheel - 18. Rear axle speed sensor - 19. Added axle suspension air springs - 20. Added axle load ratio dual stop valve- 21. Rear axle ABS solenoid valves - 22. EBL pressure sensor - 23. ABS electronic control unit - 24. Rear axle brake control relay valve - 25. Dual stop valve - 26. Controlled pressure valve with no return for ASR – 7 bars - 27. ASR control solenoid valve - 28. Front axle brake control relay valve - 29. Front axle ABS solenoid valve - 30. Front axle diaphragm brake cylinder - 31. Front axle phonic wheel - 32. Front axle speed sensor - 33. Front axle disc brake assembly - 34. Front axle parking brake - 35. Brake light control microswitch - 36. Microswitch for EDC control unit - 37. 14 bar safety valve - 38. On-off valve - A. To service (TN vehicles) and pneumatic suspensions (Y/P/PS/PT - Y/FP/FS/FT vehicles) system - B. To the service system - * Optional - ■ Version with ASR - ▲ Version without ASR.

EBS 2 working diagram for 4x2 vehicles (tractors) with CURSOR 10/13 engine

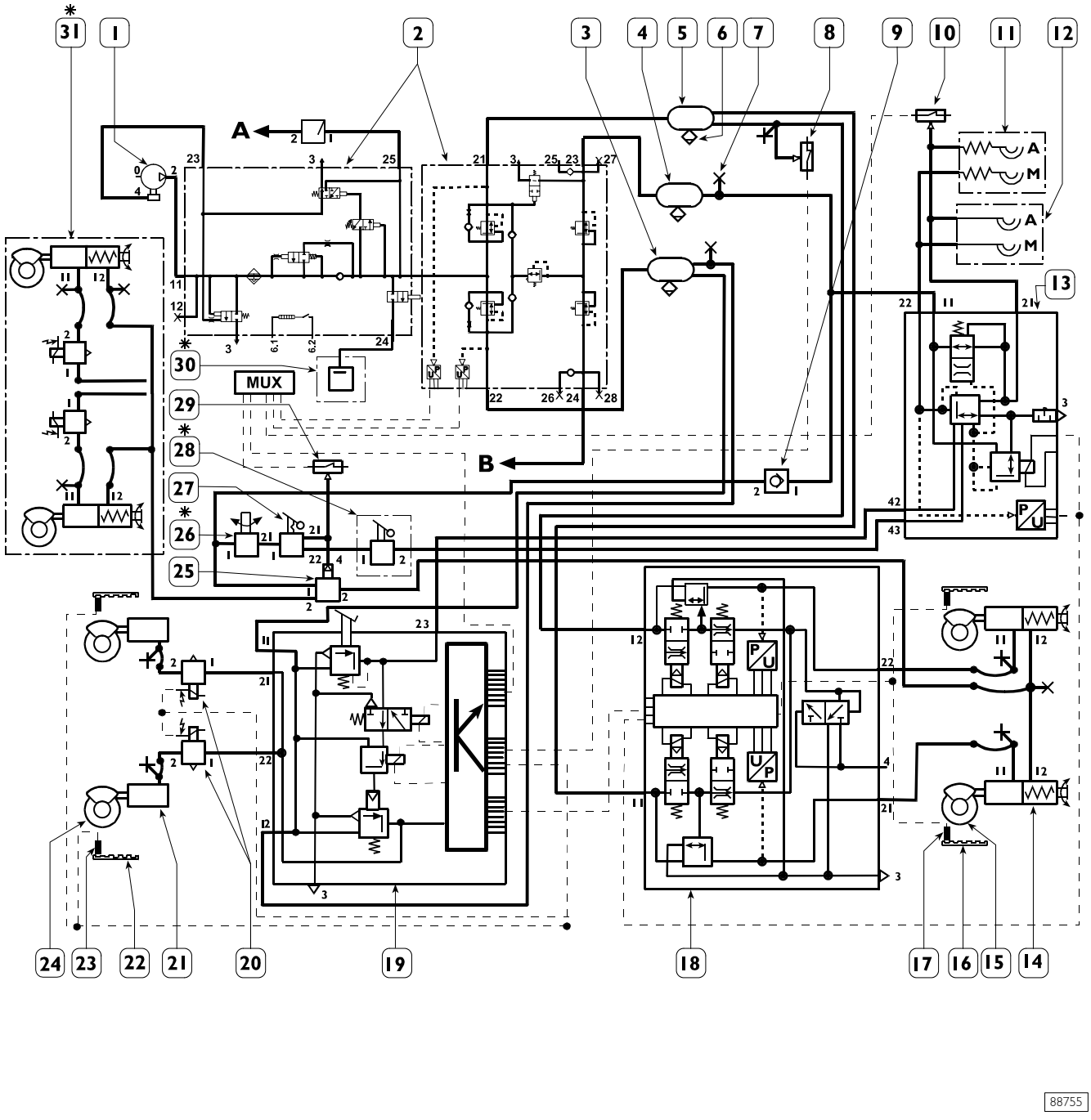
Figure 33



1. Compressor - 2. Air processing unit 10.5 bars - 3. Front axle air tank 20 l. - 4. Parking air tank 20 l. - 5. Rear axle air tank 30 l. - 6. Manual discharge valve - 7. Air test point - 8. Rear axle low pressure switch for ASR - 6.6 bars - 9. Parking system one-way valve - 10. Trailer system low pressure switch - 5.5 bars - 11. Semitrailer half-couplings - 12. Trailer brake servo control valve - 13. Rear axle combined cylinder - 14. Rear axle disc brake assembly - 15. Rear axle phonic wheel - 16. Rear axle speed sensor - 17. Rear axle brake control electro-pneumatic modulator - 18. CBU - 19. Front axle ABS solenoid valves - 20. Front axle diaphragm brake cylinder - 21. Front axle phonic wheel - 22. Front axle speed sensor - 23. Front axle disc brake assembly - 24. Parking control relay valve - 25. On-off valve - 26. Parking manual control valve - 27. Trailer slowing manual control valve - 28. Handbrake low pressure switch turned on - 6.6 bars - 29. 14 bar safety valve - 30. Front axle parking brake - A. To the air suspension system - B. To the service system - * Optional.

EBS 2 working diagram for 4x2 T/FP-CT vehicles (tractors) with CURSOR 10/13 engine

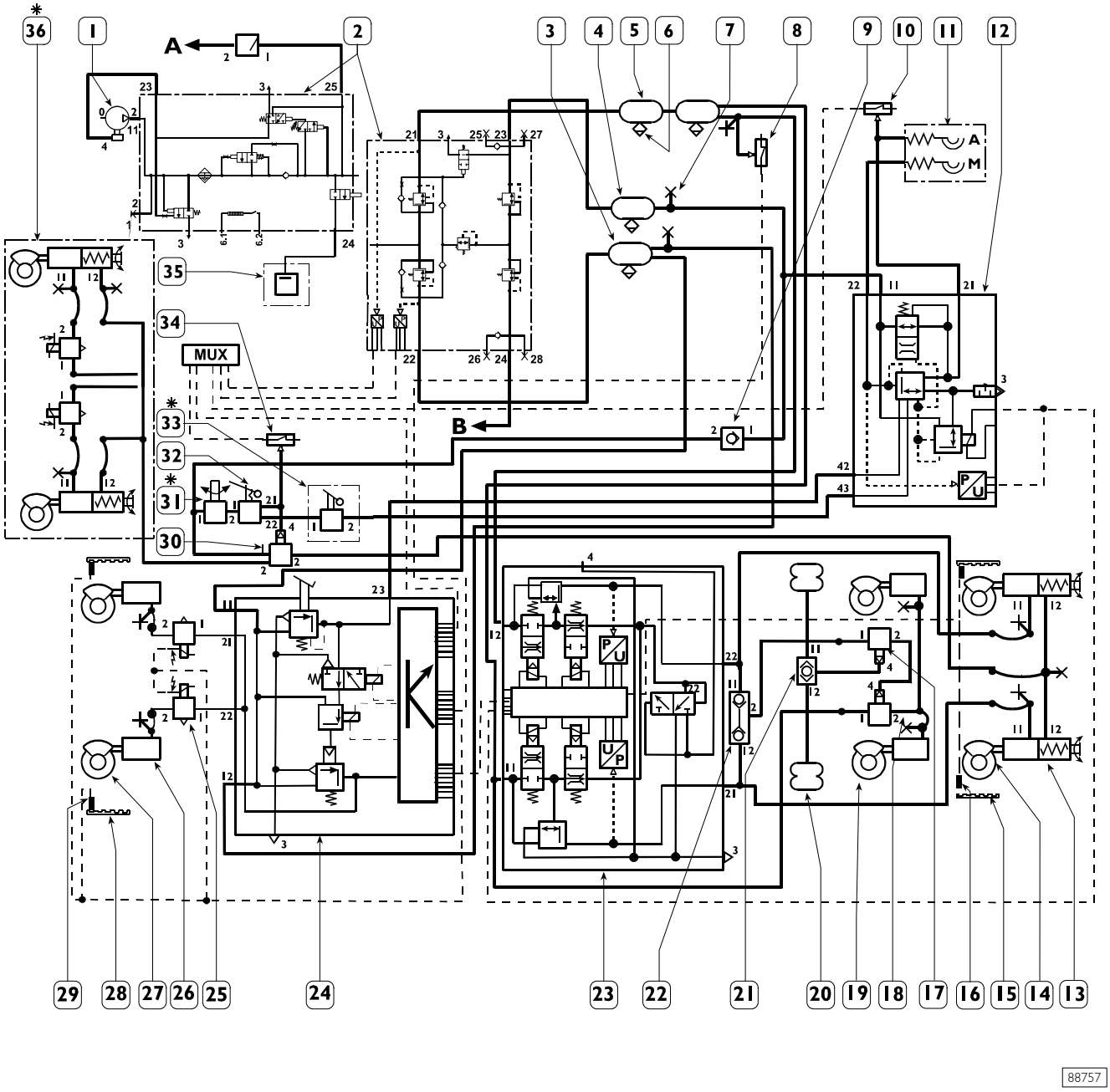
Figure 34



1. Compressor - 2. Air processing unit 10.5 bars - 3. Front axle air tank 20 l. - 4. Parking air tank 20 l. - 5. Rear axle air tank 30 l. - 6. Manual discharge valve - 7. Air test point - 8. Rear axle low pressure switch for ASR - 6.6 bars - 9. Parking system one-way valve - 10. Trailer system low pressure switch - 5.5 bars - 11. Semitrailer half-couplings - 12. ISO half coupling - 13. Trailer brake servo control valve - 14. Rear axle combined cylinder - 15. Rear axle disc brake assembly - 16. Rear axle phonic wheel - 17. Rear axle speed sensor - 18. Rear axle brake control electro-pneumatic modulator - 19. CBU - 20. Front axle ABS solenoid valves - 21. Front axle diaphragm brake cylinder - 22. Front axle phonic wheel - 23. Front axle speed sensor - 24. Front axle disc brake assembly - 25. Parking control relay valve - 26. On-off valve - 27. Parking manual control valve - 28. Trailer slowing manual control valve - 29. Handbrake low pressure switch turned on - 6.6 bars - 30. 14 bar safety valve - 31. Front axle parking brake - A. To the air suspension system - B. To the service system - * Optional

EBS 2 working diagram for 6x2 vehicles (tractors) with CURSOR 10/13 engine

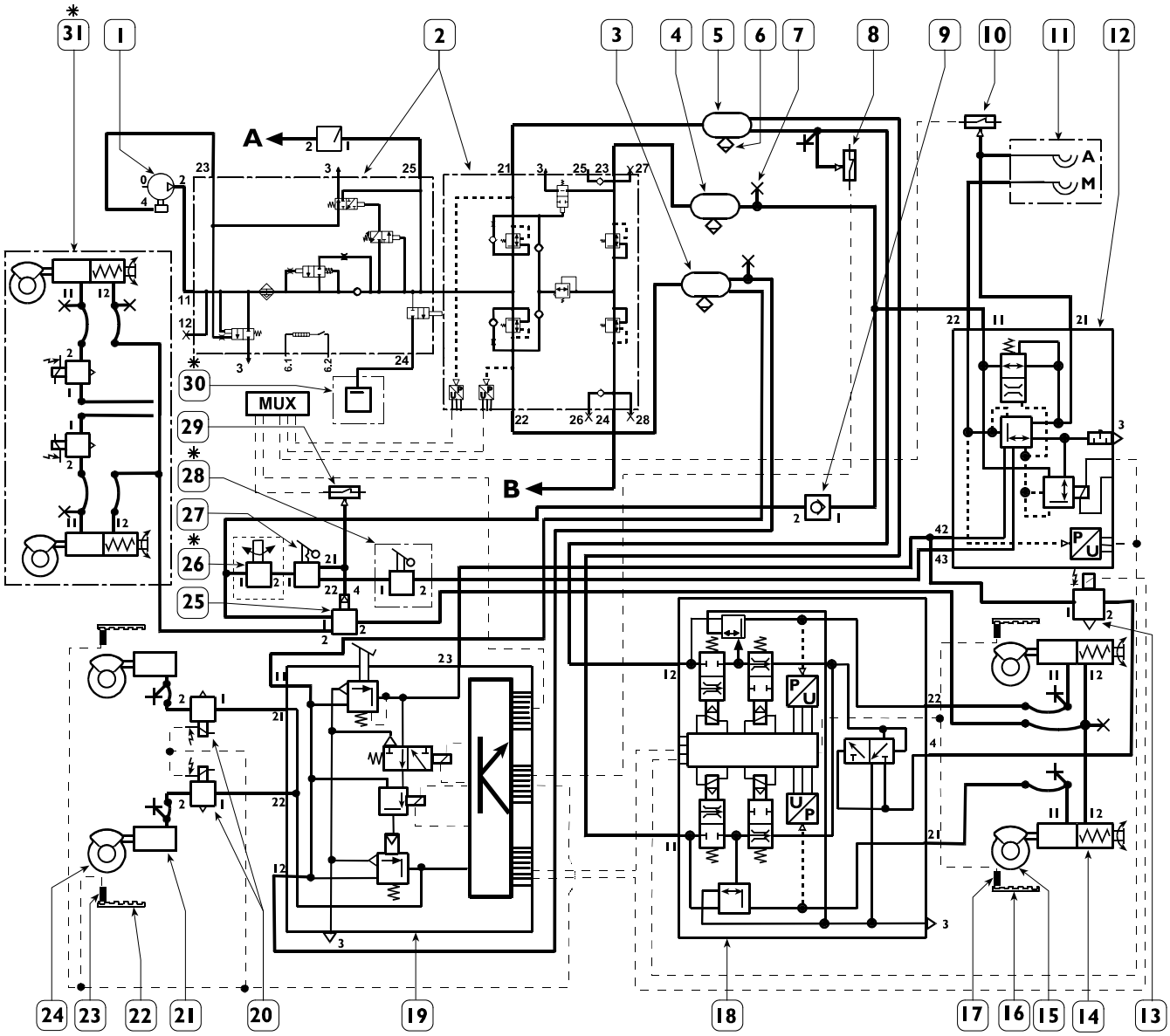
Figure 35



1. Compressor - 2. Air processing unit 10.5 bars - 3. Front axle air tank 20 l. - 4. Parking air tank 20 l. - 5. Rear axle air tank 30 l. + 15 l. - 6. Manual discharge valve - 7. Air test point - 8. Rear axle low pressure switch for ASR - 6.6 bars - 9. Parking system one-way valve - 10. Trailer system low pressure switch - 5.5 bars - 11. Semitrailer half-couplings - 12. Trailer brake servo control valve - 13. Rear axle combined cylinder - 14. Rear axle disc brake assembly - 15. Rear axle phonic wheel - 16. Rear axle speed sensor - 17. Relay valves - 18. Intermediate axle diaphragm cylinder - 19. Intermediate axle disc brake assembly - 20. Intermediate axle suspension air springs - 21. Intermediate axle load ratio dual stop valve - 22. Selector - 23. Rear axle braking control electro-pneumatic modulator - 24. CBU - 25. Front axle ABS solenoid valves - 26. Front axle diaphragm brake cylinder - 27. Front axle disc brake assembly - 28. Front axle phonic wheel - 29. Front axle speed sensor - 30. Parking control relay valve - 31. On-off valve - 32. Parking manual control valve - 33. Trailer slowing manual control valve - 34. Handbrake low pressure switch turned on - 6.6 bars - 35. 14 bar safety valve - 36. Front axle parking brake - A. To the air suspension system - B. To the service system - * Optional.

EBS 2 working diagram for 4x2 vehicles (trucks) with CURSOR 10/13 engine

Figure 36



1. Compressor - 2. Air processing unit 10.5 bars - 3. Front axle air tank 20 l. - 4. Parking air tank 20 l. - 5. Rear axle air tank 30 l. - 6. Manual discharge valve - 7. Air test point - 8. Rear axle low pressure switch for ASR - 6.6 bars - 9. Parking system one-way valve - 10. Trailer system low pressure switch - 5.5 bars - 11. ISO coupling half joints - 12. Trailer brake servo control valve - 13. Redundant solenoid valve - 14. Rear axle combined cylinder - 15. Rear axle disc brake assembly - 16. Rear axle phonic wheel - 17. Rear axle speed sensor - 18. Rear axle brake control electro-pneumatic modulator - 19. CBU - 20. Front axle ABS solenoid valves - 21. Front axle diaphragm brake cylinder - 22. Front axle phonic wheel - 23. Front axle speed sensor - 24. Front axle disc brake assembly - 25. Parking control relay valve - 26. On-off valve - 27. Parking manual control valve - 28. Trailer slowing manual control valve - 29. Handbrake low pressure switch turned on - 6.6 bars - 30. 14 bar safety valve - 31. Front axle parking brake - A. To the air suspension system - B. To the service system - * Optional

EBS 2 working diagram for 6x2 vehicles (trucks) with CURSOR 10/13 engine

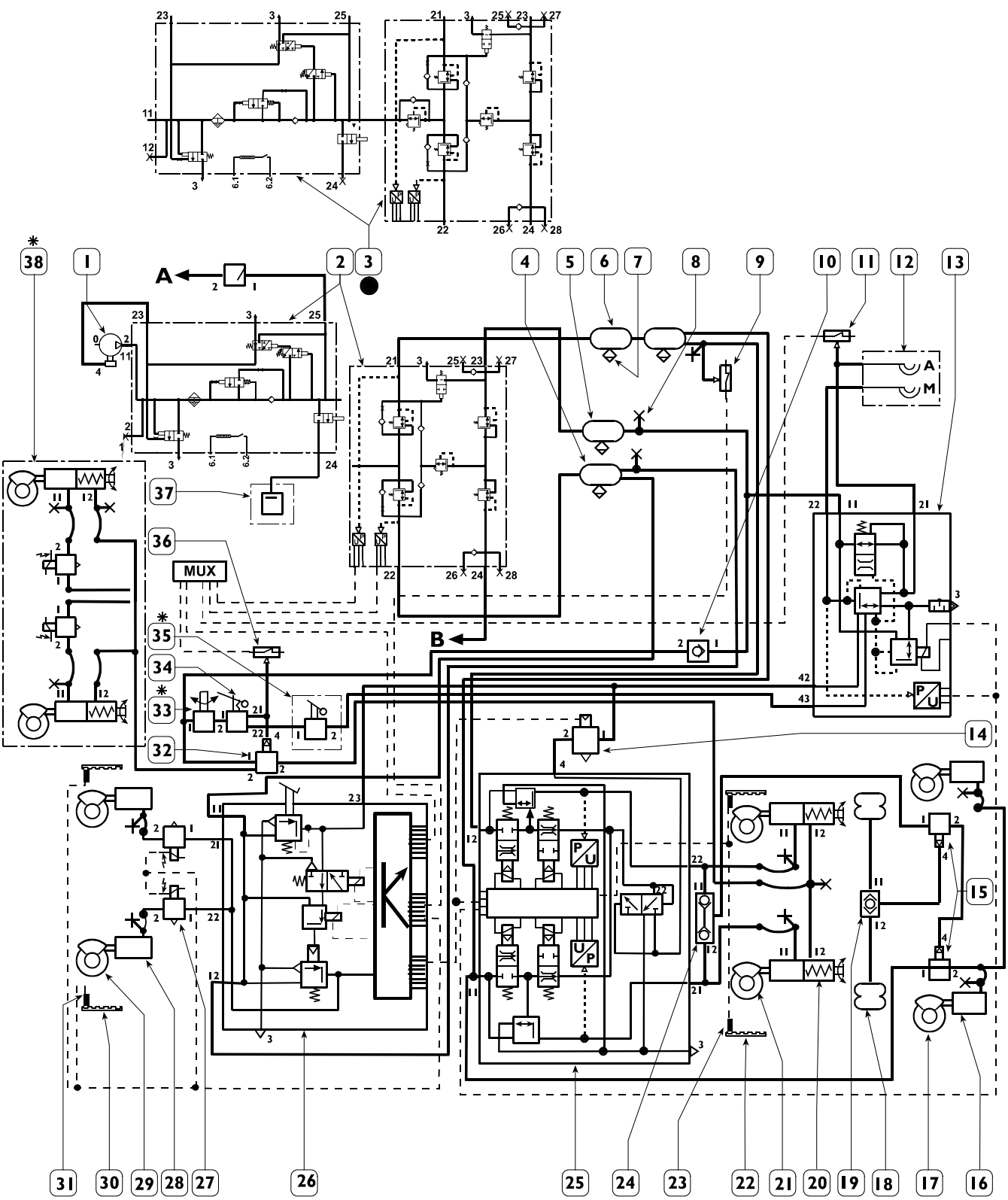
Legend

1. Compressor
2. Air processing unit - 10.5 bars
3. Air processing unit - 12.5 bars
4. Front axle air tank - 20 l.
5. Parking air tank - 20 l.
6. Rear axle air tank - 30 l. + 20 l.
7. Manual discharge valve
8. Air test point
9. Rear axle low pressure switch for ASR – 6.6 bars
10. Parking system one-way valve
11. Trailer system low pressure switch – 5.5 bars
12. Semitrailer half-couplings
13. Trailer brake servo control valve
14. Rear axle braking redundancy valve
15. Load ratio relay valve for added axle braking
16. Added axle diaphragm brake cylinder
17. Added axle ASR exclusion solenoid valve
18. Added axle suspension air springs
19. Added axle load ratio dual stop valve
20. Rear axle combined cylinder
21. Rear axle disc brake assembly
22. Rear axle phonic wheel
23. Rear axle speed sensor
24. Selector
25. Rear axle brake control electro-pneumatic modulator
26. CBU
27. Front axle ABS solenoid valves
28. Front axle diaphragm brake cylinder
29. Front axle disc brake assembly
30. Front axle phonic wheel
31. Front axle speed sensor
32. Parking control relay valve
33. On-off valve
34. Parking manual control valve
35. Trailer slowing manual control valve
36. Handbrake low pressure switch turned on – 6.6 bars
37. 14 bar safety valve
38. Front axle parking brake

A. To the air suspension system
B. To the service system
* Optional
• For CM vehicles only

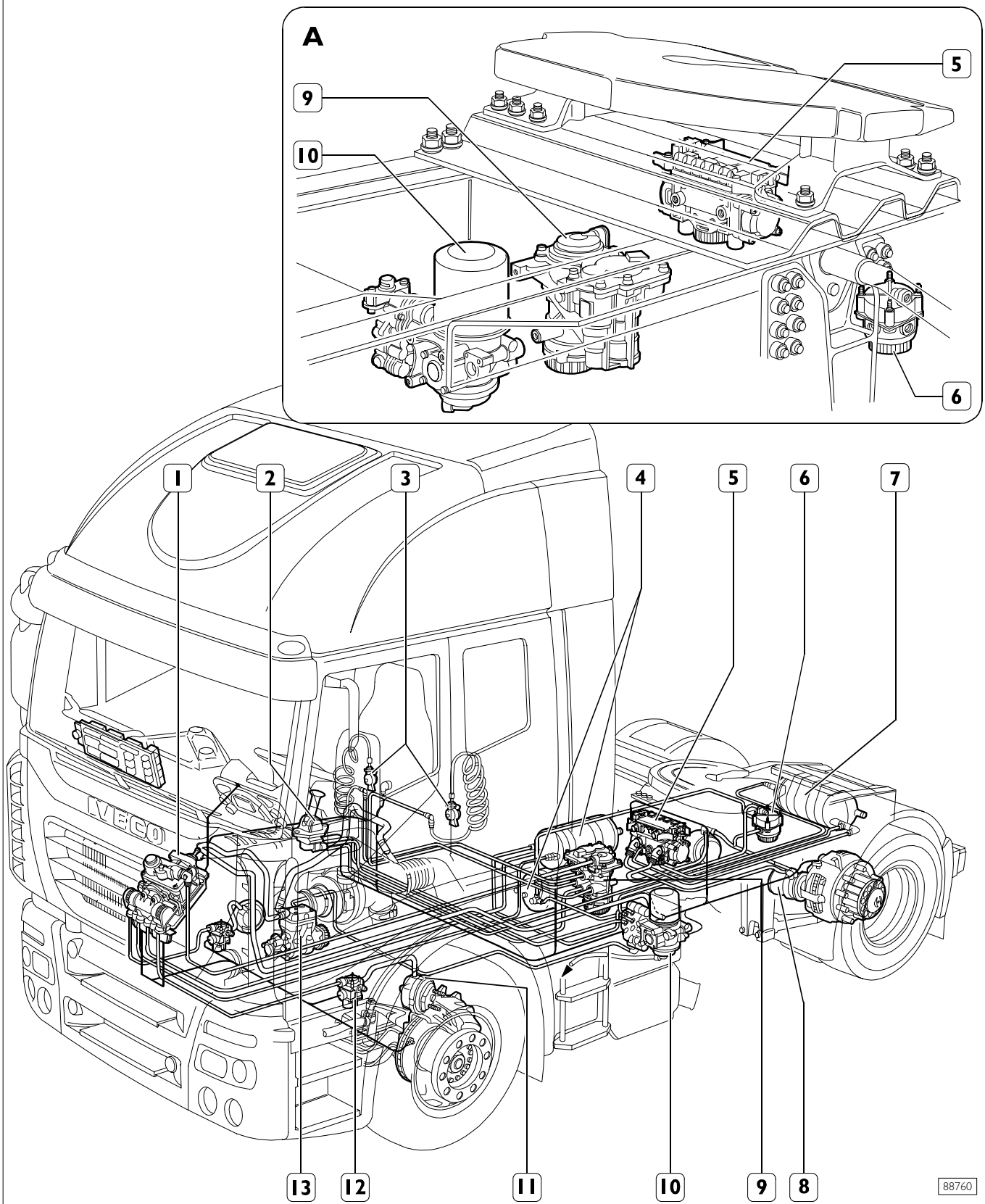
EBS 2 working diagram for 6x2 vehicles (trucks) with CURSOR 10/13 engine

Figure 37



EBS 2 system components location on vehicle (tractors variant)

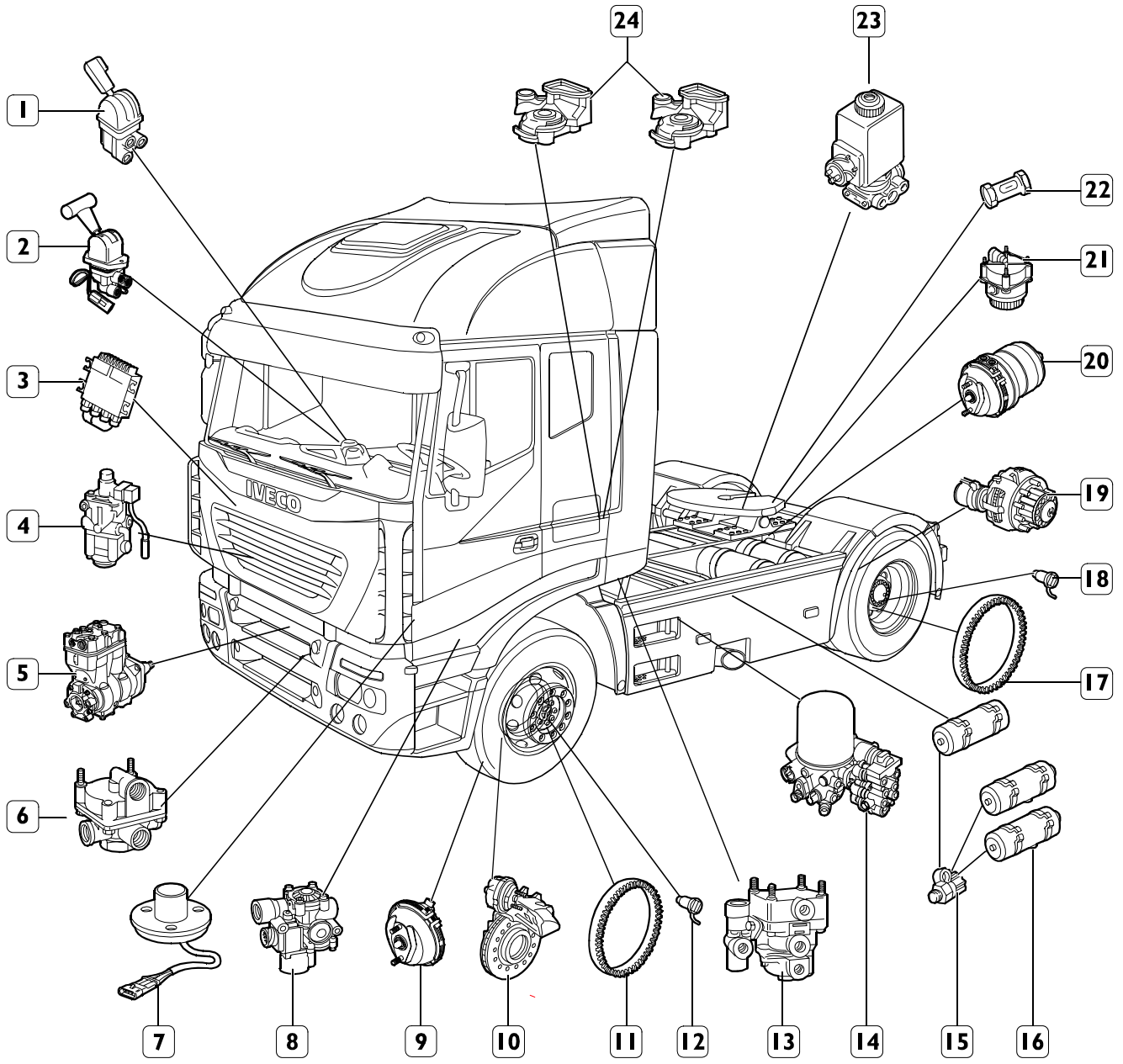
Figure 38



1. CBU (Central Brake Unit) - 2. Hand distributor for parking - 3. Coupling half joints - 4. Air tanks - 5. Axle electropneumatic modulator - 6. Relay valve for parking - 7. Air tank - 8. Spring brake cylinder - 9. Trailer drive servo-assisted distributor - 10. APU - 11. Membrane brake cylinder - 12. ABS solenoid valve - 13. Compressor - A. Real component location 5, 6, 9 and 10.

ABS-EBL system components location (tractors variant)

Figure 39



1. Trailer-only brake hand-operated control valve - 2. Parking brake hand-operated control valve - 3. Electronic control unit - 4. Duplex distributor - 5. Compressor - 6. Relay valve - 7. Pedal switch for exhaust brake control - 8. ABS solenoid valve - 9. Diaphragm brake cylinder - 10. Front disc brake assembly - 11. Phonic wheel - 12. Wheel revolution sensor - 13. Trailer drive servo-assisted distributor - 14. A.P.U. - 15. Pressure test point - 16. Air tanks - 17. Phonic wheel - 18. Wheel revolution sensor - 19 Rear disc brake assembly - 20. Combined brake cylinder - 21. Relay valve - 22. Check valve - 23. Electropneumatic valve for ASR - 24. Semi-coupling.

DESCRIPTION

Service braking

Pedal-operated, pneumatic, with electric control acting on all the wheels and on the trailer.

It is composed of two independent sections, one for activating the braking elements of the front axle, the other for activating the braking elements of the rear axle.

The division of the air system, if one section breaks down, permits the other to remain efficient.

Emergency braking

Emergency braking makes it possible to slow down the vehicle and stop it within a safety distance, even if the braking system has broken down.

It should be interpreted as a partial service brake that, thanks to the dual circuit, anyhow acts on one of the two axles.

Exhaust brake

The "exhaust brake" function is controlled by the EDC control unit that, depending on the required braking capacity, governs this function in combination with the EBS and Intarder systems (where applicable).

Parking brake

This comprises the pneumatic control of the manual control valve, a spring cylinder acting on the rear wheel brakes, locking them (on some versions the parking brake acts on the front brakes too).

In the event of the supply failing, this system automatically brakes the vehicle.

