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1. BRAKE SYSTEM AND COMPONENTS

1.1 GENERAL

Coding of components
All components have been provided with number codes.

Structure of the code

First digit
Where one connection performs several functions, additional 1st digits will be allocated. These are separated by a hyphen.

Often used:
1 energy supply (pressure)
2 energy discharge (outgoing command)
3 bleeding
4 control connection (incoming command)

Little used:
0 suction connection
5 vacant
6 vacant
7 anti-freeze connection
8 lubricating oil connection
9 coolant connection

Second digit
If there are several connections with the same function, a 2nd digit will be added immediately after the 1st one.

Application example: empty/load relay valve

Meaning:
1 air compressor energy supply
2 energy discharge (command) to the next component
41 control connection (incoming)
42 second control connection (incoming)

0

Compressor

CF65 series

Type

Make:	Knorr SWC 9057
Version:	1 cylinder, water cooled, 255 cc

CF75/85 series

Type

Make:	Wabco 911 504 ...
Version:	2 cylinder, water cooled

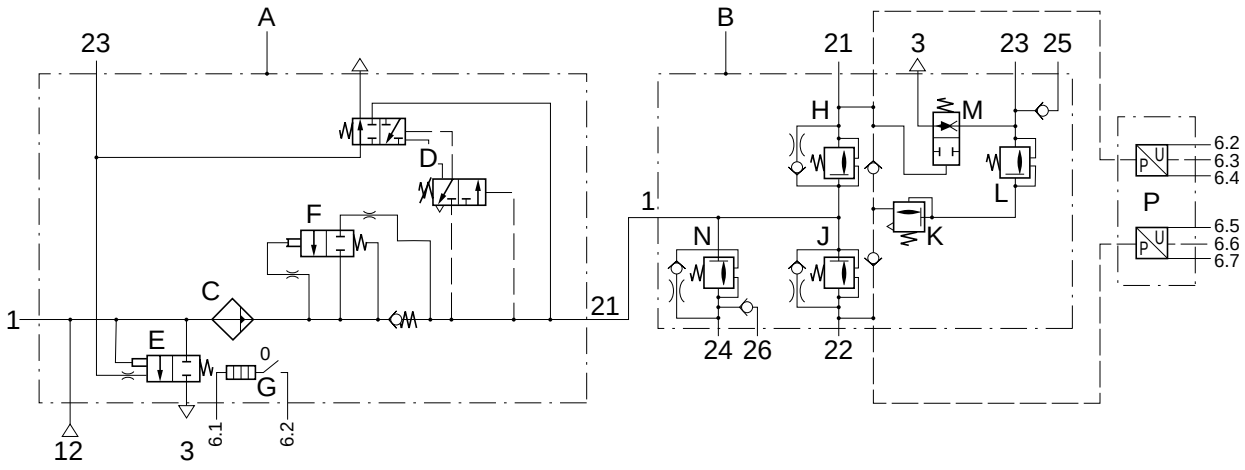
Rejection sizes Wabco 911 504 ... compressor

Cylinder bore at the turning point of the first piston ring	75.022 mm
Height of piston ring groove:	
first groove:	2.035 mm
second groove:	2.035 mm
third groove:	4.047 mm
Gudgeon pin hole diameter:	15.018 mm
Gudgeon pin diameter:	14.992 mm
Piston diameter, measured along the length of the piston pen on the underside of the piston skirt.	74.962 mm
Gudgeon pin bearing in connecting rod:	15.047 mm
Crankshaft bearing diameter, non-drive side:	35.070 mm
Crankshaft main bearing, non-drive side:	34.963 mm
Crankshaft diameter at the connecting rod:	32.963 mm

Always replace rolling bearing on drive side

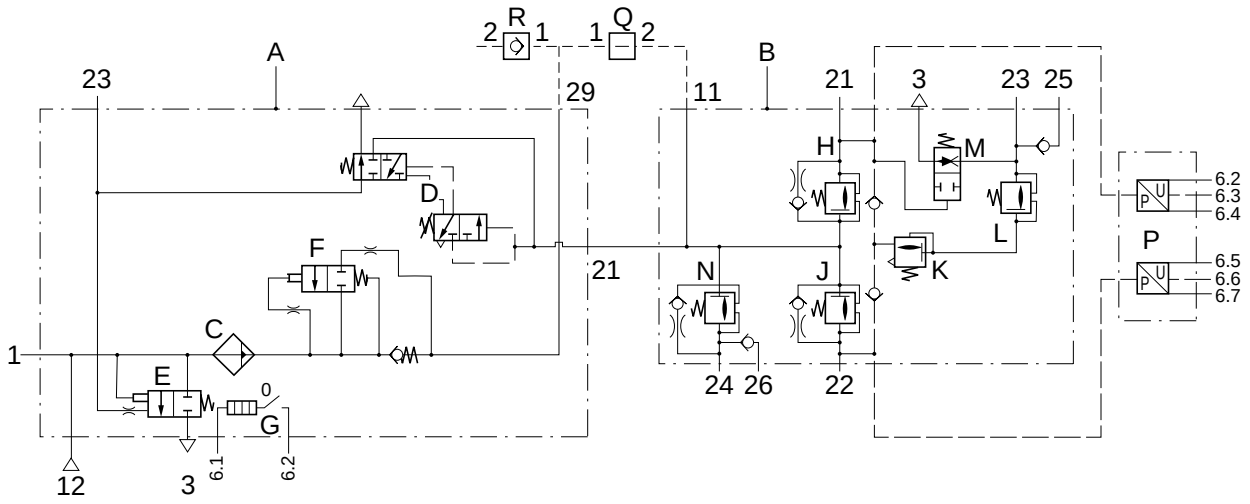
0

Air supply unit



R600702

Knorr ZB4545 - II38005F, ZB4578 - K000394, ZB4580 - K000396 versions
(used on front-axle leaf suspension)



R600703

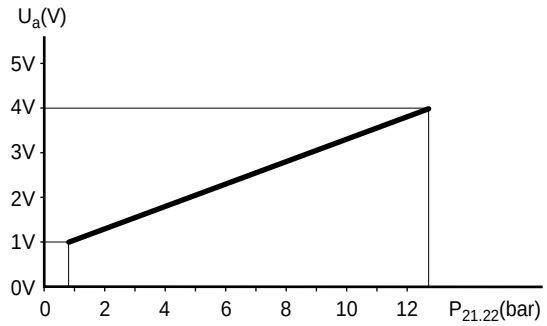
Knorr ZB4548 - II38799F, ZB4579 - K000395 versions (used on front-axle leaf suspension)

A air dryer/pressure regulator (unit)
B 4-circuit protection valve (unit)
C filter/drying grid
D pressure regulator
E blow-off valve
F pneumatic time switch for regeneration
G heating element
H pressure relief valve with bypass, circuit 1
J pressure relief valve with bypass, circuit 2
K pressure limiting valve, circuit 3
L pressure relief valve, circuit 3
M flow back valve, circuit 3
N pressure relief valve with bypass, circuit 4
P pressure sensors
Only for use on front-axle air suspension:
Q pressure relief valve
R non-return valve

0

supply pressure in circuit 1, connection 21	9.8 - 10.6 bar
supply pressure in circuit 2, connection 22	9.8 - 10.6 bar
supply pressure in circuit 3, connection 23	8.1 - 8.5 bar
supply pressure in circuit 3, connection 25	7.9 - 8.5 bar
supply pressure in circuit 4, connection 24	9.8 - 10.6 bar
supply pressure in circuit 4, connection 26	9.8 - 10.6 bar
opening pressure of circuits 1, 2 and 4	6.5 - 7.0 bar
opening pressure of circuit 3	7.0 - 7.5 bar
Static closing pressure, all circuits	≥ 4.5 bar
circuit 1 activation pressure for flow-back function of circuit 3	≤ 4.5 bar
cut-out pressure of pressure regulator	9.8 - 10.6 bar
cut-in pressure of pressure regulator	1.0 - 1.8 bar below the cut-out pressure
safety valve opening pressure	12.8 - 13.2 bar
cut-in temperature of heating element	7°C
cut-out temperature of heating element	29°C
re-set time	approx. 20 sec.

pressure sensor reading, circuits 1 and 2 (connections 6.2 - 6.7 in the diagrams above)



R600701

Pressure relief valve

overflow pressure	10.0 bar

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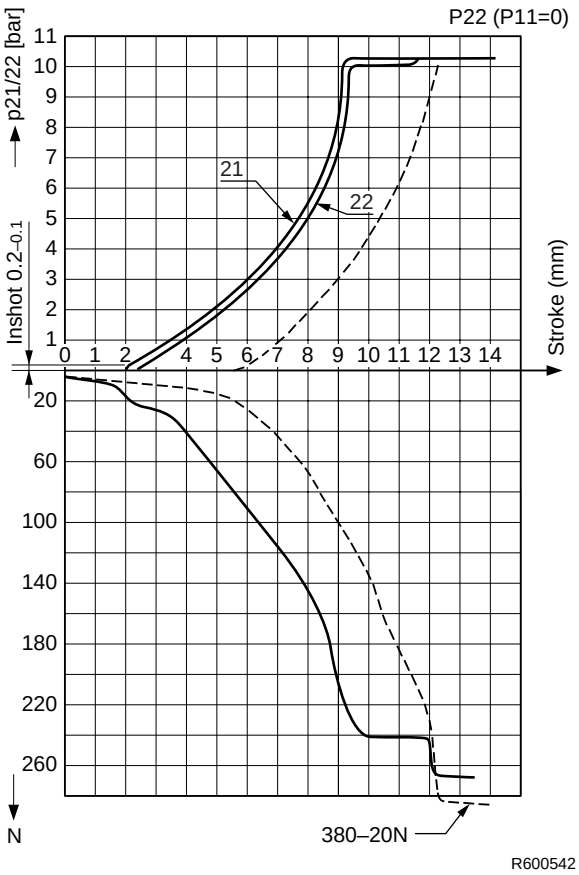
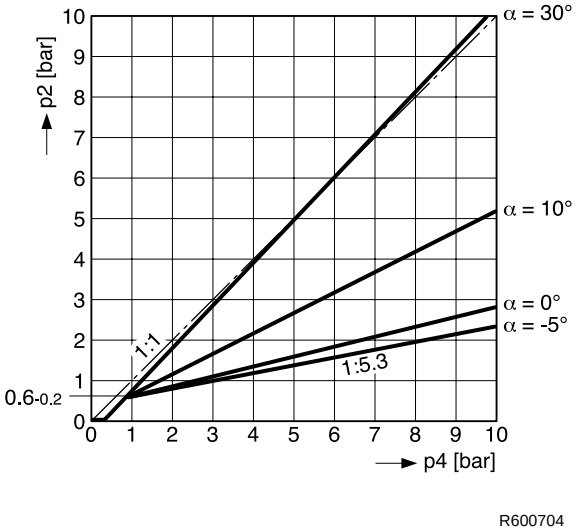
Foot brake valve
Type
Make: Knorr DX 61A

Pressure difference between circuits 1 and 2	0.25 bar
Actuating pressure difference between circuits 1 and 2	0.2 bar



Connection 11	circuit 1 supply
Connection 12	circuit 2 supply
Connection 21	circuit 1 braking pressure
Connection 22	circuit 2 braking pressure

Load sensing valve, leaf suspension
Characteristic



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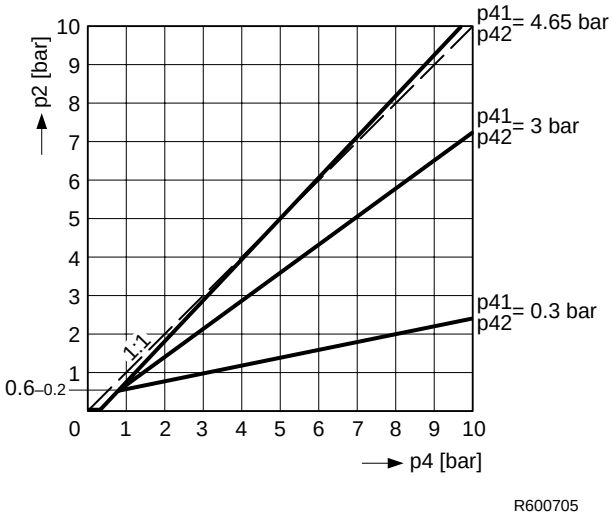
Load sensing valve, air suspension
Characteristic



Brake light switch

Type
Make: Messmer 131 733
Cut-in pressure, brake light switch (make contact) 0.4 - 0.6 bar

Note:
If the vehicle has EBS, the brake light switch is located in the foot brake valve.

Low pressure switch

Brake drum design
Make: Wabco 441 014 ...
Cut-out pressure (break contact) 4.7 - 5.7 bar

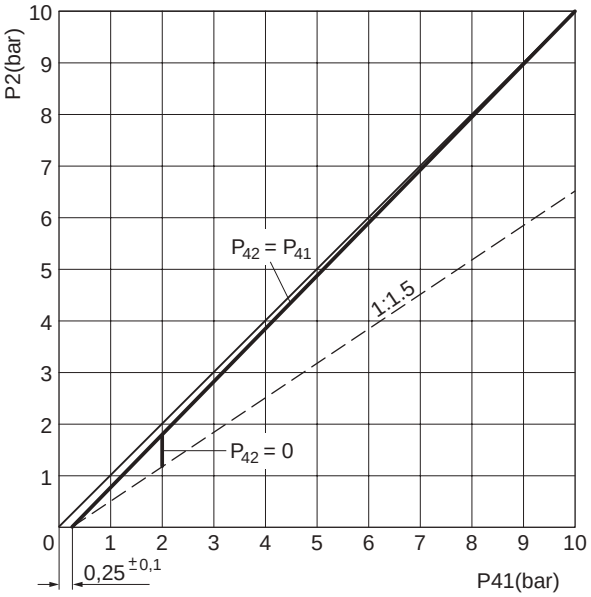
Disc brake design
Make: Wabco 441 014 ...
Cut-out pressure (break contact) 6.1 - 7.1 bar

0

Empty/load relay valve
Type
Make: Wabco 973 011 106
Maximum reduction ratio 1 : 1.5
Actuating pressure 0.25 bar

Fitted with internal filter and silencer

Application: FAT vehicle

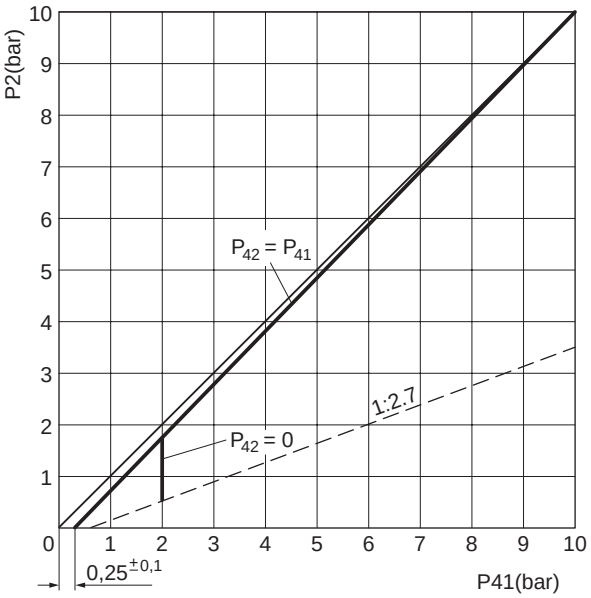


R600328

Type
Make: Wabco 973 011 107
Maximum reduction ratio 1 : 2.7
Actuating pressure 0.25 bar

Fitted with internal filter and silencer

Application: FAD vehicle
FAC vehicle
FAX vehicle
FAL vehicle



R600330

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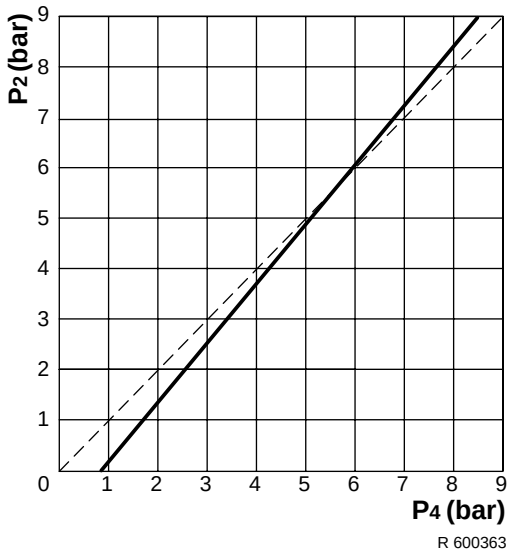
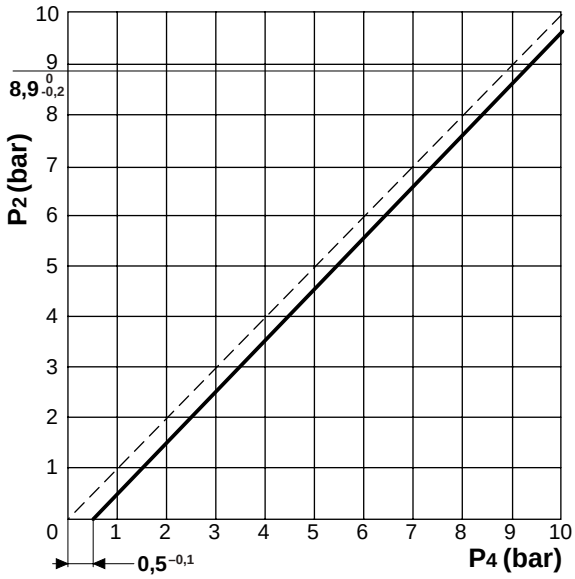
Relay valve
Version for parking brake
Make: Knorr AC 577A
Fitted with silencer



R 600363

Relay valve
Version for service brake
Make: Wabco 973 011 009
Fitted with internal filter and silencer



R 600602

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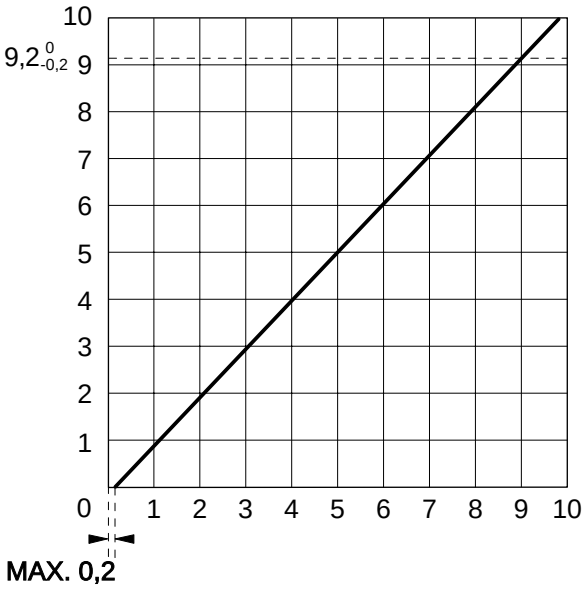
Relay valve
Version for service brake
Make: Wabco 973 011 008
Fitted with internal filter and silencer



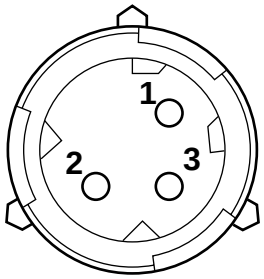
R600640

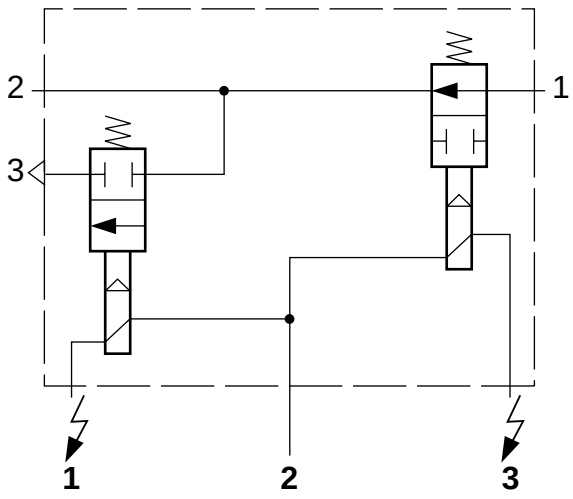
ABS valve

Resistance of magnet coil (at approx. 25°C)	10 - 20 ohm

Electrical connections

1. magnet coil bleed point
2. mass
3. magnet coil air admission point





R600370

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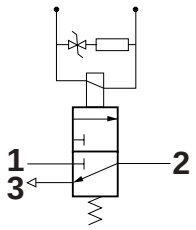
ASR solenoid valve

1. Supply
2. Port, two-way valve
3. Bleed



R600484

Trailer control valve
Type
Make: Knorr AC 599A

Explanation of graph
B Curve of intact circuit 1, circuit 2, or failure in circuit 1 or circuit 2
C Setting range, braking pressure advance

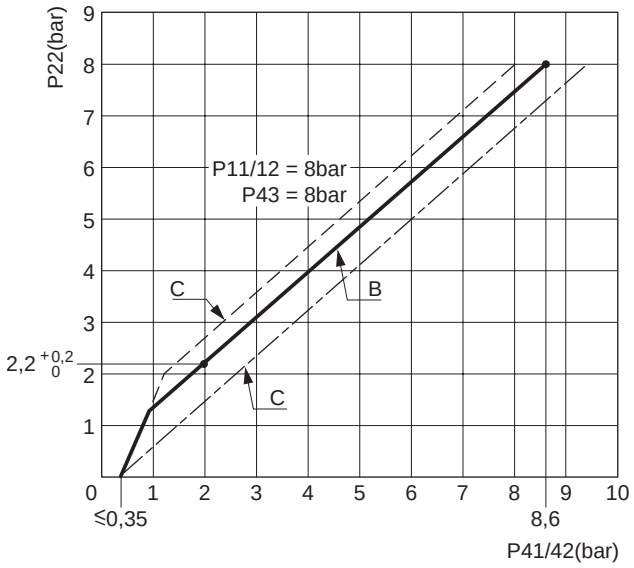
Advance

Input pressure	3 bar
Output pressure (corresponds to 0.6 bar advance = factory setting)	3 bar

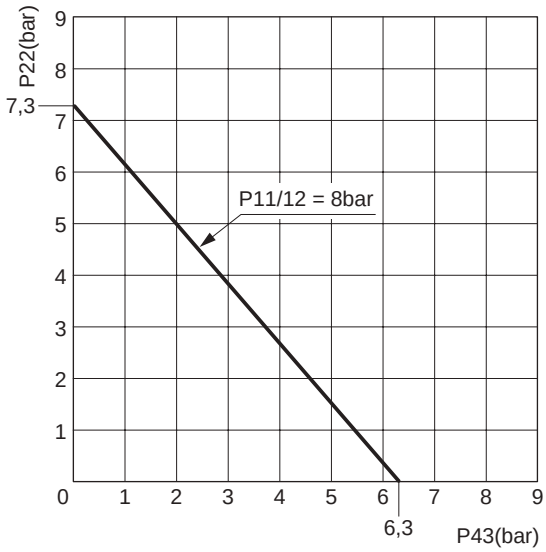
Advance adjustment

Adjusting screw (Allen type, 6 mm)
Clockwise increases the advance
Anti-clockwise decreases the advance

Explanation of graph
Output pressure on connection 22 (P22).
Graph is applicable if the parking brake is applied.