BRAKES

Front and rear disk brakes (KNORR SN7 type)

For the disc brakes, the discs are keyed onto the wheel hubs and equipped with ventilation fins that permit lowering the high temperature generated under the braking action.
The brake linings are fitted with a wear indicator connected to an indicator light on the dashboard to signal brake lining wear.
The phonic wheels of the ABS device are keyed onto the wheel hubs.

FAULT DIAGNOSIS

SECTION 1

ABS-EBS system troubleshooting can be performed with the Cluster or with the diagnosis instruments Modus, IWT and IT 2000.

Diagnosis with the cluster makes it possible to estimate the situation of faults in the system in advance, while the diagnosis instruments are essential to perform thorough diagnosis and operate on the single faults correctly.

Each single instrument displays the diagnosis and repair help.

Diagnosis Instruments

MODUS (Maintenance and Diagnostic System)

A computerized fault-diagnosis station dedicated to diagnosing the brake systems, air suspensions, engines and systems controlled electronically.

The station is equipped with auxiliary functions, such as: programming electronic control units, consulting the spare parts catalogue and service time schedules.

The vehicle has a 30-pin diagnosis socket to interface with the instrument.

IWT (IVECO Wiring Tester)

The IVECO Wiring Tester expands and integrates MODUS.

This instrument is made by IVECO to improve fault diagnosis of vehicle electric and electronic systems.

The vehicle has a 30-pin diagnosis socket to interface with the instrument; the connection between the instrument and the diagnosis socket must be made with the cable identified as no. 4.

IT 2000 (IVECO Electronic Tester)

This makes it possible to take immediate action on the vehicle, identifying it with the chassis number.

It saves the results of diagnostics actions performed.

It can be used as a portable Personal Computer, too, being fitted for remote diagnosis.

By using MODUS as the mother station it is possible to update and configure the IT 2000.

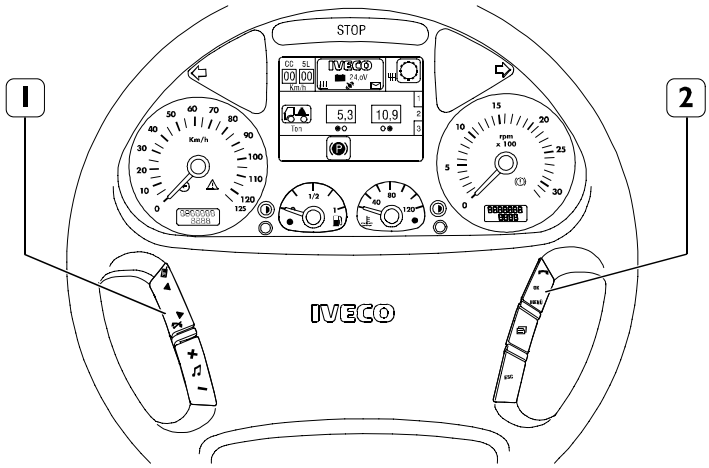
IT 2000 interfaces with the vehicle via a 30-pin diagnosis socket.

The diagnosis socket is positioned in central panel lower side in the cab (at passenger side).

Cluster Diagnosis

It is possible to access the fault memory with the "menu" function key 2 on the steering wheel.

Figure 40



With the ignition key on MAR (+15), press the "menu" function key 2; the display will show a dialogue menu containing a list of the available functions (e.g., Hi-Fi, phone, diagnostics, etc.).

With the ▲ 1 and 1 ▼ function keys, select the diagnosis function and confirm the selection with the "OK" function key 2.

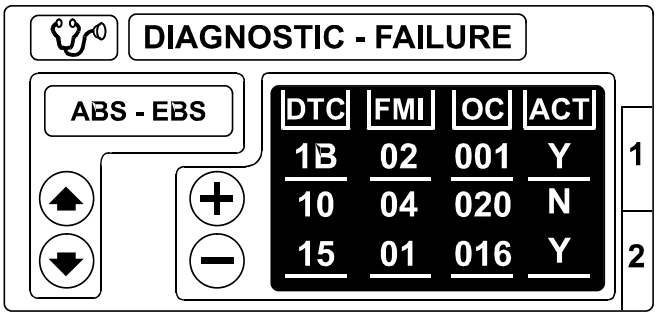
Select the ABS-EBS system with the select/confirm keys 1 and 2.

Select the ABS-EBS system with the select/confirm keys 1 and 2.

The cluster will display the first diagnostics screen.

After selecting the system, EuroTronic is displayed on a red or green background depending on whether there is any trouble.

Figure 41

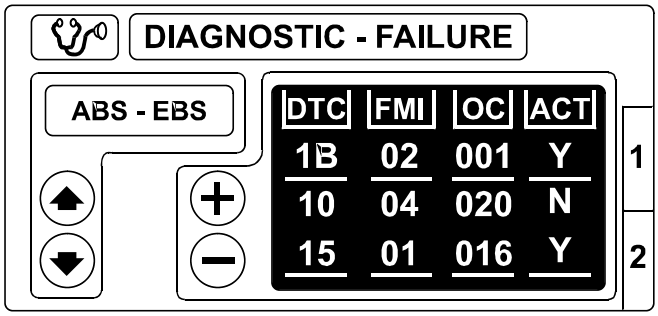


The diagnosis information shown on the cluster is split up on two screens:

- On the first one, it is possible to consult and scroll through all saved/present trouble.
- On the second one, it is possible to delete the intermittent errors (when you have the relevant password).

FIRST SCREEN

Figure 42



The information on the single faults is arranged on four columns with the following content:

DTC	FMI	OC	ACT
Displays the fault code number	Indicates the type of fault	Fault frequency meter	Fault active/not active status
Two digits (hexadecimal)	Two digits (hexadecimal)	Three digits (hexadecimal)	One character (Y = Yes, N = No)

Troubleshooting via DTC-FMI codes described under the relevant section completes the above information. Each pair of DTC-FMI codes is associated with a description of the fault, the possible system reaction and recommended repairs with the relevant checks.

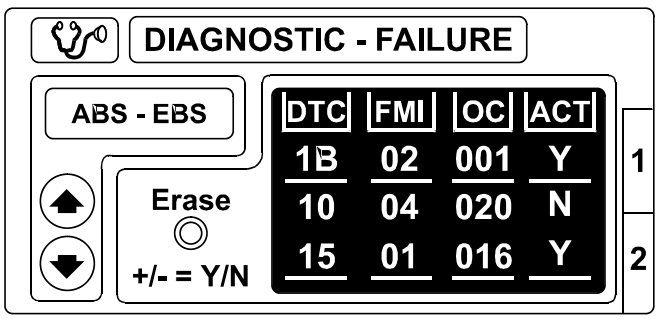
SECOND SCREEN

Deleting Errors

To select the second screen, press "page" on the steering wheel.
The fault display is eliminated as follows:

- ❑ Press "+", on the request to confirm deletion, press OK.
- ❑ Enter the required password (see the ENTERING PASSWORD paragraph).
- ❑ Press OK to confirm.

Figure 43



Entering the Password

Figure 44

Select the first number of the password with the ▲ I and I ▼ keys.
Press OK to confirm each number.
Press ◀ to delete the last number selected.
On completing the password, select the key symbol to confirm.

SECTION 2

Main operating trouble of the brake system:

1 – Poor or abnormal system charge.
2 – Poor or abnormal service braking of the rear axle.
3 – Poor or abnormal service braking of the front axle.
4 – Poor or abnormal trailer service braking.
5 – Poor or no parking braking.
6 – Poor or no trailer parking braking.
7 – Parking brake release delayed.
8 – Trailer parking brake release delayed.
9 – The vehicle skids when braking.
10 – Insufficient trailer retarder braking.
11 – Early wear of the brake linings.
12 – Brake system warning light on.
13 – Parking brake indicator light on with lever in driving position.
14 – Noisy brakes.

Electric and electronic components diagnosis must be through Modus and IWT.

1 POOR OR ABNORMAL SYSTEM CHARGE

Air system pipes leak or burst – YES → Close or replace the worn or damaged fittings. Replace the burst or damaged pipes.

NO

Inefficient air compressor operation – YES → Overhaul or replace the air compressor.

NO

Inefficient A.P.U. operation – YES → Overhaul or replace the A.P.U.

2 POOR OR ABNORMAL SERVICE BRAKING OF THE REAR AXLE

Air system pipes leak or burst – YES → Close or replace the worn or damaged fittings. Replace the burst or damaged pipes.

(continued)

Brake linings worn and/or vitrified	– YES →	Overhaul or replace the brake linings.
NO ↓		
Inefficient operation of the rear brakes	– YES →	Overhaul the rear brakes.
NO ↓		
Inefficient operation of the Duplex control valve	– YES →	Overhaul or replace the Duplex control valve.
NO ↓		
Inefficient operation of the brake cylinders	– YES →	Overhaul or replace the brake cylinders.
NO ↓		
Inefficient operation of the ABS solenoid valve	– YES →	❑ Check the electric wiring. ❑ Replace the ABS solenoid valve.
NO ↓		
Inefficient operation of the electro-pneumatic modulator of the rear axle (vehicles with EBS)	– YES →	❑ Check the wiring ❑ Replace the electro-pneumatic modulator
NO ↓		
Inefficient operation of the automatic clearance recovery device	– YES →	Replace the complete brake calliper.
NO ↓		
Inefficient operation of the Duplex control valve with electric transmitter (vehicles with EBS)	– YES →	❑ Check the wiring. ❑ Replace the Duplex Control Valve with electric transmitter

(continued)

3 POOR OR ABNORMAL SERVICE BRAKING OF THE FRONT AXLE

Air system pipes leak or burst – YES → Close or replace the worn or damaged fittings. Replace the burst or damaged pipes.

NO

Inefficient operation of the Duplex control valve – YES → Overhaul or replace the Duplex control valve.

NO

Brake linings worn and/or vitrified – YES → Overhaul or replace the brake linings.

NO

Inefficient operation of the front brakes – YES → Overhaul the front brakes.

NO

Inefficient operation of the relay valve – YES → Overhaul ore replace the relay valve.

NO

Inefficient operation of the diaphragm brake cylinders – YES → Overhaul or replace the diaphragm brake cylinders.

NO

Inefficient operation of the automatic clearance recovery device – YES → Replace the complete brake calliper.

(continued)

Inefficient operation of the ABS solenoid valve

– YES → ❑ Check the electric wiring. ❑ Replace the ABS solenoid valve.

NO

Inefficient operation of the front axle relay valve (vehicles with EBS)

– YES → ❑ Check the wiring ❑ Replace the front axle relay valve

NO

Inefficient operation of the Duplex control valve with electric transmitter (vehicles with EBS)

– YES → ❑ Check the wiring. ❑ Replace the Duplex Control Valve with electric transmitter (vehicles with EBS)

4 POOR OR ABNORMAL TRAILER SERVICE BRAKING

Air system pipes leak or burst

– YES → Close or replace the worn or damaged fittings. Replace the burst or damaged pipes.

NO

Inefficient operation of the triple control servo control valve

– YES → Overhaul or replace the triple control servo control valve.

NO

Inefficient operation of the Duplex control valve

– YES → Overhaul or replace the Duplex control valve.

NO

Inefficient operation of the A.P.U.

– YES → Overhaul or replace the A.P.U.

(continued)

Brake linings worn and/or vitrified – YES → Overhaul or replace the brake linings.

NO

Inefficient operation of the trailer brakes – YES → Overhaul the trailer brakes.

NO

Inefficient operation of the electro-pneumatic modulator of the rear axle (vehicles with EBS) – YES →
- ❑ Check the wiring
- ❑ Replace the electro-pneumatic modulator

5 POOR OR NO PARKING BRAKING

Air system pipes leak or burst – YES → Close or replace the worn or damaged fittings. Replace the burst or damaged pipes.

NO

Inefficient operation of the combined brake cylinders – YES → Overhaul or replace the combined brake cylinders.

NO

Inefficient operation of the parking brake manual control valve (lever) – YES → Overhaul or replace the lever.

NO

Brake linings worn and/or vitrified – YES → Overhaul or replace the brake linings.

(continued)

Inefficient operation of the relay valve	– YES →	Overhaul or replace the relay valve.
NO ↓		
Inefficient operation of the rear brakes	– YES →	Overhaul the rear brakes.

6	**POOR OR NO TRAILER PARKING BRAKING**

Air system pipes leak or burst	– YES →	Close or replace the worn or damaged fittings. Replace the burst or damaged pipes.
NO ↓		
Inefficient operation of the triple control servo control valve	– YES →	Overhaul or replace the triple control servo control valve
NO ↓		
Inefficient operation of the parking brake manual control valve (lever)	– YES →	Overhaul or replace the lever.
NO ↓		
Trailer brake linings worn and/or vitrified	– YES →	Overhaul or replace the trailer brake linings.
NO ↓		
Inefficient operation of the trailer brakes	– YES →	Overhaul the trailer brakes.

(continued)

Inefficient operation of the trailer control servo control valve	– YES →	❑ Check the electric wiring. ❑ Replace the trailer control servo control valve.

7 PARKING BRAKE RELEASE DELAYED

Air system pipes leak or burst	– YES →	Close or replace the worn or damaged fittings. Replace the burst or damaged pipes.

NO

Inefficient operation of the relay valve	– YES →	Overhaul or replace the relay valve

NO

Inefficient operation of the combined brake cylinders	– YES →	Overhaul or replace the combined brake cylinders.

NO

Inefficient operation of the parking brake manual control valve (lever)	– YES →	Overhaul or replace the lever.

NO

Inefficient operation of the rear brakes	– YES →	Overhaul the rear brakes.

(continued)

8 TRAILER PARKING BRAKE RELEASE DELAYED

Air system pipes leak or burst – YES → Close or replace the worn or damaged fittings. Replace the burst or damaged pipes.

NO

Inefficient operation of the triple control servo control valve – YES → Overhaul or replace the triple control servo control valve

NO

Inefficient operation of the parking brake manual control valve (lever) – YES → Overhaul or replace the lever.

NO

Inefficient operation of the trailer brakes – YES → Overhaul the trailer brakes.

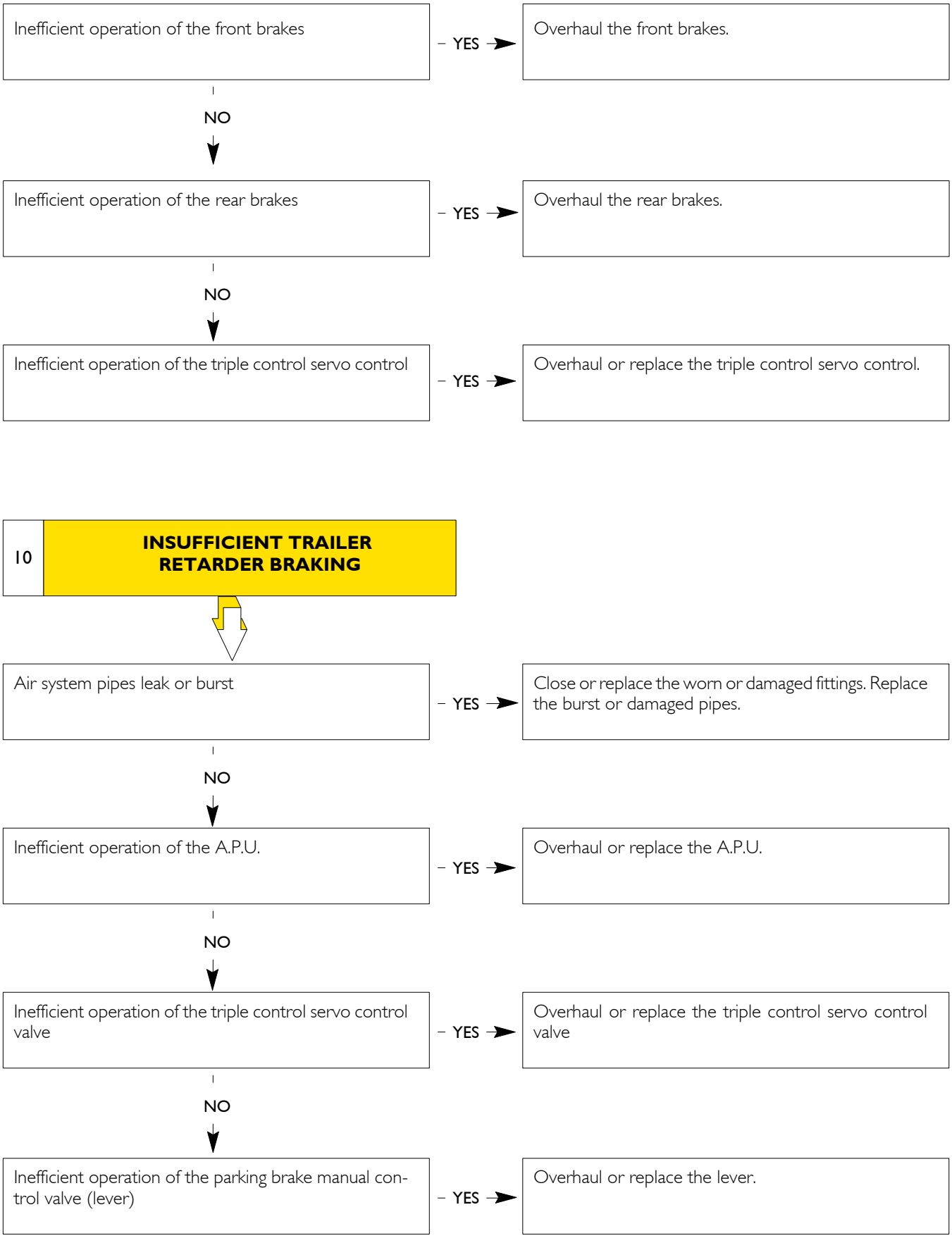
9 THE VEHICLE SKIDS WHEN BRAKING

Air system pipes leak or burst – YES → Close or replace the worn or damaged fittings. Replace the burst or damaged pipes.

NO

Inefficient operation of the Duplex control valve – YES → Overhaul or replace the Duplex control valve

(continued)


Inefficient operation of the front brakes
YES
Overhaul the front brakes.
NO
Inefficient operation of the rear brakes
YES
Overhaul the rear brakes.
NO
Inefficient operation of the triple control servo control
YES
Overhaul or replace the triple control servo control.
10
INSUFFICIENT TRAILER RETARDER BRAKING
Air system pipes leak or burst
YES
Close or replace the worn or damaged fittings. Replace the burst or damaged pipes.
NO
Inefficient operation of the A.P.U.
YES
Overhaul or replace the A.P.U.
NO
Inefficient operation of the triple control servo control valve
YES
Overhaul or replace the triple control servo control valve
NO
Inefficient operation of the parking brake manual control valve (lever)
YES
Overhaul or replace the lever.

11 EARLY WEAR OF THE BRAKE LININGS

Inefficient operation of the Duplex control valve – YES → Overhaul or replace the Duplex control valve.

NO

Inefficient operation of the brakes – YES → Overhaul the brakes.

NO

Inefficient operation of the triple control servo control valve – YES → Overhaul or replace the triple control servo control valve

NO

Inefficient operation of the relay valve – YES → Overhaul or replace the relay valve.

12 BRAKE SYSTEM WARNING LIGHT ON

Air system pipes leak or burst – YES → Close or replace the worn or damaged fittings. Replace the burst or damaged pipes.

NO

Inefficient operation of the A.P.U. – YES → Overhaul or replace the A.P.U.

(continued)

Wrong wiring of the electric circuit of the indicator light	– YES →	Find the wrong connection and restore the wiring.

13 PARKING BRAKE INDICATOR LIGHT ON WITH LEVER IN DRIVING POSITION

Wrong wiring of the electric circuit of the indicator light	– YES →	Find the wrong connection and restore the wiring.

NO ↓

Inefficient operation of the parking brake manual control valve (lever)	– YES →	Overhaul or replace the lever.

NO ↓

Inefficient operation of the A.P.U.	– YES →	Overhaul or replace the A.P.U.

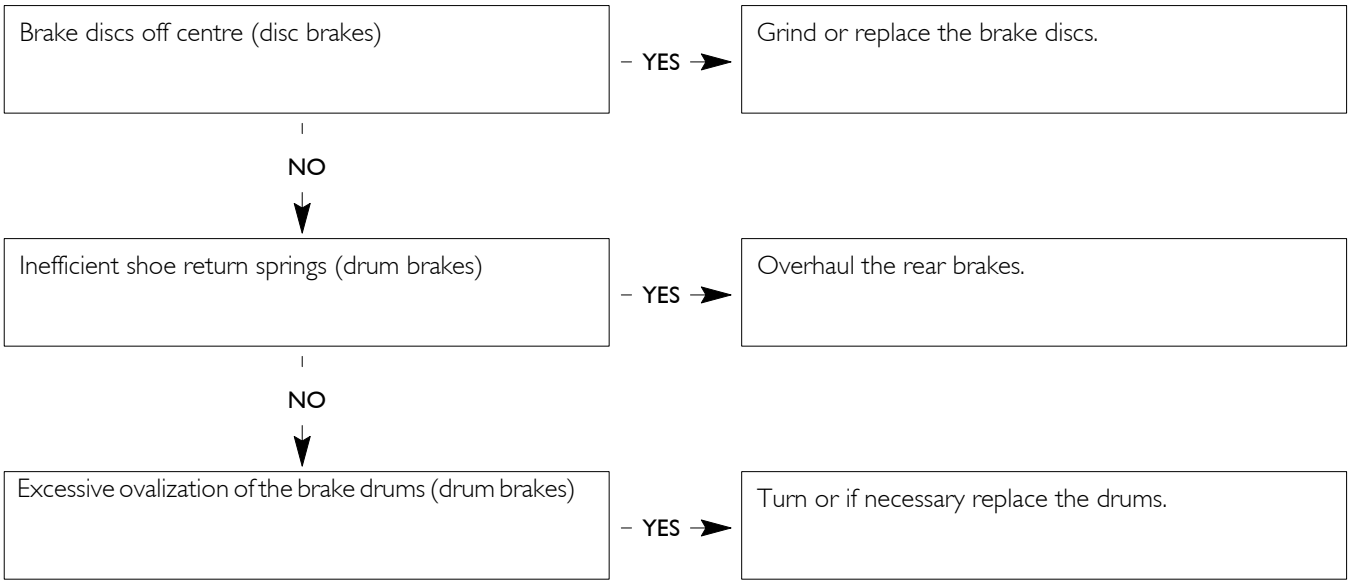
14 NOISY BRAKES

Worn brake linings	– YES →	Replace the brake linings.

NO ↓

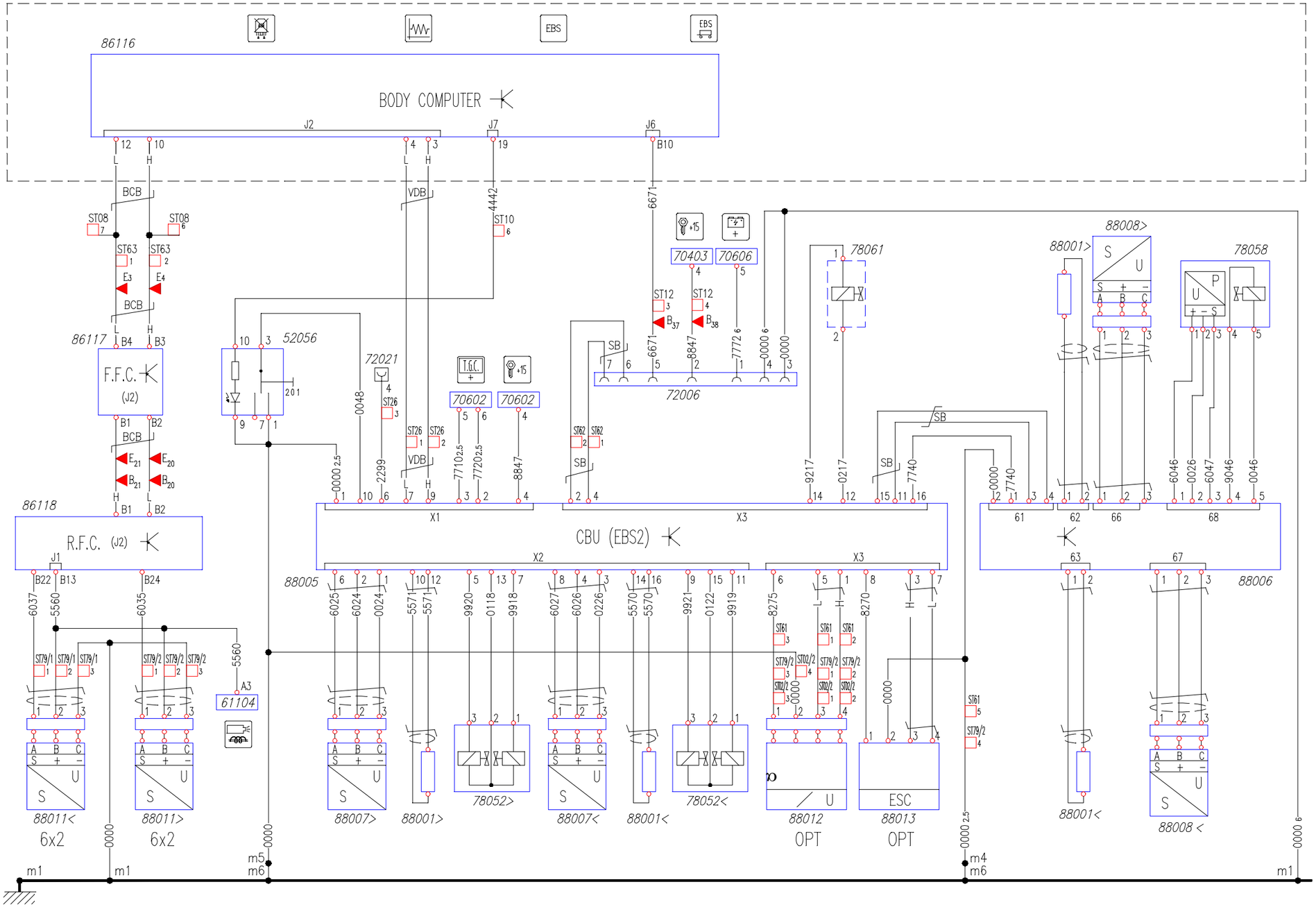
Foreign bodies between the brake linings and discs (disc brakes)	– YES →	Remove the foreign bodies between the brake linings and discs.

(continued)


Brake discs off centre (disc brakes)
YES
Grind or replace the brake discs.
NO
Inefficient shoe return springs (drum brakes)
YES
Overhaul the rear brakes.
NO
Excessive ovalization of the brake drums (drum brakes)
YES
Turn or if necessary replace the drums.

EBS 2 Working diagram

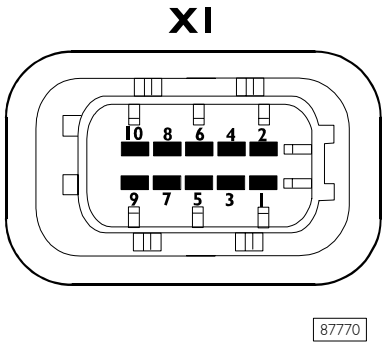
Figure 45



52056 Switch with built-in alarm indicator for ASR cutoff - 70403 Fuse holder for 4 fuses - 70602 Fuses – 70606 Fuse holder for 6 fuses - 72006 7-pole joint for tractor/trailer ABS/EBS electric connection - 72021 30-pole joint for connection to earthed diagnosis socket - 78052 Solenoid valve for ABS/EBS - 78058 Proportional valve for EBS trailer air control – 78061 Redundant solenoid valve (for carts only) - 86116 Body Computer Multiplex Central Unit - 86117 Front Frame Multiplex Central Unit – 86118 Rear Frame Multiplex Central Unit – 88001 ABS/EBS system r.p.m. sensor - 88006 Modulator for EBS rear axle air pressure control - 88007 Potentiometric sensor for front wheel pad position signalling – 88008 Potentiometric sensor for rear wheel pad position signalling - 88011 Potentiometric sensor for third axle wheel pad position signalling - 88012 SAS drive angle sensor - Steering Angle Sensor for EBS (Optional on tractors) – 88013 ESC module - Electronic Stability Control for EBS (Optional on tractors)

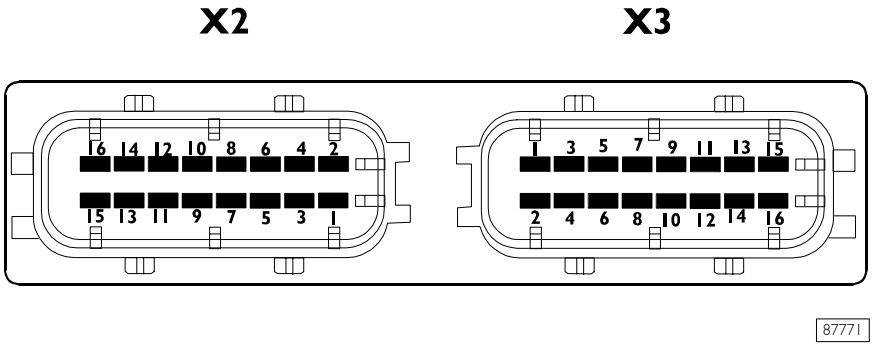
Pin – EBS 2 central unit output

Figure 46



X1 connector

PIN	CABLE	FUNCTION
1	0000	Earth
2	7720	Battery-directed power supply positive
3	7710	Battery-directed power supply positive
4	8847	Locked power supply positive
5	--	--
6	2299	K line for diagnosis connector (pin 4)
7	GN/VE	CAN «L» line
8	--	--
9	WS/BI	CAN «H» line
10	0048	Negative from ASR cutoff switch



X2 connector (positioning to the left with respect to forward ride)

PIN	CABLE	FUNCTION
1	0024	Negative for RH front wheel wear sensor (pin 3 - BR/MA - pin C)
2	6024	Positive for RH front wheel wear sensor (pin 2 - GE/GI - pin B)
3	0226	Negative for LH front wheel wear sensor (pin 3 - BR/MA - pin C)
4	6026	Positive for LH front wheel wear sensor (pin 2 GE/GI - pin B)
5	9920	Positive for RH front ABS feed solenoid valve (pin 3)
6	6025	Signal from RH front wheel wear sensor (pin 1 - SW/NE - pin A)
7	9918	Positive for RH front ABS exhaust solenoid valve (pin 1)
8	6027	Signal from LH front wheel wear sensor (pin 1 - SW/NE - pin A)
9	9921	Positive for LH front ABS feed solenoid valve (pin 3)
10	5571	RH front sensor
11	9919	Positive for LH front ABS exhaust solenoid valve (pin 1)
12	5571	RH front sensor
13	0118	Negative for RH front ABS solenoid valve (pin 2)
14	5570	LH front sensor
15	0122	Negative for LH front ABS solenoid valve (pin 2)
16	5570	LH front sensor

X3 connector (positioning to the right with respect to forward ride)

PIN	CABLE	FUNCTION
1	WS/BI	CAN «H» line to SAS steering angle sensor (pin 4) (opt)
2	WS/BI	CAN «H» line to half trailer connector (pin 6)
3	WS/BI	CAN «H» line to ESC module (pin 3) (opt)
4	GN/VE	CAN «L» line to half trailer connector (pin 7)
5	GN/VE	CAN «L» line to SAS steering angle sensor (pin 3) (opt)
6	8275	Positive for SAS steering angle sensor (pin 1) (opt)
7	GN/VE	CAN «L» line to ESC module (pin 4) (opt)
8	8270	Positive for ESC module (pin 1) (opt)
9	--	--
10	--	--
11	WS/BI	CAN «H» line to rear axle modulator (pin 3 - 61)
12	0217	Negative for rear axle redundant solenoid valve
13	--	--
14	9217	Positive for rear axle redundant solenoid valve
15	GN/VE	CAN «L» line to rear axle modulator (pin 4 - 61)
16	7740	Positive for rear axle modulator (pin 1 - 61)

Pin-out of rear axle pressure modulator
61 connector

PIN	CABLE	FUNCTION
1	77401	Positive from EBS central unit (CBU) (pin 16 – X3)
2	0000	Earth
3	WS/BI	CAN «H» line to EBS central unit (CBU) (pin 11 – X3)
4	GN/VE	CAN «L» line to EBS central unit (CBU) (pin 15 – X3)

62 connector

PIN	CABLE	FUNCTION
1	--	Right rear wheel r.p.m. sensor
2	--	Right rear wheel r.p.m. sensor

63 connector

PIN	CABLE	FUNCTION
1	--	Left rear wheel r.p.m. sensor
2	--	Left rear wheel r.p.m. sensor

66 connector

PIN	CABLE	FUNCTION
1	SW/NE	Signal from RH rear wheel wear sensor (pin 1 - pin A)
2	GE/GI	Positive for RH rear wheel wear sensor (pin 2 - pin B)
3	BR/MA	Negative for RH rear wheel wear sensor (pin 3 - pin C)

67 connector

PIN	CABLE	FUNCTION
1	SW/NE	Signal from LH rear wheel wear sensor (pin 1 - pin A)
2	GE/GI	Positive for LH rear wheel wear sensor (pin 2 - pin B)
3	BR/MA	Negative for LH rear wheel wear sensor (pin 3 - pin C)

68 connector

PIN	CABLE	FUNCTION
1	6046	Positive for trailer drive valve pressure sensor (pin 1)
2	0026	Negative for trailer drive valve pressure sensor (pin 2)
3	6047	Signal from trailer drive valve pressure sensor (pin 3)
4	9046	Positive for trailer drive proportional solenoid valve (pin 4)
5	0046	Negative for trailer drive proportional solenoid valve (pin 5)

TIGHTENING TORQUES

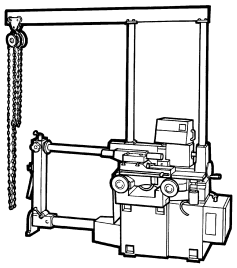
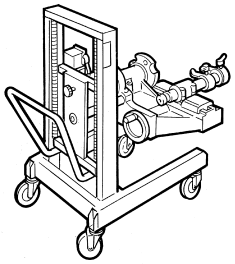
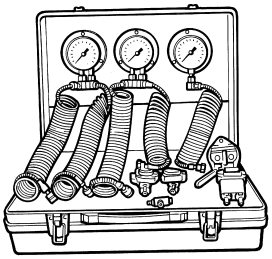
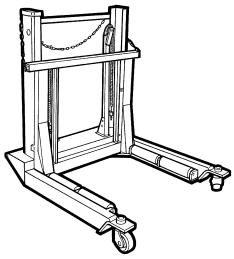
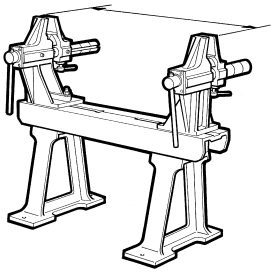
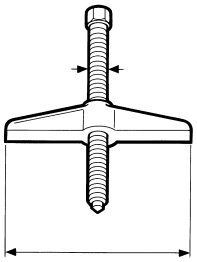
PART	TORQUE	
	Nm	(kgm)
Compressor		
Nut fixing pulley	200	(20.4)
Combined brake cylinder (for disc brakes)		
Nuts for bolts fixing cylinder to brake calliper	180 + 30	(18.3 + 0.3)
Manual brake release screw (type 14 – front disc brakes)	max 35	(max 3.6)
Manual brake release screw (type 20/27 – rear disc brakes)	max 70	(max 7.1)
Fixing fittings	40 ± 5	(4 ± 0.5)
Diaphragm brake cylinder (for disc brakes)		
Nut for fixing cylinder to brake calliper	180 + 30	(18 + 3)
Fixing fittings	40 ± 5	(4 ± 0.5)
Fixing fittings		
❑ BENDIX cylinder	17.5 ± 2.5	(1.7 ± 0.2)
❑ KNORR-BREMSE cylinder	40 ± 5	(4 ± 0.5)
❑ WABCO cylinder	45 ± 5	(4.5 ± 0.5)
Front axle disc brakes 5876-57080/DI		
Self-locking hex screw M20 x 1.5 fixing brake callipers	615.5 ± 61.5	(62.7 ± 6.2)
Nut fixing wheels	665.5 ± 66.5	(67.8 ± 6.7)
Self-locking hex screw to fix brake disc to wheel hub	281.5 ± 13.5	(28.7 ± 1.3)
Self-locking hex screw M16 x 1.5 to fix brake calliper mount to stub axle	313.5 ± 15.5	(32 ± 1.6)
Threaded plug for wheel hub cover	55 ± 5	(5.5 ± 0.5)
Ring nut fixing wheel bearings	515.5 ± 24.5	(52.6 ± 2.5)
Cylindrical head screw with hex socket to lock wheel bearing adjustment clamp	27.5 ± 2.5	(2.8 ± 0.2)
Cover for wheel hub ♦	130 ± 10	(13 ± 1)
Front axle disc brakes 55080/DI		
Nut fixing wheel	$600\ ^{+50}_{-20}$	$(61.2\ ^{+5}_{-2})$
Hex screw to fix brake disc to wheel hub	281.5 ± 13.5	(28.7 ± 1.3)
Threaded plug for wheel hub cover	55 ± 5	(5.5 ± 0.5)
Nut fixing wheel bearings	515.5 ± 24.5	(52.6 ± 2.5)
Cover for wheel hub ♦	130 ± 10	(13 ± 1)
Screw fixing nut	27.5	(2.8)
Screw fixing mount	289.5 ± 14.5	(29.5 ± 1.5)
Screw fixing brake calliper	615 ± 61	(62.7 ± 6.2)

♦ Spread a bead of sealant solely on the mating surface of the hub cover, using the specific metering device. Protect the threaded part. Use LOCTITE sealant type 574.

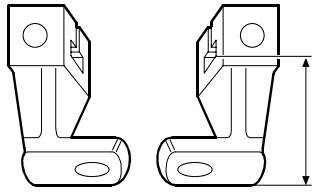
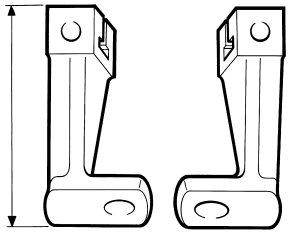
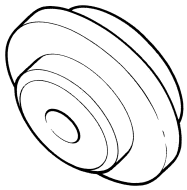
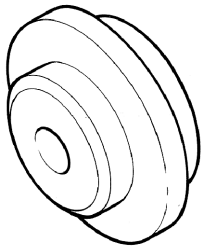
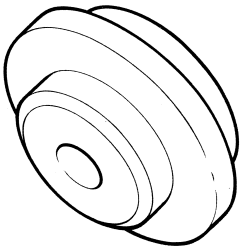
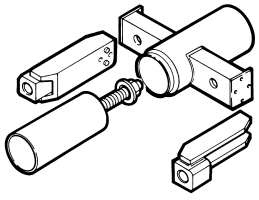
TIGHTENING TORQUES

PART	TORQUE	
	Nm	(kgm)
Added rear axle disc brakes 56082/I		
Nut fixing wheels	665 ± 61.5	(67.8 ± 6.2)
Screw fixing drive shaft flange • *	90 ± 10	(9.2 ± 1)
Ring nut fastening wheel hub bearing	932 ± 98	(95 ± 10)
Screw fixing brake disc to wheel hub	281.5 ± 13.5	(28.7 ± 1.3)
Nut for screw fixing brake calliper to mount	615.5 ± 61.5	(62.7 ± 6.2)
Nut for screw fixing brake calliper mount	289.5 ± 14.5	(29.5 ± 1.5)
• Apply LOCTITE 243 sealant onto the thread * Spread the drive shaft / wheel hub contact surface with sealant type IVECO 1905685 (LOCTITE 14780)		
MS 13-175 rear axle disc brakes		
Nut fixing wheels	665.5 ± 61.5	(67.8 ± 6.2)
Screw fixing drive shaft flange *	262 ± 27	(26.7 ± 2.7)
Ring nut fastening wheel hub	932 ± 98	(95 ± 10)
Screw fixing brake disc to wheel hub	281.5 ± 13.5	(28.7 ± 1.3)
Screw fixing brake calliper to mount	615.5 ± 61.5	(62.7 ± 6.2)
Nut for screw fixing brake calliper mount	289.5 ± 14.5	(29.5 ± 1.5)
* Spread the flange / wheel hub contact surface with sealant type IVECO 1905685 (LOCTITE 14780)		

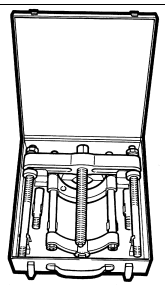
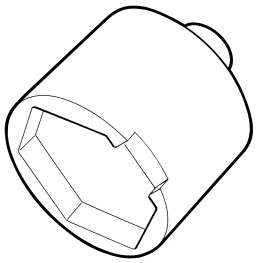
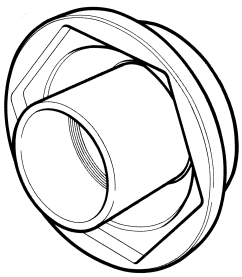
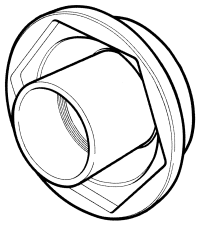
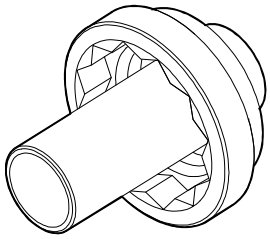
TOOLS

TOOL NO.		DESCRIPTION
99301001		Grinding and turning machine for brake discs and drums
99301005		Brake disc turning device
99305117		Instrument to check air circuits
99321024		Hydraulic trolley to remove and refit wheels
99322215		Stand for overhauling front and rear axles
99341003		Single-acting bridge

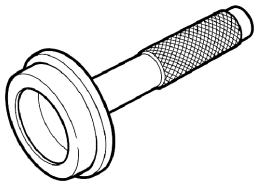
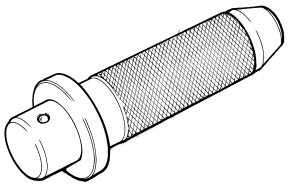
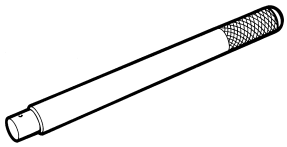
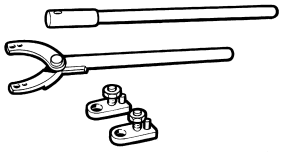
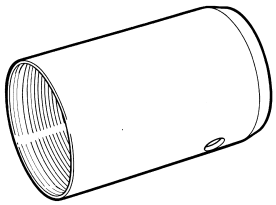
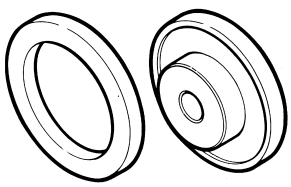
TOOLS

TOOL NO.		DESCRIPTION
99341016		Pair of brackets with hole
99341017		Pair of brackets with hole
99345049		Reaction block for extractors
99345053		Reaction block for puller tools
99345055		Reaction block for puller tools
99345103		Wheel hub fitting tool

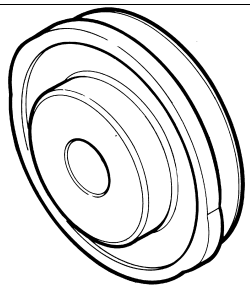
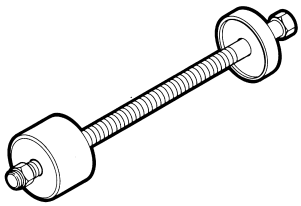
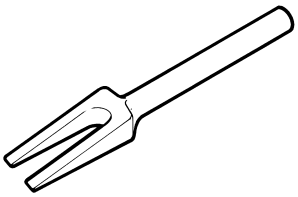
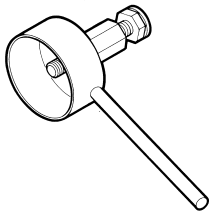
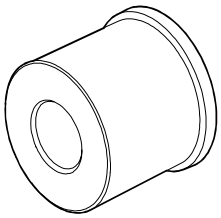
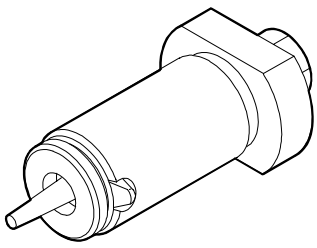
TOOLS

TOOL NO.		DESCRIPTION
99348001		Extractor with locking device
99354207		Wrench for wheel hub sumps
99355167		Wrench (114 mm) for wheel hub bearing adjustment nut
99355175		Wrench (105 mm) for wheel hub bearing adjustment nut
99355180		Wrench (105 mm) for wheel hub bearing adjustment nut
99356006		Wrench to remove and refit brake cylinder ring nut (use with 99389817)

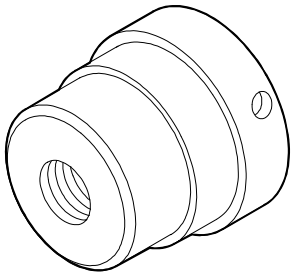
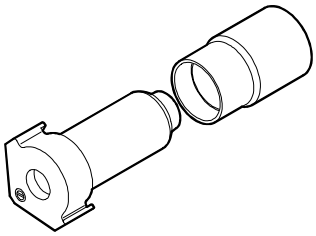
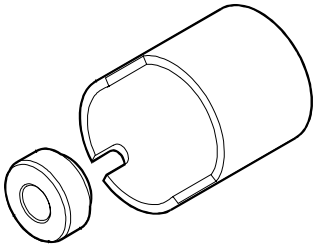
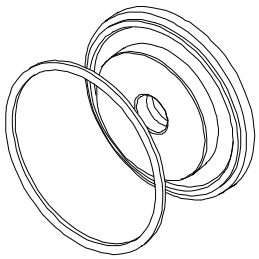
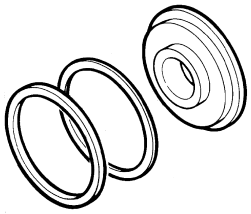
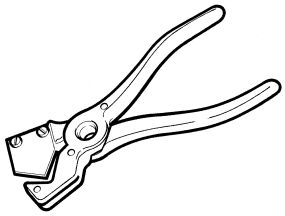
TOOLS

TOOL NO.		DESCRIPTION
99370005		Grip for interchangeable drifts
99370006		Grip for interchangeable drifts
99370007		Grip for interchangeable drifts
99370317		Reaction lever with extension to fasten flanges
99370700		Guide to fit wheel hub
99370706		Tool to drive in wheel hub bearing

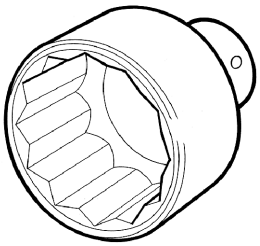
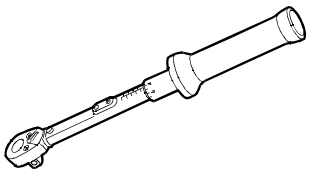
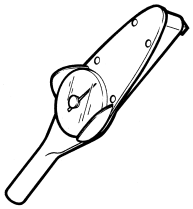
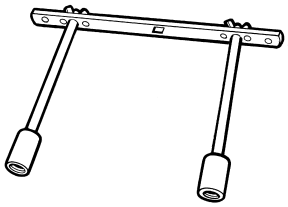
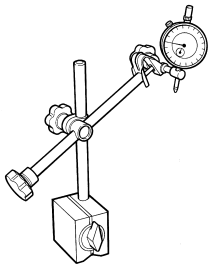
TOOLS

TOOL NO.		DESCRIPTION
99370708		Tool to drive out wheel hub bearing
99372237		Tool to mount brake caliper sliding bush guard
99372238		Tool to extract brake caliper thrust units
99372239		Tool to mount thrust units with brake caliper guard
99372240		Tool to remove and refit brake caliper sliding bush guide bushings (use with 99372237)
99372242		Tool for notching brake caliper sliding bush guide bushing

TOOLS

TOOL NO.		DESCRIPTION
99372243		Tool for mounting thrust pressure inner seals (use with 99372239) and for mounting the brass bush of brake caliper guide pin (use with 99372240 and with the screw of 99372237)
99372244		Tool for mounting the rubber bush of brake caliper guide pin (use with the screw of 99372237)
99372245		Tool for dismounting the rubber bush of brake caliper guide pin (use with the screw of 99372237)
99374132		Installer, wheel hub inner seal (use with 99370006)
99374134		Installer, wheel hub inner seal
99387050		Cutters for polyamide pipes

TOOLS

TOOL NO.		DESCRIPTION
99388001		Wrench (80 mm) for wheel hub bearing adjustment nut
99389816		Torque multiplier x 4, with square fitting, 3/4" in, 1" out (maximum torque 2745 Nm)
99389817		Torque wrench (60-32 Nm) with 1/2" square fitting
99389819		Torque wrench from 0 to 0.9 kgm with 1/4" square fitting
99395026		Tool to check rolling torque of wheel hubs (use with torque wrench)
99395684		Dial gauge with magnetic base

SPECIFICATIONS AND DATA - PNEUMATIC SYSTEM

DESCRIPTION	
Compressor	
❑ **WABCO 412 352 008**	Single cylinder
Capacity	352 cm^3
Bore	85 mm
Stroke	62 mm
Head cooling	Water
Max. continuous rpm	3000 r.p.m.
Max. working pressure	14 bar
❑ **KNORR-BREMSE 2W630R**	Twin cylinder
Capacity	628 cm^3
Bore	86 mm
Stroke	54 mm
Head cooling	Water
Max. continuous rpm	3060 r.p.m.
Max. working pressure	14 bar
A.P.U.	
❑ **KNORR Z 007035**	
Safety valve opening pressure	13.0 + 4 bar
Max. working pressure	13.0 bar
Disconnecting pressure	10.5 + 0.2 bar
Duty temperature	-40 to +80 °C
❑ **KNORR Z 007036**	
Safety valve opening pressure	14.5 + 4.0 bar
Max. working pressure	13.0 bar
Disconnecting pressure	12.5 + 0.2 bar
Duty temperature	-40 to +80 °C

Air tanks

4 x 2 vehicles	Tank capacity				Total capacity
	15L	20L	30L	80L	
P/FP-CT		2	1		70
FP-D		1	1		50
T/P/FP - LT/FP-CT		2	1		70
6x2 P vehicles YP/YPS/YPT/YFP/YFS/YTN		3	1		90
Y/FP-D/FS-D		2	1		70
6x2 C vehicles X/P/FP TX/P	 1	 2 2	 1 1		 70 85

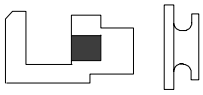
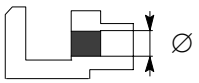
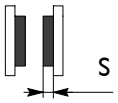
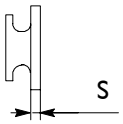
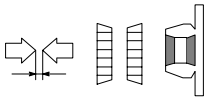
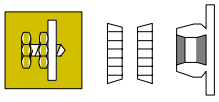
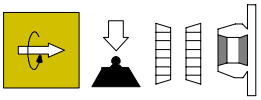
DESCRIPTION	
Manual discharge valve	
❑ Type: VOSS 520 899 750 0 - TECHNOMATIK TP 1609.00.00	
Maximum working pressure	13 bar
ABS duplex control valve	
❑ KNORR - BREMSE DX 60 A	
Supply pressure	10.5 bar
Working pressure	10.5 bar
Relay valve for parking	
❑ KNORR - BREMSE AC574AXY	
Maximum working pressure	10.2 bar
Automatic and graduated release coupling heads	
❑ BOSCH - KNORR - BREMSE - WABCO	
Working pressure	8.5 bar
EBS2 rear axle electro-pneumatic graduated release	
❑ WABCO 480 104 000 0	
Maximum working pressure	15 bar
Terminal voltage	$24\ ^{+6}_{-9,5}$ V
Max. terminal current	10A / 10 bar
CBU (Central Brake Unit)	
❑ WABCO 480 020 010 0	
Feed pressure	12,7 bar
Maximum working pressure	13 bar
Terminal voltage	24 ± 8 V
Current absorption	0,5 ÷ 11 A
ABS solenoid valve	
❑ WABCO 472 195 055 0	
Maximum working pressure	13 bar
Voltage	24 V
❑ KNORR BREMSE IC 57664	
Maximum working pressure	10,2 bar
Voltage	24 V

DESCRIPTION	
EBS 2 trailer servo control valve	
❑ WABCO 480 204 002 0	
Supply pressure	8.5 bar
Max. working pressure	13 bar
Voltage	$24^{+8}_{-6,5}$ V
Max. permanent voltage between orifice 6.4 and 6.5	8 V
Max. current	1.4A
Outlet pressure	8,5 bar
Parking brake control valve (vehicles suited for towing)	
❑ KNORR - BREMSE DPM 60 EY	
Supply and working pressure	8.5 bar
Travel of control lever (discharge) with start of emergency braking (point of resistance)	67°
Parking braking	73°
Test braking to check supply to triple control valve	86°
Parking brake control valve (standby vehicles)	
❑ KNORR - BREMSE DPM 61 EY	
Supply and working pressure	8.5 bar
Travel of control lever (discharge) with start of emergency braking (point of resistance)	67°
Parking braking	73°
Test braking to check supply to triple control valve	
Dual stop valve (for vehicles with ABS/EBL)	
❑ WABCO 434 208 029 - WABCO 434 500 003 0	
Supply pressure	10 bar
ABS trailer triple servo control valve	
❑ WABCO 973 009 0130 - KNORR - BREMSE AC 597 B	
Supply pressure	8.5 bar
Predominance	0.2 bar
Differential control pressure (pipes 41 and 22)	$2.5^{+0.3}_{-0.5}$ bar
Pressure test point valve	
Maximum working pressure	12.5 bar
ASR control normally-closed solenoid valve	
❑ WABCO 472 170 606 0	
Working pressure	5.5 ÷ 11 bar
Maximum supply pressure	13 bar
Voltage	24 V
Current	0.69 Amp

DESCRIPTION	
Redundant valve (for vehicles with EBS 2)	
❑ WABCO 472 173 226 0	
Working pressure	0 ÷ 11 bar
Maximum supply pressure	13 bar
Voltage	24 V
Current	0.69 A
ABS electronic control unit	
❑ BOSCH 446 004 320	
Supply voltage	24 Volt
ESP electronic central unit (optional on tractors only)	
❑ WABCO 446 065 005 0	
Supply voltage	24^{+8}_{-12} Volt
Combined brake cylinder (for front disc brake)	
❑ Type 20 - 22 - 24: KNORR - BREMSE Z 003479	
❑ Type 22 - 24: KNORR - BREMSE Z 003480	
Maximum working pressure	
- fitting 11	10.7 bar
- fitting 12	8.5 bar
Minimum stroke	64 mm
Diaphragm brake cylinder (for added axle disc brake)	
❑ Type 12: KNORR - BREMSE IC 72561	
Maximum working pressure	10.7 bar
Minimum stroke	57 mm
❑ Type 14: KNORR - BREMSE IC 72563	
Maximum working pressure	10.7 bar
Minimum stroke	57 mm
Combined brake cylinder (for rear disc brake)	
❑ Type 20/27 KNORR - BREMSE IC 68086	
Maximum working pressure	
- fitting 11	10.7 bar
- fitting 12	8.5 bar
Minimum stroke	64 mm
Pressure sensor	
❑ WABCO 441 040 015 - 441 044 002 0	
Supply voltage	8 - 32 V
Measurement range	0 - 10 bar
Low-pressure switch	
❑ F 130 46 S - F 130 47 S	
Trip pressure	6.6 ± 0.2 bar

DESCRIPTION	
On-off valve (For Sweden only)	
❑ WABCO 434 205 061	
Working pressure	10 bar
Controlled pressure valve	
❑ WABCO 434 100 199 - KNORR - 1B 435 47 - BENDIX VPC 4M	
Opening pressure	$7^{+0.1}_{-0.3}$ bar
One-way valve	
❑ PEL 50 473 - C	
Working pressure	12 bar
Backpressure	0.2 bar
Trailer automatic and handbrake engaging low-pressure switch	
❑ F 130 48	
Trip pressure	5.5 ± 0.2 bar

SPECIFICATIONS AND DATA - BRAKES

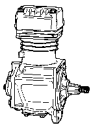
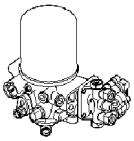
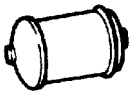
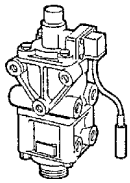
	**DISC BRAKES:** **FRONT AXLE** **CENTRAL ADDED AXLE** **REAR AXLE** **REAR ADDED AXLE**		**5876/4/5 - 5886/5** **5876/2/4** **MS 13-175** **55080/DI (DN8071) - 57080/DI (N8072)** **56082/DI (N9171)**	
	Brake calliper cylinders: - number - diameter	 Ø mm	 2 68	
	Brake lining thickness: - normal - minimum permissible	 S mm S mm	 21 2	
	Brake disc diameter	Ø mm	432	
	Brake disc thickness: - normal - minimum permissible	 S mm S mm	 45 37 (4 mm each side)	
	Operating clearance	G mm	0.5 to 1	
	**WHEEL HUBS**		FRONT AXLES 5876/2/4/5 - 55080/DI-57080/DI 5886/5	56082/DI
	Wheel hub bearings		2 with tapered rollers	2 with tapered rollers Unit-Bearing
	Hub bearing end float	mm	max 0.16	-
	Hub bearing end float adjustment		Not adjustable Tightening ring nut to torque	
	Rolling torque	da Nm	0.50 max.	
	Oil for wheel hub bearings Tutela W 140/M-DA (TRUCK FE-AXLE protection only on the rear axles of vehicles with F3A/F3B Engines) Quantity of oil for each hub	Litres kg	0.33 (•) 0.30 (•)	- -

• Quantities are referred to axles.

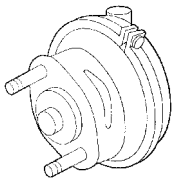
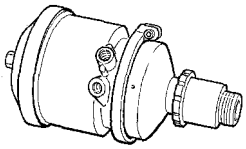
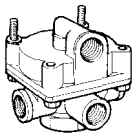
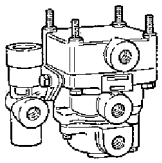
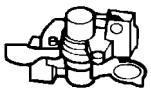
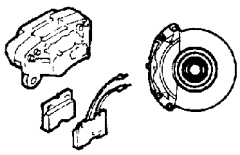
CHECKS ON MAIN COMPONENTS OF BRAKE SYSTEM

Since the vehicle system is type approved to European code standards, it is vital to periodically check its efficiency and that of the relevant components with the device 99305117.
These checks should be carried out with the vehicle stationary, using the compressed air of the tanks filled by the compressor, with the engine started.

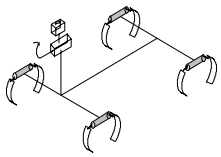
Always lock the vehicle before doing any work. Periodically check the pressure gauges, comparing them with a sample pressure gauge.

DEVICE	DESCRIPTION	TASK
	Compressor	Check the tightness of fittings and compressor fixing; make sure the cooling fins are not dirty.
	A.P.U. (Air Processing Unit)	Using a bleed valve or loosening a screw plug (with integrated bleed hole), check whether the air drier works properly. In this case, the air needs to come out of the tank without there being any trace of condensation water.
	Air tanks for: ❑ Front axle ❑ Rear axle ❑ Parking + trailer ❑ Services ❑ For regeneration	Check the seal and corrosion protection. Drain the condensate off from the tanks via the drain valve.
	Duplex control valve	Check that the pedal gasket is not worn, that the brake control linkage is properly tightened and lubricated, not out of shape. Check that the lever housings are neither worn nor oxidized.
	Pneumatic pressure test points	Check the safety caps are on
	Parking brake control valve	Apply the parking brake control valve till it trips; the pressure gauge on the test point has to show pressure discharge down to 0 bar in 1 sec.
	Parking brake control valve (with check position)	At the same time, at the automatic coupling pipe, the pressure gauge has to show a pressure of 7.5 bars.

(continued)

	**Diaphragm cylinder**	Check its fixing, integrity and seal. The bleed hole must be facing downwards and must not be clogged.
	**Combined cylinder**	Check its fixing, integrity and seal. The bleed hole must be facing downwards and must not be clogged.
	**Relay valve**	Check its operation and seal, evaluating how fast the brake cylinders act.
	**Servo control valve with triple control for trailer braking, with modulated servo diverter incorporated**	Fill the tank. Connect one pressure gauge to the automatic coupling head and one to the graduated coupling head. A pressure of 1 bar, sent by the twin control valve, must at the graduated coupling head correspond to a pressure of from 0.8 to 1.5 bars. Make a full braking (vehicle stationary). The coupling head must have available the required braking pressure or a pressure decreased by 0.5 bars. Apply the parking brake; at the graduated coupling head, the pressure must stay unchanged or decreased by 0.5 bars.
	**Coupling heads**	Check there is no dirt or damage in the coupling guides. After coupling is made, press the brake pedal and check the seal and stability between the coupling heads introducing air at 8.5 bars. Check there is no air leakage from the coupling gaskets.
	**Disc brake calliper** **Brake disc** **Brake linings**	Check the wear of the brake linings, scoring and wear of the brake disc, efficiency of the pistons, wear of the dust caps.

(continued)

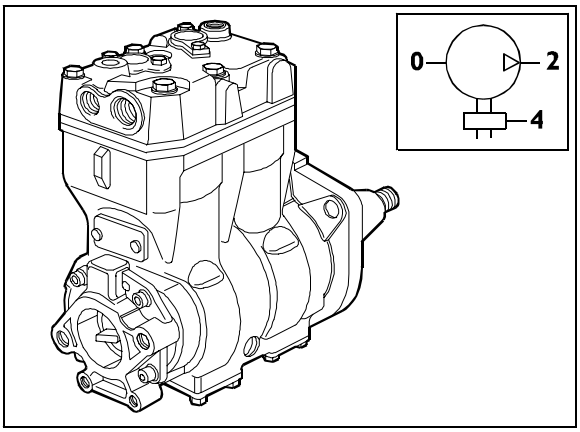


Pipes and fittings	Check the metal pipes are in a perfect state, with no dents or cranks; the polyamide pipes must have no cracking or cuts. Check moreover they are far from sharp edges of the bodywork and chassis that could damage them. Check that all the pipe brackets are firmly secured, their slackening causes vibration with the ensuing risk of breakage. Check that the polyamide pipes have not come into contact with oil or mineral grease, rubber solvents. Press forcefully on the brake pedal and check the pipes do not swell. Check there is no leakage from the various fittings or it will be necessary to tighten them fully, but taking care not to cause any abnormal torsion on the pipes. In all the above cases it is necessary to replace the relevant parts if there is even the slightest doubt about their efficiency. Apart from their conditions, it is advisable to replace the flexible hoses after considerable mileage or after a lengthy period of using the vehicle in order to prevent sudden bursting due to ageing and fatigue.
Seal of pneumatic system with engine off and under activation pressure	This check is carried out by introducing air pressure into the system of no less than 5 bars, spreading fairly dense soapy water over the couplings and fittings with a soft brush and seeing there is no leakage. Air leakage corresponding to a soap bubble of Ø 25 mm in 5 seconds is tolerated, or anyhow a max. fall in pressure within 10 min. of 2% of the disengagement pressure = 0.22 + 0.02 bars.
Seal of pneumatic system in the partial braking range with 3 bars	For 3 min. the pressure has to remain stable in the pneumatic system. This check should be made with the parking brake disengaged.

MAIN COMPONENTS OF THE BRAKING SYSTEM

790510 Compressor

Figure 47

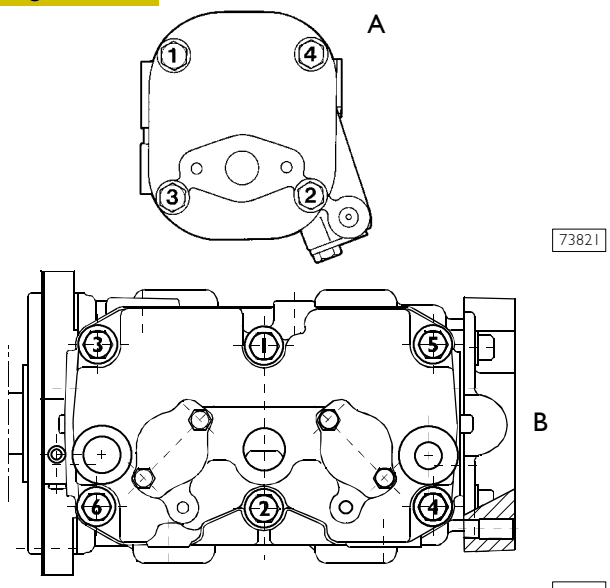


73820

It produces compressed air needed to supply the pneumatic system. Depending on the version, it may be a single- or twin-cylinder compressor.

Head locking screw tightness

Figure 48



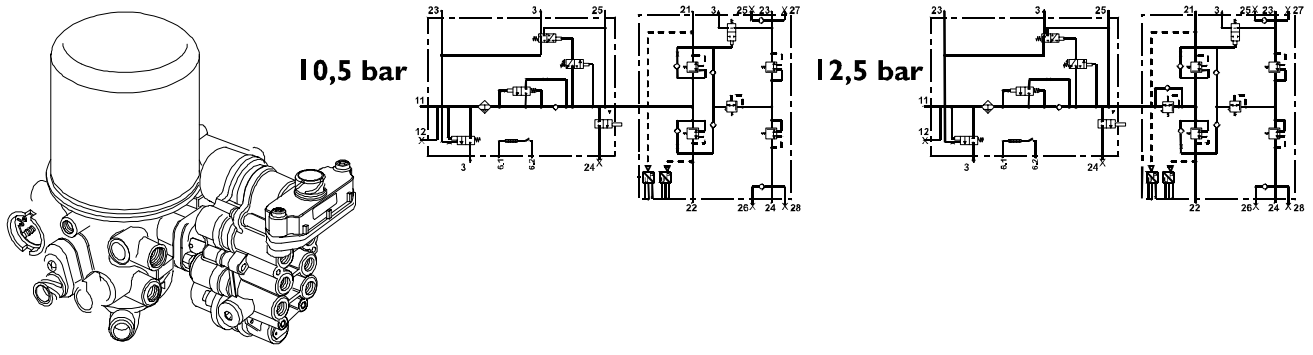
A = single-cylinder compressor
B = twin-cylinder compressor
Following the order shown in the figure, tighten the screws fixing the cylinder head to the required torque.