R600333



R600332

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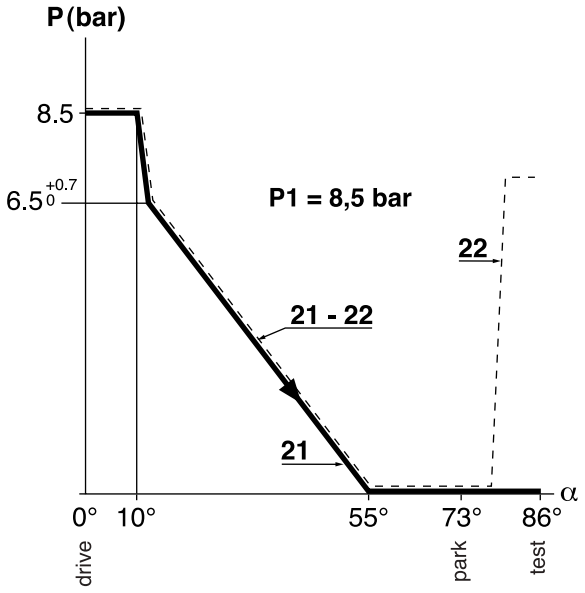
Safety valve

Type
Make: Voss 0 268 874 200
Opening pressure reading approx. 16 bar

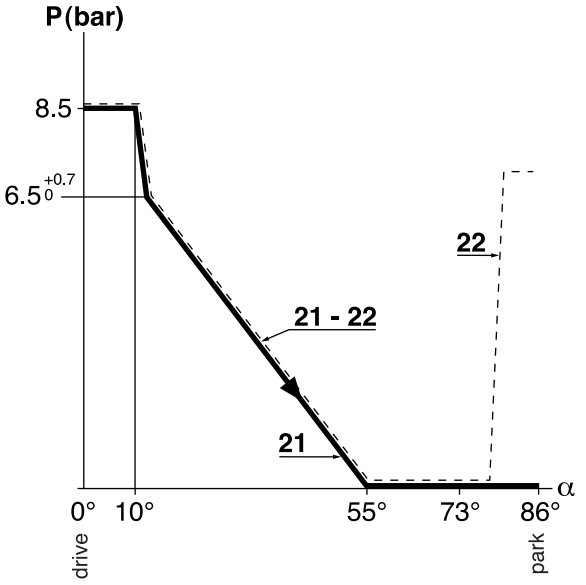
Parking brake valve with drawn vehicle connection
Type
Make: Knorr DPM90DA (with test position)
Knorr DPM93D (without test position)
Knorr DPM90AA (without test position with electrical switch) (special application)

Max. output pressure in driving position (with test position) approx. 8.5 bar



R600699

Max. output pressure in driving position (with test position) approx. 8.5 bar



R600706

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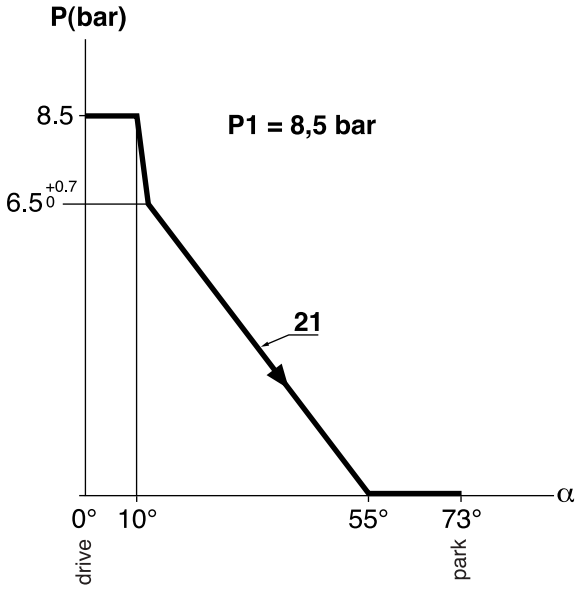
Parking brake without drawn vehicle connection
Type

Make:	Knorr DPM92D
Max. output pressure in driving position	approx. 8.5 bar



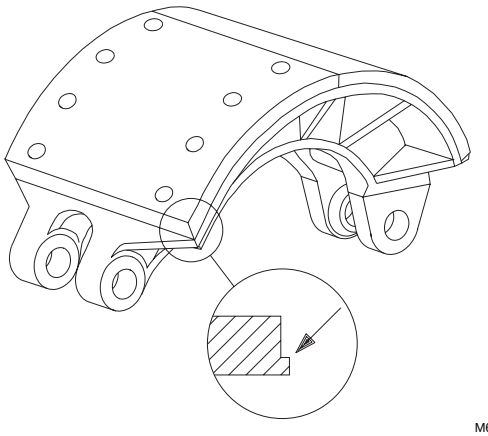
R600700

Brake lining
Drum brakes

TYPE	NOTES
DAF 2100	Installed on LHD vehicles
DAF 3100	Installed on RHD vehicles
Beral 1561	09N044 leading rear axle (used on FTP vehicle)

The bearing pattern of the brake lining can be improved by grinding down the brake lining to a diameter which is max. 1 mm smaller than the drum diameter.
The space between brake shoe and lining must not be more than 0.1 mm.

Minimum brake lining thickness
height of wear indicator or 1 mm above rivet head


M6002

09N044 leading rear axle (used on FTP vehicle)
Minimum lining thickness 5 mm

Disc brakes, SB7000 and SN7000 series

TYPE	NOTES
DAF 1200	Fitted to all vehicles

Brake drum
General
A brake drum may be used until the inside diameter has reached the maximum permissible value, as specified in the table below.

As soon as this diameter is exceeded, the brake drum must be replaced.

Brake diameter	Standard brake-drum diameter in mm		Maximum in mm	Maximum reconditioning dimension in mm
		Ovality		
12 $^{3}/_{8}$"	314	+ 0,127	317,3	316,3
13"	330,2	+ 0,127	333,2	332,3
15 $^{1}/_{2}$"	393,7	+ 0,127	396,7	395,7
16"	406,6	+ 0,250	409,6	408,6
16 $^{1}/_{2}$"	420	+ 0,250	425	423
310 mm	310	+ 0,210	313	312
325 mm	325	+ 0,230	328	327
360 mm	360	+ 0,230	363	362
375 mm	375	+ 0,230	378	377
420 mm	420	+ 0,250	425	423

09N044 leading rear axle (used on FTP vehicle)

Brake diameter	Standard brake-drum diameter in mm	Maximum in mm	Maximum reconditioning dimension in mm
300 mm	300		298 - 299 mm

The ovality (deformation) of the brake drum is checked with the drum in position on the hub, or on a brake dynamometer.

Brake drums with cracks exceeding a width of 0.7 mm or a length of 50 mm may not be reused.

0

Automatic slack adjuster for drum brakes

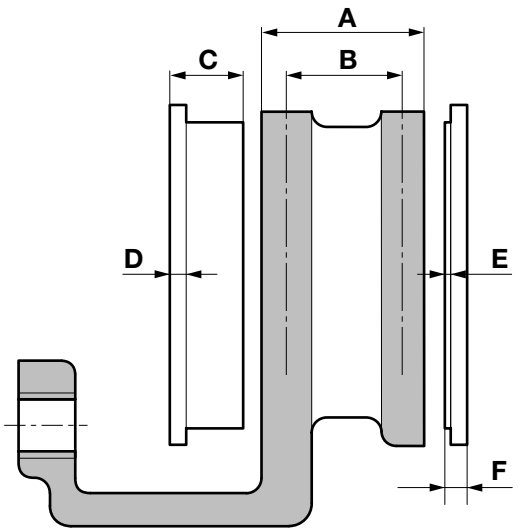
Automatic slack adjuster travel (Haldex)	35 - 40 mm
Reverse torque value of adjusting bolt	> 18 Nm
Axial play on the brake camshaft	0.5 - 1.0 mm

Brake pad

maximum brake pad thickness (C)	30 mm
0 minimum lining thickness (E)	2 mm
minimum brake pad thickness (F), with 9 mm rear plate thickness (D)	11 mm

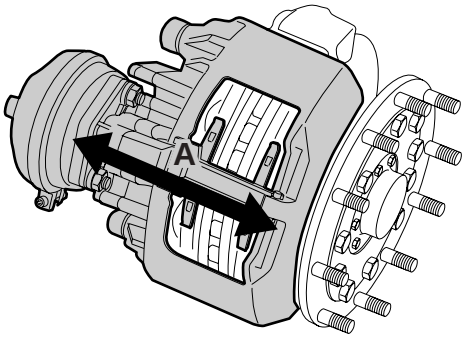
replacing:
all brake pads at the same time for each axle, and with the specified lining only.

Brake pad/brake disc play 0.6 - 1.0 mm

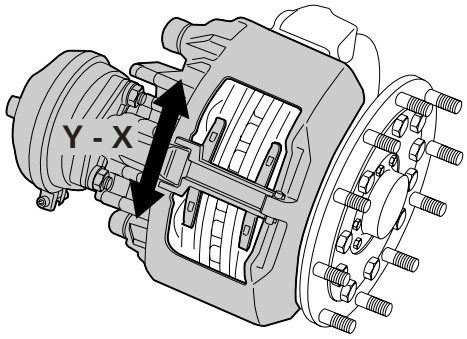


R600489

Brake caliper



R600708



R600712

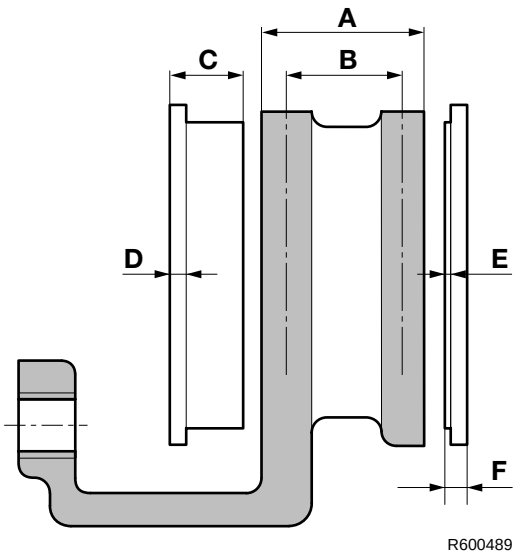
Brake caliper play in axial direction (direction A)	0.6 - 1.0 mm
Brake caliper play on the guide sleeves ("Y" - "X")	Maximum 2.0 mm

0

Brake disc

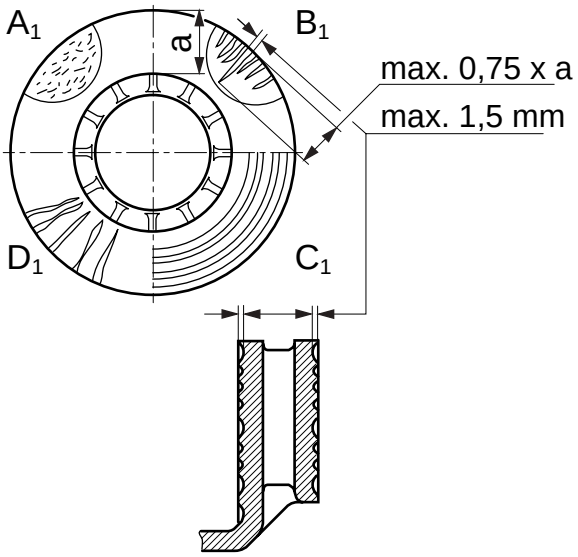
maximum brake disc thickness (A) 0	45 mm
minimum brake disc thickness (B) (rejection dimension, disc needs to be replaced)	37 mm
minimum thickness, turning dimension	40 mm

Note:
If it is established during brake pad replacement that the brake thickness is less than or equal to 39 mm, the brake disc must also be replaced.



The following signs of wear are permissible:
A1 crazy cracking.
B1 cracks running to the centre up to 1.5 mm wide and deep, max. 0.75 x friction surface width (a).
C1 unevenness in the disc surface up to 1.5 mm.

Not permissible:
D1 through-going cracks.



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1.2 TIGHTENING TORQUES

Note:
The tightening torques stated in this section are different from the standard tightening torques stated in the overview of the standard tightening torques.

The other threaded connections not specified must therefore be tightened to the torque stated in the overview of standard tightening torques.

When attachment bolts and nuts are replaced, it is important that - unless stated otherwise - these bolts and nuts are of exactly the same length and property class as those removed.

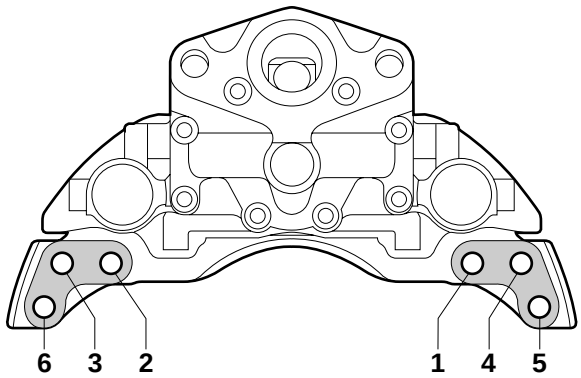
SAFETY VALVE

Attachment	72 Nm

BRAKE CALLIPER - BRAKE CARRIER

Sliding sleeve Allen screws (SB7000)	285 Nm (1)
Sliding sleeve Allen screws (SN7000)	180 Nm + 90° (1)
Brake caliper attachment bolts	440 Nm (2)
Pressure tool, guide bush bellows	8 Nm
Rubber bearing bush pressure tool (only SN7000)	8 - 45 Nm

(1) Always use new bolts, provided with locking compound. New bolts are supplied with locking compound already applied.
(2) In the case of versions with Knorr disc brakes, the attachment of the brake caliper against the stub axle changed starting from production week 2002-25. Five bolts are now used instead of six bolts. There is still a hole for the 6th bolt (5) on the brake carrier, but there is no hole on the stub axle.



R600520

BRAKE DISC

Locking plate attachment bolts	30 Nm

0

BRAKE CYLINDER

Attachment nuts	195 Nm
Release bolt	45 Nm
Release bolt (version with indication pin)	75 Nm

SPRING BRAKE CYLINDER

Fixing nuts of spring brake cylinder	180 - 210 Nm
Fixing bolts of the brake chamber clamping strap	34 Nm
Release bolt (at least 5.1 bar)	25 Nm

VOSS COUPLING 232

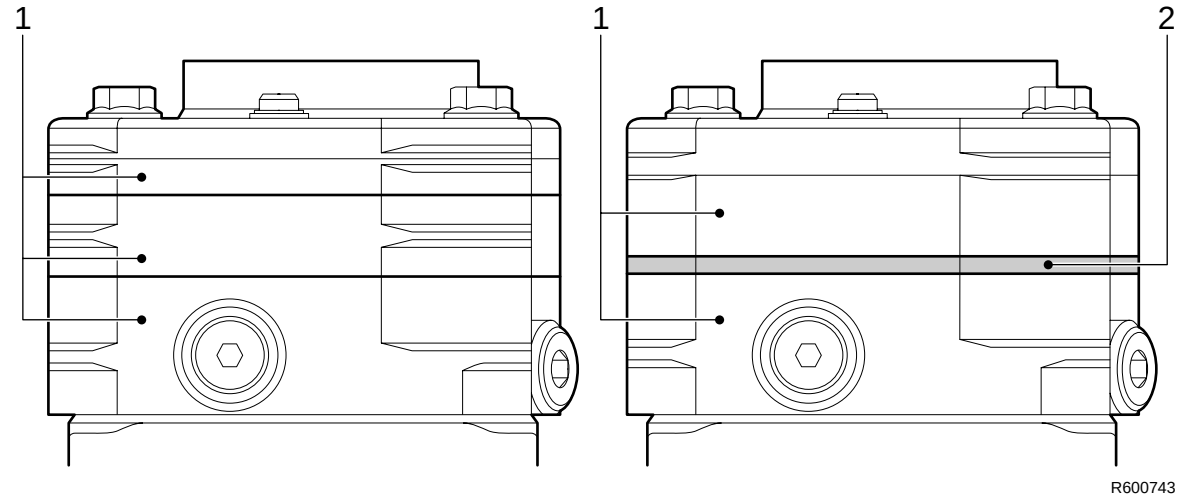
Socket	12 Nm

BLOW-OFF VALVE

Attachment	25 Nm

Air compressor

There are two types of compressors: one version used in production until 2002-47 and one version used in production from 2002-48.
Compressors can be identified as follows:



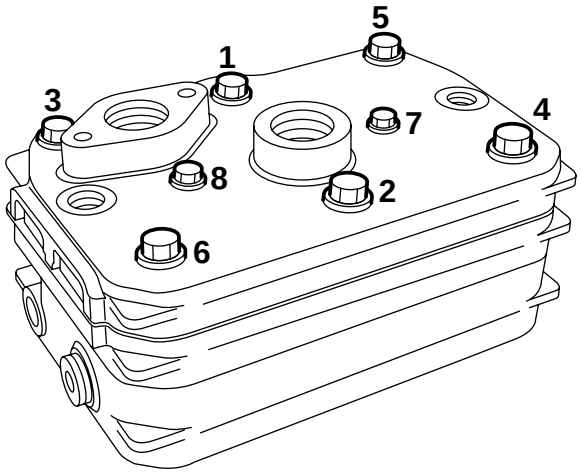
< 2002-48 ≥ 2002-48

The cylinder head of compressors used up to 2002-48 consists of three aluminium parts (1).
The cylinder head of compressors used from 2002-48 consists of two aluminium parts (1) and a steel plate (2).