Fault diagnosis

TROUBLE	POSSIBLE CAUSE	REMEDY
Oil leakage from the flange on the outside	Incorrect tightening torque	Lock the screws to the required values.
	Flange seal surfaces not perfectly flat.	Check the sealing surfaces, replace any defective parts or make them level.
	Gasket broken.	Change the gasket.
	Shaft gasket damaged.	Change the gasket.
Oil leakage from the head	Scraper ring worn (noted because the seal seat is shiny).	Replace the piston assembly.
	Defective assembly of the scraper ring.	It should be fitted with the word TOP facing the head of the compressor.
	Scraper ring and piston rings all on the same vertical line.	Fit at 120° to each other.
	Cylinder scored or ovalized.	Grind the cylinder and mount an uprated piston.
Total lack of compression	Compression or intake valve deteriorated.	Replace deteriorated parts.
	Piston rings all on the same vertical line.	Mount rings at 120° to each other.
	Perforation of the piston or breakage of parts connected to the piston.	Replace the piston assembly.
	Gaskets damaged.	Replace the gaskets.
	Energy-saving device in open position during intake.	Replace the cylinder head.
Poor efficiency	Piston rings worn.	Replace the piston (together with piston rings).
	Air leakage between cylinder and head.	Replace the gasket and lock the screws with the required torque.
	Energy-saving device, intake or compression valves deteriorated.	Replace the deteriorated parts.
	Excessive clearance between piston and cylinder.	Grind the cylinder and mount an uprated piston.
	Particles of carbonized oil between the intake and compression valves.	Clean the valves.
Mechanical noise	Too much clearance between the small end and pin, between the pin and hole in the piston, between the shaft and big end, between the shaft and bushings and between the piston and cylinder.	Check the tolerance of the couplings at issue.
	To much clearance between the piston and cylinder.	Grind the cylinder and mount an uprated piston.
	Too much incrustation between the piston and cylinder head caused by burnt oil.	Clean the incrusted parts and replace the valves.
Water blow-by	Head gasket or coupling faces scored and uneven.	Replace the damaged parts.

A.P.U. (Air Processing Unit)

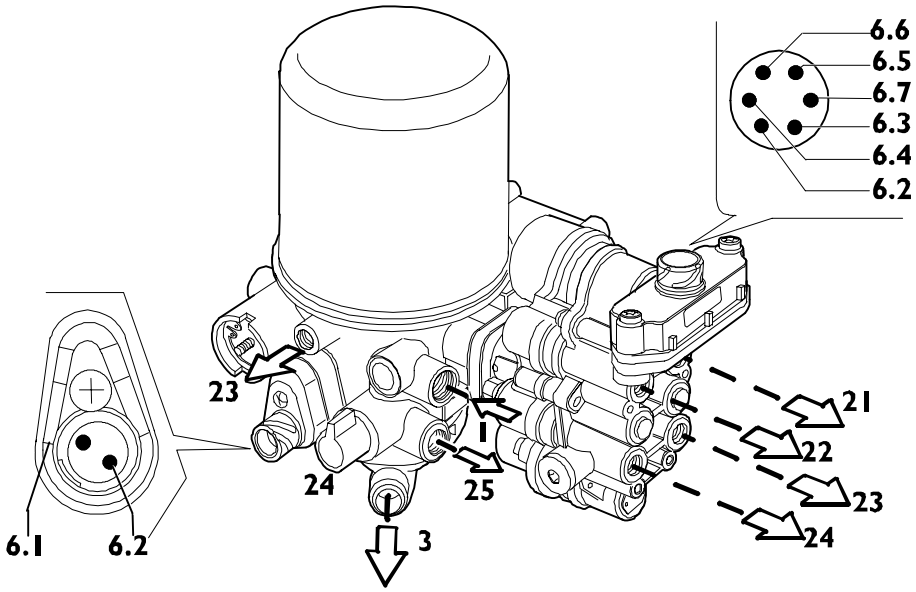
Figure 49



73913

Its function is to keep the air clean and at the right moisture level in the system.
In addition, it has to distribute and keep the pressure needed for the operation of the connected systems at the outlet.
On CM (Movable Body) vehicles, the component is used with a setting of 12.5 bars, while versions below this one have a setting of 10.5 bars.
The A.P.U. contains two pressure sensors connected with an MUX system to display the front/rear axle pressure on the Cluster.

Figure 50



Pneumatic connections

1 - Compressor feed
24 - Pressure intake
25 - Outlet for 10.5 bar / 12.5 bar pneumatic suspension for mobile cases
23 - To compressor for Energy Saving drive
3 - Exhaust into atmosphere
21 - To 10.5 bar rear axle air tank
22 - To 10.5 bar front axle air tank
23 - To trailer parking and reloading air tank and to hand distributor for 8.5 bar parking brake
24 - To 8.5 bar services tank

Thermostatic resistor connections (<7° ÷ >29°)

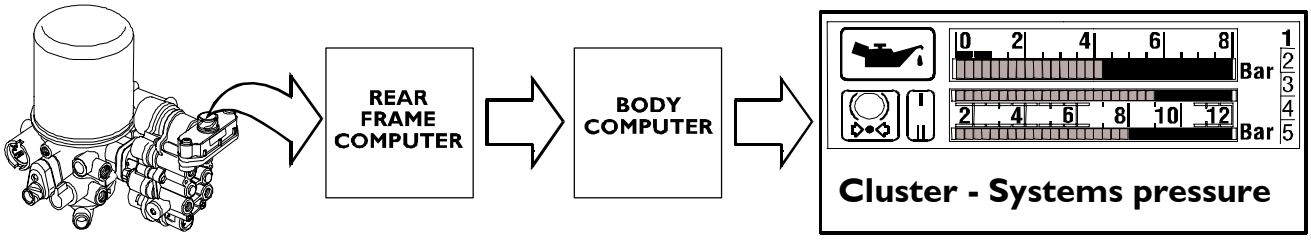
6.1 - Negative for thermostatic resistor
6.2 - Positive for thermostatic resistor

Pressure switch electric connections on four-way protection valve

6.2 - Signal
6.3 - Positive for power supply
6.4 - Negative
6.5 - Signal
6.6 - Positive for power supply
6.7 - Negative

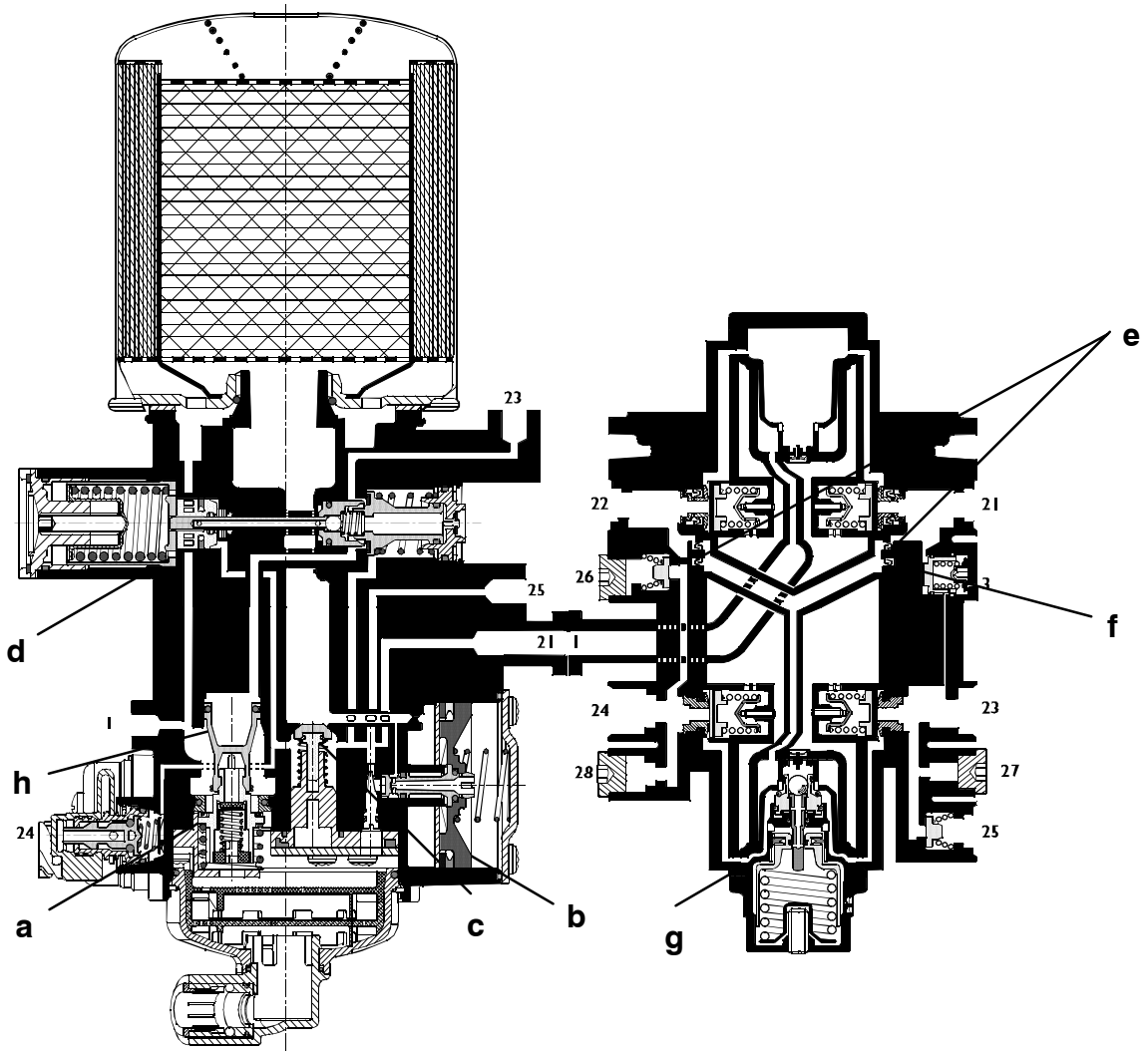
System for signalling on cluster

By this new component, systems pressure is displayed on IVECO Colour Display in following way:



OPERATION

Figure 51



RE-CHARGING STEP:

(10.3 + 0.2 bar Regulator) Compressed air from compressor at feed "1" is arranged on system "**a**" safety valve (calibrated to 13^{+4} bar for components limited to 10.5 bar, calibrated to 14.5^{+4} for components calibrated to 12.5 bar), and through dedicated channel reaches the drier filter.

Compressed air by passing through the filter releases its own moisture and, so dried, will be able to reach and feed, through the calibrated hole, the chamber of timer "**b**"; at the same time it opens holding single acting valve "**c**", and in this way it can feed outlet pressure intake 24, pressure regulator "**b**", outlet for feeding pneumatic suspension circuit 25, and through outlet 21 it feeds the four-way protection valve by its lying beneath pressure valves and is controlled by brake system outlets 21 and 22.

On reaching ≤ 7.5 bar pressure, the controlled pressure valves of above outlets open and, therefore, rear axle braking system 21 and front axle braking system 22 are fed; at the same, time through the two single acting valves "**e**", the pressure reducing device can be reached; since the pressure reducing device is open, this device allows pressure to pass to the controlled pressure valves of secondary sections.

Pressure at outlet 21 feeds the safety valve "**f**" of section 23, lifting it to seal position.

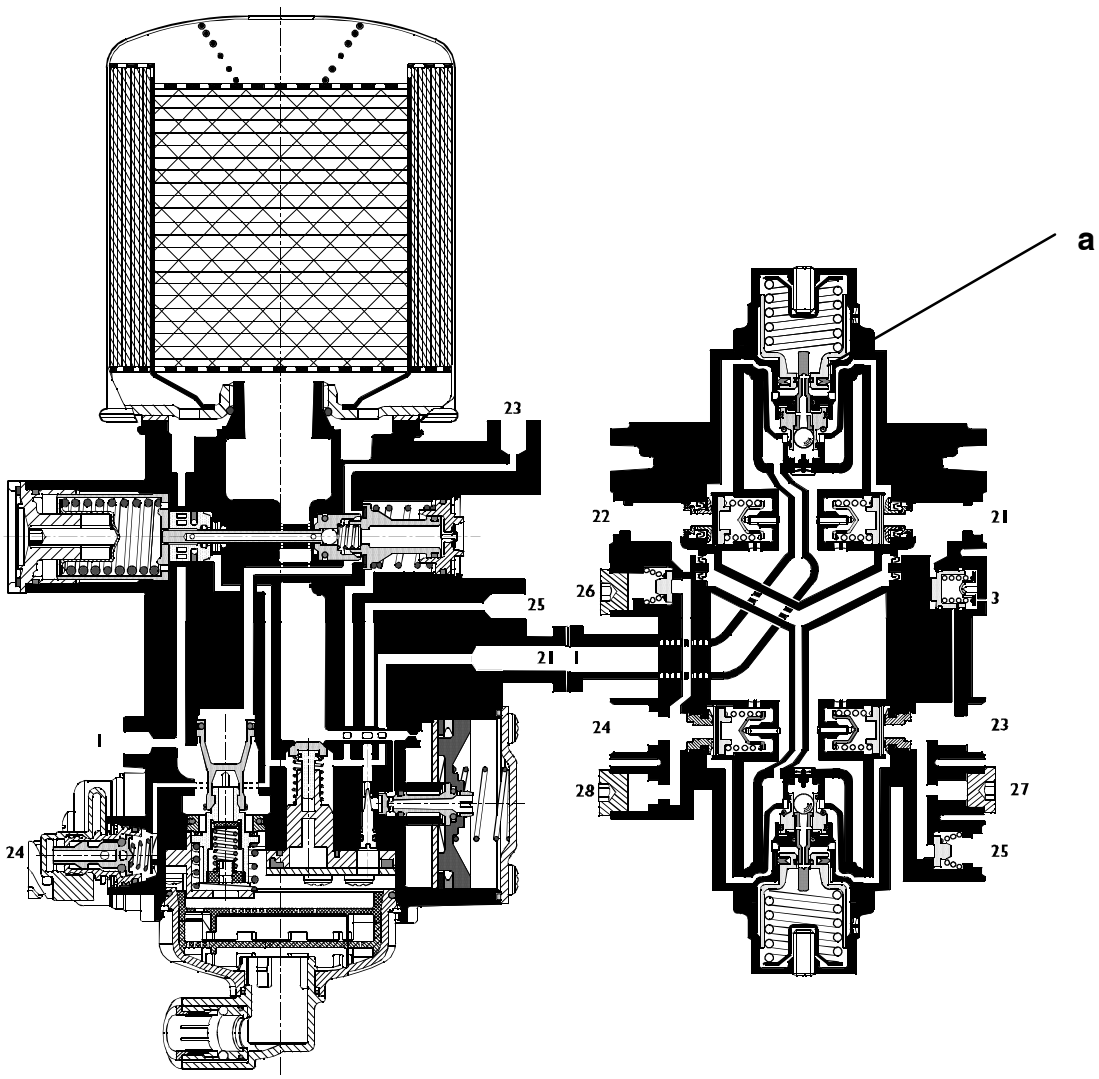
By further increasing pressure and reaching > 8 bar pressure, controlled pressure valves of secondary sections can open, and, consequently, outlets 23 and 25 can be fed, opening dedicated single acting safety valve and outlet 24.

These sections are fed and limited until the integrated pressure reducing device, calibrated to 8.5 bar, reaches the intervention pressure.

When regulator calibration $10.3^{+0,2}$ bar pressure is reached, the regulator is opened and, consequently, exhaust valve "**h**" is opened, causing a pressure drop within the drier from holding single acting valve "**c**" closing.

At the same time, through outlet 23, there will be sent the intervention pressure of the Energy Saving device integrated into compressor head and drier filter regeneration step activation, since the slow pressure drop in timer feed chamber enables pressure return from systems for ~20 seconds. This pressure, directed inside the filter, will assure filter regeneration and be released into atmosphere through exhaust 3.

Figure 52



000701t

RE-CHARGING STEP: (12.5 + 0.2 bar regulator)

This component assures 12.3 + 0.2 bar pressure at outlet 25 of pneumatic suspension, while maintaining the same calibrations as the former one at the outlets of the four-way protection valve.

In order to assure this functionality, it will be provided with a pressure reducing device "**a**" calibrated to $10.3^{+0,2}$ bar on outlets 21 and 22; therefore, the re-charging will be similar to the already described one but for the pressure reducing device being closed on reaching above pressure and the regulator release occurring on reaching 12.3 + 0.2 bar pressure.

DUCT 21 FAILURE STEP

Where a failure occurs at the four-way protection valve main circuit, component behaviour will be as below:

The pressure drop affecting outlet 21 results in a general pressure fall throughout the component, until the controlled pressure valve of faulty section reaches 6.5 bar closing pressure.

This pressure decrease also affects regulator "**d**", which shifts and returns to the re-charging condition.

At the same time, the pressure drop at outlet 21 causes safety valve "**f**" of parking duct to shift and open on discharging, so forcing duct 23 of protection valve to discharging, and causes the single acting valve of outlet 25 to close, so assuring pressure to be maintained in spring cylinders and preventing tractor parking self-braking.

In this failure condition, the half-trailer or connection, if any, will on the contrary be shifted to automatic braking.

System re-charging, assured by regulator intervention, will take pressure back to the opening levels of the controlled pressure valve of faulty section, corresponding to ≤ 7,5 bar, so assuring this pressure to be present in all the outlets of the component.

DUCT 24 FAILURE STEP

Where a failure occurs at the four-way protection valve secondary circuit, component behaviour will be as below:

The pressure drop affecting outlet 24 causes the pressure reducing device to open, so affecting the whole component, until the controlled pressure valve of faulty section reaches 6.5 bar closing pressure.

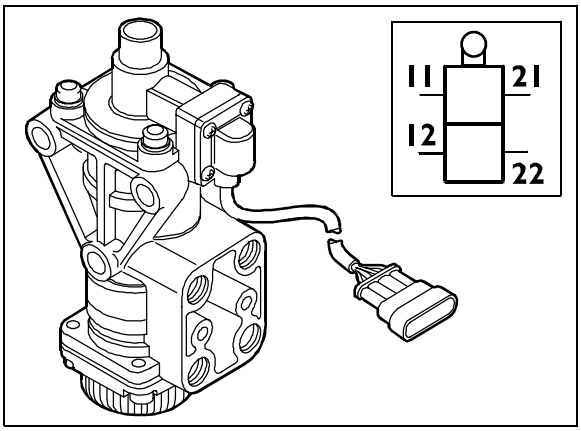
This fact causes the pressure regulator to open and return to the re-charging step.

System re-charging, assured by regulator intervention, will take pressure back to the opening levels of the controlled pressure valve of faulty section, corresponding to > 8 bar, so assuring this pressure to be present in all the outlets of the component.

In the case of any failure in protection valve, system feed is assured at pressure levels that guarantee system functionality; however, filter regeneration is not assured any more since this function is only activated when regulation pressure is reached, which in a failure condition cannot be reached any more.

793110 Duplex control valve (vehicles without EBS)

Figure 53



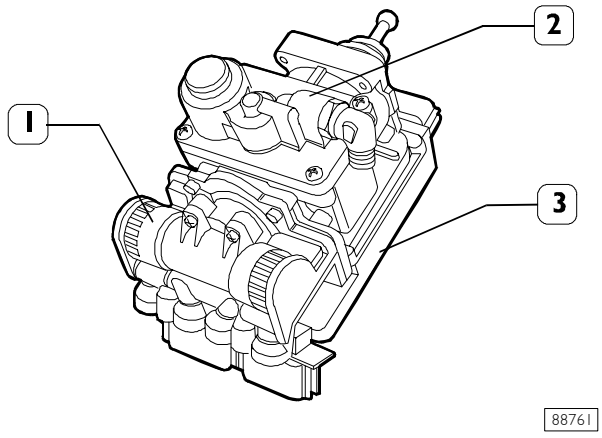
It takes air from the tanks and distributes it to the braking elements.
It is self-limited, that is it limits the delivery of air at a set maximum pressure, the outcome of which is a greater availability of energy and a constant maximum braking pressure irrespective of the pressure swings in the tanks.

Fault Diagnosis (vehicles without EBS)

TROUBLE	POSSIBLE CAUSE	REMEDY
Air leaks from the outlet hole	Leaks from the outlet pipes due to wear of the gaskets	Overhaul the device, replacing the worn parts.
Control valve with abnormal self-limitation	Self-limitation higher or lower than as required	Set the device using the specific screw.
Vibration during braking	Spring wear Air leakage due to piston gaskets in the two sections	Overhaul the device, replacing the worn parts. Overhaul the device, replacing the worn parts.
Abnormal operation of the brake light switch	It fails to close the electric circuit It fails to open the electric circuit	Replace the switch. Replace the switch.

CBU (Central Brake Unit) (vehicles with EBS 2)

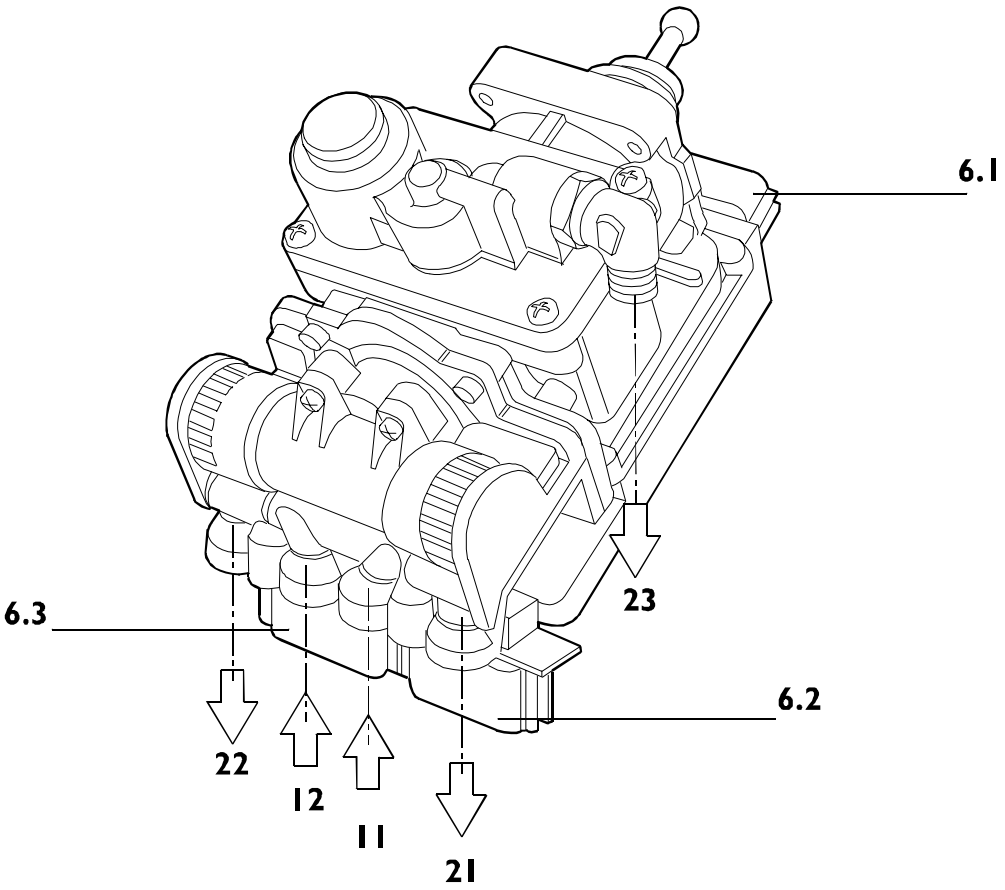
Figure 54



This component integrates the functions of following components:

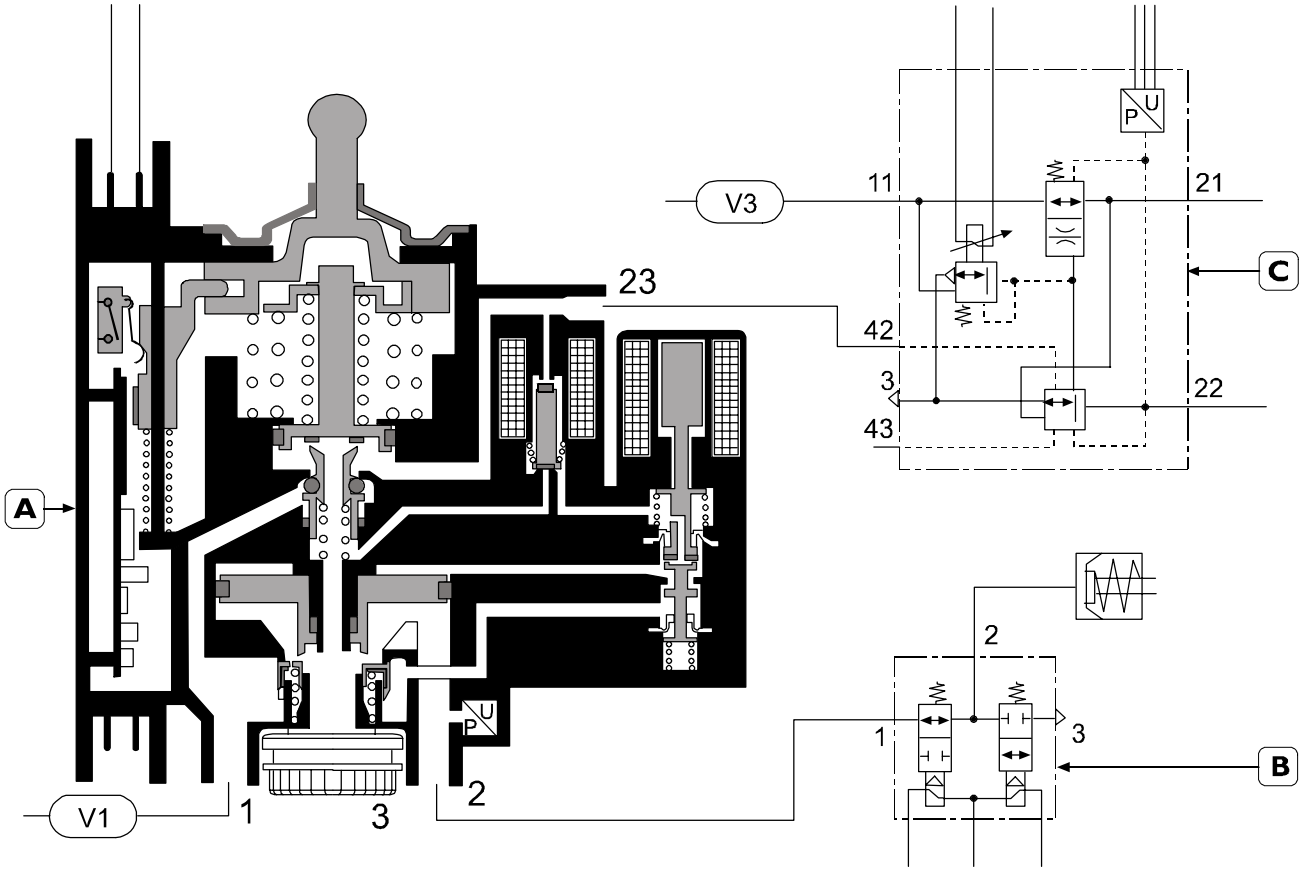
- duplex distributor, which generates electric and pneumatic signals to increase or decrease pressure in the braking system;
- electronic central unit, which has the task of managing the braking system determining deceleration values as a function of parameters detected from various components;
- proportional relay valve, which modulates pressure at front axle;
- Back up valve assuring braking even in case of electric failure.

Figure 55



Pneumatic connections		Electric connections	
11	From axle air tank	6.1	Cab inner side X1 connector
12	From axle air tank	6.2	Connector X2 on cab outer side (positioning to the left with respect to forward ride)
21	To ABS solenoid valve	6.3	Connector X3 on cab outer side (positioning to the right with respect to forward ride)
22	To ABS solenoid valve		
23	To trailer drive servo-assisted distributor		

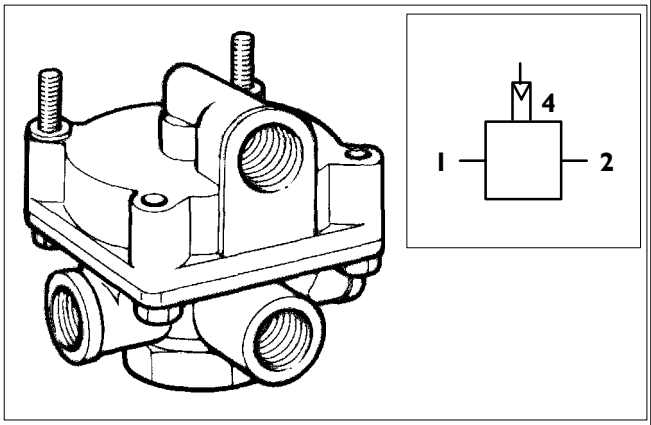
Figure 56



A. CBU (Central Brake Unit) - B. ABS solenoid valve - C. Servo-assisted distributor for trailer drive - V1, V3. Air tanks - 1, 11, 12. Feeds - 2, 21, 22, 23. Outlets - 3. Exhaust - 42, 43. Control pressures

793331 Relay valve (vehicles without EBS)

Figure 57



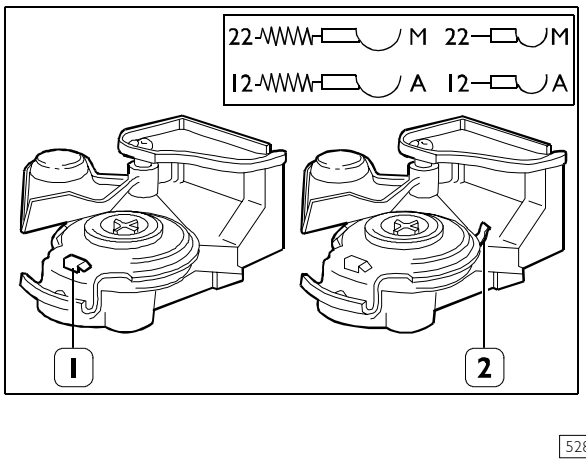
The device allows to speed up compressed air release from combined cylinder section, so cutting down braking time.

Fault Diagnosis (vehicles without EBS)

TROUBLE	POSSIBLE CAUSE	REMEDY
Air leaks from the outlet with the control pipe exhausting	Leakage from the introduction or from the seals.	Overhaul the device, replacing any defective parts.
Air leaks from the outlet with supply in the control pipe	Leakage from the piston gasket or from the exhaust valve.	Overhaul the device, replacing any defective parts.

798510 Coupling heads

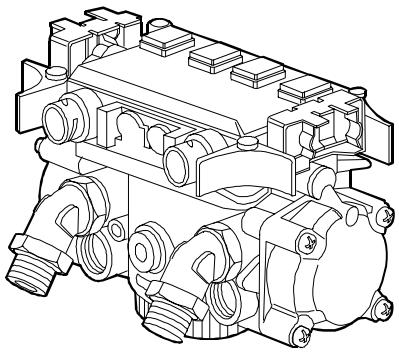
Figure 58



The version for the "Graduated" pipe is equipped with a red cover and a safety projection (1), while the version for the "Automatic" pipe is equipped with a yellow cover and a side safety projection (2). The safety projections are used to avoid coupling errors.

Electropneumatic modulator (vehicles with EBS 2)

Figure 59



88763

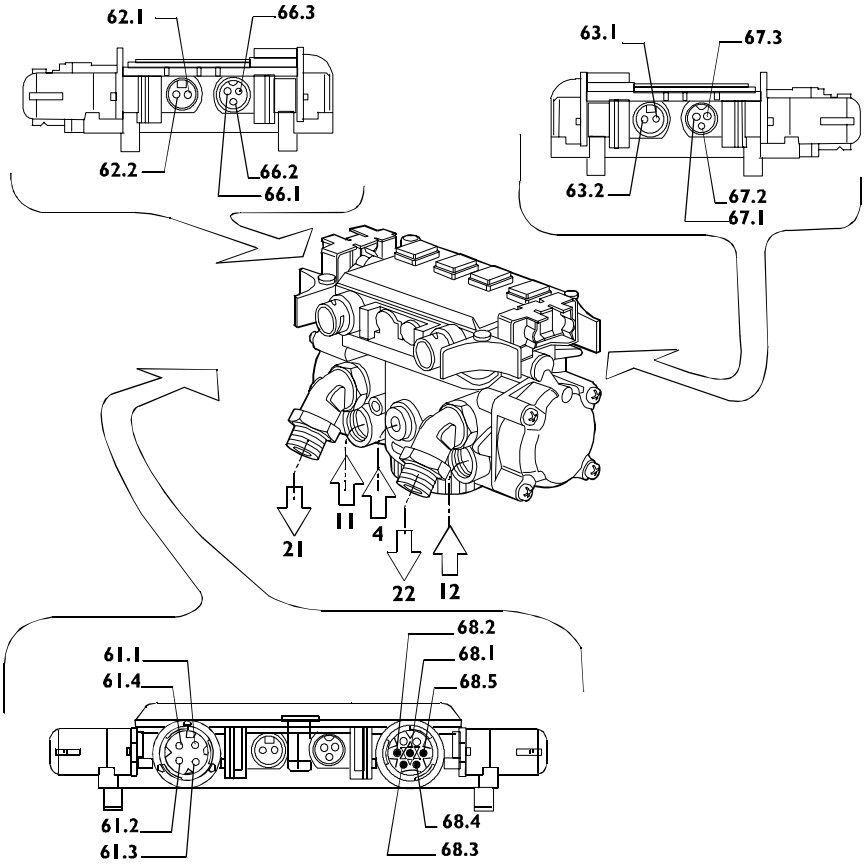
Its task is to modulate pressure at rear axle brake cylinders.

It is provided with an electronic central unit which controls rear r.p.m. sensors and rear axle braking gaskets wear.

This electronic central unit communicates via CAN network with the electronic central unit of the EBS that is integrated in the CBU.

In carts, at gate 4, the redundant valve is connected enabling pneumatic braking in the case of an electric failure.

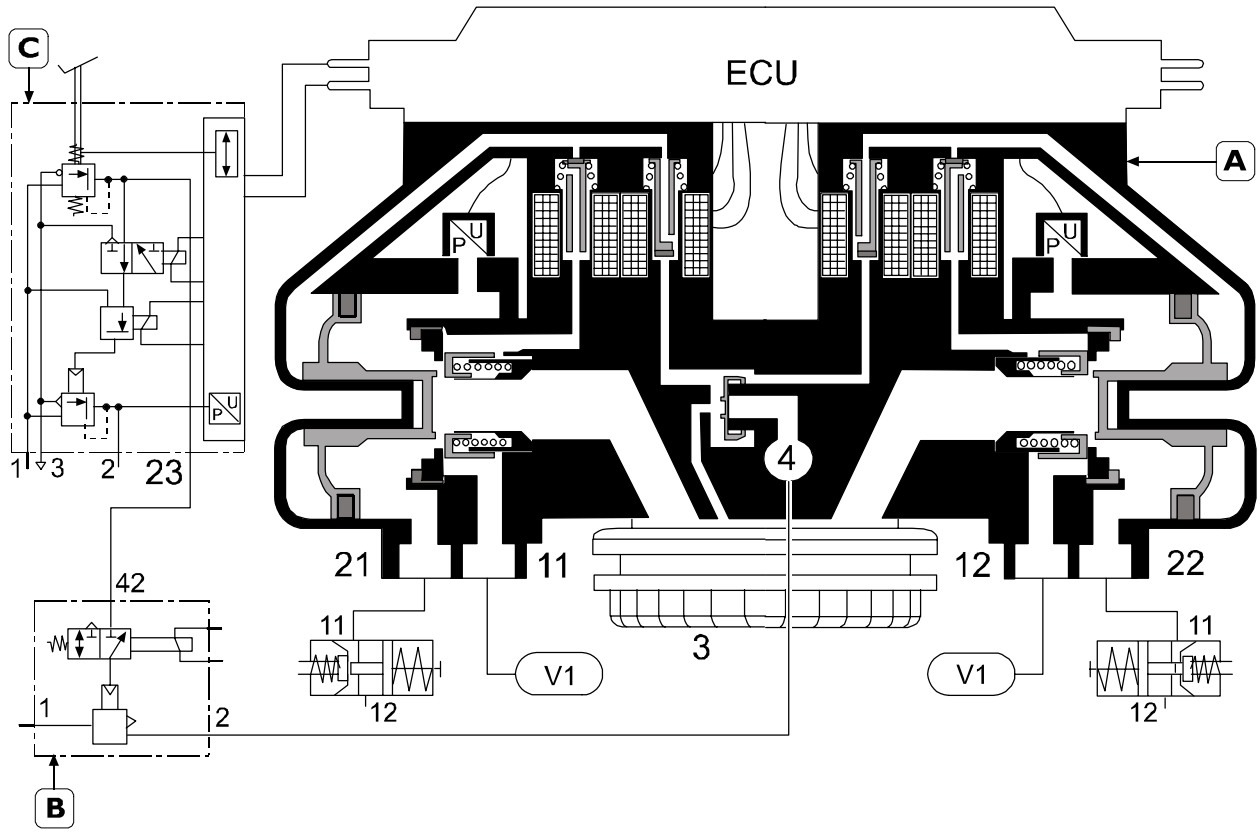
Figure 60



88764

Pneumatic connections			Electric connections			
11	-	From axle air tank	61.1	-	Positive	Central units connection line
12	-	From axle air tank	61.2	-	Earth	
21	-	To (LH) axle brake cylinder	61.3	-	CAN "H"	
22	-	To (RH) axle brake cylinder	61.4	-	CAN "L"	
3	-	Exhaust	62.1/63.1	-	Speed signal	Speed sensors
4	-	Redundant connection	62.2/63.2	-	Speed signal	
			66.1/67.1	-	Positive	Wear sensors
			66.2/67.2	-	Earth	
			66.3/67.3	-	Signal	
			68.1	-	Positive	Trailer drive valve
			68.2	-	Earth	
			68.3	-	Signale	
			68.4	-	CAN "H"	
			68.5	-	CAN "L"	

Figure 61



A. Rear Axle Modulator - B. Redundant valve - C. CBU (Central Brake Unit) - V1. Air tank - 1, 11, 12. Feeds - 2, 21, 22, 23. Outlets - 3. Exhaust - 4. Redundant connection - 42. Control pressure

Operation

Braking phase

The CBU informs the modulating valve electronic control unit via CAN. It controls the modulating valve so that the discharge solenoid valve is closed and the input one is opened.

The pressurised air will reach the brake cylinders causing the vehicle braking.

The outlet pressure will be proportional to the control signals and will be constantly controlled by the two built-in pressure sensors.

Depending on the signals coming from the speed sensors, the electronic control unit controls that the deceleration effect corresponds to the calculated one by constantly informing the CBU.

If the requested deceleration percentage or the grip of the wheel on the road decrease, the electronic control unit will enable the fit modulations of the braking pressure.

When the brake pedal is released, the component will remove the braking action from the rear axle, disabling the solenoid valves, which will return to the closed position on inputs, and discharging the braking pressure.

Besides, the component electronic unit controls and transmits to the CBU, via CAN network, the percentage wear status of the rear axle brake linings.

Braking in electric failure

TRACTORS

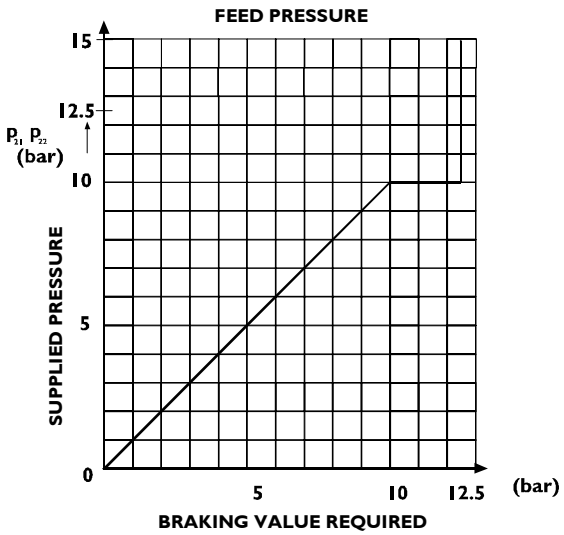
In case of electric failure, it will not be possible to brake the rear axle as this function is electrically enabled only. Braking will be ensured on the front axle and on the connected semitrailer only.

TRUCKS

In trucks, in the case of a failure of the electric system, the redundant valve opens, enabling axle braking

Performance diagram

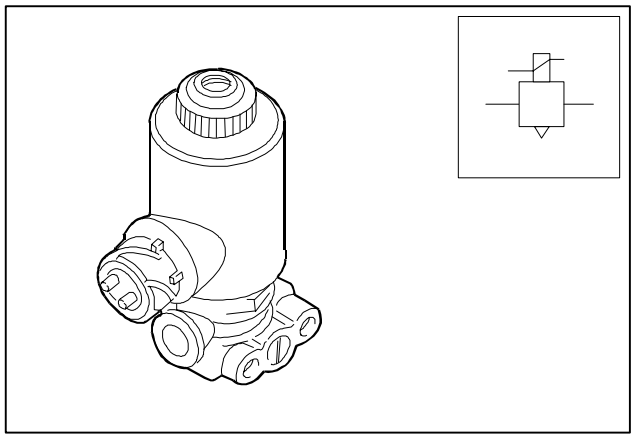
Figure 62



88765

Redundancy valve (for 4x2 and 6x2 trucks)

Figure 63

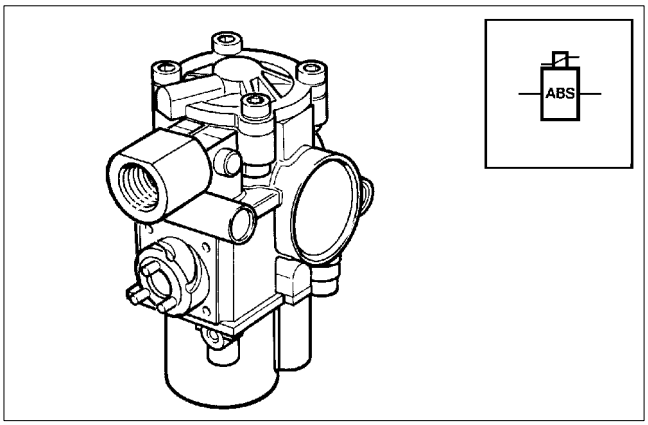


90143

This component has the task of ensuring the rear axles brake even if the EBS is entirely out of service.

ABS solenoid valve

Figure 64

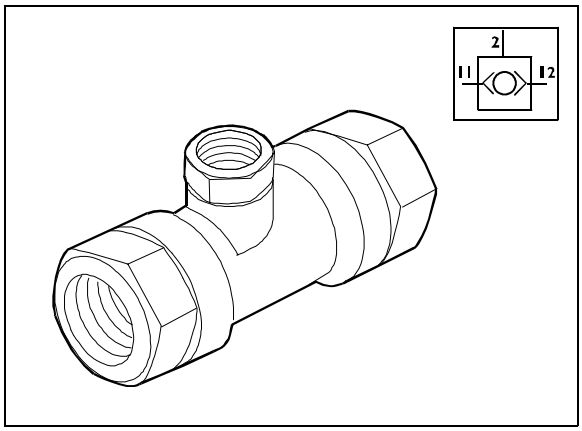


35805

This component modulates the air pressure in the brake circuits. When the electronic control unit detects a tendency for one of the wheels to lock, the valve shuts off the supply to the brake cylinder, preventing the wheel from locking.

Dual stop valve

Figure 65

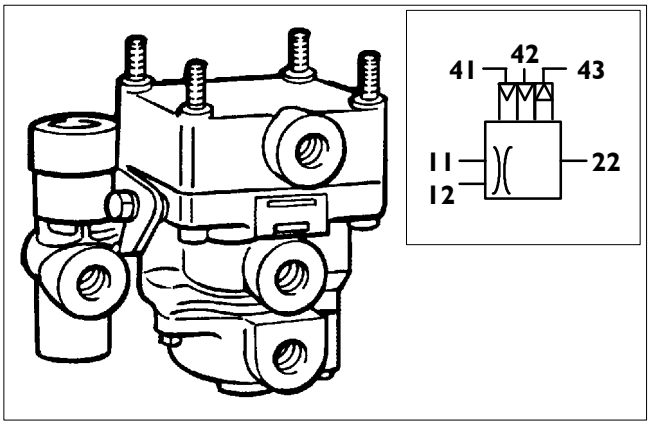


73919

On vehicles with an ABS/EBL system, this component has the task of sending the rear axle braking control relay valve the control pressure from the duplex control valve (normal working function). With the ASR function active, this component will send the activation pressure from the ASR solenoid valve. In addition, it is used on 6x2 vehicles to transmit the pressure in the air springs, to the added axle braking control relay valve, according to the load. On vehicles with the EBS, it has the task of sending the pressure of the front axle braking relay valves according to the load bearing on the air springs of the added axle.

793332 Triple servo control valve (vehicles without EBS)

Figure 66



33986

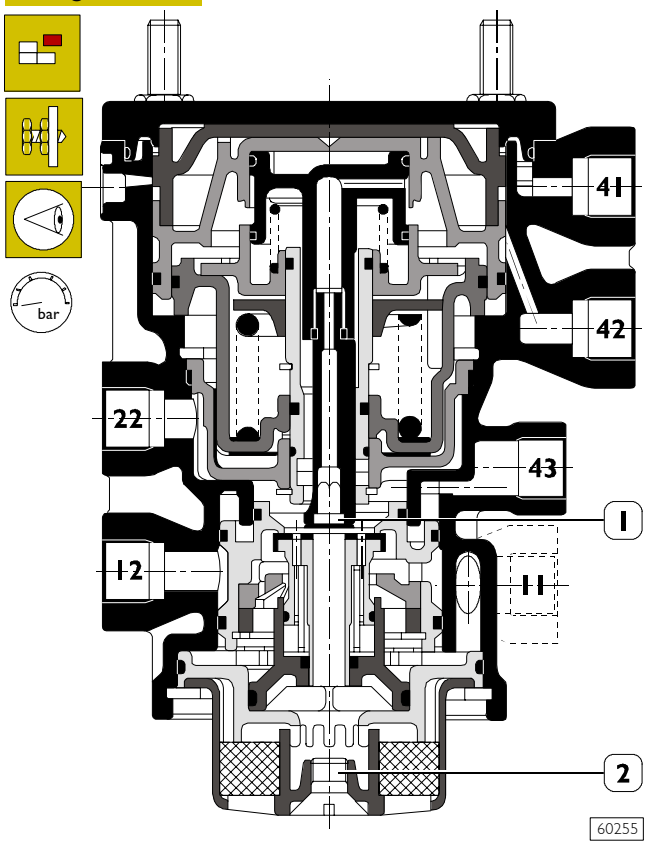
The device controlled by the two independent circuits of the duplex control valve and the spring brake circuit of the tractor controls trailer braking.
It incorporates a device making it possible to brake the trailer even in the event of control pipe failure.

Predominance control

It is equipped with a predominance adjustment device.

KNORR - BREMSE AC 597 B

Figure 67

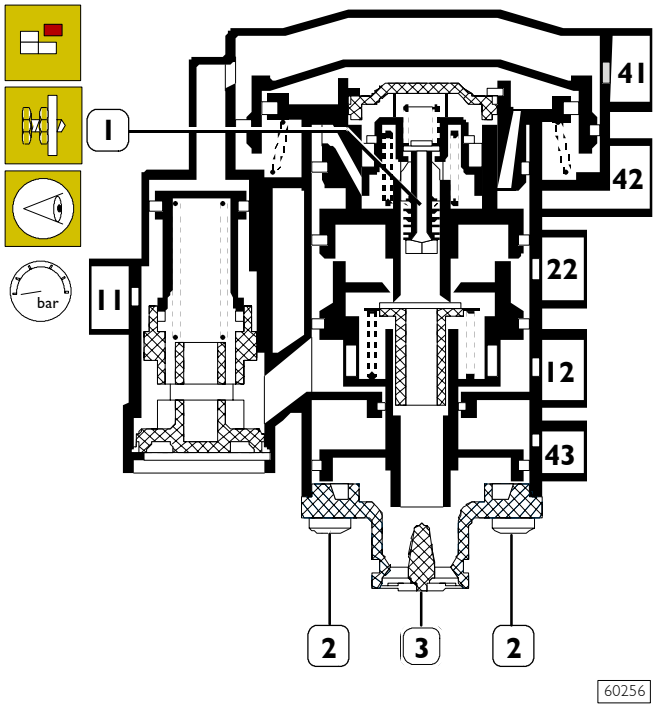


The operations to carry out to adjust the predominance of the servo control valve type KNORR – BREMSE AC 597 B are performed in the following order:

- ❑ undo the screw (2) from the silencer body;
- ❑ insert an Allen wrench into the hole through the silencer body and turn the hexagonal hole of the body (1);
- ❑ turning it CLOCKWISE increases the predominance;
- ❑ turning it ANTICLOCKWISE decreases the predominance.

WABCO 9730090130

Figure 68



The operations to carry out to adjust the predominance of the servo control valve type WABCO 973 009013 are performed in the following order:

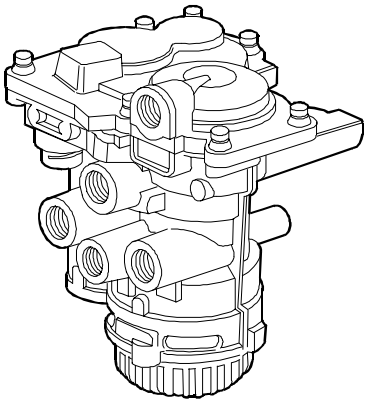
- ❑ Remove the screws (2) and take off the cover (3).
- ❑ Turn the screw (1) to adjust the predominance.
- ❑ Turning it CLOCKWISE decreases the predominance.
- ❑ Turning it ANTICLOCKWISE increases the predominance.

Fault Diagnosis

TROUBLE	POSSIBLE CAUSE	REMEDY
Air leaks from the outlet when at rest	Leaks from the gaskets.	Overhaul the device, replacing the worn parts.
	Exhaust valve and seat defective	Overhaul the device, replacing the worn parts.
Outlet pressures not as required	Air leaks from the gaskets.	Overhaul the device, replacing the worn parts.
	Pistons and seats worn or defective.	Overhaul the device, replacing the worn parts.
	Springs yielded.	Overhaul the device, replacing the worn parts.

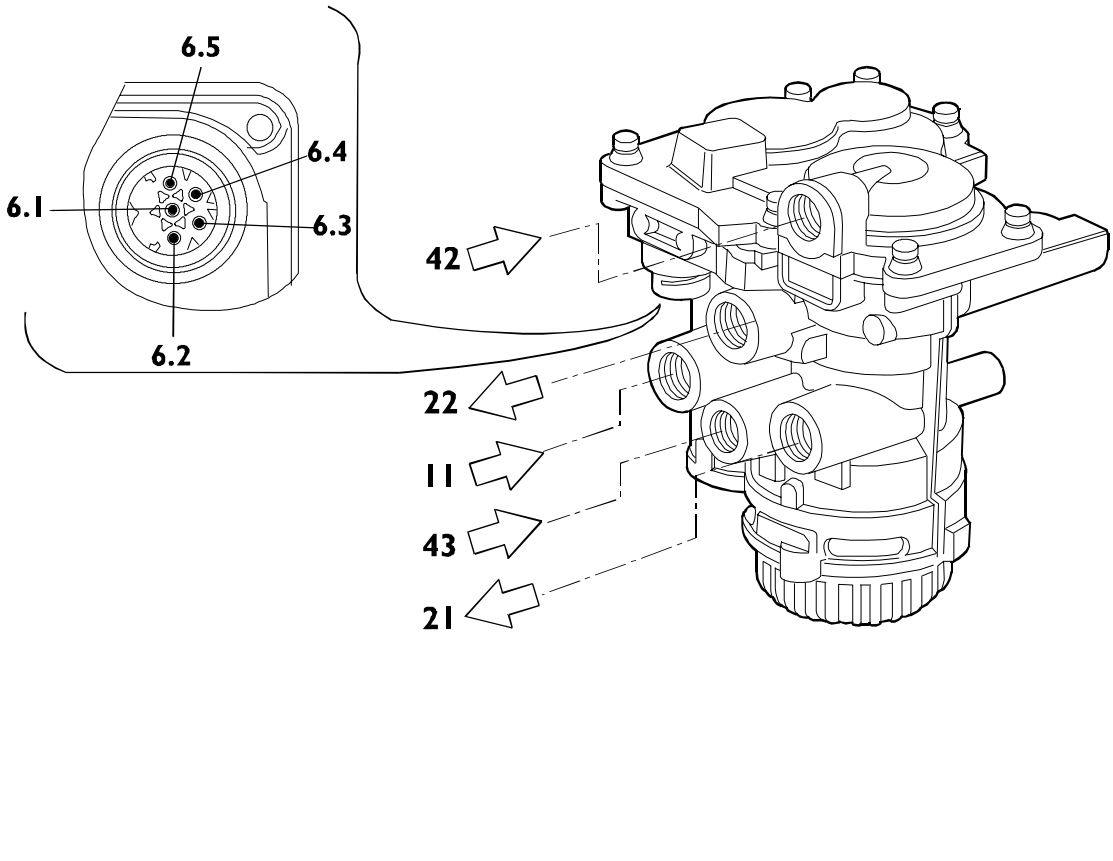
Trailer drive servo-assisted distributor (vehicles with EBS 2)

Figure 69



Valve task is to assure both all braking (service, parking, rescue) levels and the adaptation of the prevalence to trailer.

Figure 70



Pneumatic connections			Electric connections		
11	-	From air tank to trailer	6.1	-	Positive Pressure sensor
21	-	To automatic coupling joint	6.2	-	Earth Pressure sensor
22	-	To moderable coupling joint	6.3	-	Signal Pressure sensor
42	-	From (drive) CBU	6.4	-	Positive Solenoid
3	-	Exhaust	6.5	-	Negative Solenoid

Operation

Braking phase

Depending on signals from CBU, servo-assisted distributor proportional valve is conveniently activated.

The enabling of the latter causes the opening of the input valve and the pressurised air may reach and move the control relay device and simultaneously move the adjusted servo-switch.

The movement of the control relay closes the discharge and opens the input valve. The so-defined pressure will reach the automatic servo control valve of the trailer through outlet **22** and start braking.

Through pressure sensor, CBU will be acquainted of supplied pressure and at the same time, through **42** command, safety pressure arrives from CBU.

In this way, the central unit integrated in CBU detects, through axle speed sensors, the actual slowdown obtained on the half trailer and, if necessary, will provide to optimise it by properly adapting necessary prevalence value (0.5 to 1.2 bar), and will store it.

When the brake pedal will be released, the control unit will disable the solenoid valve causing the discharge of the control and braking pressures.

Parking braking

By operating the hand-operated control valve, pressure is discharge at control **43** of the component. This causes the movement of the internal piston which, intercepting the relay closes the discharge and feed the adjustable outlet **22** achieving in this way the pneumatic parking of the semitrailer.

The control unit will be informed of the braking situation by the built-in pressure sensor.

When the hand-operate control valve position is reset, in running conditions, the pressure to control **43** will be restored, The movement of the internal piston will cause the discharge the adjustable pressure of outlet **22** and the non-braking of the semitrailer.

Braking in electric failure

In electric failure conditions, the driver will be informed by the turning on of the light on the dashboard.

No braking electric signals will be transmitted when pressing the brake pedal, but the safety pressure to outlet **21** of the control valve reaching control **42** of the servo control valve will be ensured.

This pressure will directly control the relay device, ensure the pressure to the adjusted outlet pressure **22**. Braking pressure will be proportional to the control pressure.

On releasing brake pedal, **42** command will be directly released by CBU so having the relay lifted and moderable pressure and half trailer breaking released.

Braking with failure of the adjustable line

During the braking phase with the line **22** in failure conditions, the braking pressure is discharged in the atmosphere through the line breaking.

The electronic control unit is informed by the pressure sensor of the pressure drop. The electronic control unit, therefore, fully enable the control solenoid valve with no results.

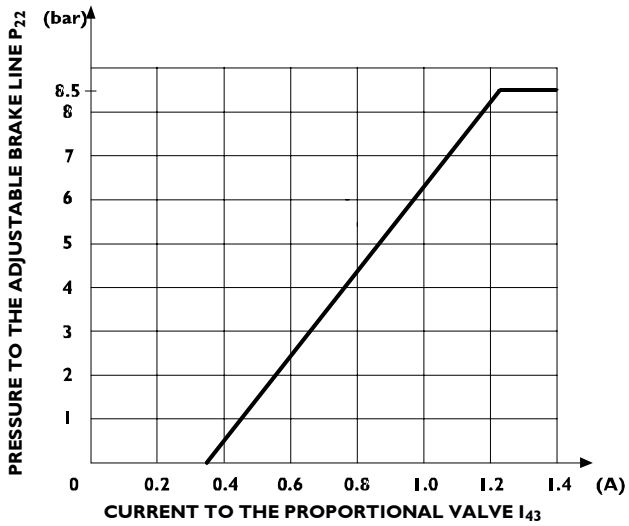
This will cause a decrease in the pressure of the automatic line **21** and the closing of the adjusted servo control valve which stops the input to the automatic line.

The pressure drop in the automatic line causes the operation of the semitrailer servo control valve in automatic braking mode.

When the brake pedal is release, the return to its position of the adjusted servo control valve allows the automatic pressure reset and the semitrailer non-braking.

Performance diagram

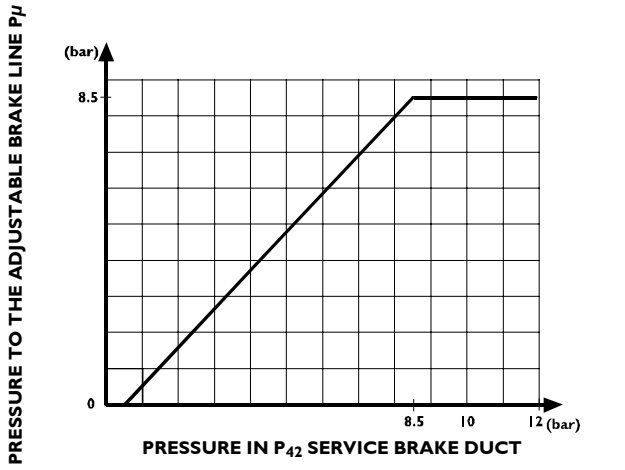
Figure 71



62337

Braking with electric control

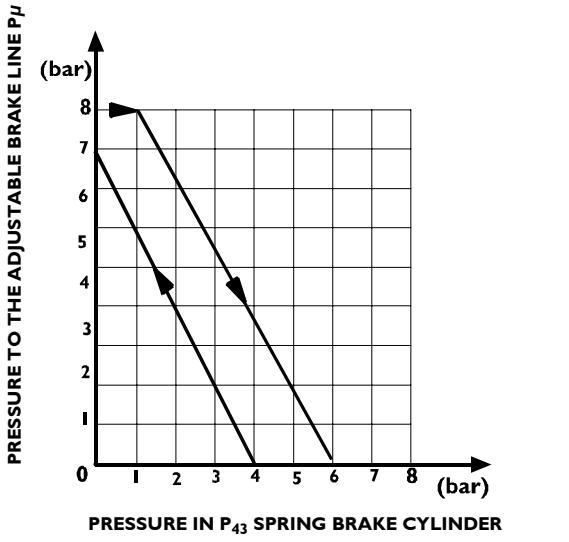
Figure 72



88767

Braking with electric signal failure

Figure 73

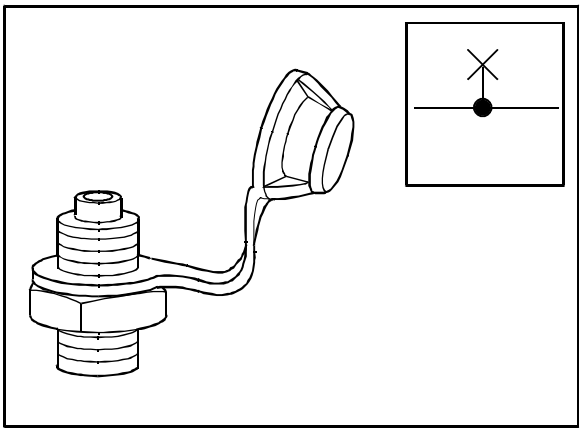


88768

Parking braking

Pressure test point valve

Figure 74

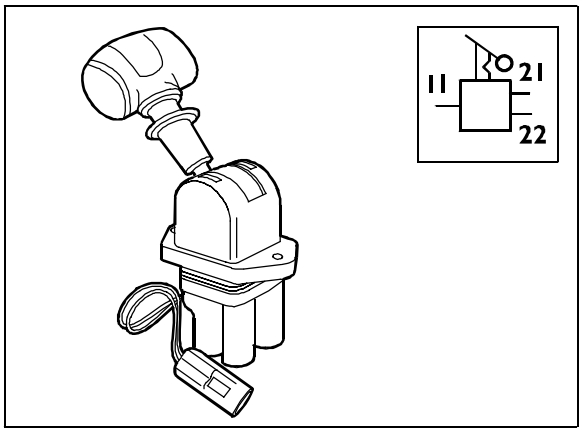


71953

The pressure test points are in the pipes or tanks of the pneumatic system in order to make it easier to hook up pressure gauges for fault diagnosis.

794310 Parking brake hand control valve (vehicles suited to towing)

Figure 75



79514

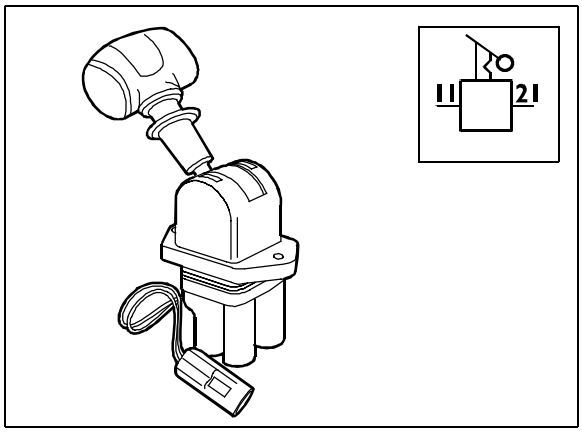
This device provides emergency and parking braking for the tractor and trailer.
Additionally, it makes it possible to check the braking effect of the tractor. This is vital when the vehicle is parked on a steep slope.

Fault Diagnosis (parking brake control valve)

TROUBLE	POSSIBLE CAUSE	REMEDY
Air leaks from the outlet with the control lever:		
in the release position	Exhaust valve, seat or seal defective	Check and overhaul the device, replacing any defective parts
in the braking position	Control valve, seals and valve to control component worn	Thoroughly clean the various parts comprising it
Difficulty in turning the control lever	Interference in the control valve	Overhaul the device and moisten all the sliding parts

793336 Parking brake control manual distributor (standby vehicles)

Figure 76

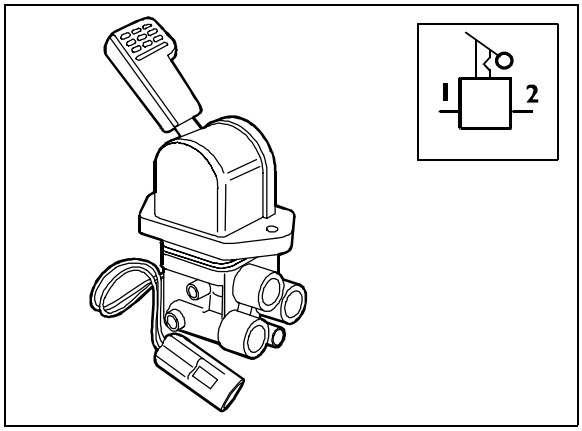


79515

The apparatus, inserted into tractor parking brake circuit, allows to actuate vehicle help and parking braking by releasing the air in spring cylinders.

Manual control valve to slow down the trailer (optional)

Figure 77



73922

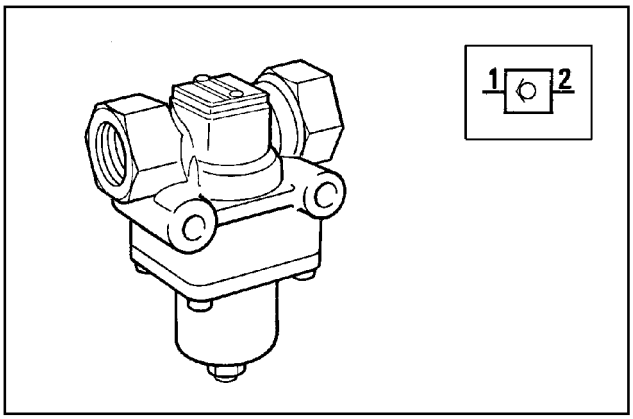
This component, in the parking circuit between the manual control valve and the trailer servo control valve, makes it possible to activate braking to slow down just the semitrailer according to the control given by the driver. It is an optional fitting and is anyhow bound by the current type-approval regulations in the various countries.