Air compressor tightening torques greater than or equal to 2002-48

Delivery valve attachment nuts	5 Nm + 90° angular displacement
Connecting rod bolts	6 Nm + 70° angular displacement

0

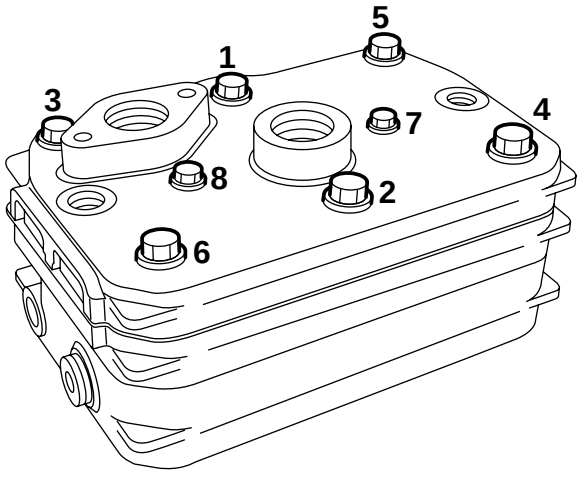


R600742

Cylinder head bolts	
Phase 1, bolts 7 - 8 (in sequence)	6 Nm
Phase 2, bolts 7 - 8 (in sequence)	90° angular displacement
Phase 3, bolts 1 - 2 - 6 - 5 - 4 - 3 (in sequence)	30 Nm
Phase 4, bolts 1 - 2 - 6 - 5 - 4 - 3 (in sequence)	90° angular displacement
Phase 5, bolts 7 - 8 (in sequence)	10 Nm
Phase 6, bolts 7 - 8 (in sequence)	90° angular displacement

Air compressor tightening torques greater than or equal to 2002-48

Delivery valve attachment nuts	5 Nm + 90° angular displacement
Connecting rod bolts	6 Nm + 70° angular displacement



R600742

Cylinder head bolts	
Phase 1, bolts 1 - 2 - 3 - 4 - 5 - 6 (in sequence)	30 Nm
Phase 2, bolts 1 - 2 - 3 - 4 - 5 - 6 (in sequence)	90° angular displacement
Phase 3, bolts 7 - 8 (in sequence)	7 Nm
Phase 4, bolts 7 - 8 (in sequence)	90° angular displacement

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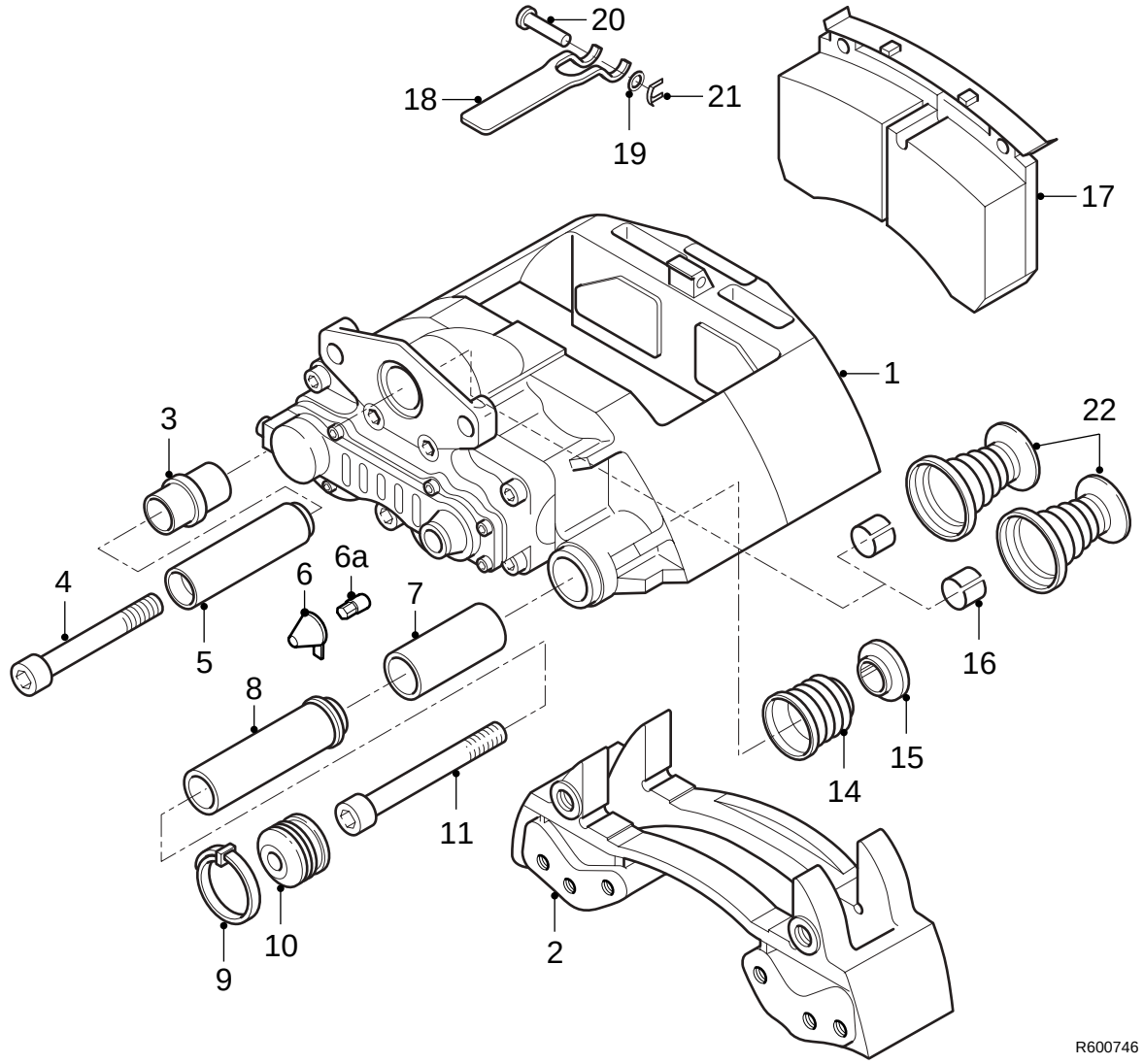
1.3 LUBRICANTS

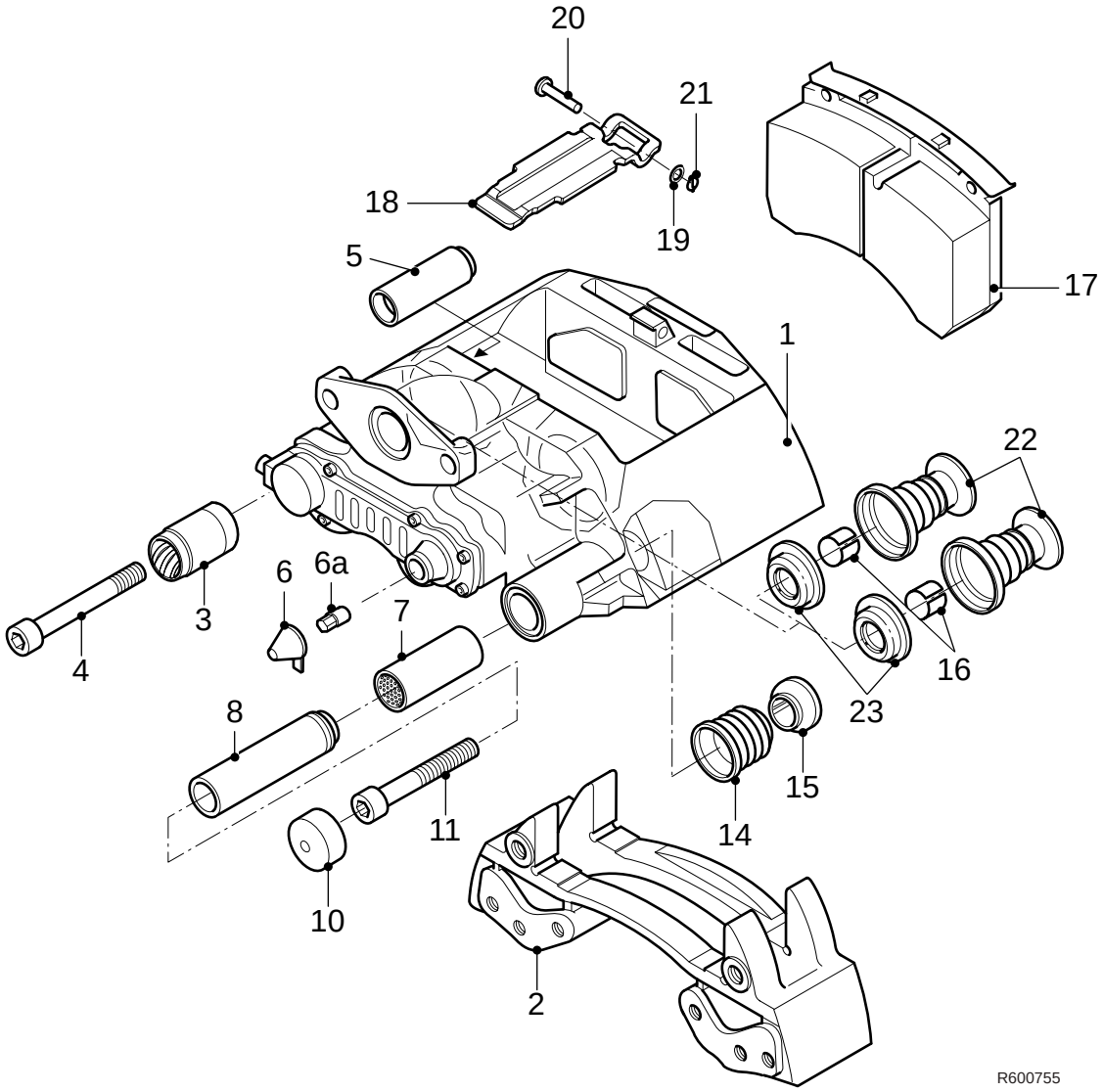
Brake calliper
Knorr SB7000



Renolit HLT2 (white) for parts 6, 7, 8, the adjusters (not shown), the brake cylinder lever and the flange surface for attachment of the brake cylinder	(DAF no. 1448907)
Sytheso GL EP1 (green), for parts 3, 5	(DAF no. 1448908)

0

Knorr SN7000



Renolit HLT2 (white) for parts 3, 6, 7, 8, the adjusters (not shown), the brake cylinder lever and the flange surface for attachment of the brake cylinder (DAF no. 1448907)

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2. BRAKING PERFORMANCE AND BRAKE EQUALISATION

2.1 GENERAL

EBS tyre class
The tyre sizes are classified into tyre classes. This tyre class information is necessary to be able to assess the brake presentation, by measurements of brake force.
This tyre class information is also necessary for the EBS system to be able to evaluate whether the electric EBS unit is programmed when the tyre size is changed..

Tyre size change in EBS system

If the tyre size is changed in an EBS system and the tyre size of the front and rear axle no longer fall in the same tyre class, the changed tyre sizes must be programmed into the electronic EBS unit.

Tyre class	Tyre size
Class 0	215/75 R 17.5
	235/75 R 17.5
Class 1	295/60 R 22.5
	255/70 R 22.5
	315/60 R 22.5
	275/70 R 22.5
Class 2	305/70 R 22.5
	315/70 R 22.5
	385/55 R 22.5
	295/80 R 22.5
	11 R 22.5
Class 3	385/65 R 22.5
	315/80 R 22.5
	11.00 R 20
	12 R 22.5
	12.00 R 20
	13 R 22.5

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Tyre size change in EBS 2 system

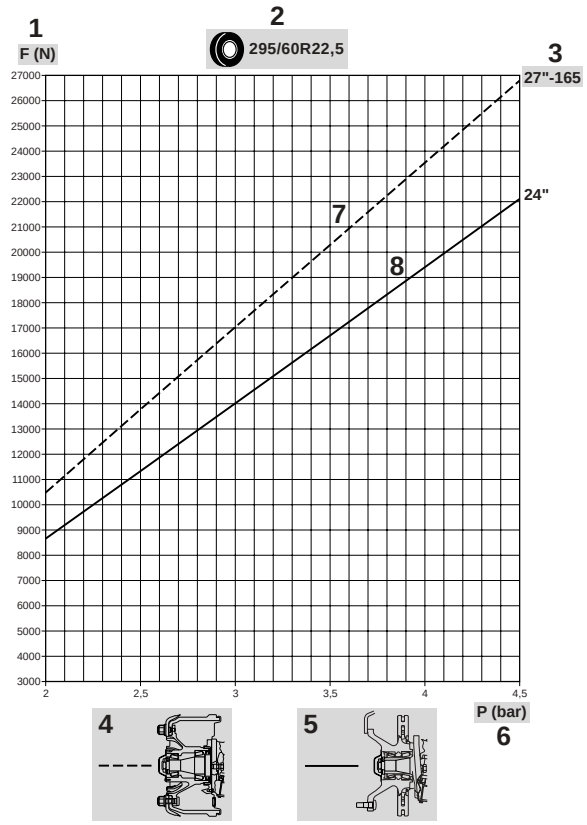
If the tyre size is changed in an EBS 2 system and the tyre size of the front and rear axle no longer fall in the same tyre class, it is not necessary to program the electronic ESB 2 unit because the electronic ESB 2 unit will automatically recognise this change in tyre size.

OVERVIEW OF BRAKING FORCES OF EBS SYSTEM

This overview lists the braking forces graphs based on tyre size. These braking force graphs apply to the prime mover with EBS; these braking force graphs can be used to check the braking performance of an EBS prime mover.

Graph explanation

1 Brake force per wheel (N)
2 Tyre size
3 Type of brake cylinder + brake lever length (if applicable)
4 Brake drum design
5 Disc brake construction
6 Pressure in brake cylinder (P)
7 Reference line of measured braking force per wheel; the example shows a brake drum construction and a 27" brake cylinder with a brake lever length of 165 mm.
8 Reference line of the measured braking force per wheel; the example shows a disk brake construction and a 24" brake cylinder.



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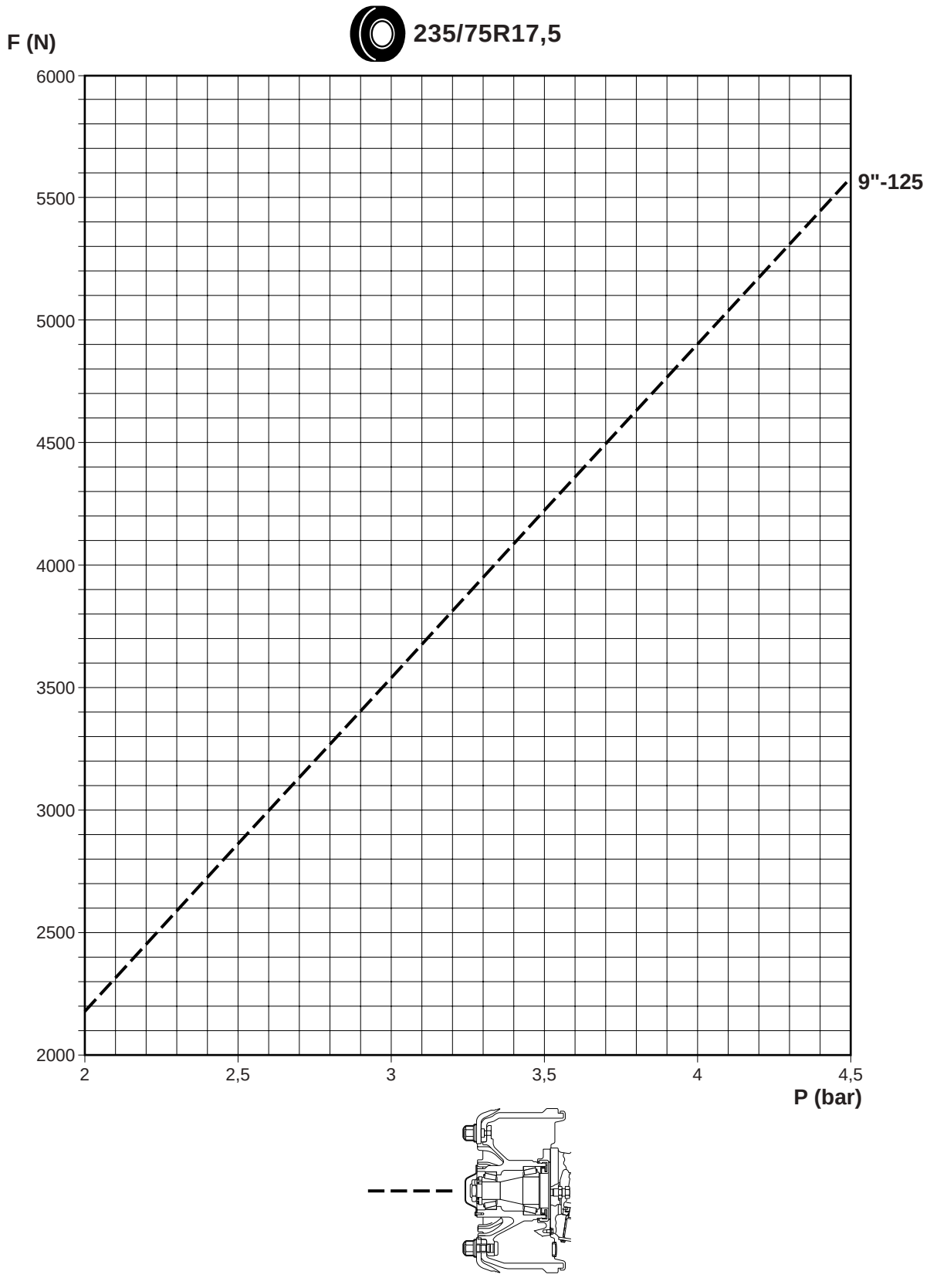
Braking force graphs



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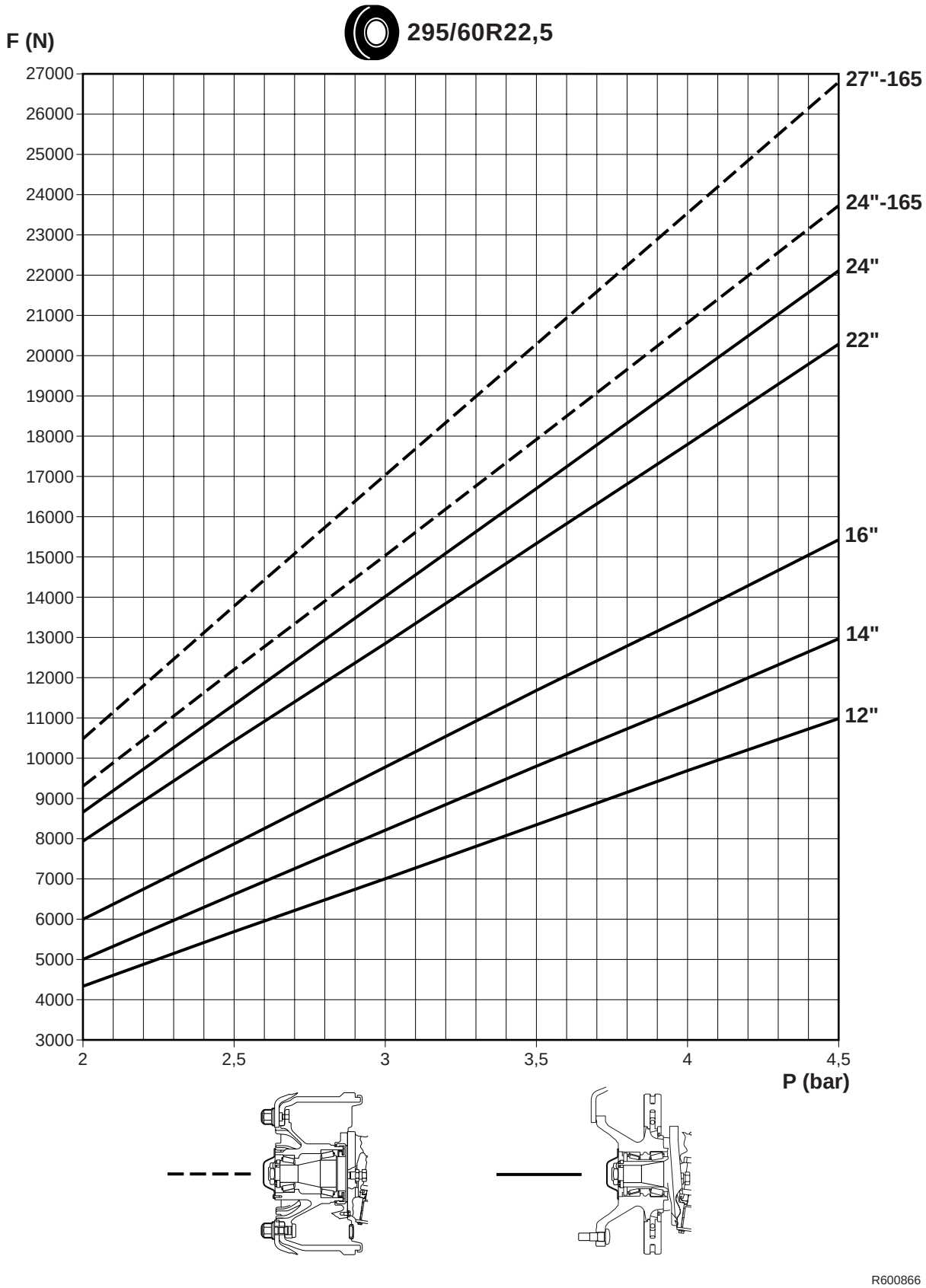

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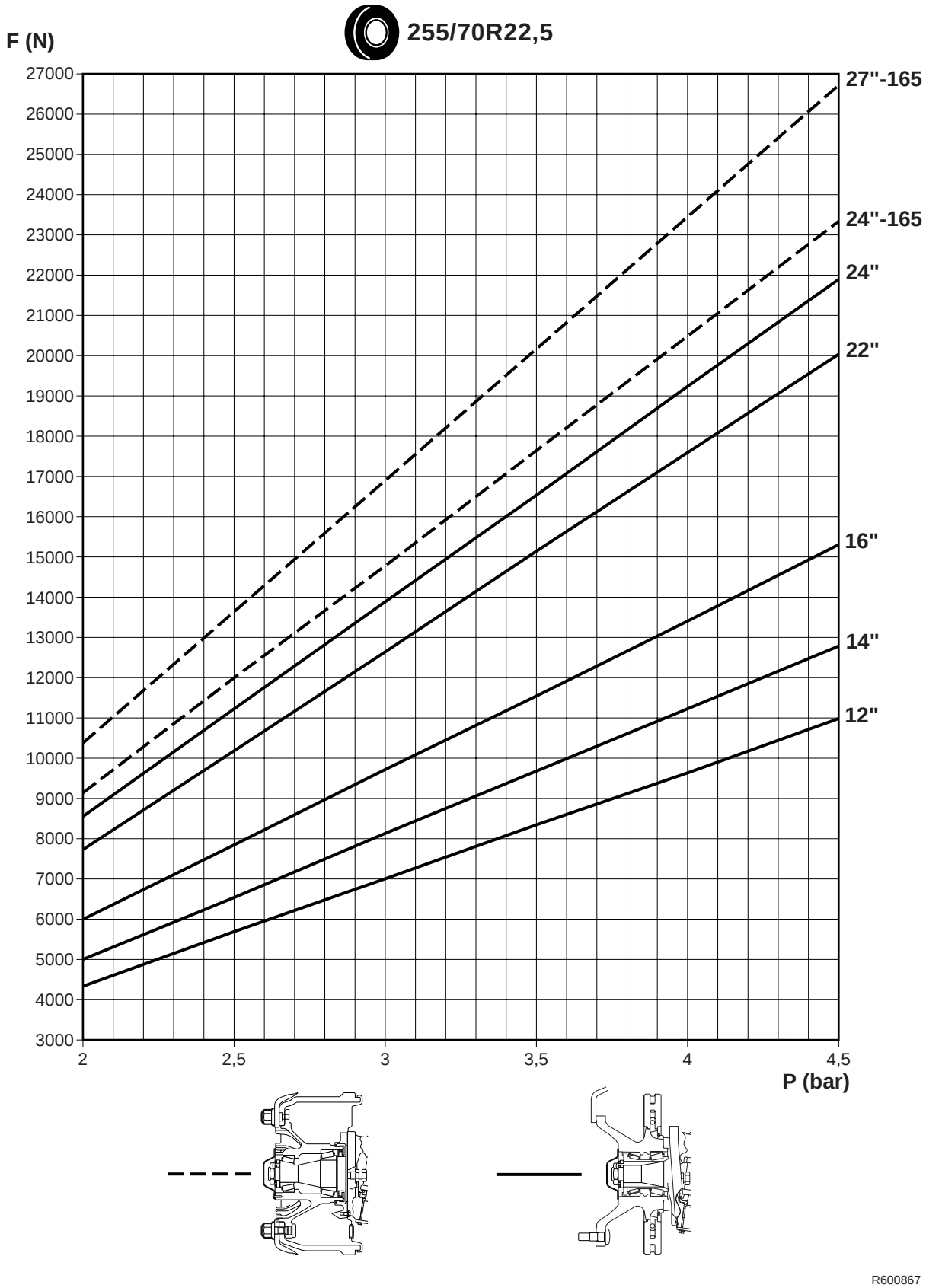

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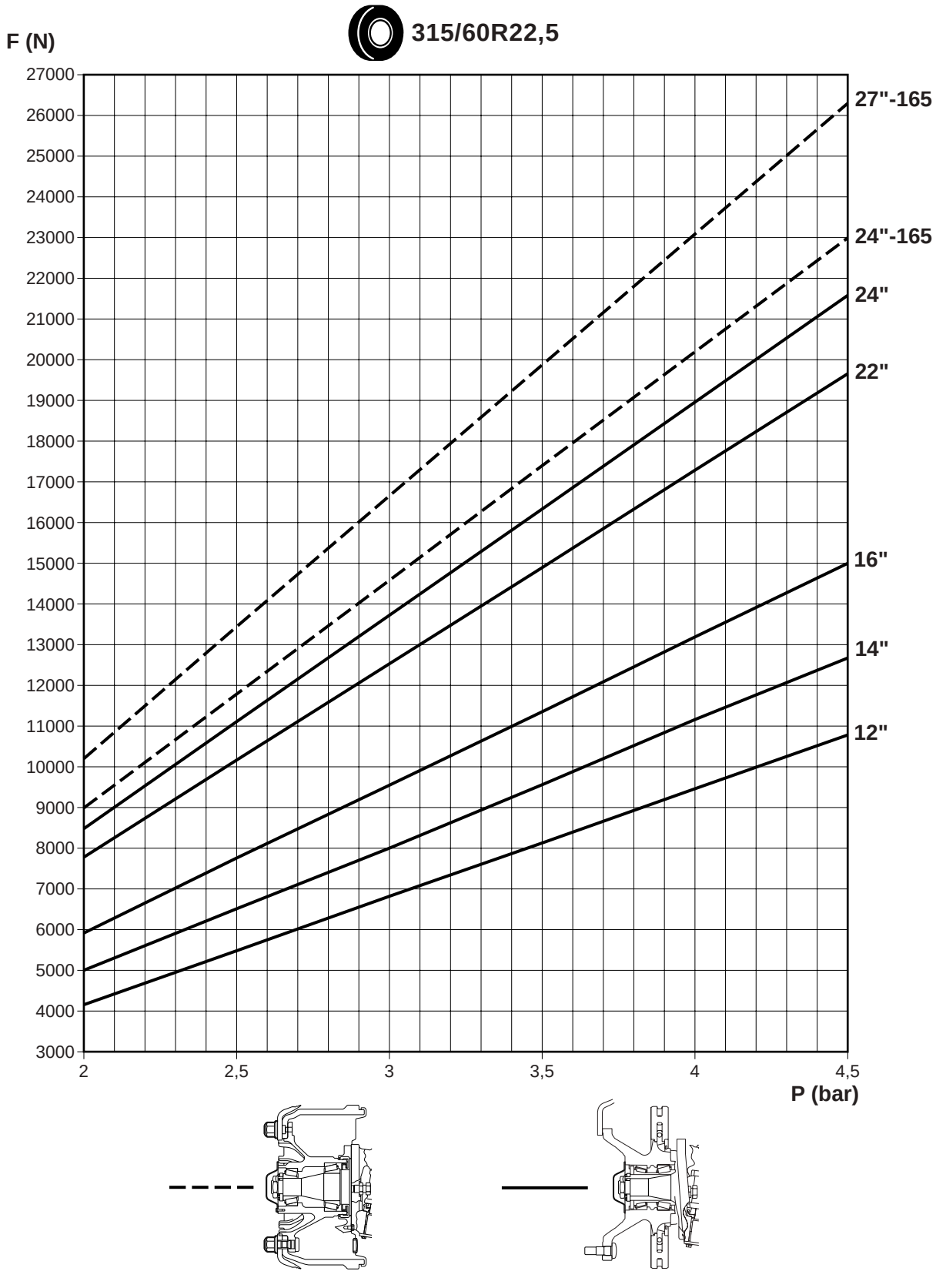

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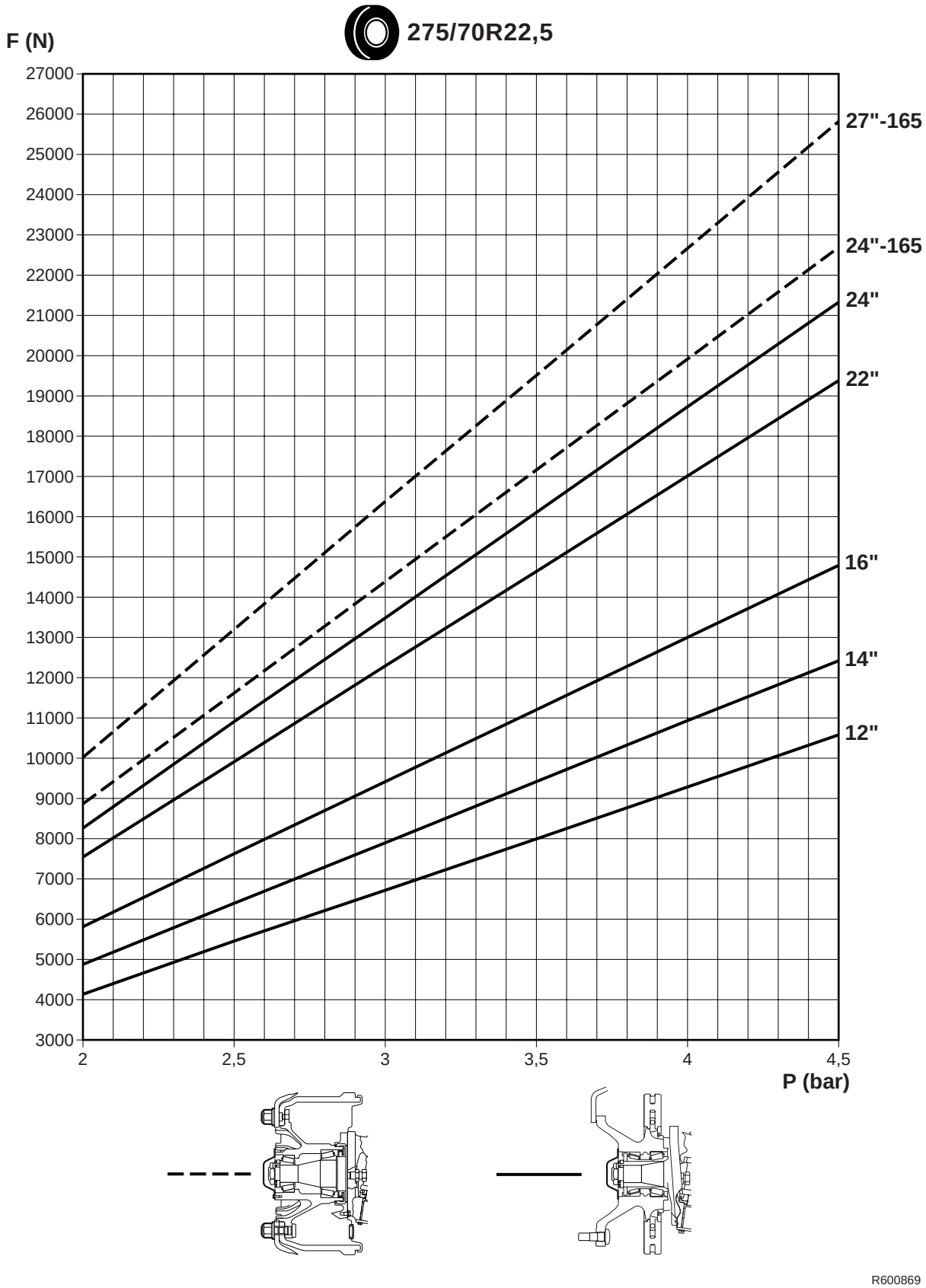

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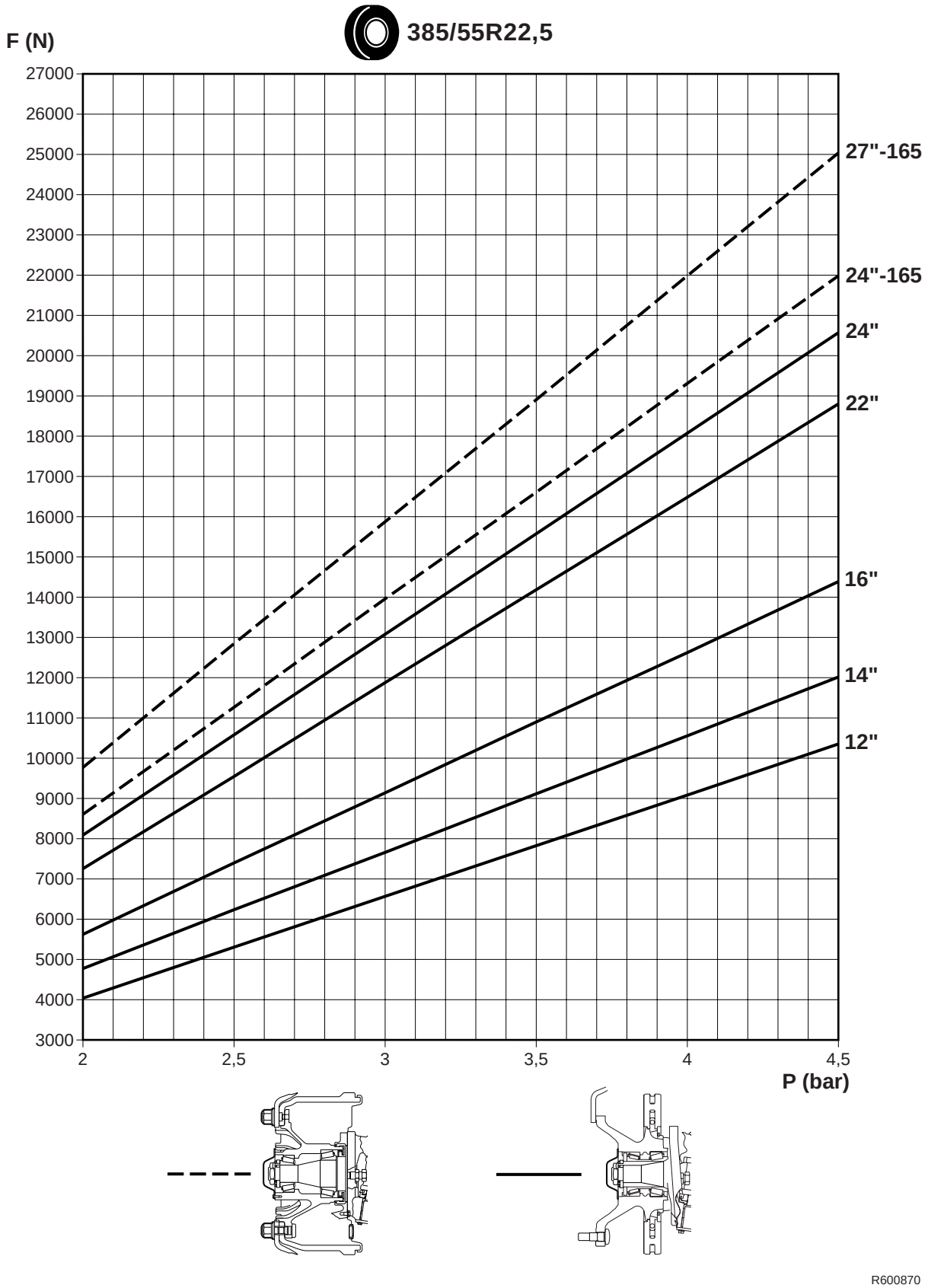

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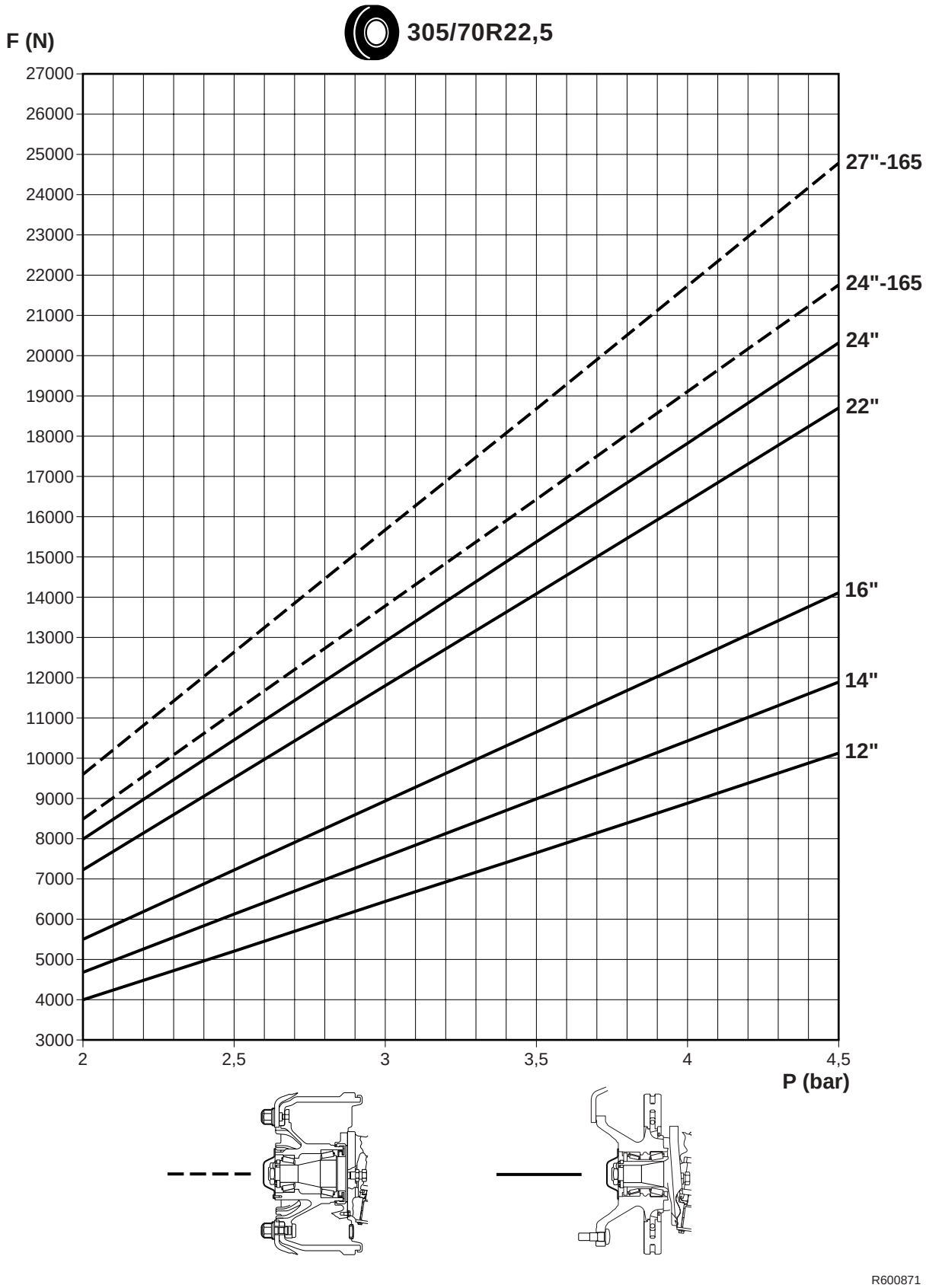

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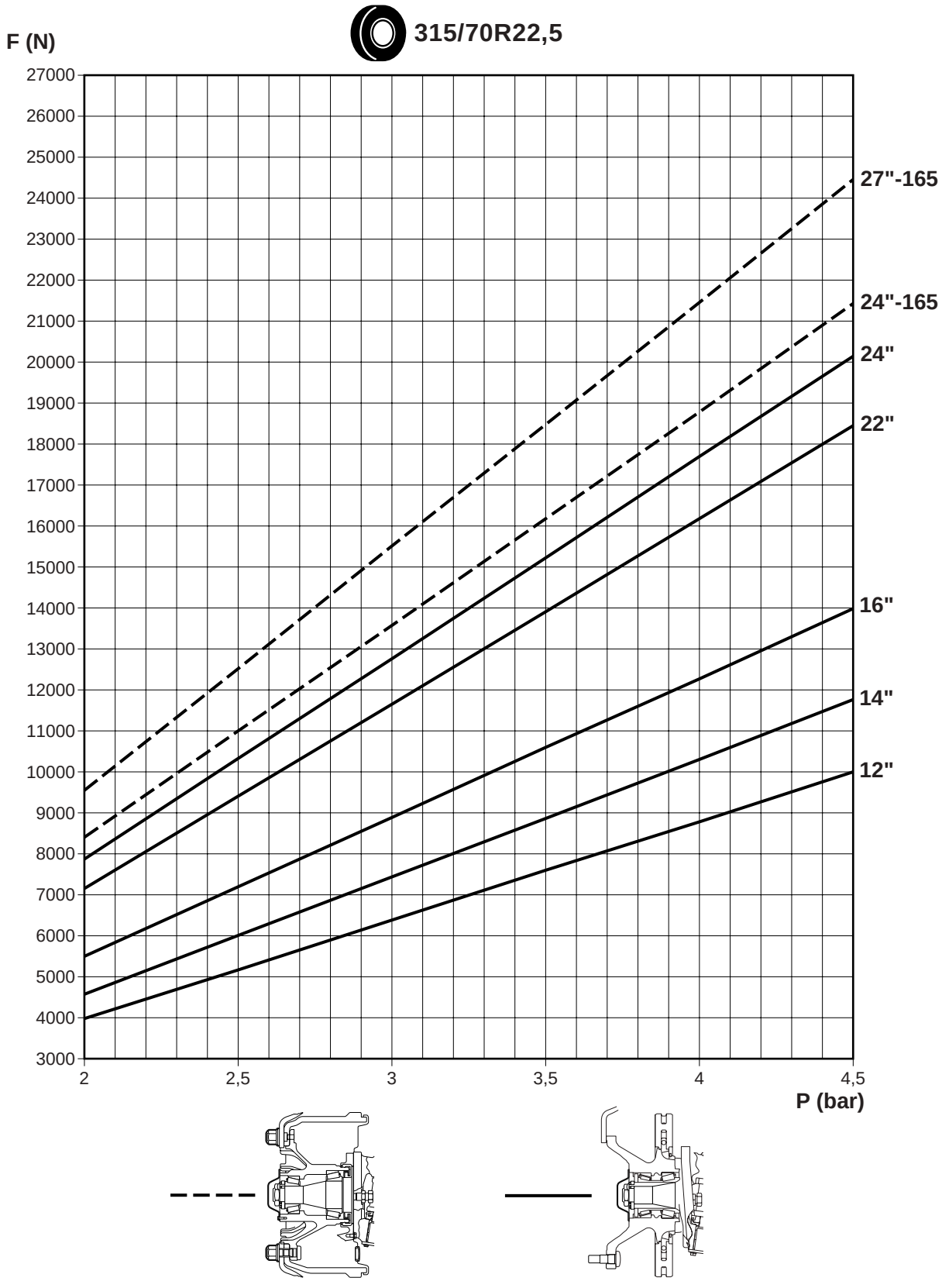

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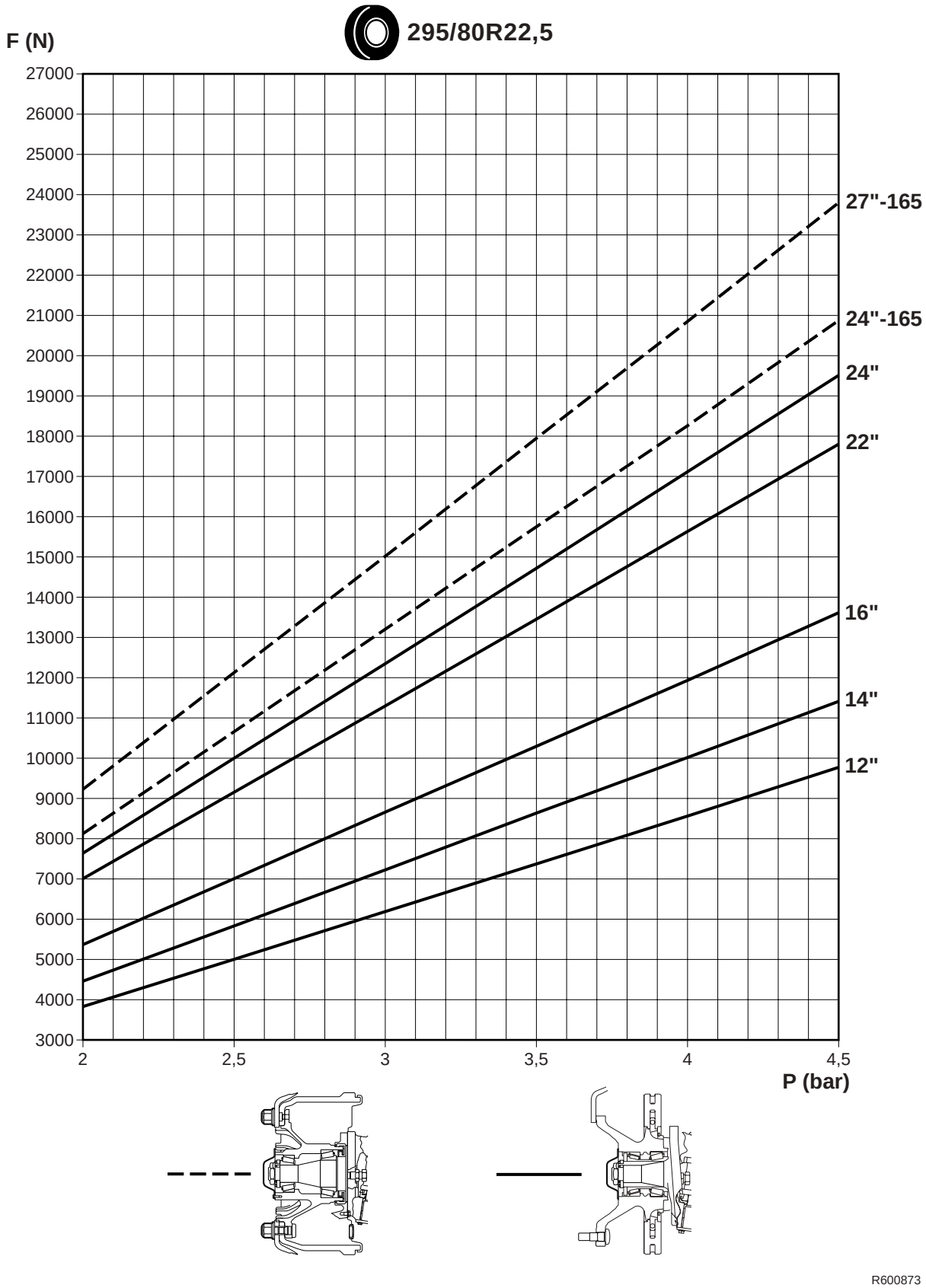