Fault Diagnosis (parking brake control valve)

TROUBLE	POSSIBLE CAUSE	REMEDY
Air leaks from the outlet with the control valve lever in the brake release position	Piston, outlet valve, seals worn or defective.	Clean thoroughly, check the rubber parts and the seats are sound.
Air leaks from the outlet with the control valve lever in the emergency or parking braking position	Piston and associated seal defective or deteriorated.	Clean thoroughly, check the parts and overhaul the device, replacing the defective parts.
Air leaks from the cover of the control valve lever	Plate, gasket, seals worn.	Clean the parts thoroughly, check the surfaces of the gasket and seals, check the integrity of the rubber parts and the relevant seats. Overhaul the device, replacing the defective or worn parts, and restore the mating faces if necessary.
Control valve lever hard to turn	Interference inside the control valve.	Clean thoroughly and check all the component parts. Overhaul the device, replacing defective parts. During assembly, grease all the sliding parts in moderation. If you find any defects or wear such as to jeopardize operation, replace the complete device.

Controlled pressure valve

Figure 78



73923

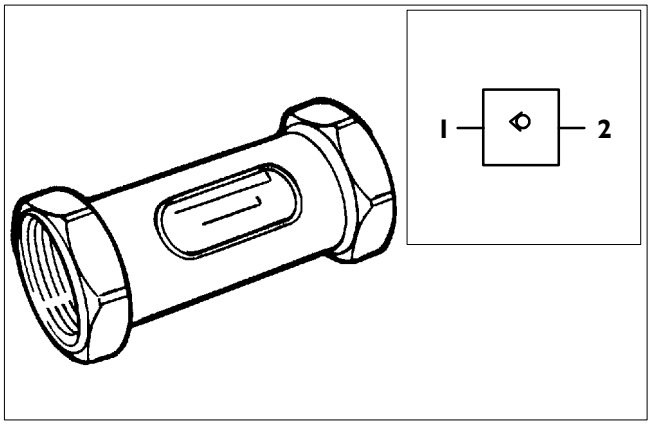
Its job is to break off the flow of air to the ASR solenoid valve when the pressure of the rear axle system falls under 7.5 bars after a breakdown or too much air being drawn off.

Fault Diagnosis

TROUBLE	POSSIBLE CAUSE	REMEDY
Vent at outlet	Diaphragm leaks	Overhaul the device, replacing any worn parts
Air leaks from the join between the two half-bodies	Leakage from the diaphragm fitting	
Vent on delivery (into the atmosphere) with supply at a lower pressure than the setting	Leakage from inlet valve or its seat	Overhaul the device, replacing any worn parts

793319 Check valve (vehicles suited to towing)

Figure 79

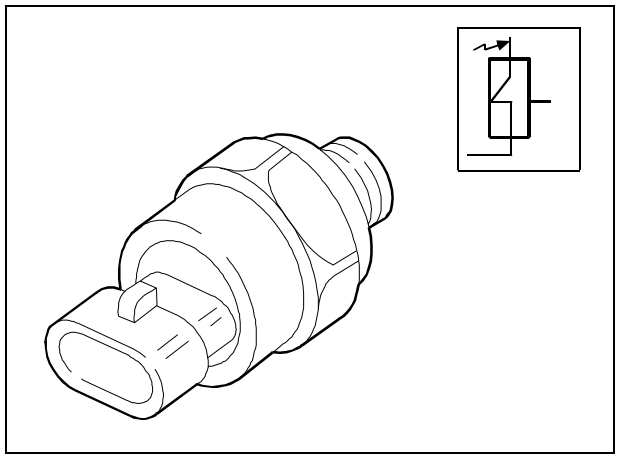


33987

This permits compressed air to pass in the direction shown by the arrow on the valve body, preventing its backflow.

Low-pressure switch

Figure 80

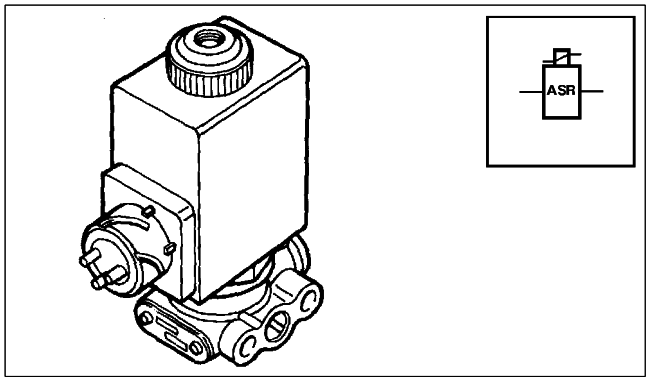


73924

The purpose of this component is to warn the driver, with indicator lights on the CLUSTER, and the electronic control unit of low pressure in the system.

526724 Electro-pneumatic valve for ASR

Figure 81

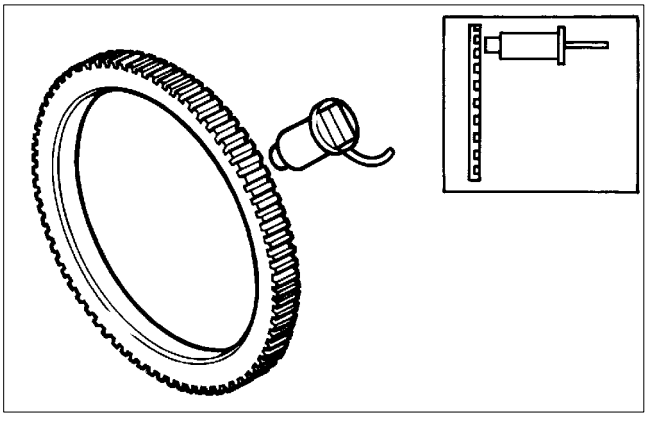


35384

This device brakes the driving wheels, via the brake anti-lock modulator, whenever a tendency for one or more driving wheels to skid is detected.
The valve is normally closed. When the electronic control unit detects a tendency to skid of one or more driving wheels, it sends a signal to the solenoid valve, which energizes and lets air pass to the brake anti-lock modulators that brake the wheels. The solenoid valve de-energizes when the wheels have reached the right degree of friction on the road surface.

526713 Speed sensor
566712 Phonic wheels

Figure 82

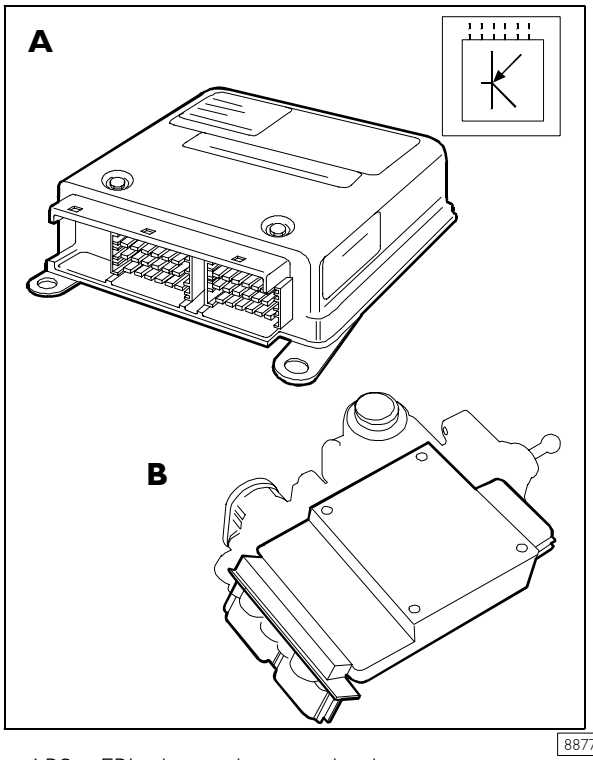


35383

The speed sensors and phonic wheels have the job of detecting the speeds of the respective wheels.
The phonic wheel is housed on the wheel hub and turns at the same speed as the wheel. It generates alternating voltages in the sensors by induction. The frequency of these voltages is in proportion to the speed of rotation of the respective wheel. These voltage signals are transmitted to the control unit to be suitably processed. A sensor and a phonic wheel are fitted for each wheel. This arrangement makes it possible to control an individual braking pressure for each wheel during adjustment, optimizing travelling stability and braking distance.

526711 Electronic control unit

Figure 83



88772

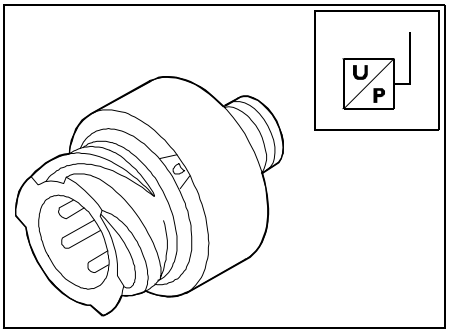
A = ABS – EBL electronic control unit
B = EBS 2 electronic control unit (CBU)

Its purpose is to control the brake system, producing deceleration in relation to the parameters detected by the various system components.
The electronic control unit is equipped with a highly advanced self-diagnosis system and it is able to identify and save any trouble, even of an intermittent nature, occurring to the system during operation, in relation to the environmental conditions, ensuring the most correct and reliable repairs.

EBS 2 central unit is integrated in CBU (Central Brake Unit) and able to drive slowdown auxiliary systems (engine brake and Retarder) optimising the intervention in such a manner as to both assure better system operation and reduce breaking gaskets wear.

Pressure sensor

Figure 84

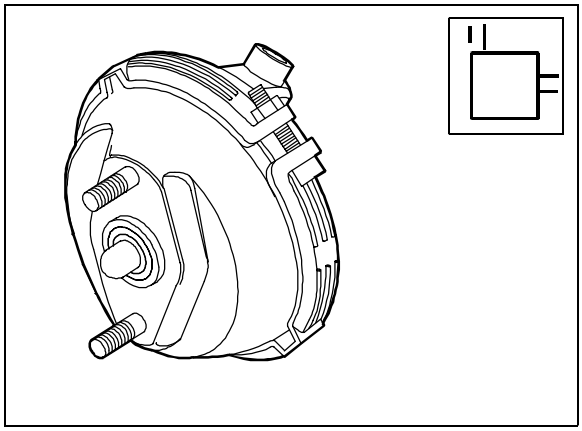


52722

In ABS/EBL systems, its job is to inform the electronic control unit of the extent of action required by the driver.
In EBS 2 systems, this component is integrated in the front axle, rear axle and trailer control valves.

794911 Diaphragm brake cylinder (for front and added front axle disc brake)

Figure 85

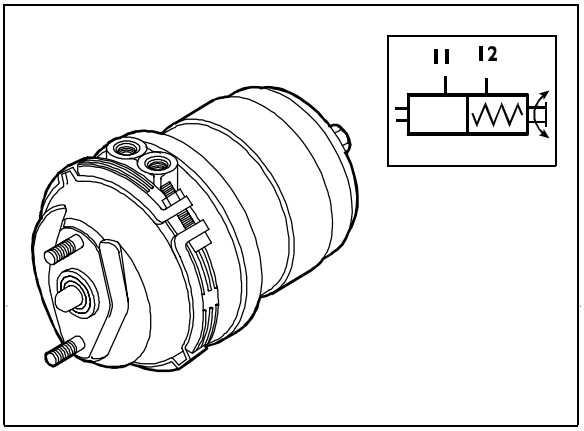


73926

This device transmits the force given by the compressed air, as the brake pedal is pressed, to the mechanical service braking device. If there is any trouble, it is necessary to replace the entire cylinder.

794922 Combined brake cylinder (for front and rear disc brake)

Figure 86

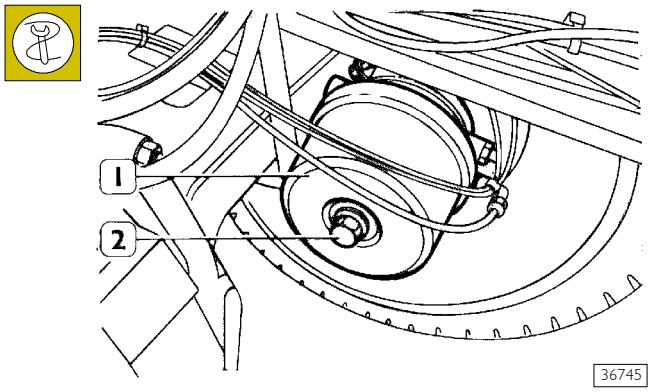


73927

This device is composed of two parts: a diaphragm brake for service braking and a spring brake for parking and emergency braking if the braking system fails.

Combined cylinder emergency brake release device

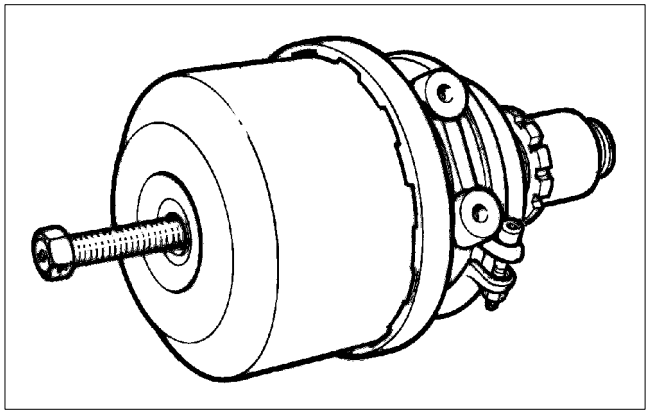
Figure 87



If it were not possible to supply the spring section of the combined cylinder (2) pneumatically, it is possible to release the vehicle brake manually to permit towing. To release the vehicle brake you need to unscrew the screw (1) fully.

Repairs

Figure 88



Before detaching the combined cylinder from the vehicle, carry out the manual brake release procedure for the combined cylinder as described above.

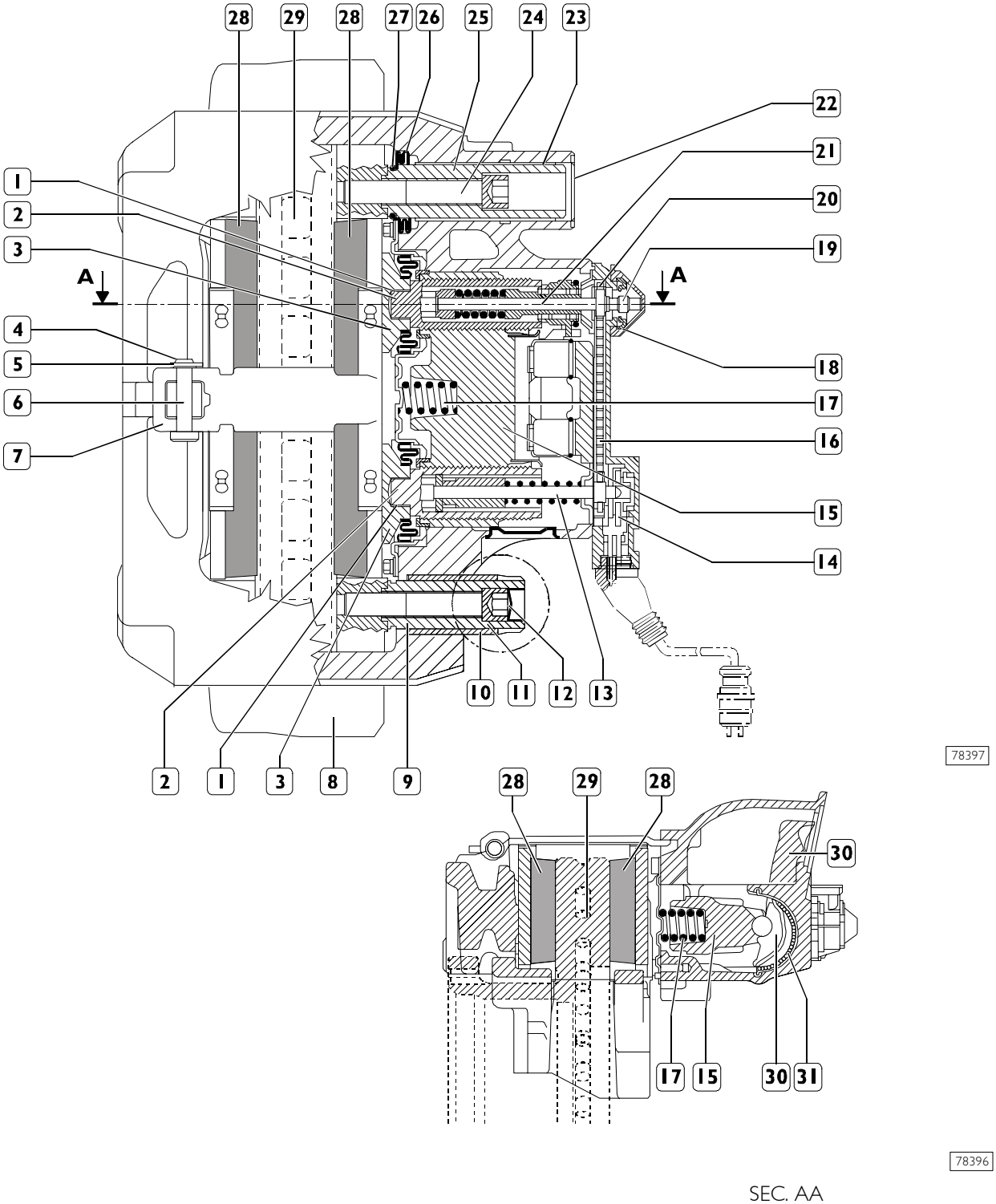
Before removal, it is recommended to thoroughly clean the outer parts of dirt and other debris that on getting inside could damage the cylinder.
If there is any trouble with the spring section of the cylinder, do not dismantle it as this can be dangerous.

Fault Diagnosis

TROUBLE	POSSIBLE CAUSE	REMEDY
Air leaks from the outlet or retaining clamp	Diaphragm punctured or broken. Diaphragm lip broken. Retaining clamp locking screws loose.	Replace the diaphragm Tighten the screw
Air leaks from the diaphragm section supply	Deterioration of the parts forming the spring section	Overhaul the device, replacing any worn parts.

5274 DISC BRAKES KNORR TYPE (CALIPER SN7)

Figure 89



1. Dry bush - 2. Threaded hose - 3. Piston - 4. Washer - 5. Spring split pin - 6. Pin - 7. Retaining plate - 8. Supporting plate - 9. Guide pin - 10. Guide bush - 11. Sliding pin - 12. Plug - 13. Dragging device - 14. Wear sensor - 15. Rear axle- 16. Chain - 17. Spring- -18. Cover - 19. Adapter - 20. Chain gear - 21. Adjusting device- -22. Cover - 23. Brass bush - 24. Sliding pin - 25. Sliding bush - 26. Inner protection - 27. Ring - 28. Brake lining - 29. Brake disc body - 30. Lever - 31. Cam bearing.

Operation (See previous figure)

Braking stage

During braking, the diaphragm cylinder rod presses down on the lever (30).
The force is transferred to the axle (15) by the bearing in an off - centered position (31)
Through the threaded sleeves (2) and pistons (3), the force is conveyed to the inner braking lining (28).
Once the play between brake linings (28) and brake disc (29) has been recovered, the force is conveyed to the outer brake lining (28), due to brake caliper displacement.
The brake linings (28) pressing on the brake disc (29) produce the braking power.

Releasing stage

As soon as the pressure on the brake is reduced, the pressure spring (17), the rear axle (15) along with threaded sleeves (2) and lever (32) go back to their original positions.

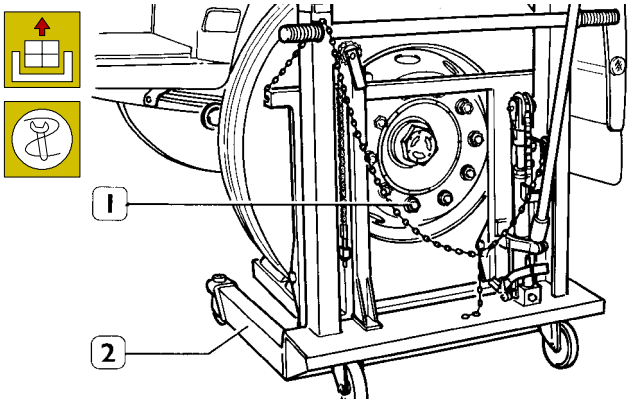
Automatic play recovery

The brake is equipped with automatic adjustment device, which keeps the operating play between brake linings and brake disc constant.
Every time the brake is operated, the adjustment device (21), which is integral with the lever (32), is automatically started.
If worn brake linings and brake discs increase the operating play, the adjustment device (21) and drag link (13) turn the threaded sleeves (2) so to recover said increase in play.
The operating clearance should be between 0.6 and 1.1 mm; lower clearances might cause overheating problems.

CHECKS

Checking the automatic play recovery system efficiency

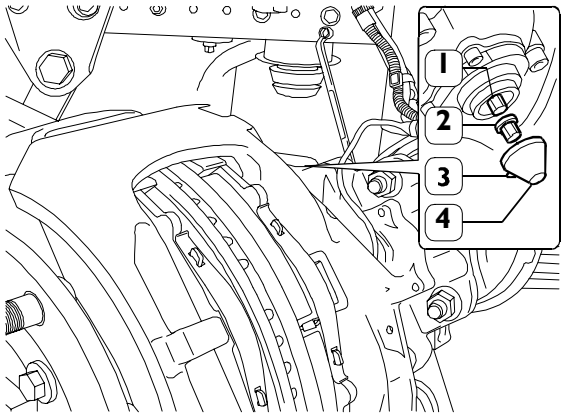
Figure 90



40570

Remove the lock nuts and wheels, using hydraulic stand 99321024 (1).

Figure 91

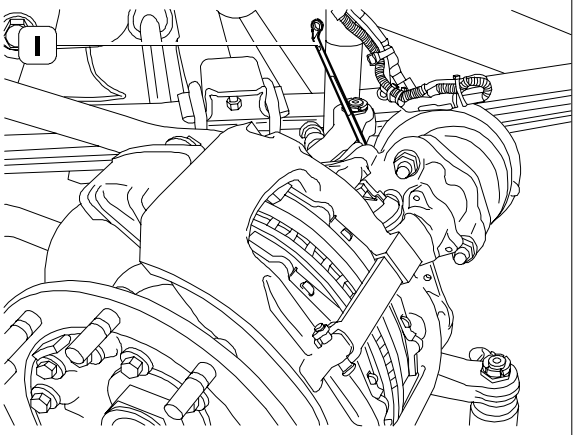


78622

Remove the plug (4) using the tab (3) and make sure the adapter (2) is not lost.

Never turn the adjusting pinion (1) without fitting the adapter (2) first. If the adapter cut torque is overcome, the adapter gets broken.
Try again with a new adapter and if also in this case it gets broken, the caliper should be replaced because there is an inner damage.

Figure 92



60759

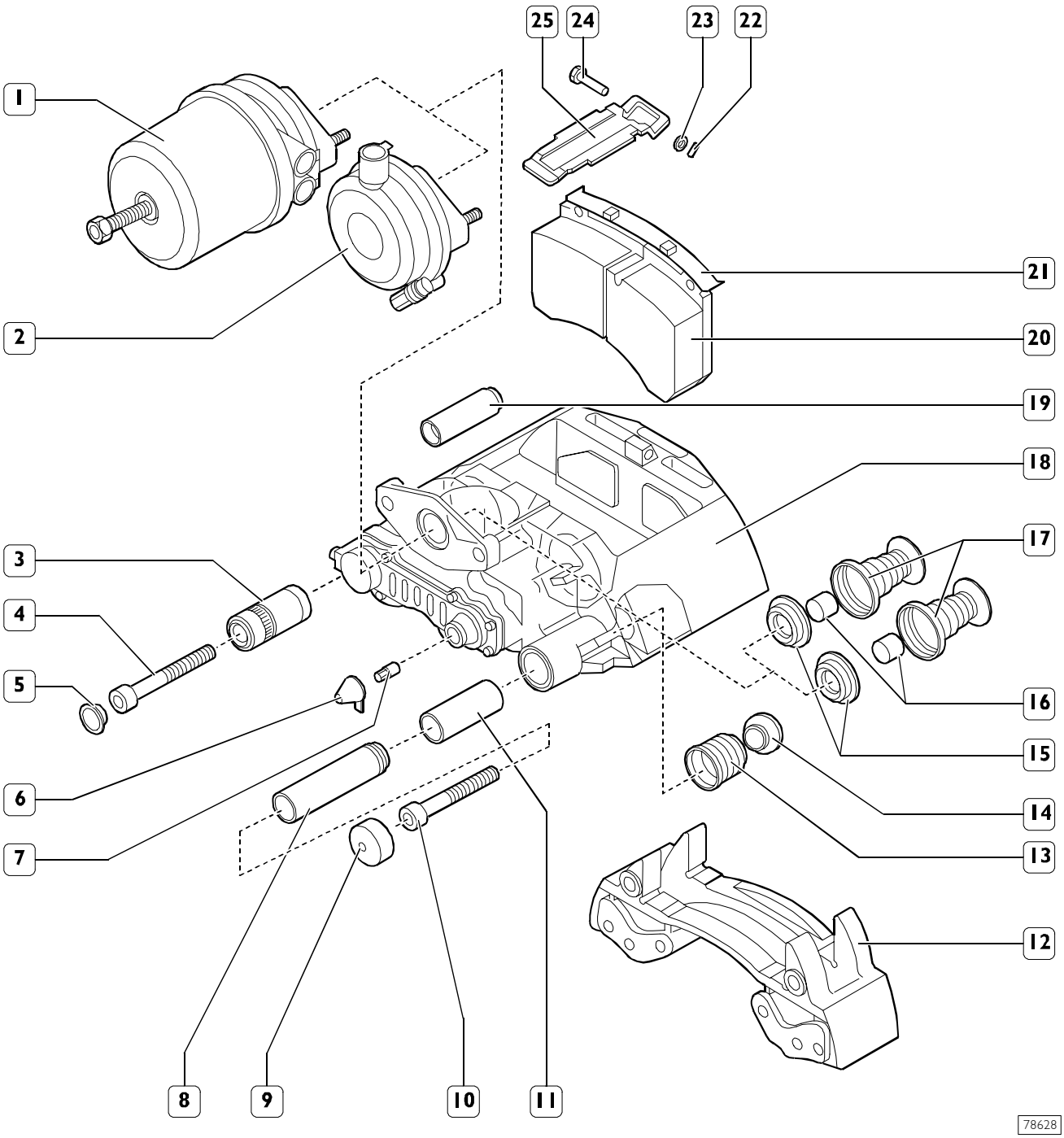
Using a suitable wrench (1), rotate the adjustment pinion counterclockwise by 2-3 with the adapter (2, Figure 91) installed turns, thus increasing the play between brake linings and brake disc.

Operate the brakes for about 5-10 times and make sure the wrench (1) moves clockwise with small increments, up to complete recover of play between braking linings and brake disc.

Otherwise, i.e. if the wrench does not turn, turns just once or turns in both directions, this means the automatic play recovery system is faulty. Replace the caliper, following the procedure given subsequently, then fit back the wheels.

Brake caliper components

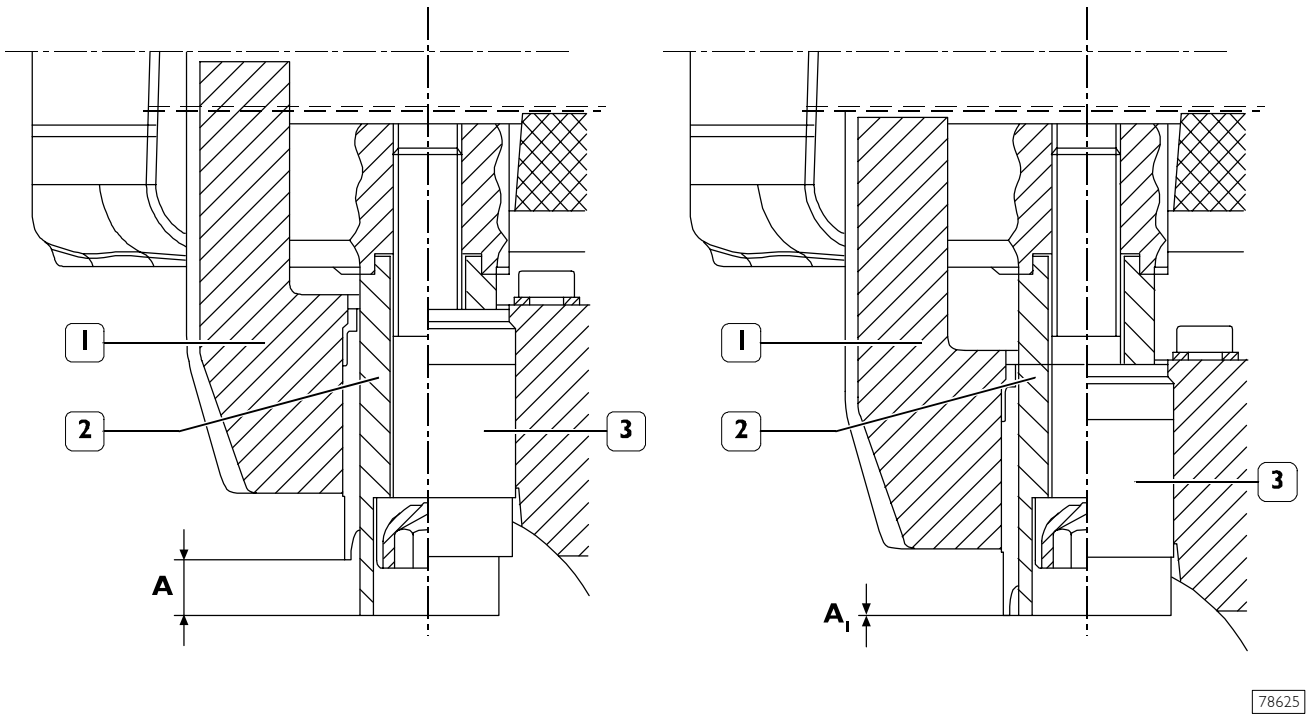
Figure 93



1. Combined brake cylinder - 2. Membrane brake cylinder - 3. Rubber bushes - 4. Sliding pins - 5. Plug - 6. Adjusting unit cover - 7. Adapter - 8. Guide pin - 9. Cover - 10. Sliding pin - 11. Brass bushes - 12. Carrying plate - 13. Protection cowling - 14. Ring - 15. Inner seals - 16. Bushes - 17. Plungers - 18. Brake caliper - 19. Guide pin - 20. Braking seal - 21. Spring - 22. Split pin - 23. Washer - 24. Pintle - 25. Check plate.

Check of braking seals thickness

Figure 94



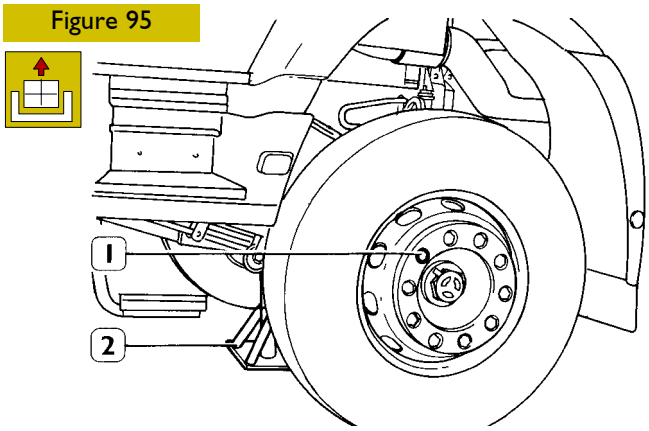
1. Brake caliper - 2. Sliding bush - 3. Rubber bush - A. Bush position with new seals - A_1. Bush position with worn out braking seals (perform an accurate check with wheels dismounted).

The condition of braking seals can be visually determined without dismounting wheels, by checking that A > 1 mm. Otherwise, it is needed to dismount the wheels and perform an accurate check as described below.

5274 OVERHAULING FRONT DISC BRAKES

527417 Replacing brake linings

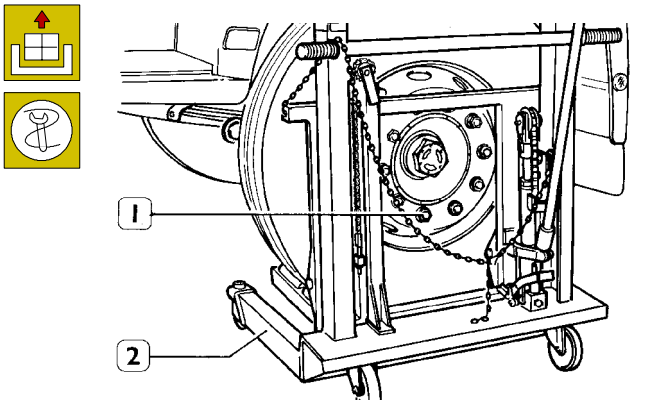
Figure 95



40569

Set the vehicle on flat ground and lock the rear wheels.
Loosen the nuts (1) fixing the front wheels.
Lift the vehicle at the front with a hydraulic lift and set it on two stands (2).