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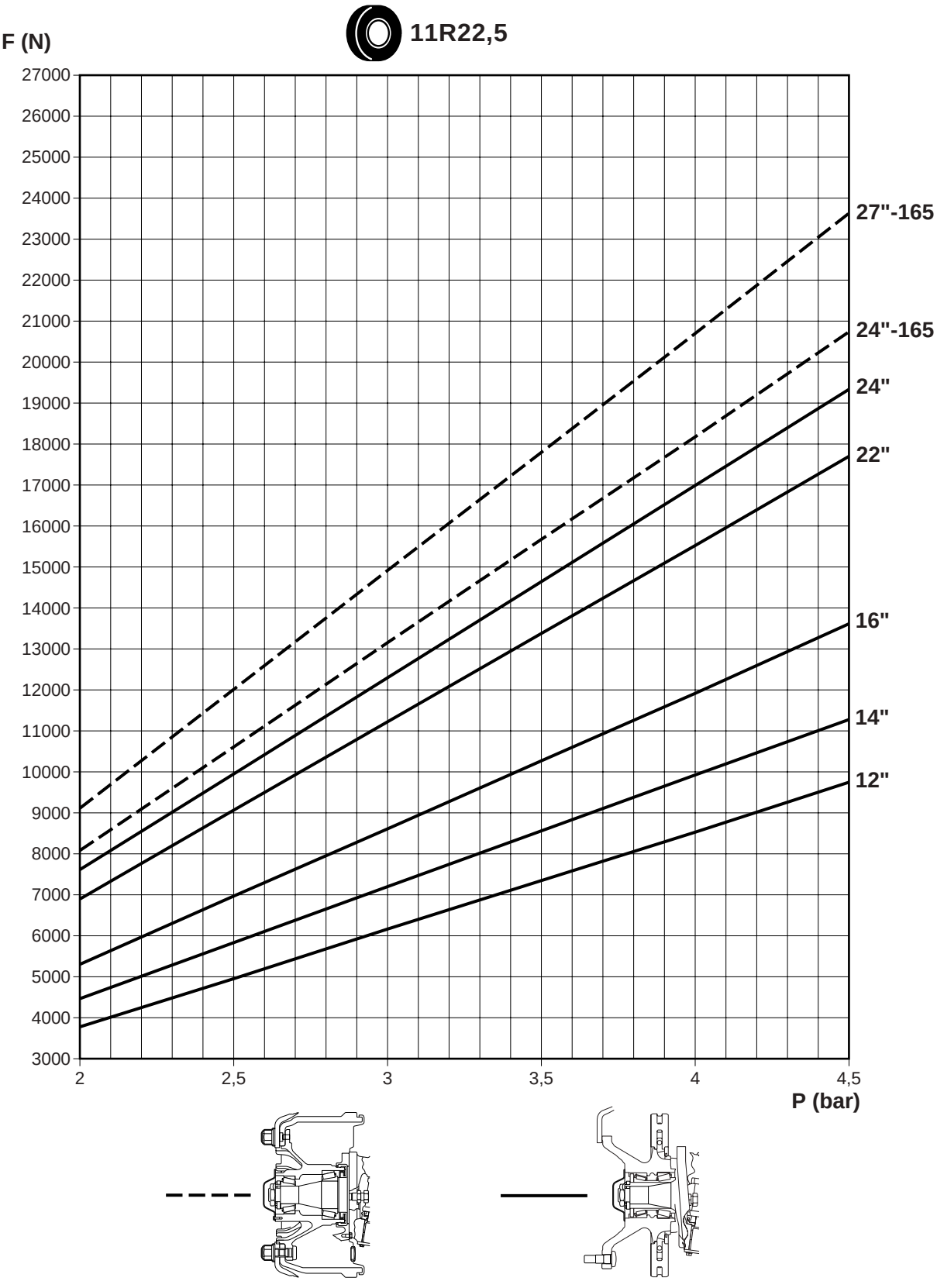

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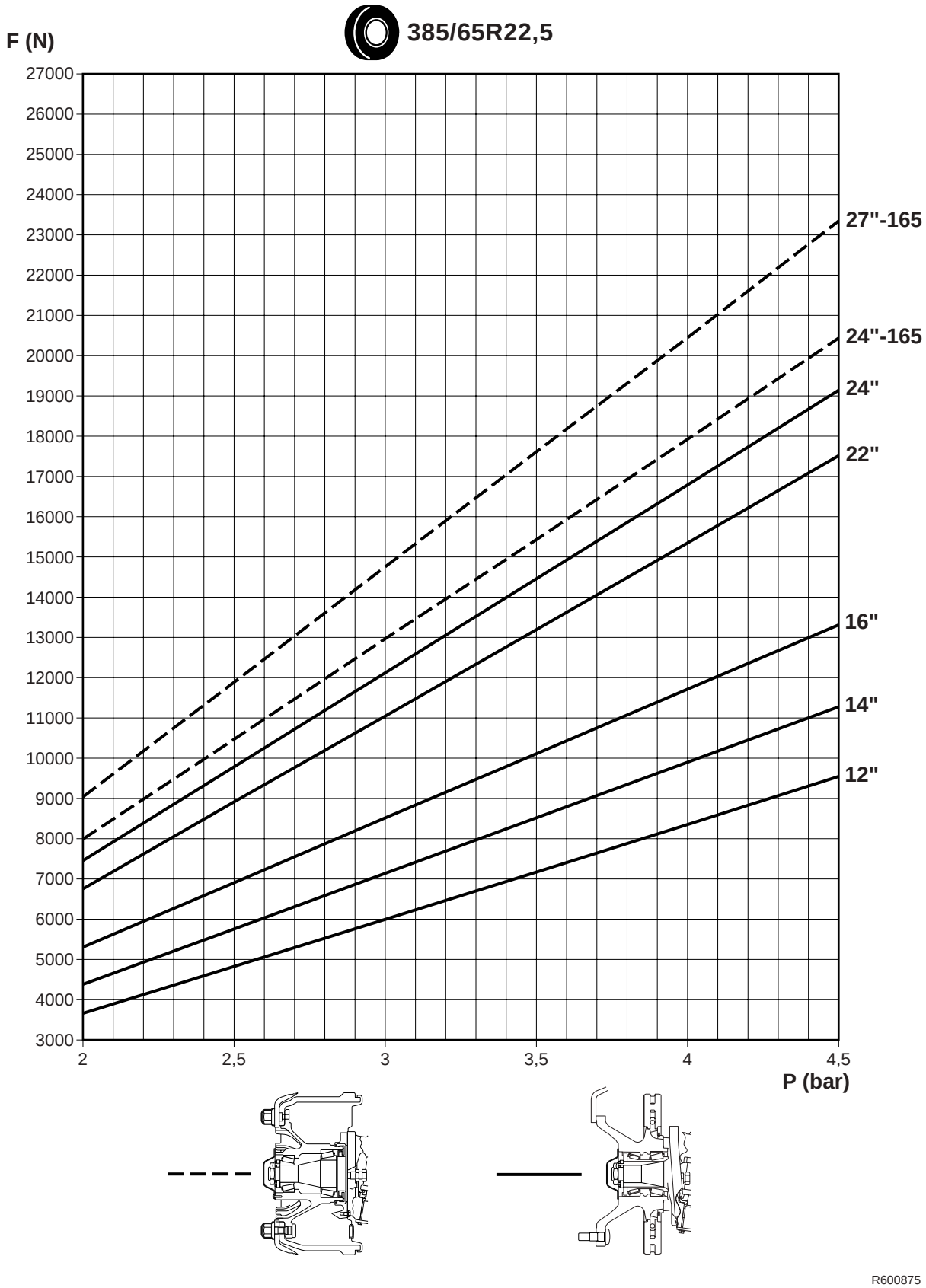

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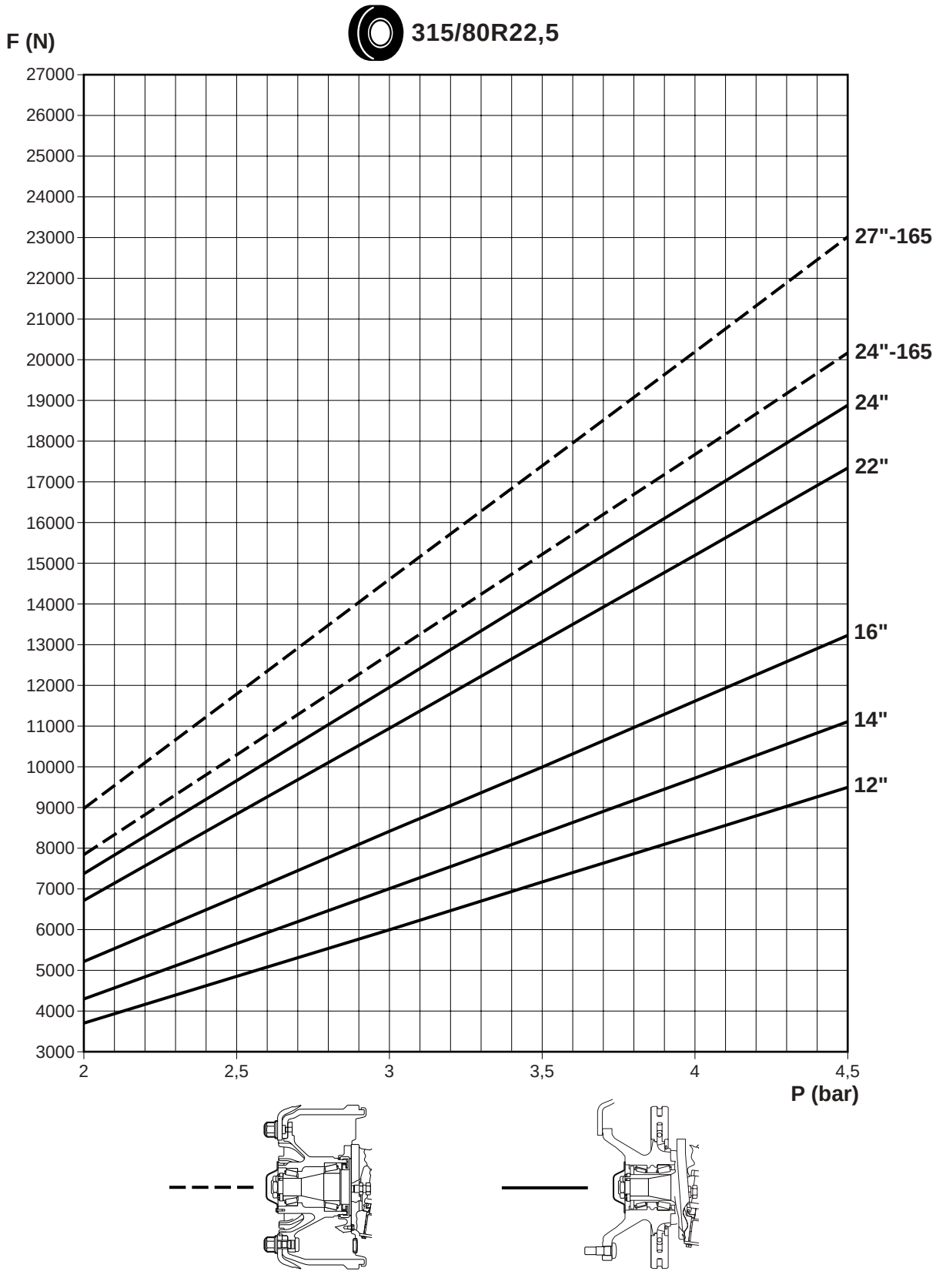

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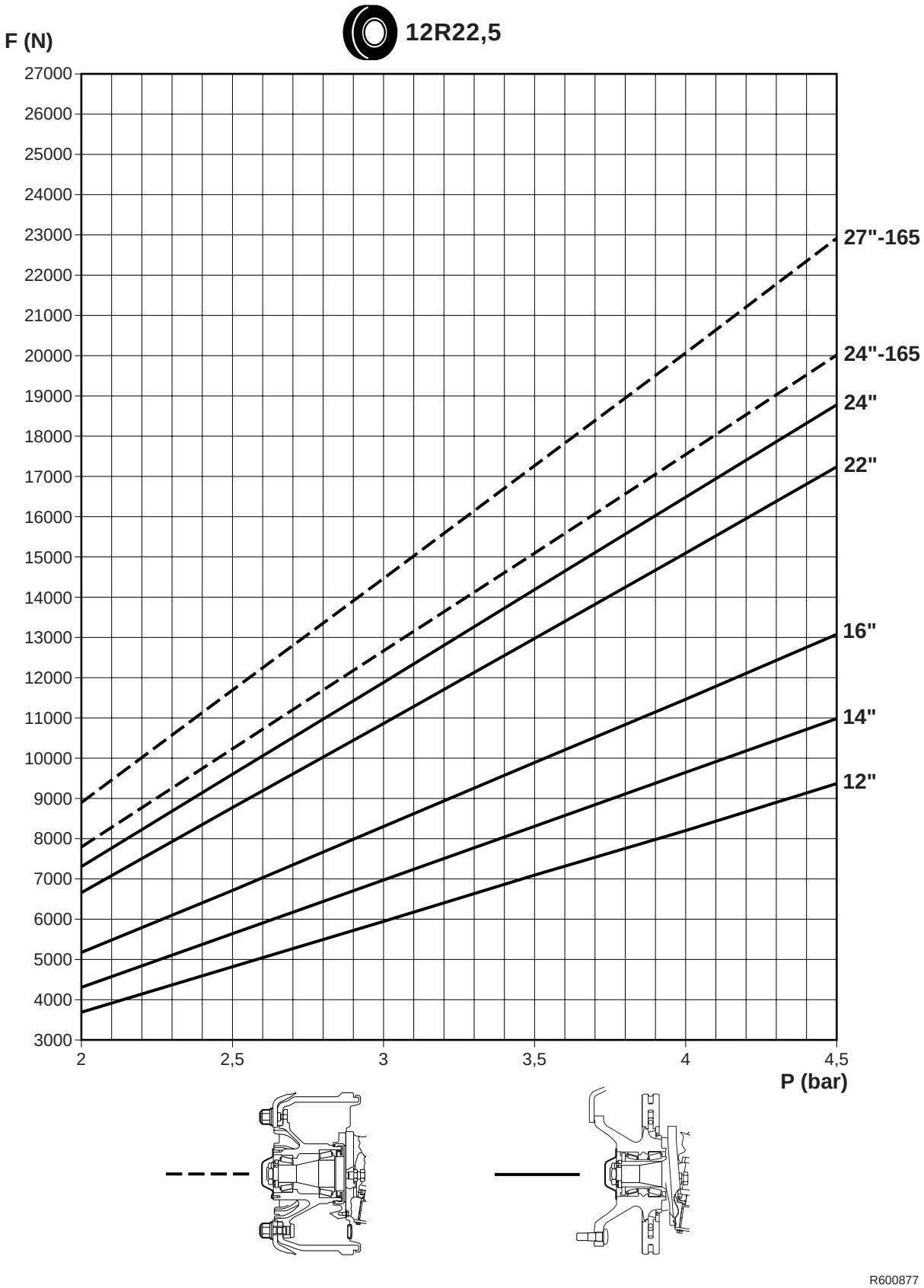

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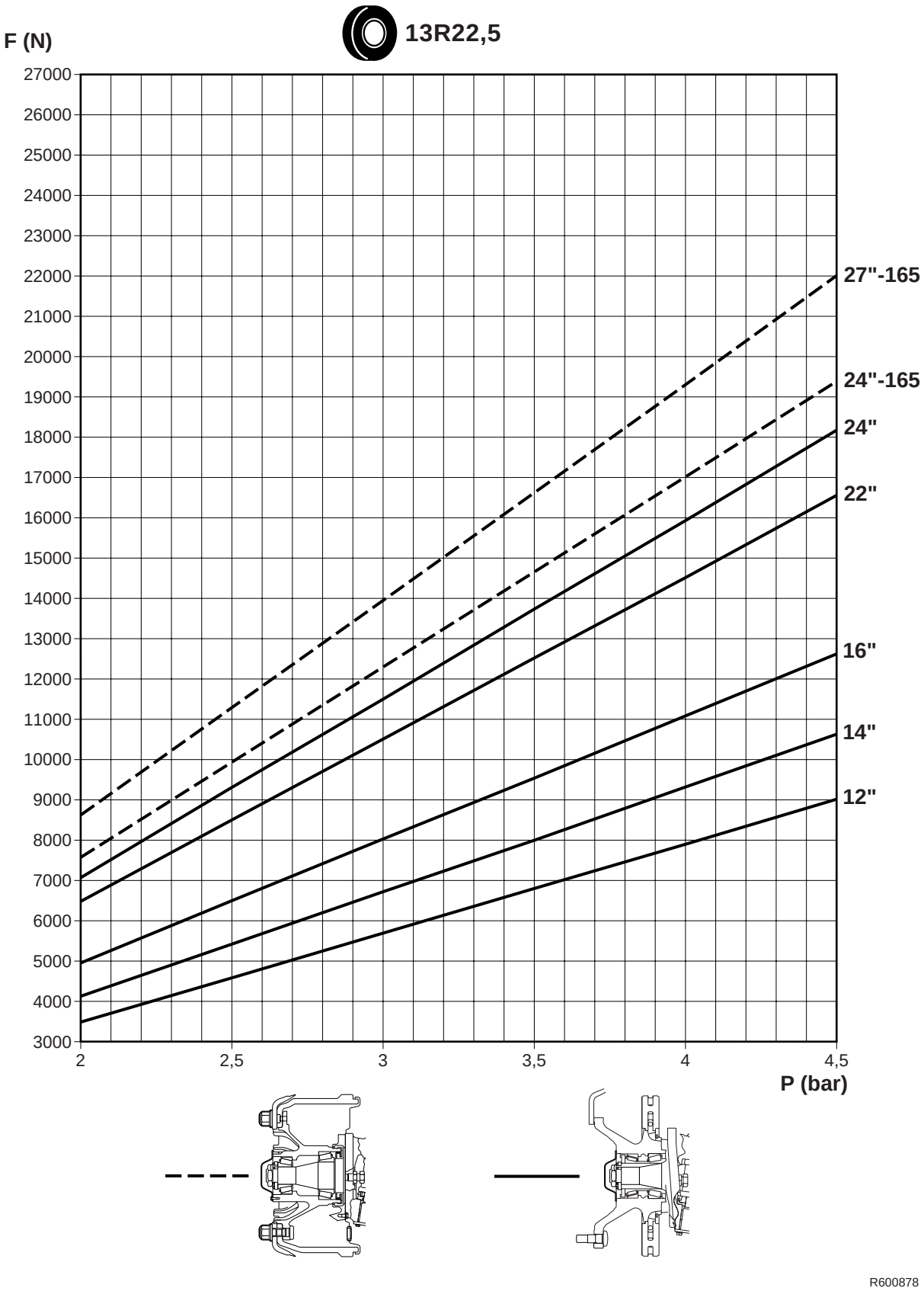

CONTENTS

1

1. DISC BRAKE CONSTRUCTION

1.1 FAULT-FINDING TABLE

SYMPTOM: SQUEALING/NOISE DURING BRAKING	
Possible cause	**Remedy**
Worn brake pads	Check brake pads and brake disc thickness
Loose parts	Check disc brake construction
Wear/damage to hub bearing	Check hub bearing play
Wear to internal parts of disc brake construction	Check internal parts
Incorrect vehicle combination	Check vehicle combination
Incorrect front axle/rear axle brake pressure setting	Check front axle/rear axle setting

SYMPTOM: IRREGULAR BRAKE PAD WEAR	
Possible cause	**Remedy**
Fouled/corroded guide sleeves	Check the guide sleeves
Dirt accumulation between moving parts of the disc brake construction	Clean the disc brake construction
Moisture and dirt on internal mechanical parts	Check and clean the brake calliper seals
Brake pad stuck in the brake calliper. Incorrect play between brake pads and brake carrier	Check the play between brake pads and brake carrier

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SYMPTOM: VEHICLE PULLS TO ONE SIDE DURING BRAKING	
Possible cause	**Remedy**
Difference in tyre pressure	Check/correct tyre pressure
Difference in tyre size	Check tyres
Different brake cylinder diameters	Check brake cylinder diameters
Broken springs in brake cylinders	Check brake cylinders
Leaking brake cylinders	Check brake cylinders
Fouled brake cylinders	Check brake cylinders for fouling
Excessive stub axle bearing play	Check stub axle bearing play
Excessive steering ball joint play	Check steering ball joint play
Excessive shackle pin play	Check shackle pin play
Incorrect vehicle combination	Check vehicle combination
Incorrect ABS operation	Check ABS operation
Brake pad stuck in the brake calliper. Incorrect play between brake pads and brake carrier	Check the play between brake pads and brake carrier

SYMPTOM: POOR BRAKING DECELERATION	
Possible cause	**Remedy**
Overload due to excessive loading	Check vehicle loading condition
System pressure too low	Check pressure regulator setting
Air leakage in the brake system	Check the brake system for leakage
Insufficient braking power/poor condition of trailer vehicle brake system	Check trailer vehicle
Pinched brake lines	Check/replace brake lines
Brake cylinder stroke too large	Check automatic brake adjuster
Frozen brake system	Check brake system
Brake components affected by road salt	Check brake components for fouling
Fouled brake cylinders	Check brake cylinders for fouling
Incorrect brake cylinder diameter	Check brake cylinders
Incorrect operation/setting of load sensing valve	Check operation/setting of load sensing valve
Incorrect vehicle combination	Check vehicle combination
Incorrect ABS operation	Check ABS operation
Brake pad stuck in the brake calliper. Incorrect play between brake pads and brake carrier	Check the play between brake pads and brake carrier

SYMPTOM: VIBRATIONS DURING BRAKING	
Possible cause	**Remedy**
Incorrect wheel tightening procedure	Tighten wheels according to tightening procedure
Non-standard wheels fitted	Fit only standard wheels
Overload due to excessive loading	Check vehicle loading condition
Incorrect front axle/rear axle brake pressure setting	Check front axle/rear axle setting
Wrong brake pad quality	Check brake pads
Dirt/deposits on brake disc	Check/clean brake disc
Loose parts	Check disc brake construction
Wear/damage to hub bearing	Check hub bearing play
Damage to disc brake	Check thickness and condition of brake disc
Play in cab suspension	Check cab suspension
Incorrect vehicle combination	Check vehicle combination

SYMPTOM: LOCKING OF THE BRAKES	
Possible cause	**Remedy**
Incorrect setting of load sensing valve	Check setting of load sensing valve
Thermal overload of non-locking axle brake pads	Check non-locking axle brake pads
Incorrect system pressure due to incorrect pressure regulator setting	Check pressure regulator setting
Defective trailer vehicle brake system	Check trailer vehicle brake system
Incorrect vehicle combination	Check vehicle combination
Incorrect ABS operation	Check ABS operation
Tyres have too little profile	Check profile
Brake pad stuck in the brake calliper. Incorrect play between brake pads and brake carrier	Check the play between brake pads and brake carrier

1

SYMPTOM: INCREASED BRAKE PAD WEAR	
Possible cause	**Remedy**
Overload due to excessive loading	Check vehicle loading condition
Incorrect setting of load sensing valve	Check setting of load sensing valve
Incorrect vehicle combination or front axle/rear axle combination	Check vehicle combination or front axle/rear axle combination
Defective trailer vehicle brake system	Check trailer vehicle brake system
Air pressure in spring brake cylinders too low during driving, dragging brakes	Check air pressure in spring brake cylinders with the parking brake valve in the driving position
Dragging brakes because parking brake is not released	Check release of parking brake
Dirt under foot brake valve/floor mat too high	Check for free movement of foot brake valve
Contaminated/blocked brake valve vents	Check valve vents
Brake pad stuck in the brake calliper. Incorrect play between brake pads and brake carrier	Check the play between brake pads and brake carrier
Incorrect setting of the trailer vehicle control valve/trailer vehicle reaction valve	Check setting of the trailer vehicle control valve/trailer vehicle reaction valve

SYMPTOM: DRAGGING BRAKES	
Possible cause	**Remedy**
Leaking foot brake valve to circuit 1 and/or 2	Check the foot brake valve for leaks
Dirt/deposits in brake calliper of disc brake	Check freedom of movement of brake calliper
Brake pads set too tightly	Check minimum brake pad play
Air pressure in spring brake cylinders too low during driving	Check output pressure of the double-check relay valve Check four-circuit safety valve for contamination Check output pressure of the parking brake valve in the driving position
Output supply pressure from trailer vehicle control valve to trailer/semi-trailer too low	Check output supply pressure of the trailer vehicle control valve
Dirt under foot brake valve/floor mat too high	Check for free movement of foot brake valve
Contaminated/blocked brake valve vents	Check valve vents
Brake pad stuck in the brake calliper. Incorrect play between brake pads and brake carrier	Check the play between brake pads and brake carrier

2. DRUM BRAKE CONSTRUCTION

2.1 FAULT-FINDING TABLE

SYMPTOM: SQUEALING OF THE BRAKES	
Possible cause	**Remedy**
Loose brake shoes	Check brake shoe attachment
Loose brake lining on brake shoe	Check brake lining/rivets
Incorrect turning of the brake linings, brake lining is incorrectly positioned against the brake drum	Check brake lining contact pattern
Incorrect quality of brake linings	Check brake linings
Brake drums not or unsatisfactorily reconditioned	Check brake drums
Different or no standard quality of brake drums	Check brake drums
Maximum brake drum reconditioning dimension exceeded	Check brake drums
Cracked brake drums	Check length and depth of the cracks in the brake drums
Loose brake camshaft bearing	Check brake camshaft bearing
Worn cam rollers/cam roller bearing	Check/replace cam rollers/cam roller bearing
Incorrect vehicle combination	Check vehicle combination
Incorrect front axle/rear axle brake pressure setting	Check front axle/rear axle setting

SYMPTOM: VEHICLE PULLS TO ONE SIDE DURING BRAKING	
Possible cause	**Remedy**
Worn brake lining/drum	Check brake lining/drum
Difference in tyre pressure	Check/correct tyre pressure
Difference in tyre size	Check tyres
Different quality of brake linings	Check brake linings
Incorrect turning of the brake linings, brake lining is incorrectly positioned against the brake drum	Check brake lining contact pattern
Different brake shoe return springs, too slack	Check brake shoe return springs
Brake linings affected by grease or oil	Check seals and/or cam rollers for excess grease or oil
Damaged brake lining surface	Check brake linings
Non-tapered brake linings	Check brake linings
Different brake cylinder diameters	Check brake cylinder diameters
Broken springs in brake cylinders	Check brake cylinders
Leaking brake cylinders	Check brake cylinders
Fouled brake cylinders	Check brake cylinders for fouling
Defective brake adjuster(s)	Check automatic brake adjuster
Incorrectly set brake adjuster travel	Check brake adjuster travel setting
Brake camshaft freedom of movement	Check brake camshaft freedom of movement
Excessive stub axle bearing play	Check stub axle bearing play
Excessive steering ball joint play	Check steering ball joint play
Excessive shackle pin play	Check shackle pin play
Incorrect vehicle combination	Check vehicle combination
Incorrect ABS operation	Check ABS operation

SYMPTOM: POOR BRAKING DECELERATION	
Possible cause	**Remedy**
Overload due to excessive loading	Check vehicle loading condition
System pressure too low	Check pressure regulator setting
Air leaks in the brake system	Check the brake system for leaks
Insufficient braking power/poor condition of trailer vehicle brake system	Check trailer vehicle
Pinched brake lines	Check/replace brake lines
Brake cylinder stroke too large	Check automatic brake adjuster
Frozen brake system	Check brake system
Brake components affected by road salt	Check brake components for fouling
Fouled brake cylinders	Check brake cylinders for fouling
Incorrect brake cylinder diameter	Check brake cylinders
Brake linings affected by grease or oil	Check seals and/or cam rollers for excess grease or oil
Incorrect turning of the brake linings, brake lining is incorrectly positioned against the brake drum	Check brake lining contact pattern
Damaged brake lining surface	Check brake linings
Poor quality of brake linings	Check brake linings
Glazed brake linings	Check brake linings
Damaged brake shoes	Check brake shoes
Seized brake shoe bearing	Check brake shoe bearing
Loose brake camshaft bearing	Check brake camshaft bearing
Worn cam rollers/cam roller bearing	Check cam rollers/cam roller bearing
Incorrect operation/setting of load sensing valve	Check operation/setting of load sensing valve
Incorrect vehicle combination	Check vehicle combination
Incorrect ABS operation	Check ABS operation

SYMPTOM: VIBRATIONS DURING BRAKING	
Possible cause	**Remedy**
Incorrect wheel tightening procedure	Tighten wheels according to tightening procedure
Non-standard wheels fitted	Fit only standard wheels
Overload due to excessive loading	Check vehicle loading condition
Incorrect front axle/rear axle brake pressure setting	Check front axle/rear axle setting
Incorrect quality of brake linings	Check brake linings
Incorrect turning of the brake linings Blunt tool used during turning	Check brake linings
Loose brake lining on brake shoe	Check brake lining/rivets
Loose brake shoes	Check brake shoe attachment
Brake drums not or unsatisfactorily reconditioned	Check brake drums
Different or poorer quality brake drums	Check brake drums
Cracked brake drums	Check length and depth of the cracks in the brake drums
Deformed/oval-shaped brake drums	Check brake drums
Hardened areas in the brake drum due to thermal overload	Check/replace brake drums
Play in cab suspension	Check cab suspension
Incorrect vehicle combination	Check vehicle combination

SYMPTOM: LOCKING OF THE BRAKES	
Possible cause	**Remedy**
Incorrect setting of load sensing valve	Check setting of load sensing valve
Thermal overload of non-locking axle brake linings	Check non-locking axle brake linings
Incorrect or non-reconditioned brake linings	Check brake linings
Blunt tool used during turning of the brake linings	Check brake linings
Different or poorer quality brake drums	Check brake drums
Hardened areas in the brake drum due to thermal overload	Check/replace brake drums
Loose brake camshaft bearing	Check brake camshaft bearing
Worn cam rollers/cam roller bearing	Check cam rollers/cam roller bearing
Incorrect system pressure due to incorrect pressure regulator setting	Check the pressure regulator setting
Defective trailer vehicle brake system	Check trailer vehicle brake system
Incorrect vehicle combination	Check vehicle combination
Incorrect ABS operation	Check ABS operation
Tyres have too little profile	Check profile

SYMPTOM: INCREASED BRAKE LINING WEAR	
Possible cause	**Remedy**
Overload due to excessive loading	Check vehicle loading condition
Incorrect foot brake valve stop bolt setting (residual pressure)	Check foot brake valve setting
Incorrect setting of load sensing valve	Check setting of load sensing valve
Incorrect vehicle combination or front axle/rear axle combination	Check vehicle combination or front axle/rear axle combination
Defective trailer vehicle brake system	Check trailer vehicle brake system
Highly contaminated brakes, seized brake shoe pivot points	Check brake shoe freedom of movement, clean brakes
Different/incorrect quality of brake linings	Check brake linings
Return spring too slack or broken	Check return spring
Defective brake adjuster	Check automatic brake adjuster
Cracked brake drums	Check length and depth of the cracks in the brake drums
Air pressure in spring brake cylinders too low during driving, dragging brakes	Check air pressure in spring brake cylinders with the parking brake valve in the driving position
Dragging brakes because parking brake is not released	Check release of parking brake
Dirt under foot brake valve/floor mat too high	Check for free movement of foot brake valve
Contaminated/blocked brake valve vents	Check valve vents

SYMPTOM: DAMAGED BRAKE DRUMS	
Possible cause	**Remedy**
Overload due to too large brake load	Check vehicle load situation and vehicle use
Poorer quality of brake drums	Check quality/make of brake drums
Incorrect wheel tightening procedure	Tighten wheels according to tightening procedure
Highly contaminated brakes	Clean brakes
Incorrect quality of brake linings	Replace brake linings
Incorrect turning of the brake linings, brake lining is incorrectly positioned against the brake drum	Check brake linings
Loose brake camshaft bearing	Check brake camshaft bearing
Brake drums reconditioned more than maximum permitted diameter	Replace brake drums
Incorrect operation of double-check function in the brake system	Check brake system double-check function

SYMPTOM: DAMAGED BRAKE LININGS	
Possible cause	**Remedy**
Overload due to too large brake load	Check vehicle load situation and vehicle use
Highly contaminated brakes	Clean brakes
Poor quality of brake linings	Check quality/make of brake linings
Frozen or rusted brakes released by using force	Replace brake linings
Incorrect turning of the brake linings Blunt tool used during turning	Check/replace brake linings
Rivet pressure too high during installation of brake linings on brake shoes	Apply correct rivet pressure during installation of brake linings on brake shoes
Rivet pressure too low during installation of brake linings on brake shoes Loose brake lining on brake shoe	Apply correct rivet pressure during installation of brake linings on brake shoes
Incorrect sequence when applying rivets during installation of brake linings on brake shoes	Follow correct sequence when installing the brake lining
Deformed and/or damaged brake shoes	Check/replace brake shoes
Damaged lining due to broken return spring	Check return spring

SYMPTOM: DRAGGING BRAKES	
Possible cause	**Remedy**
Incorrect foot brake valve stop bolt setting (residual pressure)	Set stop bolt
Leaking foot brake valve to circuit 1 and/or 2	Check the foot brake valve for leaks
Air pressure in spring brake cylinders too low during driving	- Check output pressure of the double-check relay valve - Check four-circuit safety valve for contamination - Check output pressure of the parking brake valve in the driving position
Highly contaminated brakes, seized brake shoe pivot points	Check brake shoe freedom of movement, clean brakes
Broken or too slack return springs between the brake shoes.	Check return spring
Incorrect type of brake lining	Check type and size of brake lining
Brake camshaft freedom of movement	Check brake camshaft freedom of movement
Defective brake adjuster	Check automatic brake adjuster
Output supply pressure from trailer vehicle control valve to trailer/semi-trailer too low	Check output supply pressure of the trailer vehicle control valve
Dirt under foot brake valve/floor mat too high	Check for free movement of foot brake valve
Contaminated/blocked brake valve vents	Check valve vents

CONTENTS

2

1. GENERAL

1.1 BRAKE DIAGRAMS

Due to the large number of variants for each vehicle type and for each country, it is impractical to list all these variants.

A selection is therefore shown which can form the basis for other variants.

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2. BRAKE DIAGRAMS FOR FULLY PNEUMATIC BRAKE SYSTEM

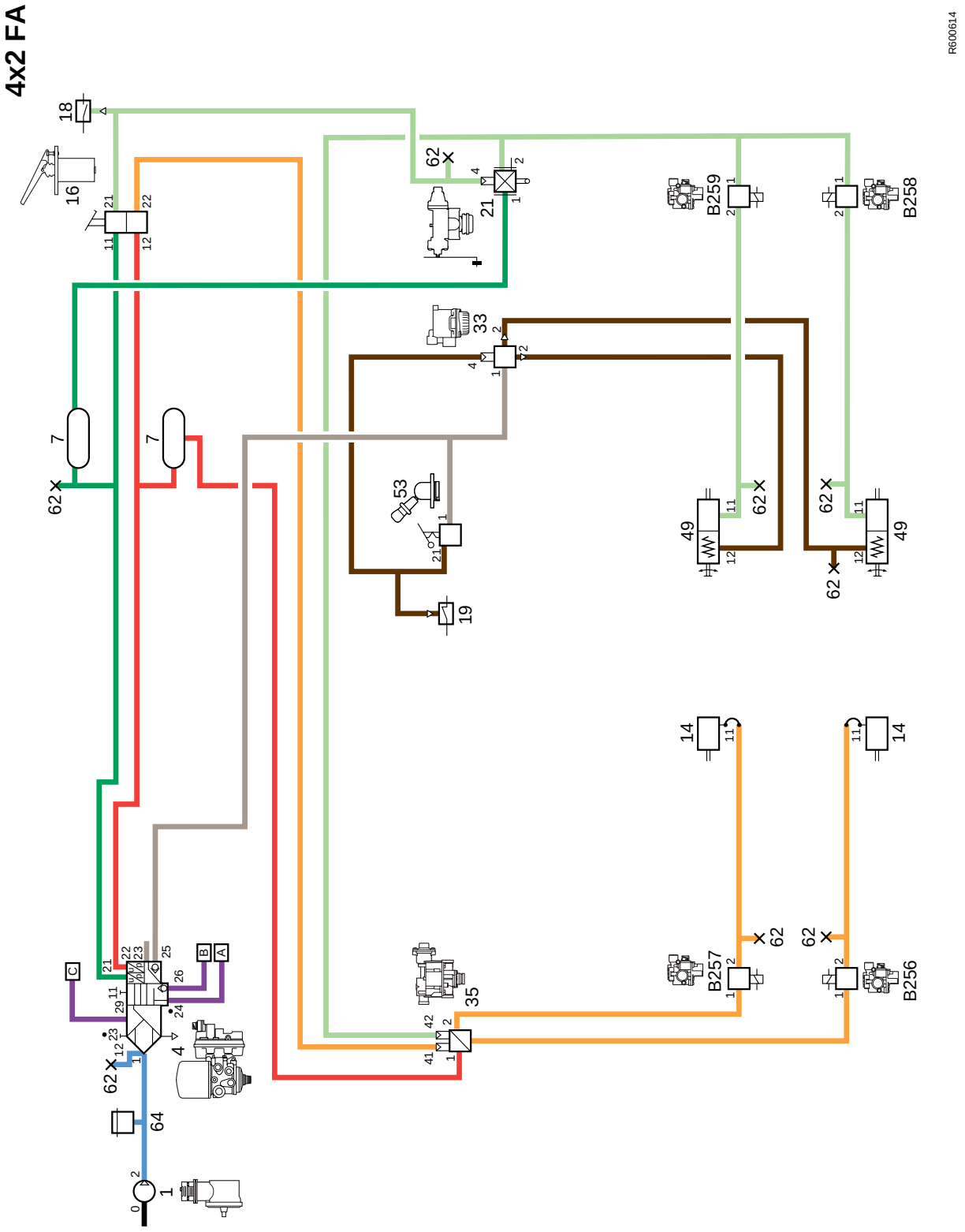
2.1 LEGEND, BRAKE DIAGRAMS FOR THE FULLY PNEUMATIC BRAKE SYSTEM

Component no.	Description
1	Compressor
2	Pressure relief valve (with full reverse flow)
4	Air supply unit A = connection + reservoir, auxiliary consumers B = connection, ECAS, rear axle + AS Tronic C = connection, ECAS, front axle
5	Non-return valve
7	Air reservoir
10	Two-way valve (switch to lowest pressure)
11	Two-way valve (switch to highest pressure)
12	Coupling head
14	Brake cylinder
15	Independent trailer vehicle brake
16	Foot brake valve
18	Brake light switch
19	Parking brake low-pressure switch
21	Load sensing valve, leaf suspension
22	Load sensing valve, air suspension
33	Relay valve
35	Empty/load relay valve
46	Trailer vehicle control valve
49	Spring brake cylinder
52	Parking brake valve with trailer steering
53	Parking brake valve without trailer steering
62	Emergency filler/test/tyre pump connection
64	Safety valve
B256	ABS valve, front axle, left
B257	ABS valve, front axle, right
B258	ABS valve, rear axle, left
B259	ABS valve, rear axle, right
B237	ASR valve

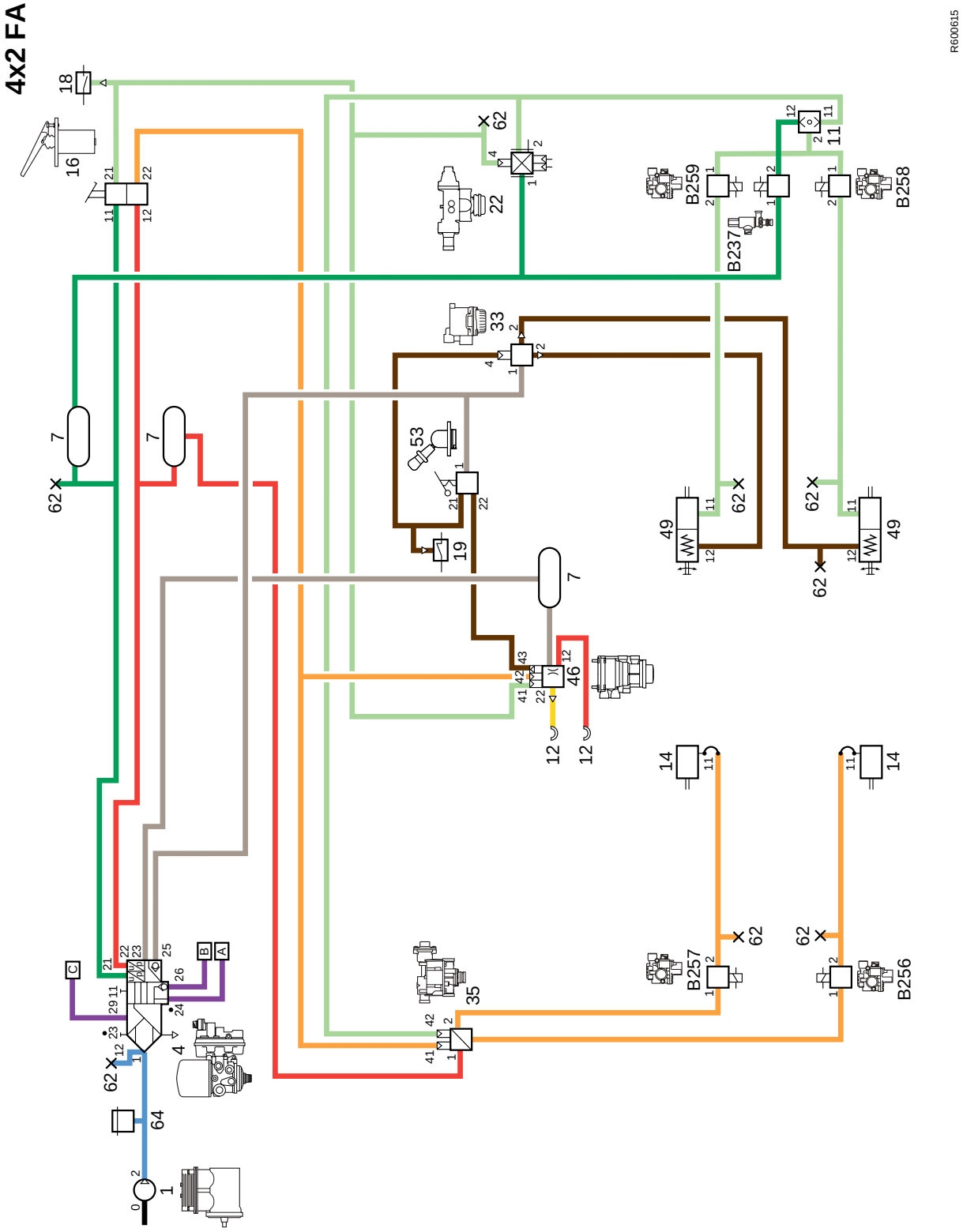
2.2 BRAKE DIAGRAMS FOR FULLY PNEUMATIC BRAKE SYSTEM