Figure 96

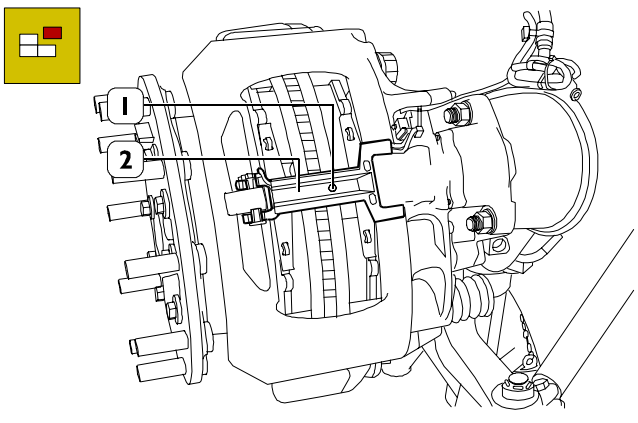


40570

Unscrew the fixing nuts and with the aid of the hydraulic trolley 99321024 (1) remove the wheels.

For vehicles without EBS

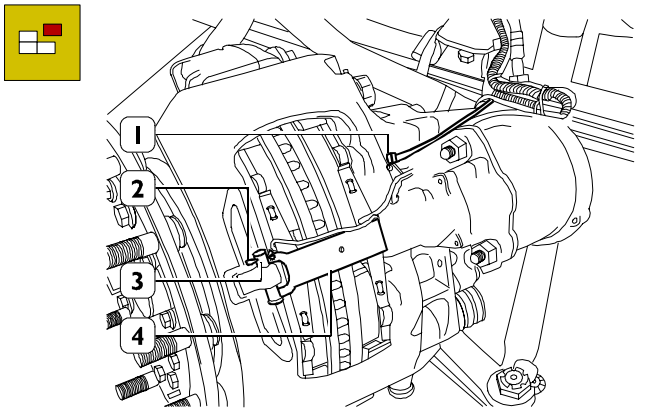
Figure 97



49157

Remove the screw (1) and the wear sensor cable retaining plate (2).

Figure 98



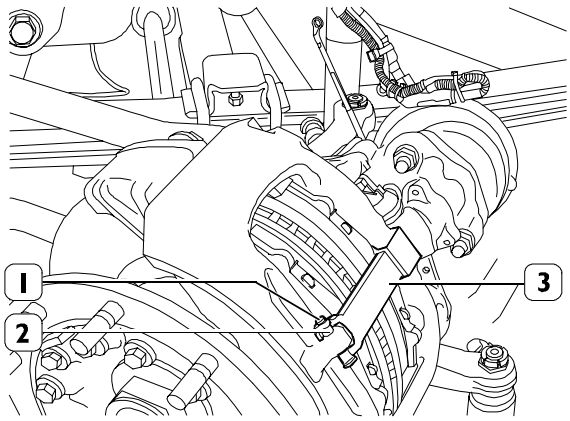
49158

Disconnect the electrical connection (1) from the calliper body.
Remove the split pin (2), pin (3) and brake lining retaining plate (4).

No lifting devices are to be fixed to plate (4).

For vehicles with EBS

Figure 99

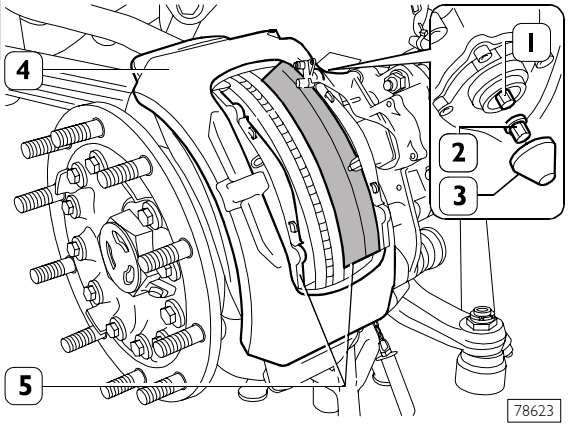


60860

Remove the split pin (1), pin (2) and brake lining retaining plate (3).

If plate (3) is damaged or worn out, it must be replaced.
No lifting devices are to be fixed on plate (3).

Figure 100

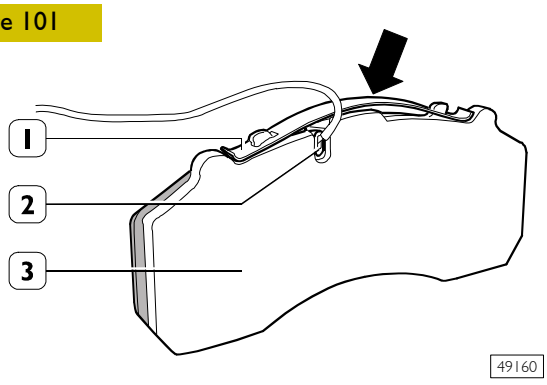


Remove the plug (3). Turn the adjustment device (1) operating on the adapter counterclockwise with a wrench, to insert the pistons within the caliper body and extract brake linings (4), suitably moving the caliper body (3).

Never operate directly on the registration pinion (1) without having first of all fitted the adapter (2). If the cutting torque of the adapter is exceeded, this will break.
Test with a new adapter. If this also breaks, the caliper must be replaced because it is damaged.

For vehicles without EBS

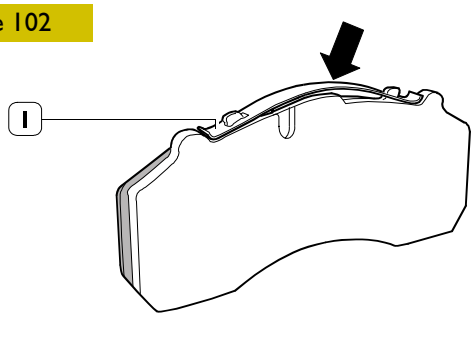
Figure 101



Press (→) on the spring (1) and remove it. Remove the wear sensors (2) from the brake linings (3).

For vehicles with EBS

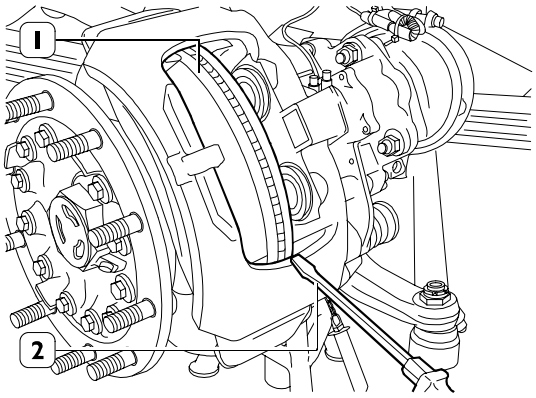
Figure 102



Press (→) on the spring (1) and remove it. If necessary, replace it with a new one.

For all vehicles

Figure 103



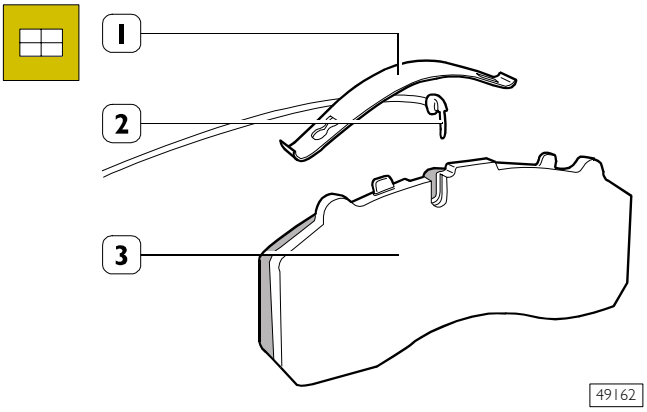
Remove dirt and rust from around the edge of the brake disc with a scraper or an old screwdriver (2) resting on the calliper body, turning the disc (1).
Finish the job with abrasive cloth. Remove the remains with the aid of an aspirator, or rags and a brush.
Do not use petrol or other petroleum products that could cause trouble for the brakes.
Use only methylated spirit or isopropyl alcohol.
Carefully clean the surfaces of the braking area of the brake disc.

Visually check the conditions of the dust caps, if deformed or broken it is necessary to replace them. This requires removing the brake calliper, so it is recommended to remove the brake calliper body together with the bearing plate for a thorough overhaul.

Check that the calliper slides freely on its guides.
If you find any trouble on a single brake calliper it is wise to overhaul both brake callipers completely.
Remove the dirt from the brake calliper with a wire brush, without damaging the dust caps.
Clean the sliding surfaces of the brake linings.
Check the conditions of the brake disc and make sure it is not corroded, scored or grooved. Light surface cracks are acceptable, but it is necessary to grind the brake disc as described under the relevant section heading. On the contrary, if it is worn, replace the brake disc.
If one needs to be replaced, it is recommended to replace both brake discs.
Check the state of the springs and wear sensors, replace them if necessary.

For vehicles without EBS

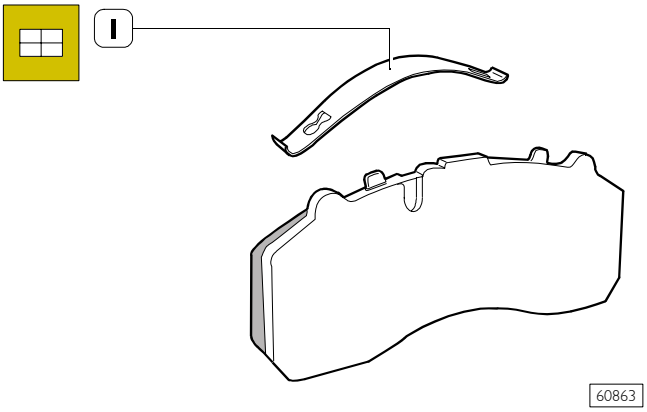
Figure 104



Insert the wear sensor (2) into its seat on the brake lining (3). Mount the spring (1) in the opposite sequence to that for disassembly.

For vehicles with EBS

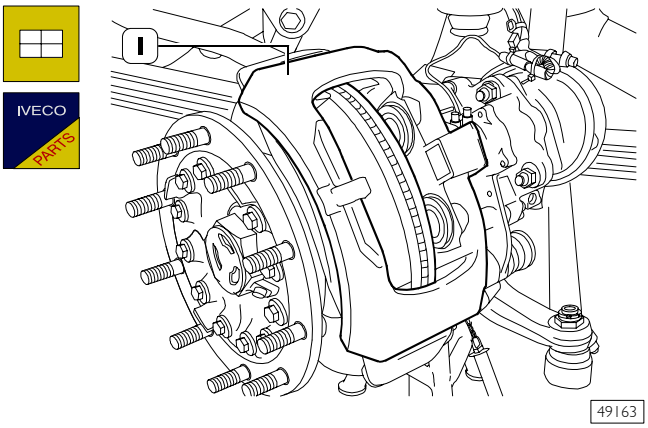
Figure 105



Mount the spring (1) in the opposite sequence to that for disassembly.

For all vehicles

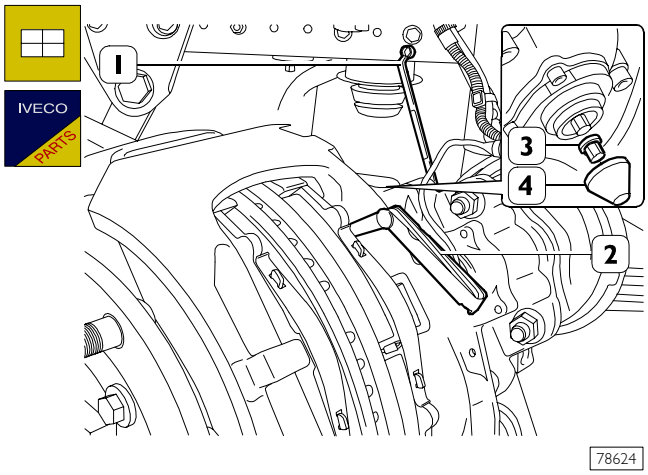
Figure 106



Insert the new linings in the brake calliper (1) and check they slide freely in their seats.

If you find it necessary to replace the pair of brake linings, always replace them with a full set for each axle.

Figure 107

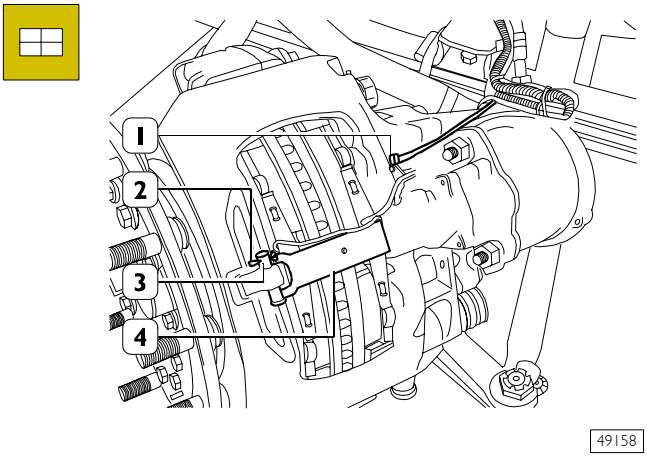


Using the wrench (1), act on the adaptator retriever pin to get a play not lower than 0.7 mm between brake lining and brake disk, which can be measured using the thickness gauge (2). Replace the cover (4) and lubricate it with white grease RENOLIT HLT2.

Make sure that the outer protecting plug and the seal ring are correctly fitted, in order to prevent water leaks inside the play automatic retriever.

For vehicles without EBS

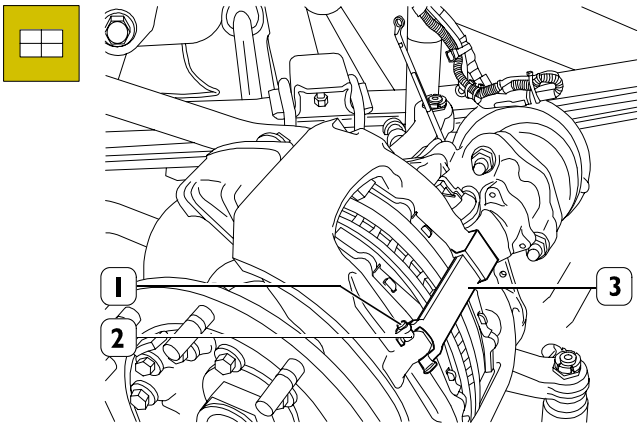
Figure 108



Make the electrical connection (1) and secure it to the calliper body.
Mount the plate (4), pin (3) and split pin (2).

For vehicles with EBS

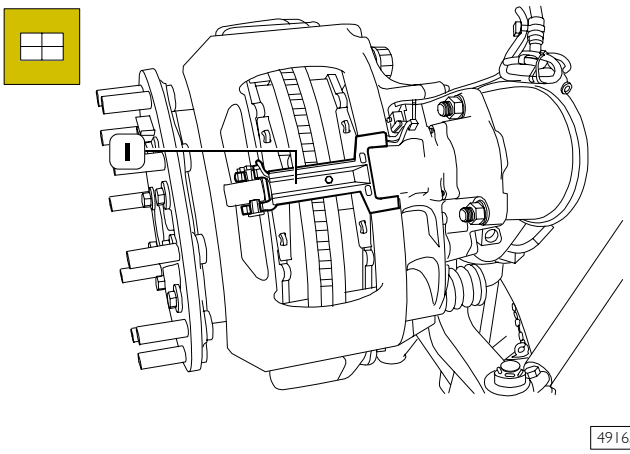
Figure 109



Mount the plate (3), pin (2) and split pin (1).

For vehicles without EBS

Figure 110



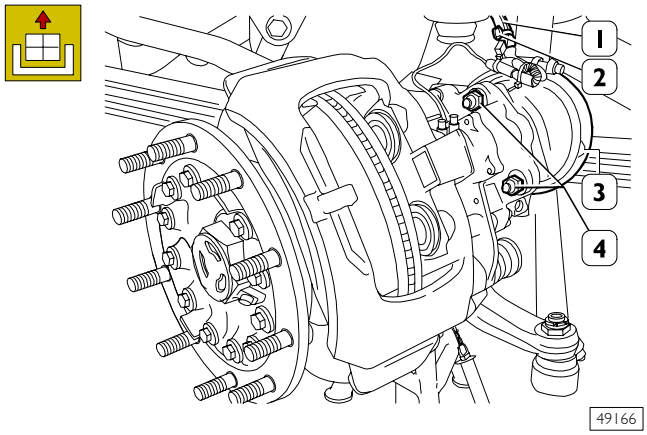
Mount the wear sensor cable retaining plate (1).
Using the hydraulic trolley 99321024, fit on the wheels. Lower the vehicle. Lock the nuts fixing the wheels to the required torque.
Fit the safety cap onto the wheel hubs.
Proceed as described on the opposite side.
After repairing the vehicle brakes, press the brake pedal repeatedly, while the vehicle is moving, in both directions, in order to wear in the brake linings.

527413 Removing and refitting brake callipers

Removal

Forvehicles without EBS

Figure 111

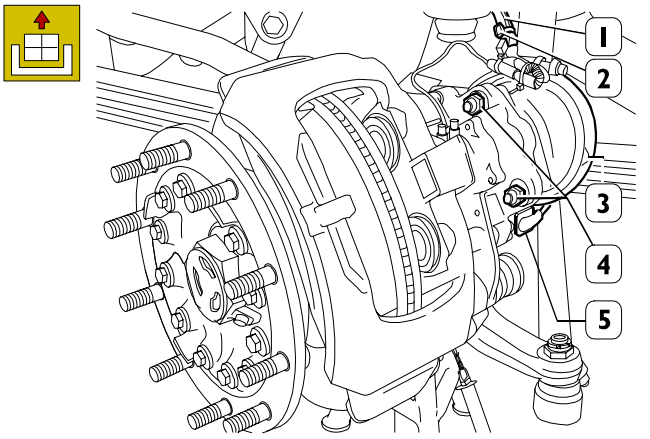


To remove the brake linings, keep to the above description in the paragraph for replacing brake linings. Remove the clamps (2). Disconnect the diaphragm cylinder supply pipe (1). Unscrew the nuts (4) and remove the diaphragm cylinder (3).

Nuts (4) are to be discarded.

For vehicles with EBS

Figure 112

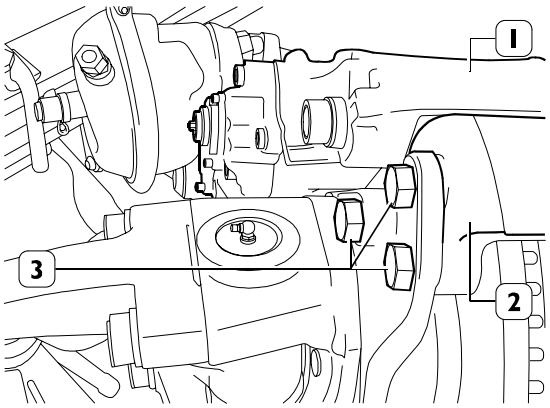


To remove the brake linings, keep to the above description in the paragraph for replacing brake linings. Remove the clamps (2). Disconnect the diaphragm cylinder supply pipe (1). Unscrew the nuts (4) and remove the diaphragm cylinder (3). Disconnect the electrical connection (5) of the calliper body.

Nuts (4) are to be discarded.

For all vehicles

Figure 113



49167

Remove the screws (3) and disconnect the brake calliper (1) together with the bearing plate (2).

Be very careful in removing and carrying the calliper (1) as it is heavy and floating on the support plate (2). Keep the caliper only on the outer side. Never put your fingers between the caliper (9) and the supporting plate.

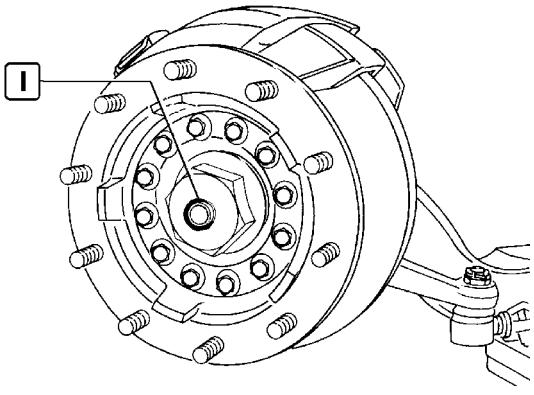
Refitting

For refitting, carry out the steps described for removal in reverse order, keeping to the required tightening torques.

520620 Removing and refitting wheel hubs

Removal

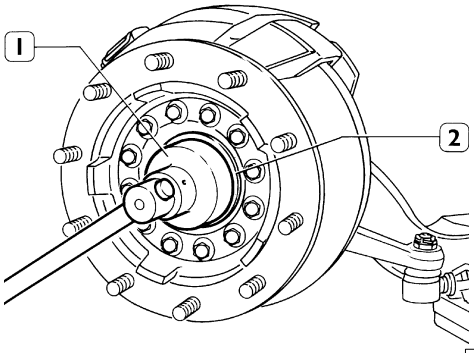
Figure 114



77206

Rotate wheel hub in order to take screw plug (1) downwards; unscrew the plug and drain oil into a suitable tank.

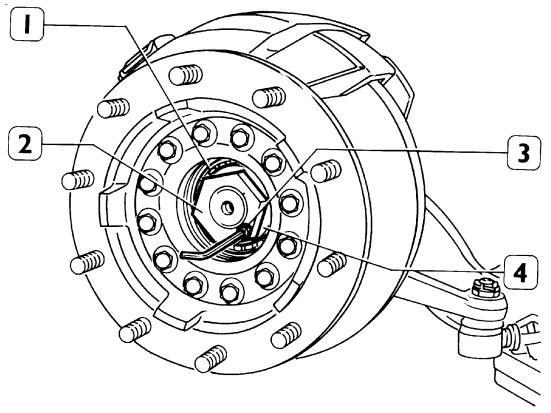
Figure 115



36407

Block rotation of the wheel hub appropriately and, using the wrench 99354207 (1), unscrew the oil cover (2).
Drain off all the oil.

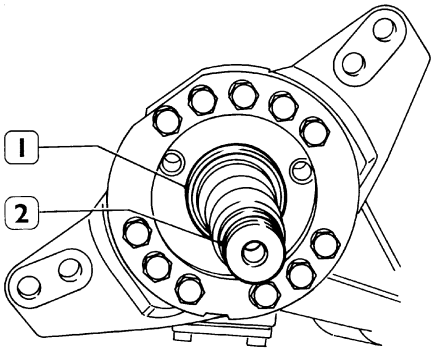
Figure 116



36408

Undo the safety screw (3). With the wrench 99388001, unscrew the adjustment ring nut (2), remove the washer (4), outer bearing (1) and remove the brake disc together with the wheel hub, spacer and internal bearing.

Figure 117



38596

Visually check the diameter of the gasket ring (1) has no accidental dents or scratches.
Replace the internal gaskets of the wheel hubs and, if necessary, the ring (1), according to what described in the "Repairing handbook".
Using the adjustment ring nut, check that the thread (2) has no stiffness. If it has, use appropriate means to get rid of the stiffness.
Remove the opposite brake assembly, keeping the components separate.

Refitting

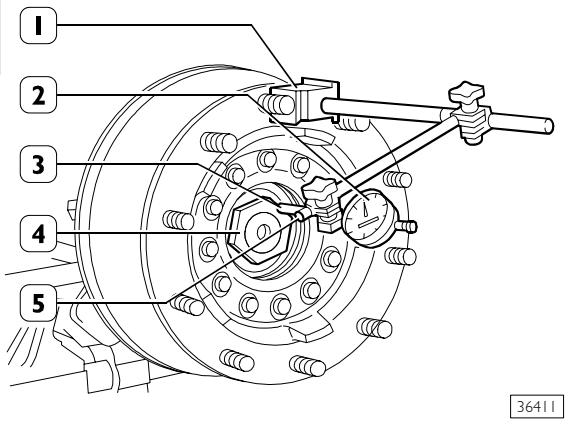
Make sure the surfaces of all the parts inside the hub are thoroughly clean, with no waste or burrs.

Lubricate the bearings with Tutela W 140/M-DA oil (Tutela TRUCK Fe-Axle for vehicles with rear disk brakes).

Key the wheel hub on the stub axle together with the brake disc. Insert the internal spacer onto the stub axle then position the external bearing and thrust washer.

Screw down and lock the adjustment ring nut to the required torque.

Figure 118

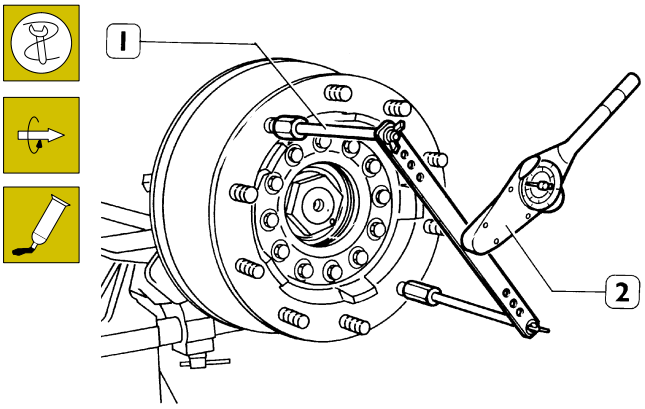


36411

Strike the wheel hub a few times with a mallet in an axial direction, turn it in both directions to free the bearing rollers. Fit the magnetic base (1) together with the dial gauge (2) on the wheel hub. Set the pointer of the dial gauge (3) at right angles to the shank of the stub axle.

Reset the dial gauge with a pre-load of 1.5 ÷ 2 mm.
With the aid of a lever, move the wheel hub axially and measure the end float, which must be 0.16 mm (maximum value).
On obtaining the required end float, lock the screw (5) retaining the adjustment ring nut (4) to the required torque.

Figure 119



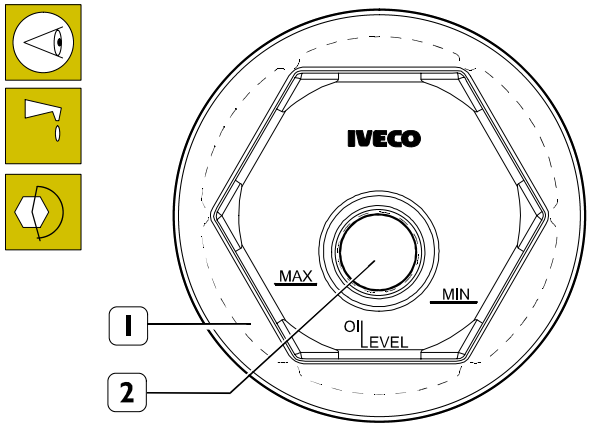
36412

Apply tool (1) 99395026 on wheel hub stud bolts and use torque meter 99389819 (2) to check whether the wheel hub rolling torque is at the set value.

Deposit a sealing bead (Loctite type 574) exclusively on the hub cover ledge surface and protect the threaded part.

Tighten to torque the hub cover (1, Figure 120).

Figure 120

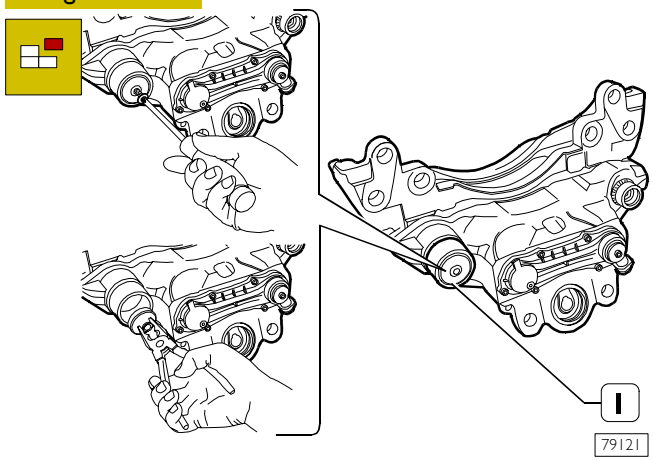


79068

Rotate the wheel hub until when hub cover (1) is positioned as shown in the figure. Restore the prescribed quantity of oil into the hub cover (1) through filling hole (2). Tighten the plug on the hub cover (1) to the set torque.

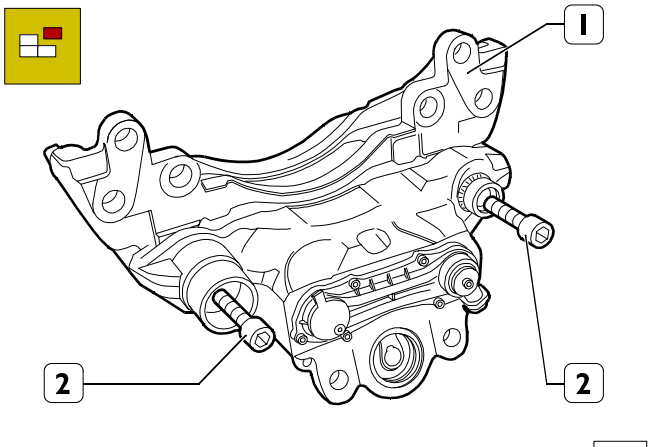
BRAKE CALIPER OVERHAUL
Disassembly

Figure 121



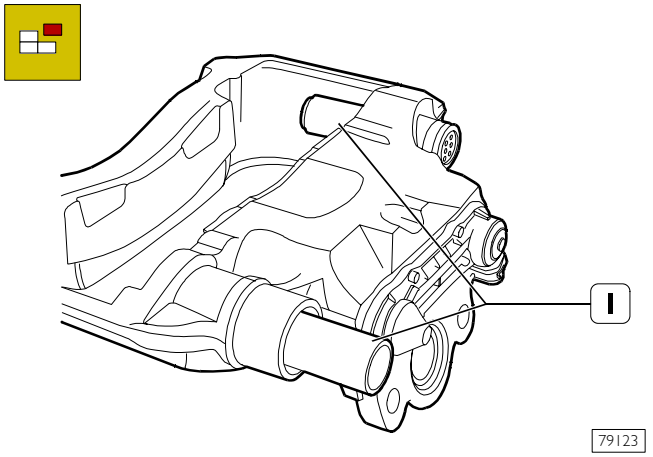
Place the brake caliper on the bench and block it in a vice. Remove the cover (1) and make a hole in it with a Parker screw.

Figure 122



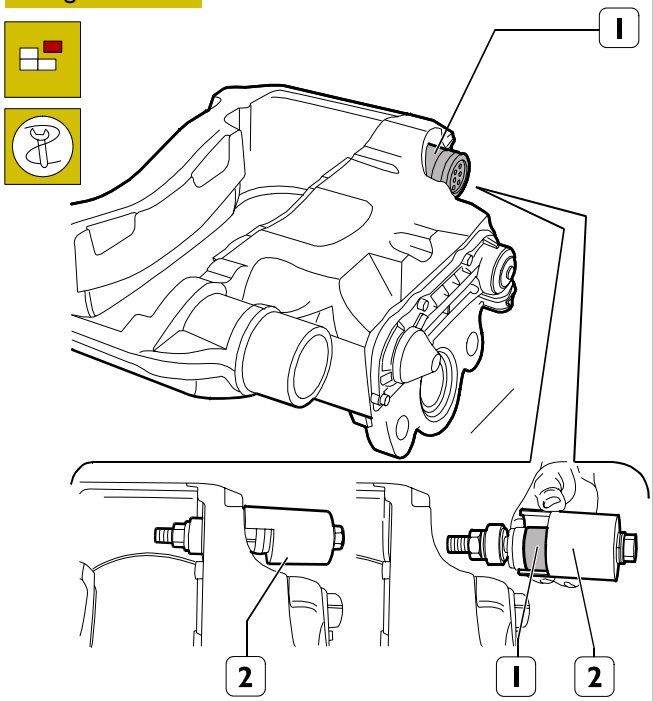
Refit the supporting plate (1) and remove the fastening screws (2).

Figure 123



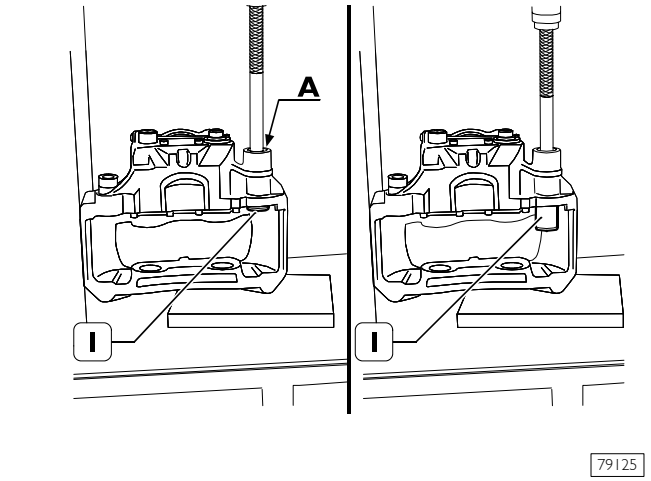
Remove the sliding bushes (1).