Brake diagram no.	Vehicle configuration
R600614	4x2 vehicle, FA configuration - Without trailer connection - With disc brakes on the rear axle - With leaf-sprung rear axle - With ABS, without ASR
R600615	4x2 vehicle, FA configuration - With trailer connection - With disc brakes on the rear axle - With air-sprung rear axle - With ABS/ASR
R600616	6x4 vehicle, FTT configuration - With trailer connection - With drum brakes on the rear axle - With leaf-sprung rear axle - With ABS, without ASR - Situation with spring brake cylinder on front axle
R600768	8x2 vehicle, FAC/FAX configuration - With trailer connection - With disc brakes on the rear axle - With air-sprung rear axle - With ABS/ASR - Situation with spring brake cylinder on front axle
R600618	8x2 vehicle, FAC/FAX configuration - Without trailer connection - With drum brakes on the rear axle - With leaf-sprung rear axle - With ABS, without ASR - Situation with spring brake cylinder on front axle
R600619	8x4 vehicle, FAD configuration - Without trailer connection - With drum brakes on the rear axle - With leaf-sprung rear axle - With ABS, without ASR - Situation with spring brake cylinder on front axle
R600769	6x4 vehicle, FTT configuration - With trailer connection - With drum brakes on the rear axle - With leaf-sprung rear axle - With ABS, with ASR - Situation with spring brake cylinder on front axle
R600770	8x4 vehicle, FAD configuration - With trailer connection - With drum brakes on the rear axle - With leaf-sprung rear axle - With ABS, with ASR - Situation with spring brake cylinder on front axle - With leaf-sprung rear axle - With ABS, with ASR - Situation with spring brake cylinder on front axle