Figure 124



Use tool 99372245 (2) (to be used with screw in tool 99372237) to disassemble the rubber sleeve (1).

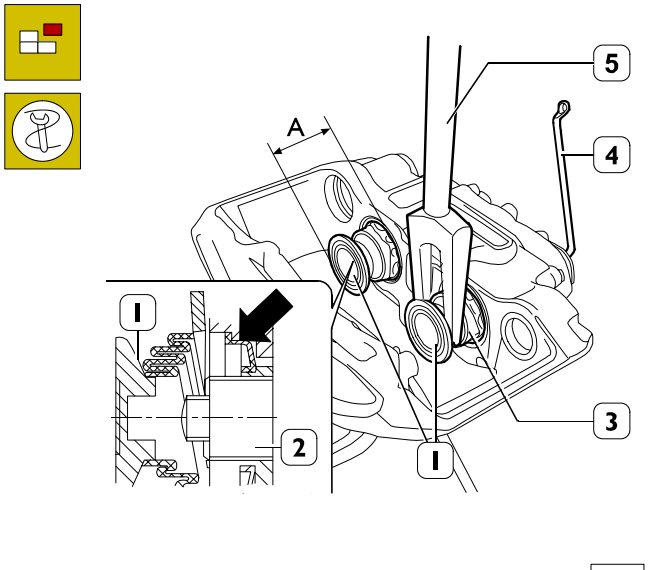
Figure 125



Take the caliper to the press.

Insert the appropriate beater in the brass bush housing (1) (See arrow A). Use the press to remove the bush (1).

Figure 126



Place the caliper on the bench and block it in a vice. Use the wrench (4) to operate the clearance recovery device so that the piston (1) comes out of the caliper body for a maximum of 30 mm (value A).
Take off the dust-guard from the caliper body and use tool 99372238 (5) to remove the thrust pressing devices (1) of the caliper together with the protection casings (3).

Value A must not be overcome because threaded hoses (2) are synchronised. If the threaded hoses (2) reach their over-travel, they loose synchronism and the brake caliper must be replaced. The brake caliper inner parts must never be removed.
For this reason you are recommended non to slacken or to remove the cover retaining screws..

Component part cleaning and check

To wash metal parts, use a solution of hot water with Fiat LCD detergent. Use a metal brush to remove dirt from the caliper body and then a little brush to remove the residuals and to clear accurately the guide pin and the sliding bush housings.

Use a synthetic brush with the right dimensions to remove the grease left on the sliding bush housings.

Clean the caliper body accurately with compressed air.

Use a piece of cloth soaked with isopropyl alcohol or similar to clean the sliding bushes accurately.

Check the wear conditions of the sliding bushes and their housings on the brake caliper body. Make sure they are not damaged or worn, especially the sliding surfaces. Fit the bushes in their housings and check they slide regularly.

Fit the bushes in their housings, check they slide correctly, otherwise replace or restore their housings on the caliper body, if needed.

Regular braking depends mainly on the brake caliper sliding on the guide pins.

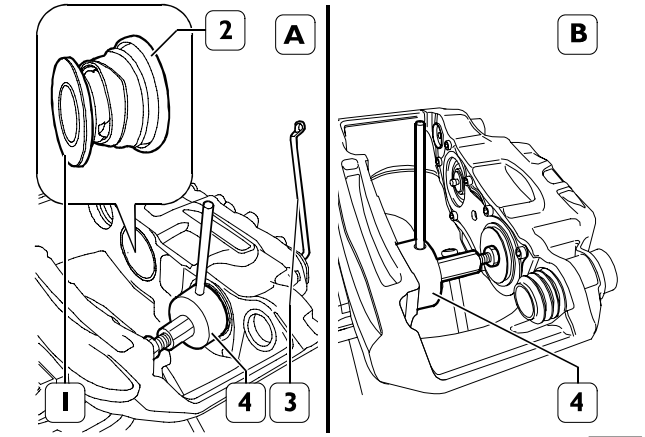
Check the wear conditions of the brake lining retaining pins and the related safety pins. If they are worn or damaged, replace the worn parts.

It is advisable to replace all rubber and plastic parts and the brass bush even if they do not seem damaged or worn at sight.

Assembly

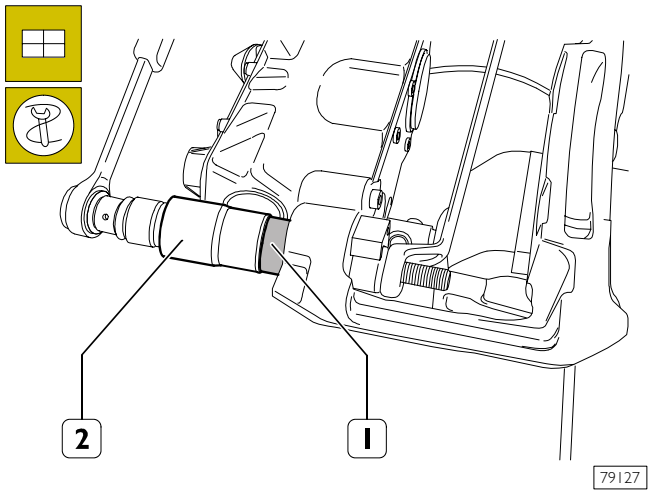
Make sure all the brake caliper components are perfectly clean. Possible abrasive residuals should be removed with a cloth soaked in isopropyl alcohol or similar.

Figure 127



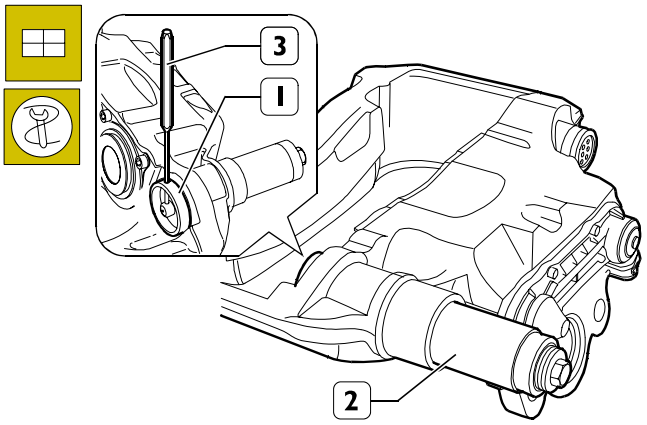
Use tool 99372239 (4) (see figure A) to fit the protection casings (2). Use the same tool 99372239 (4) fitted on the other side (see figure B) to insert the pistons (1). Use the wrench (3) to operate the clearance recovery device and ad just the pistons (1).

Figure 128



Use tool 99372244 (2) (to be used with the screw in tool 99372237) to assemble the rubber sleeve (1).

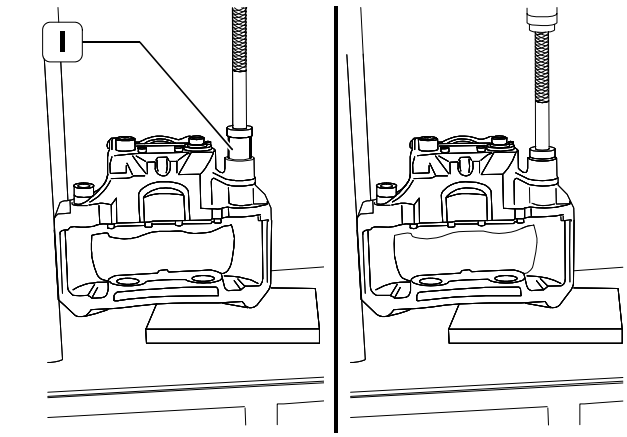
Figure 129



79128

Use tool 99372243 (1) (to be used with tool 99372240 and use screw in tool 99372237) to assemble the brass bush (2) in its seat, by blocking its rotation by means of a suitable tool (3) (punch or screwdriver).

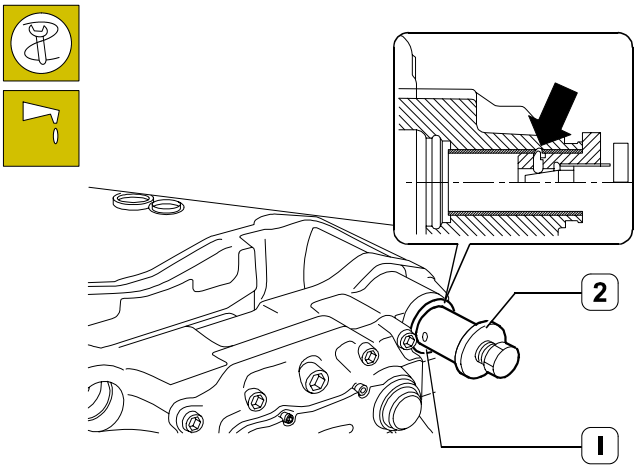
Figure 130



79129

Place the caliper under the press. Use the press to fit the brass bush (1) in its housing until is comes out of the lower side by 1 mm.

Figure 131

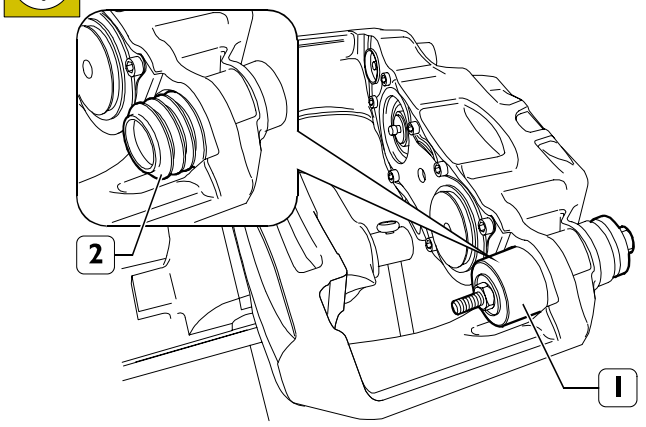


60745

Use the appropriate tool 99372242 (2) to carry out bruising in the point (→) next to the caliper body groove, in order to prevent the brass bush (1) from moving.

Make sure there are no burrs in the bush housing, otherwise remove them. Apply white grease RENOLIT HLT2 on the bush.

Figure 132



79130

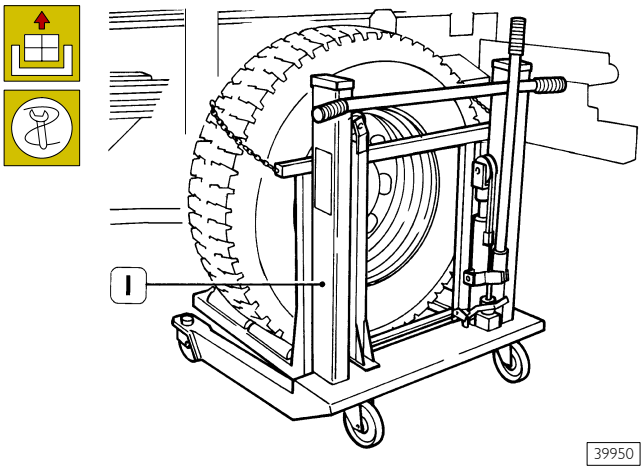
Place the caliper on the bench and block it in the vice. Fit the protection casing (2) by means of tool (1) 99372237.

Reverse the removal order to fit the sliding bushes and the supporting plate.

5274 OVERHAULING REAR DISC BRAKES

527417 Replacing brake linings

Figure 133



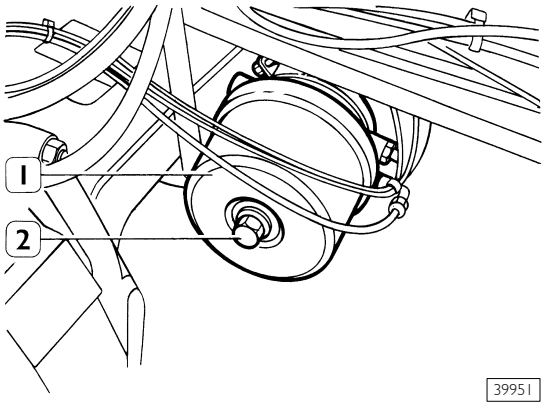
39950

Park the vehicle on level ground. Put the parking brake lever into the off position and loosen the nuts fixing the rear wheels. Using a hydraulic jack, lift the vehicle at the rear and rest it on the special stands. Using the hydraulic trolley 99321024 (1), take off the wheels.

Overhaul braking unit, observing – in dismounting and overhauling the brake caliper – the procedure described for front disk brakes, since it is similar.

Examine the state of wear of the brake disc surfaces. If you find different values to the ones given in the characteristics and data table, remove it as follows.

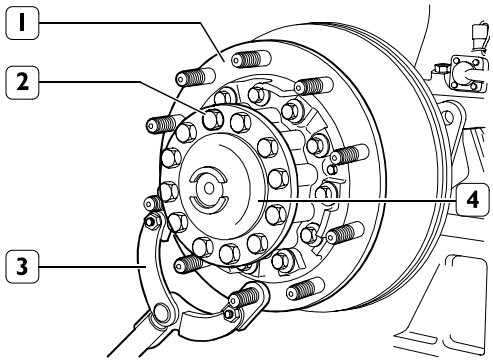
Figure 134



39951

Fully unscrew the screw (2) to manually release the combined cylinder (1) and detach it from the brake calliper.

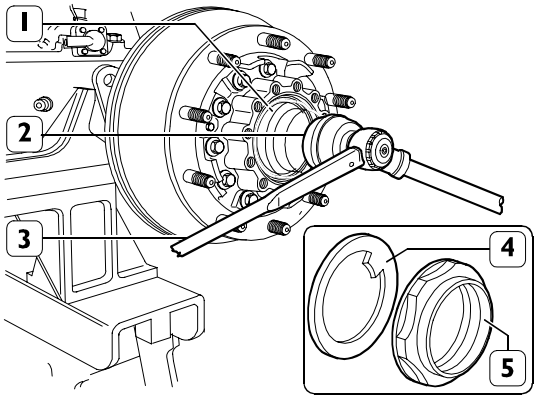
Figure 135



72744

Place a container under the wheel hub to collect the oil. Block wheel hub (1) rotation with the retaining tool 99370317 (3).
Take out the screws (2) and extract the drive shaft (4).

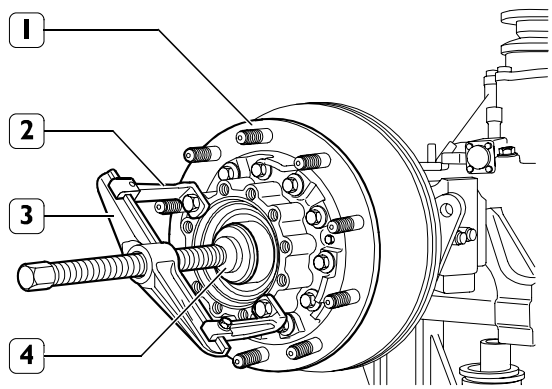
Figure 136



72745

Lift the notch on the ring nut (5). With wrench 99355175 (1) and multiplier 99389816 (2), take off the ring nut (5) holding the wheel hub bearing. Remove the retaining ring (4).

Figure 137

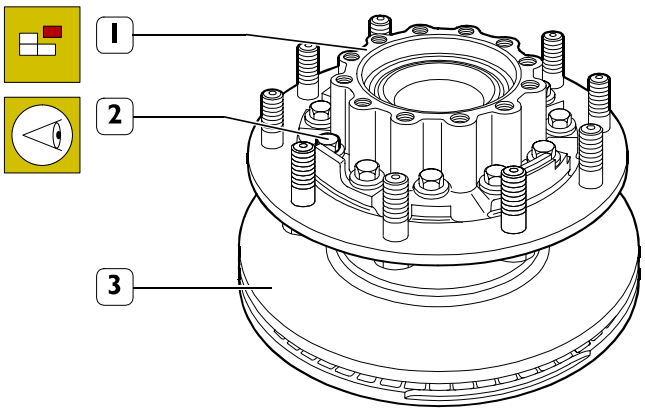


72746

Remove the wheel hub (1). Should this prove difficult, use the extractor comprising the brackets 99341017 (2), bridge 99341003 (3) and block 99345049 (4) fitted as shown in the figure.

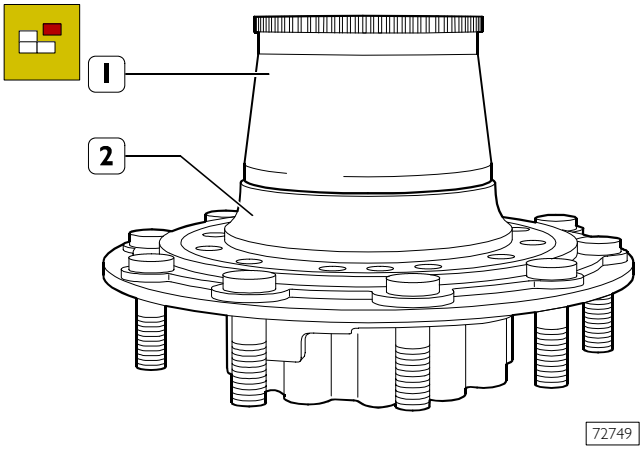
Check the state of the wheel hub bearing, rear axle housing sleeve and calliper mounting plate. Replace any worn or damaged parts as described under "Overhauling the wheel hubs" of rear axle MS 13-175 with disc brakes.

Figure 138



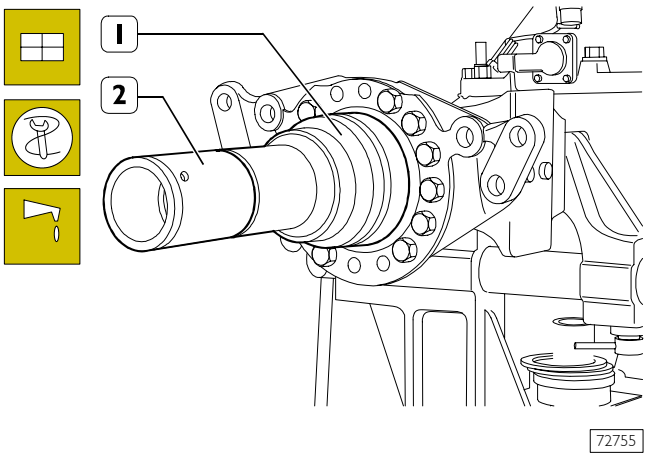
Take out the screws (2) and remove the wheel hub (1) from the brake disc (3). Turn and grind the brake disc as described in the section or replace it if necessary.

Figure 139



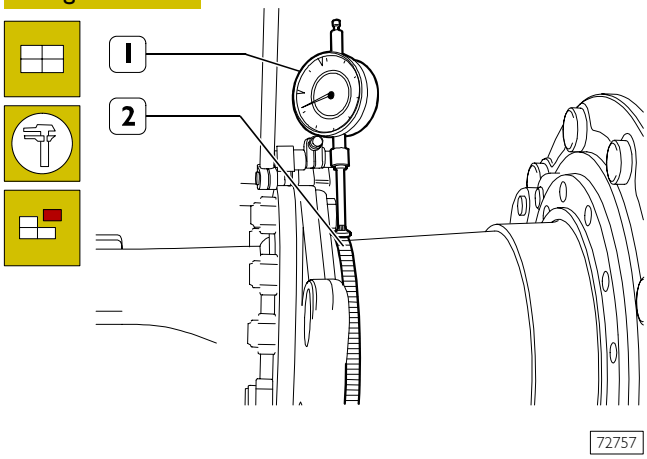
The phonic wheel (1) is removed from the wheel hub (2) with general tools.
To assemble the phonic wheel, heat it to approx. 150°C and fit it on the wheel hub (2).
On completing assembly, make sure the phonic wheel (1) rests correctly on the hub seat.

Figure 140



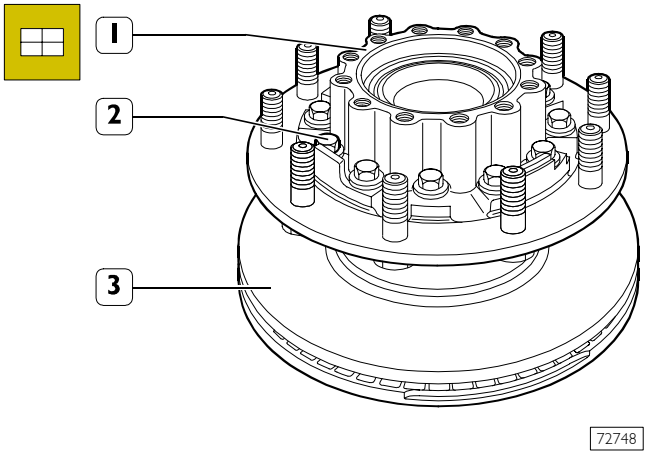
Screw the tool 99370700 (2) onto the sleeve (1) of the rear axle housing.
Lubricate the outside of the tool (1) with Tutela Truck Fe-Axle.

Figure 141



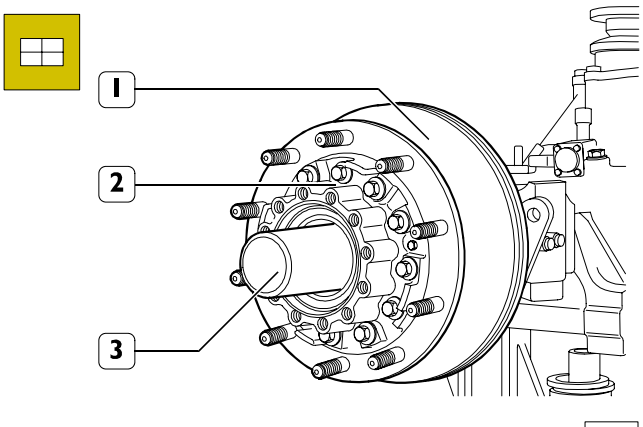
Fit the wheel hub (3) on the sleeve of the rear axle housing and with the dial gauge (1) with a magnetic base check that the error of concentricity of the phonic wheel (2) is no greater than 0.2 mm. Remove the wheel hub (3).

Figure 142



Fit the brake disc (3) onto the wheel hub (1) and screw down the screws (2).

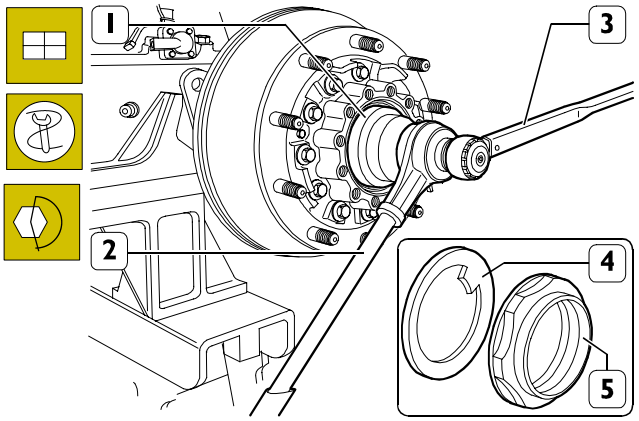
Figure 143



72758

Sling the brake disc (1) with a rope and hook this onto a lift. Fit the wheel hub (2) onto the sleeve of the rear axle housing. Remove the tool 99370700 (3).

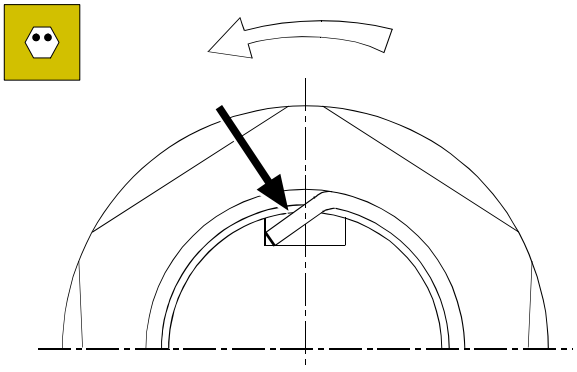
Figure 144



72759

Position the retaining ring (4) so as to insert the tab into the groove in the sleeve. Lastly, screw down the ring nut (5). Using wrench 99355175 (1), the multiplier 99389816 (2) and the torque wrench (3), tighten the ring nut (5) to the required torque.

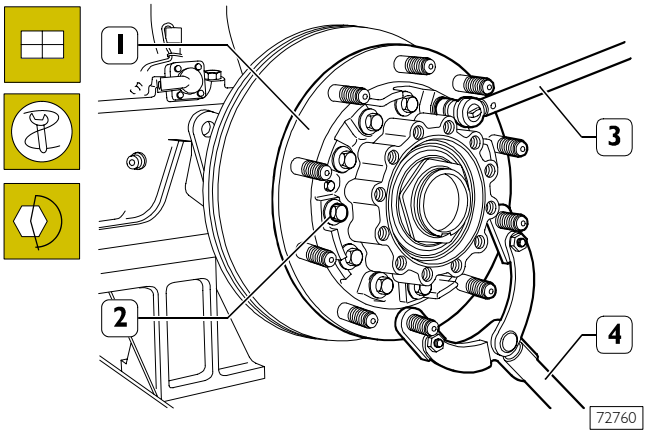
Figure 145



74371

After tightening with a specific tool, make the cut and bend to prevent the ring nut unscrewing, as shown in the figure. The arrow shows the direction of unscrewing the ring nut.

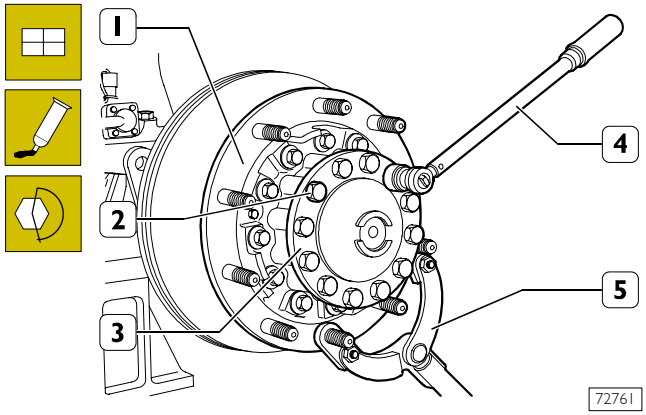
Figure 146



72760

Block rotation of the wheel hub (2) with tool 99370317 (4) and tighten the screws (3) fixing the brake disc (1) to the wheel hub to the required torque.

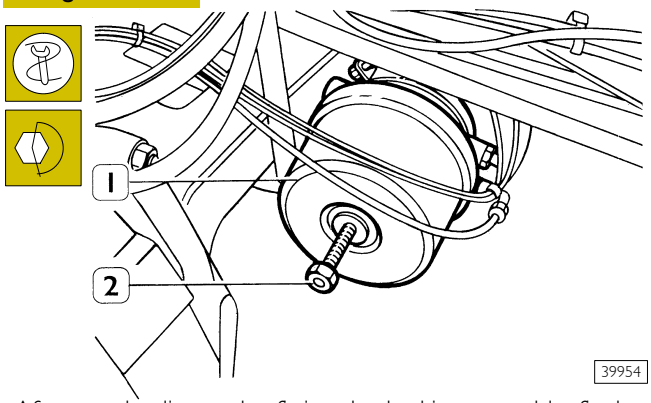
Figure 147



72761

Spread IVECO 1905685 sealant (LOCTITE 14780) onto the contact surfaces, drive shaft flange and wheel hub and insert the drive shaft into the rear axle housing.
Screw down the screws (2) fixing the drive shaft (3) to the wheel hub and tighten with the torque wrench (4) to the required torque. Remove the tool 99370317 (5).

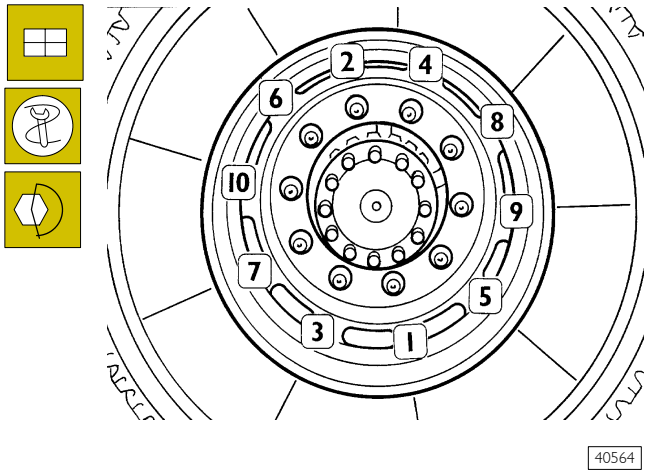
Figure 148



39954

After overhauling and refitting the braking assembly, fit the cylinder (1) following the procedure described for the front brake cylinder.
Supply the cylinder (1) by pressing the service brake and tighten the fixing ring nut to the required torque with the wrench 99356006. Restore operation of the cylinders (1) governing the parking brake by fully screwing down the screw (2).

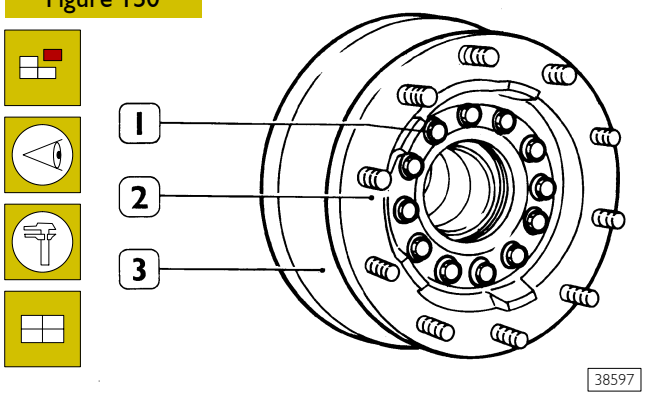
Figure 149



Using the hydraulic trolley 99321024 fit on the wheels. Lower the vehicle. Lock the nuts fixing the rims to the required tightening torque according to the diagram shown in the figure Proceed as described on the opposite side.
On completing this process, start the engine to recharge the pneumatic system.
Drive the vehicle in both directions, press the brake pedal repeatedly, to let the brake linings settle in.

527411 OVERHAULING BRAKE DISCS

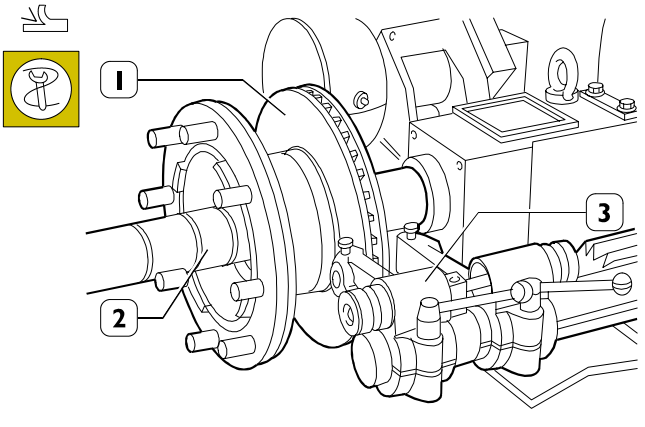
Figure 150



Examine the state of wear of the surfaces of the brake discs. Finding other values to the ones given in the characteristics and data, turn and grind the brake discs or, if necessary, replace them. Remove the screws (1) and detach the hub (2) from the disc (3). Replace the disc (3) and refit it following the reverse procedure to the one described above.

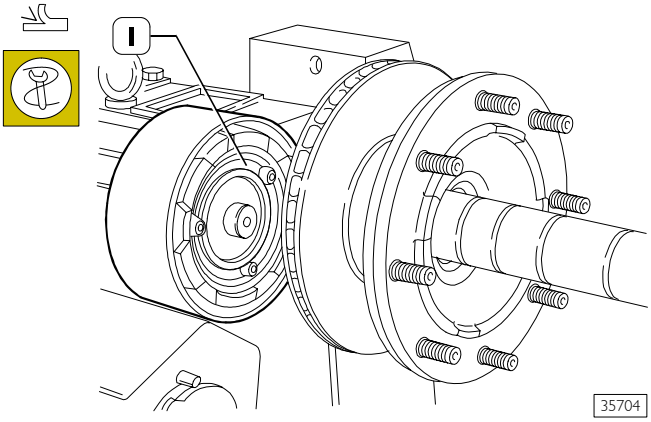
527411 TURNING AND GRINDING BRAKE DISCS

Figure 151



- ❑ Key onto the shaft of the lathe 99301001 (2) the brake disc (1) together with the hub.
- ❑ Key onto the shaft a set of spacers that eliminate the end float of the assembly; screw on the locking nut and fit the mount of the lathe shaft.
- ❑ Position the tool holder (3) in line with the brake disc (1), then adjust the depth of the tools.
- ❑ Proceed with turning and grinding the brake disc (1), operating with one or more passes to remove material depending on the scoring found.

Figure 152



Using the specific grinding tool 99301001 (1) fitted to the lathe 99301001, grind both working surfaces of the brake disc.

When grinding, move the sector wheel forwards gradually, to remove all remains of turning.