BRAKE DIAGRAM R600614



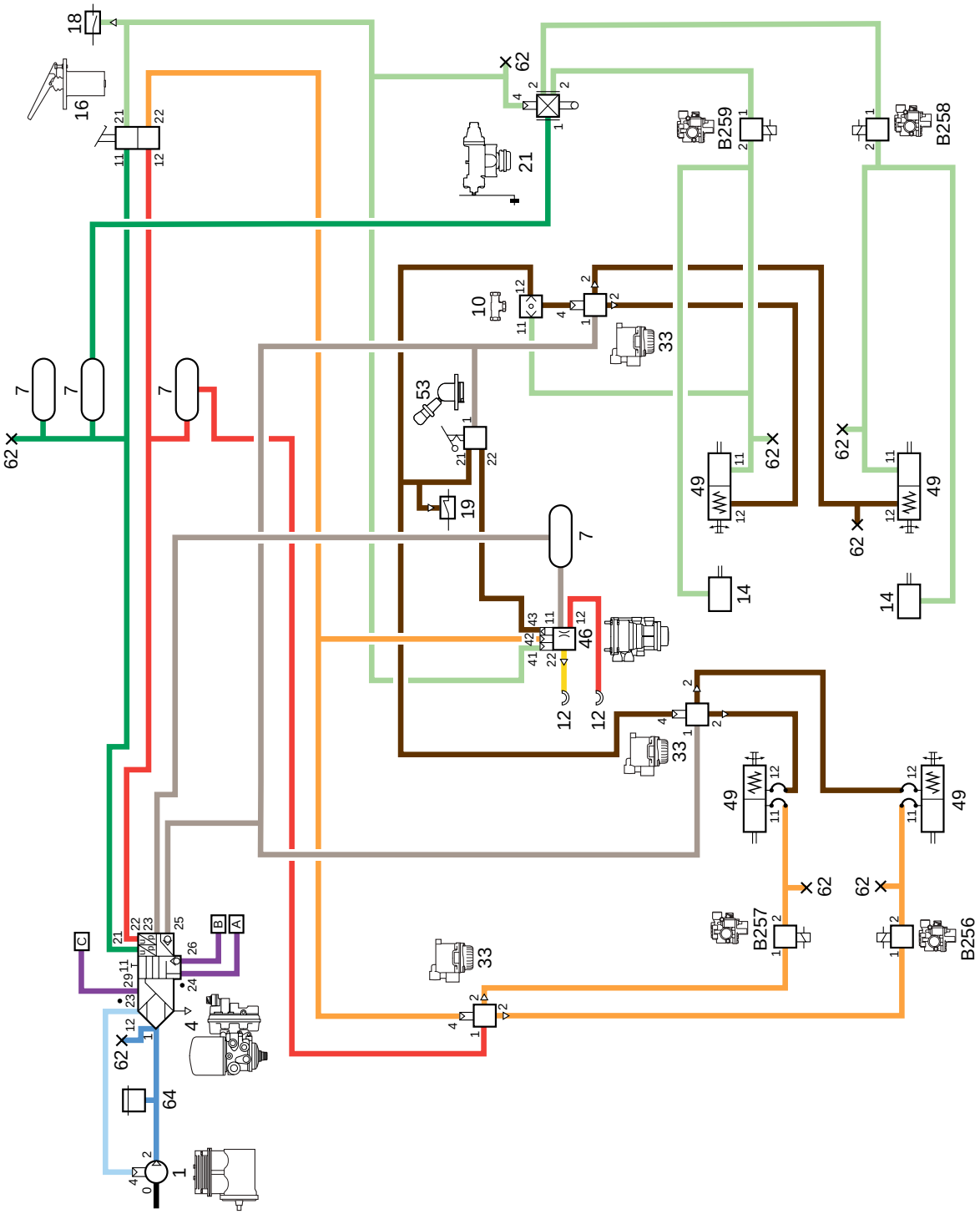
BRAKE DIAGRAM R600615



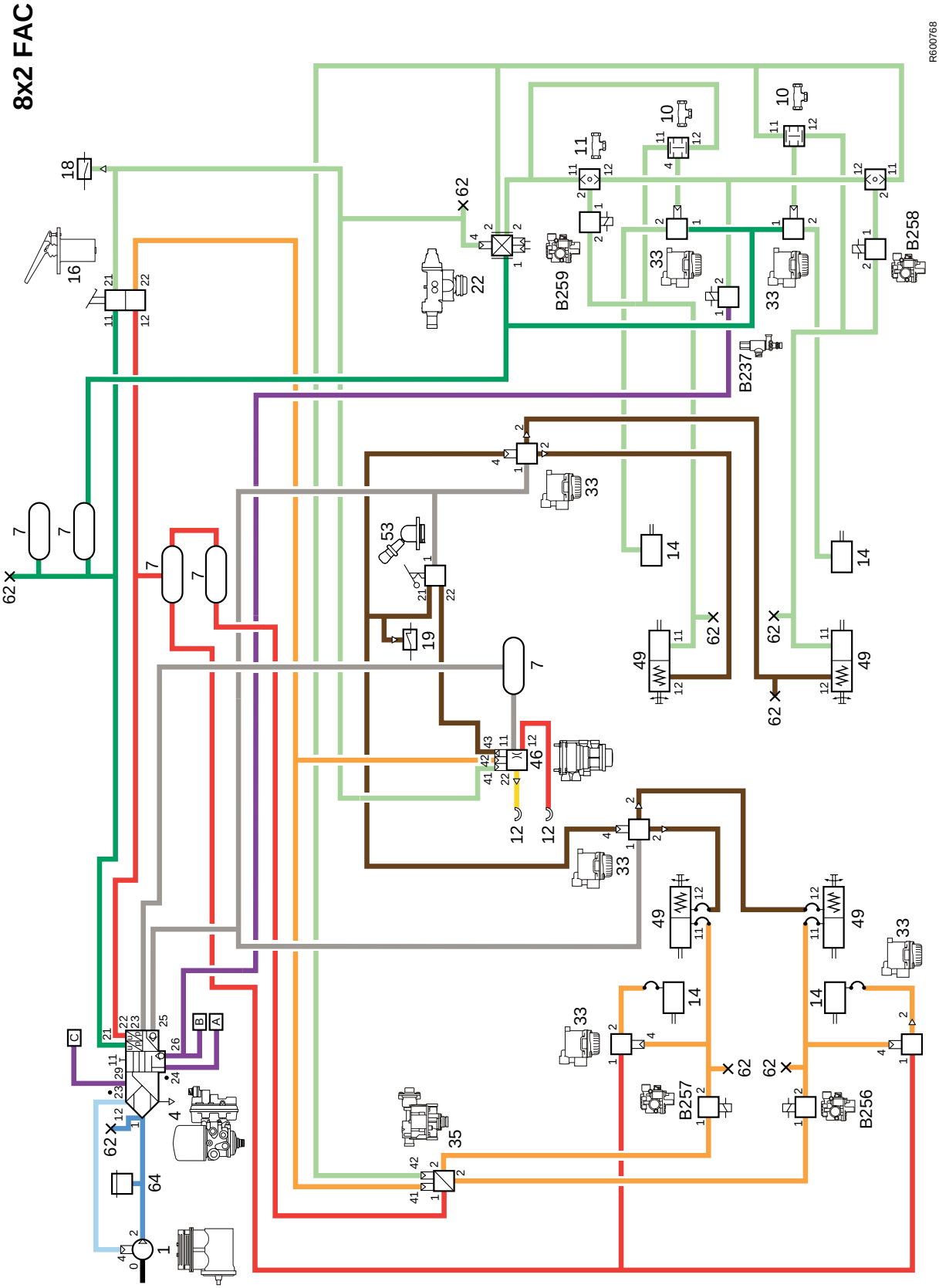
BRAKE DIAGRAM R600616

6x4 FTT

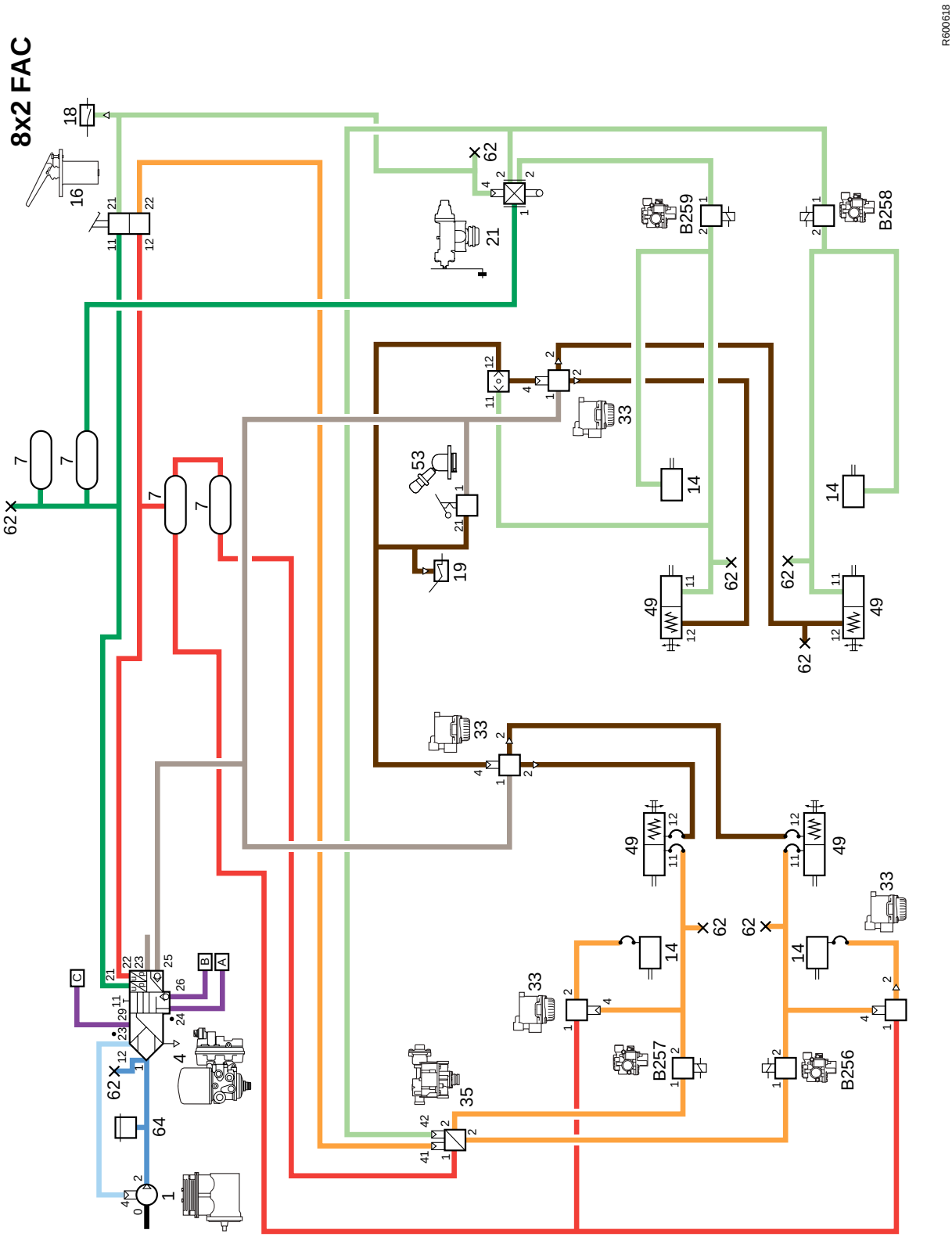
R600616



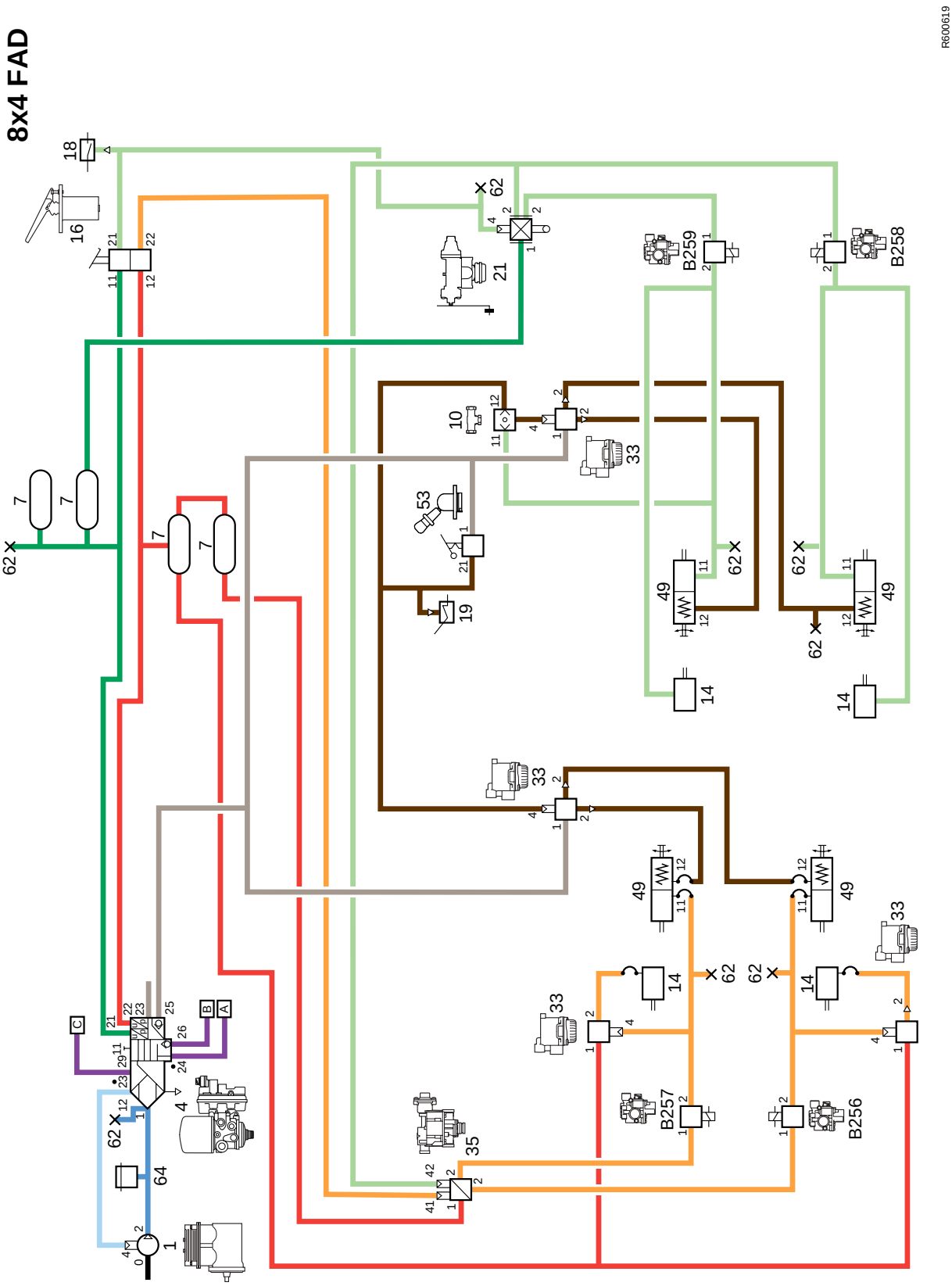
BRAKE DIAGRAM R600768



BRAKE DIAGRAM R600618



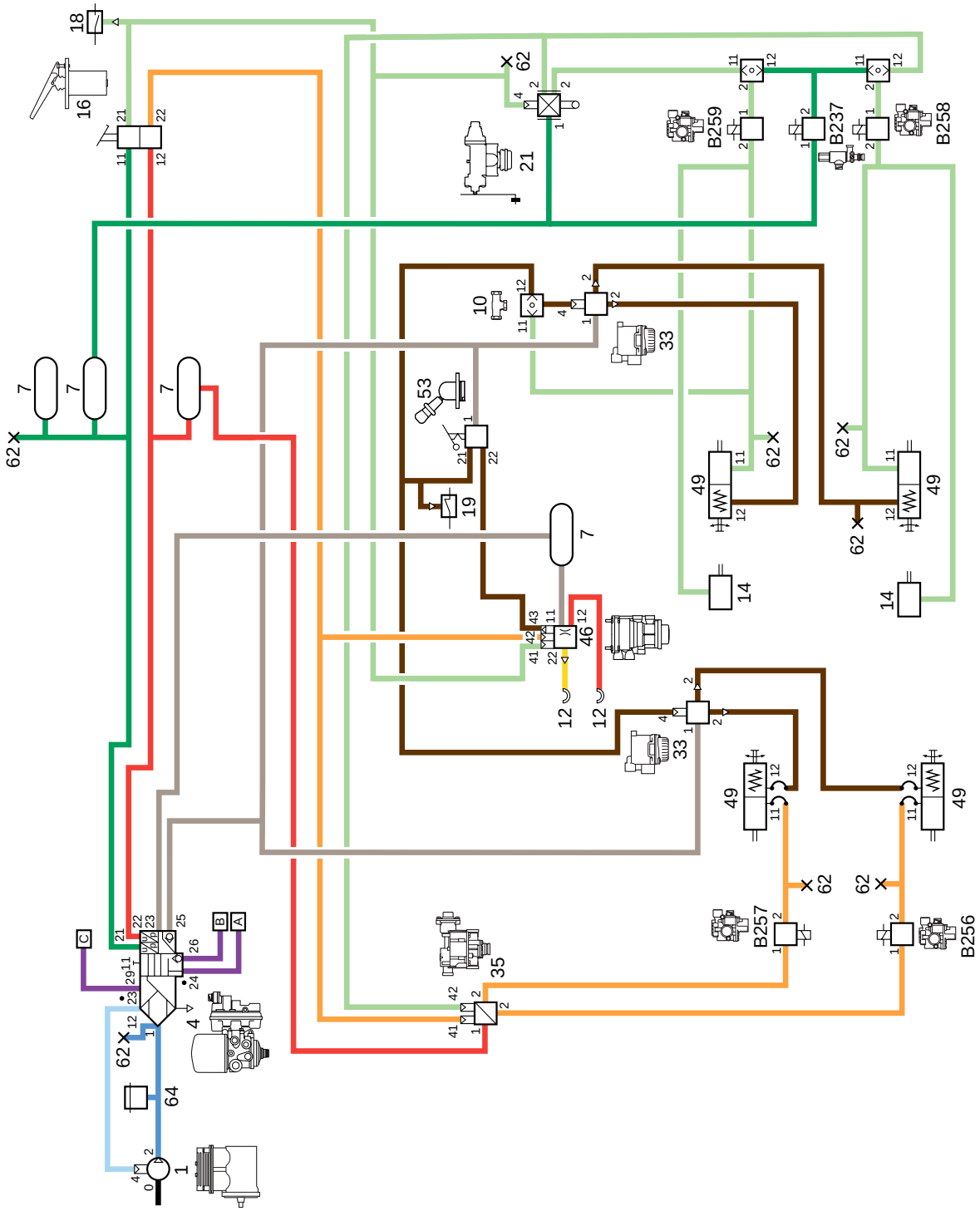
BRAKE DIAGRAM R600619



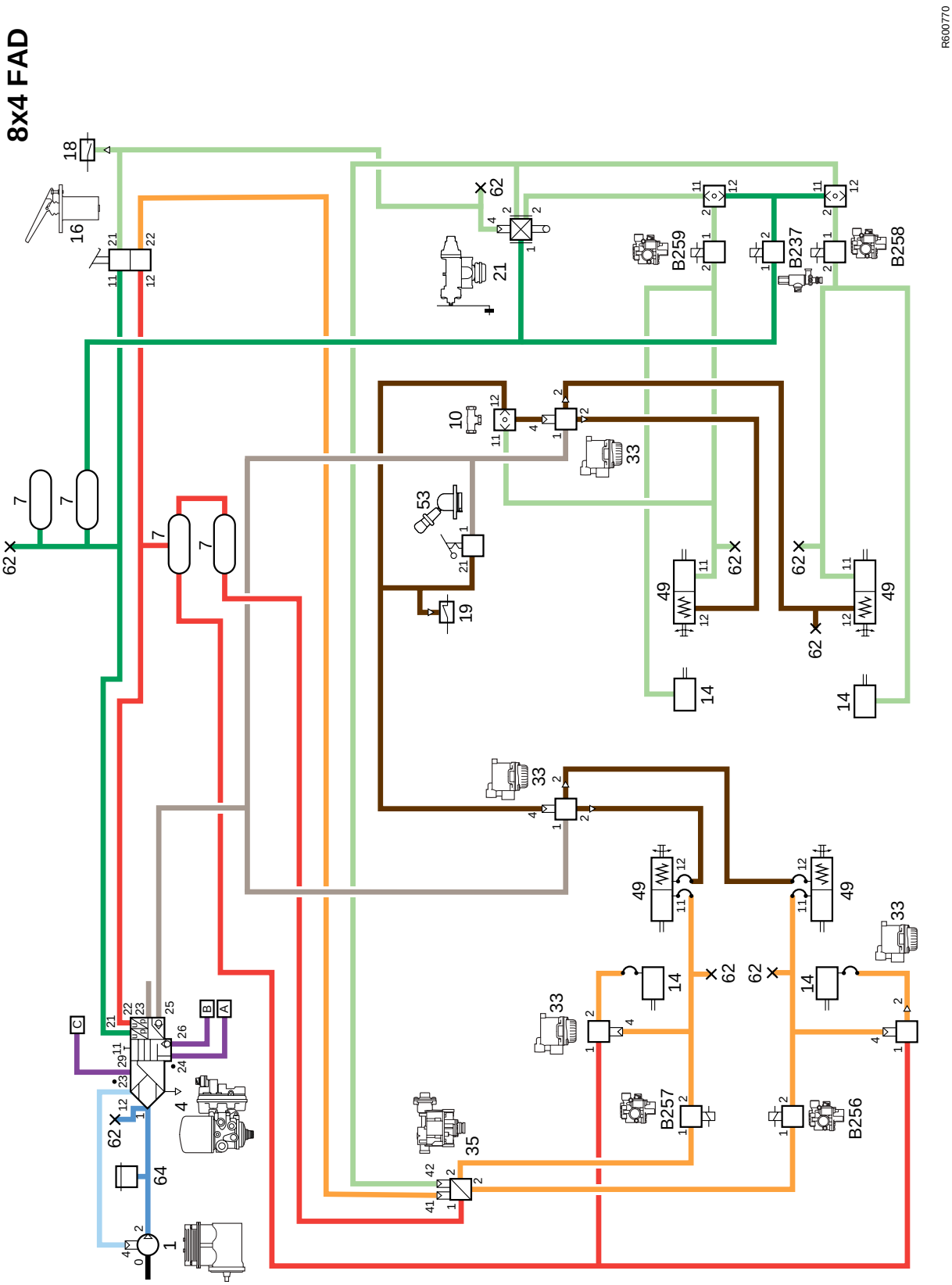
BRAKE DIAGRAM R600769

6x4 FTT

R600769



BRAKE DIAGRAM R600770



CONTENTS

3

1. GENERAL

1.1 BRAKE DIAGRAMS

Due to the large number of variants for each vehicle type and for each country, it is impractical to list all these variants.

Thus a selection has been shown which can form the basis for other variants.

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2. EBS BRAKE SYSTEM BRAKE DIAGRAMS

2.1 LEGEND, EBS BRAKE SYSTEM BRAKE DIAGRAMS

Component no.	Description
1	Compressor
2	Pressure relief valve (with full flow-back)
4	Air supply unit A = connection point + reservoir, auxiliary consumers B = connection, ECAS, rear axle + AS Tronic C = connection, ECAS, front axle
5	Non-return valve
7	Air reservoir
10	Two-way valve (switch to lowest pressure)
11	Two-way valve (switch to highest pressure)
12	Coupling head
14	Brake cylinder
15	Independent trailer brake
18	Brake light switch
19	Parking brake low-pressure switch
33	Relay valve
49	Spring brake cylinder
52	Parking brake valve with trailer control
53	Parking brake valve without trailer control
62	Emergency filler/test/tyre pump connection
64	Safety valve
B256	ABS valve, left front axle
B257	ABS valve, right front axle
B306	Redundancy valve
B307	Front axle modulator
B308	Trailer control valve
B309	ASR cut-off valve
D879	Rear axle modulator
F628	Foot brake valve

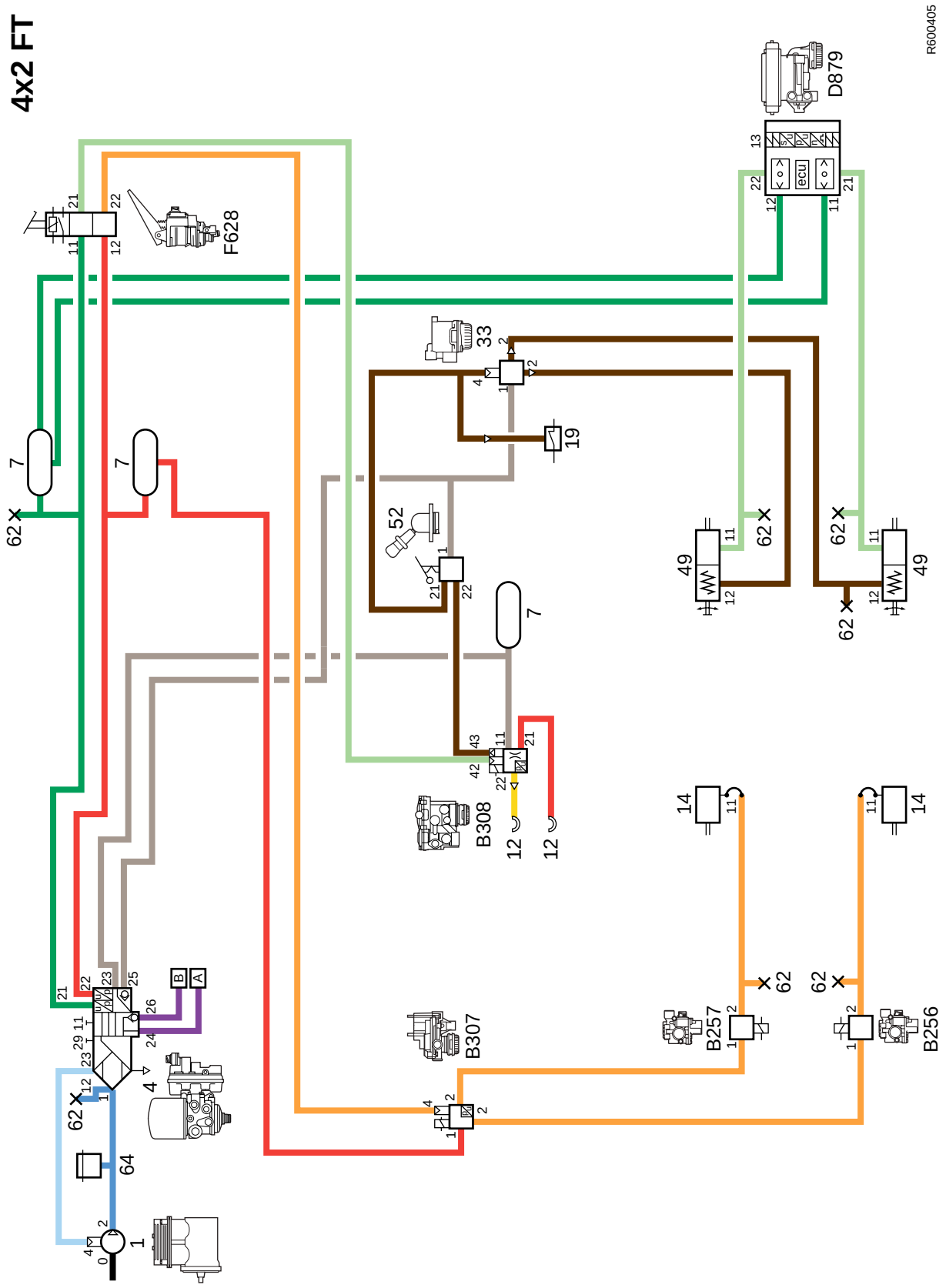
Note:
- Two-way valve (10) only fitted on 6x2 vehicles with ASR.
- Two-way valve (11) only fitted on vehicles with brake drums on the rear axle.
- Redundancy valve (B306) not fitted on 4x2 vehicles, FT version.
- ASR cut-off valve (B309) only fitted on 6x2 vehicles with ASR.

2.2 EBS BRAKE SYSTEM BRAKE DIAGRAMS

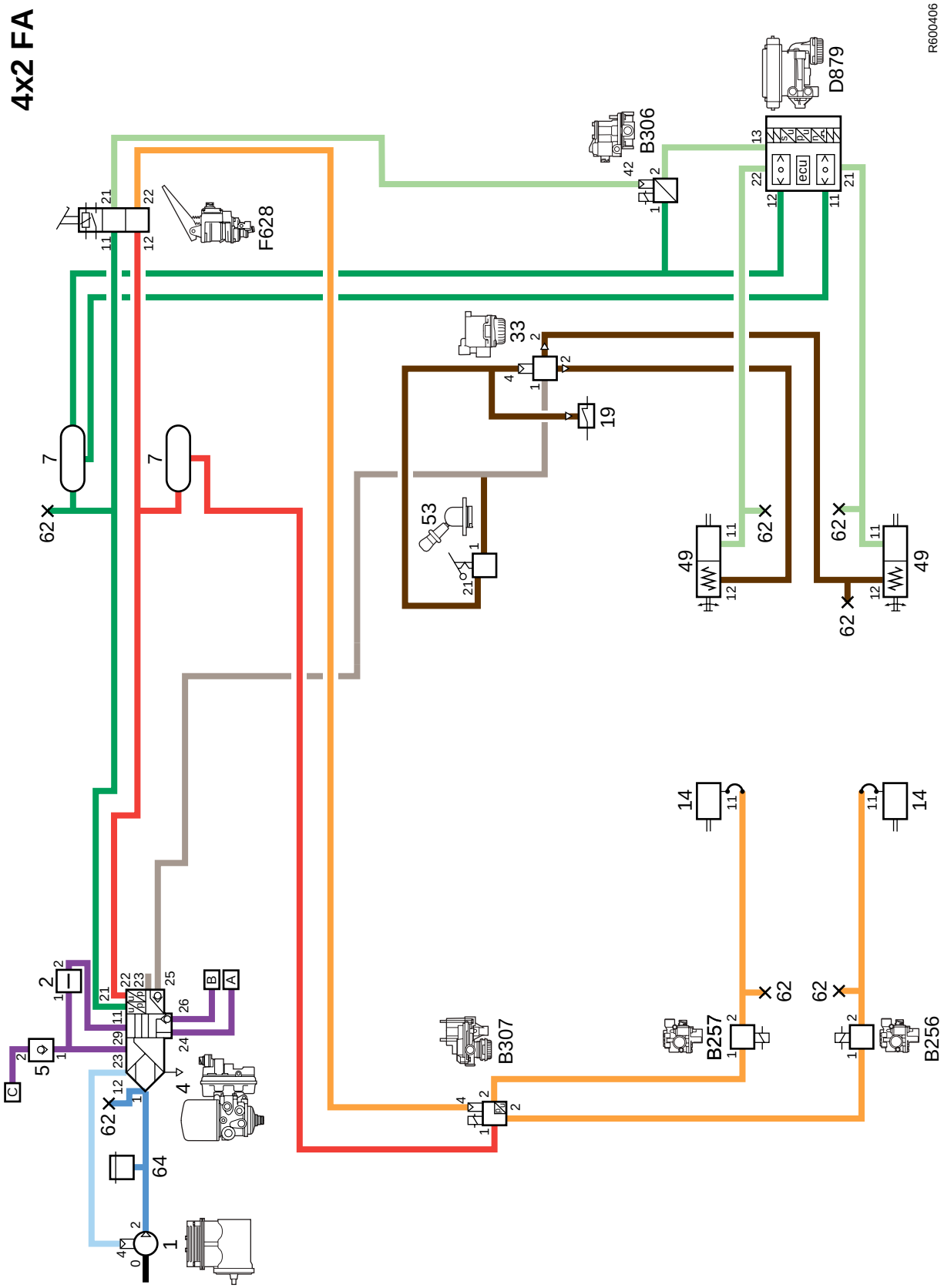
Brake diagram no.	Vehicle version
R600405	4x2 vehicle, FT version: - With trailer connection - With disc brakes on the rear axle
R600406	4x2 vehicle, FA version: - Without trailer connection - With disc brakes on the rear axle - With air-sprung front axle
R600407	4x2 vehicle, FA version: - With trailer connection - With drum brakes on the rear axle
R600408	6x2 vehicle, FT(.) /FA(.) version: - With trailer connection - With disc brakes on the rear axle - With ASR
R600409	6x2 vehicle, FT(.) /FA(.) version: - With trailer connection - With disc brakes on the rear axle - Without ASR
R600410	6x2 vehicle, FT(.) /FA(.) version: - With trailer connection - With drum brakes on the rear axle - With ASR
R600684	6x2 vehicle, FT(.) /FA(.) version: - With trailer connection - With disc brakes on the rear axle - Without ASR - Situation with spring brake cylinder on front axle
R600685	6x2 vehicle, FTP/FAR version with axle load ratio 11.5/6.7: - With trailer connection - With disc brakes on the rear axle - Without ASR
R600686	6x2 vehicle, FTP/FAR version with axle load ratio 11.5/6.7: - With trailer connection - With disc brakes on the rear axle - With ASR
R600757	4x2 vehicle, FT version - With trailer connection - With disc brakes on the rear axle - With independent trailer brake

3

Brake diagram R600405



Brake diagram R600406



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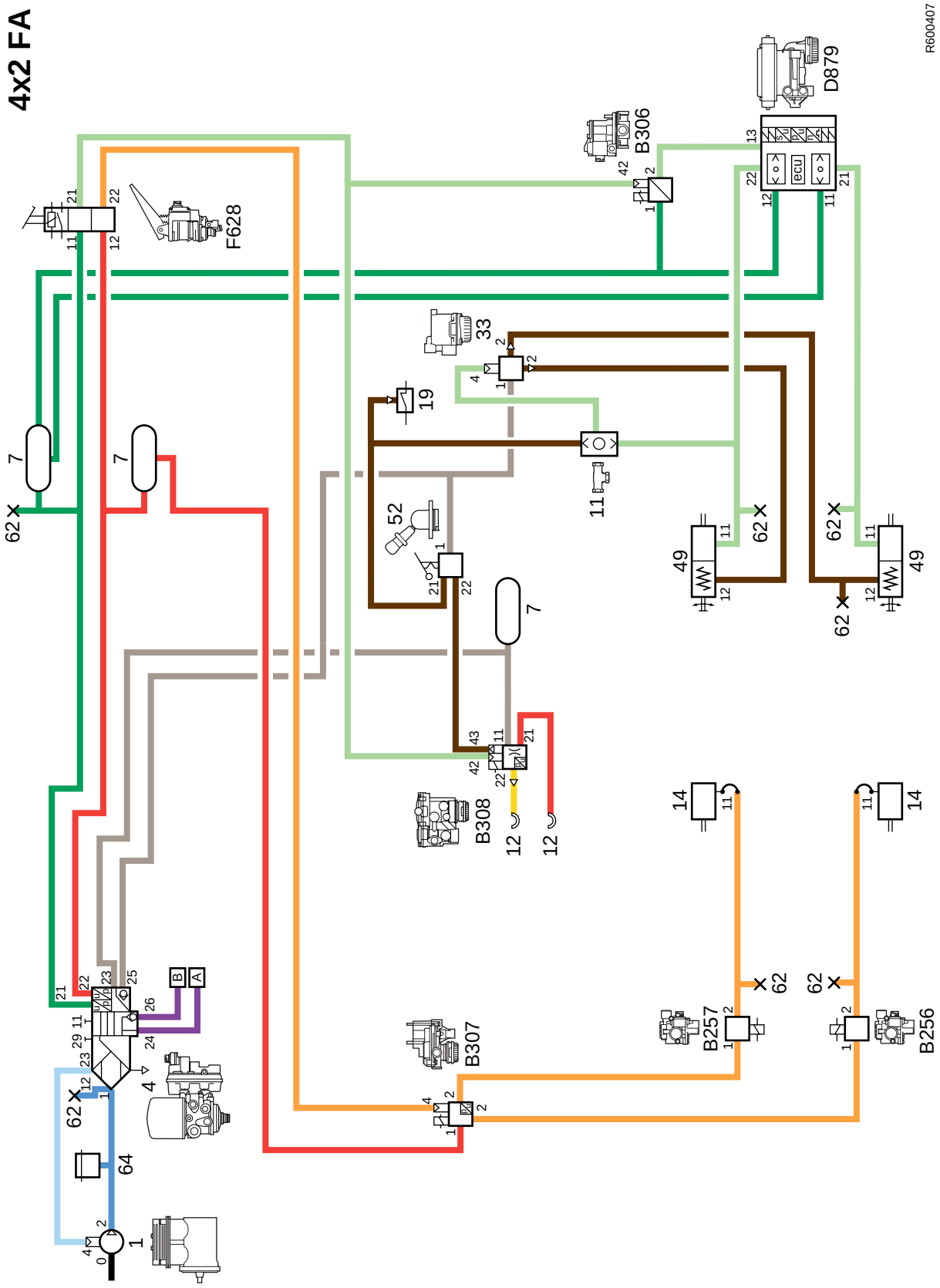
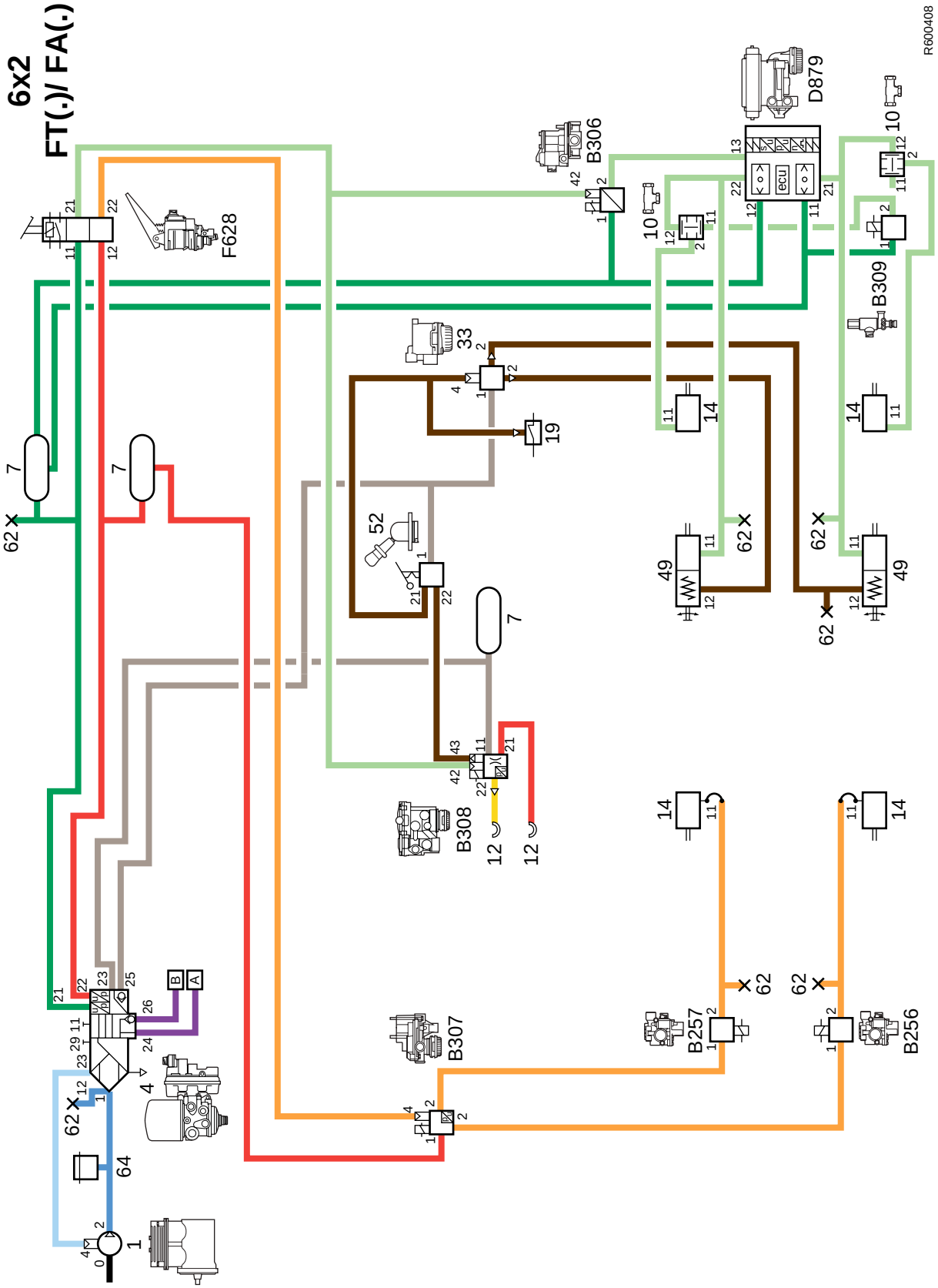
Brake diagram R600407



Brake diagram R600408



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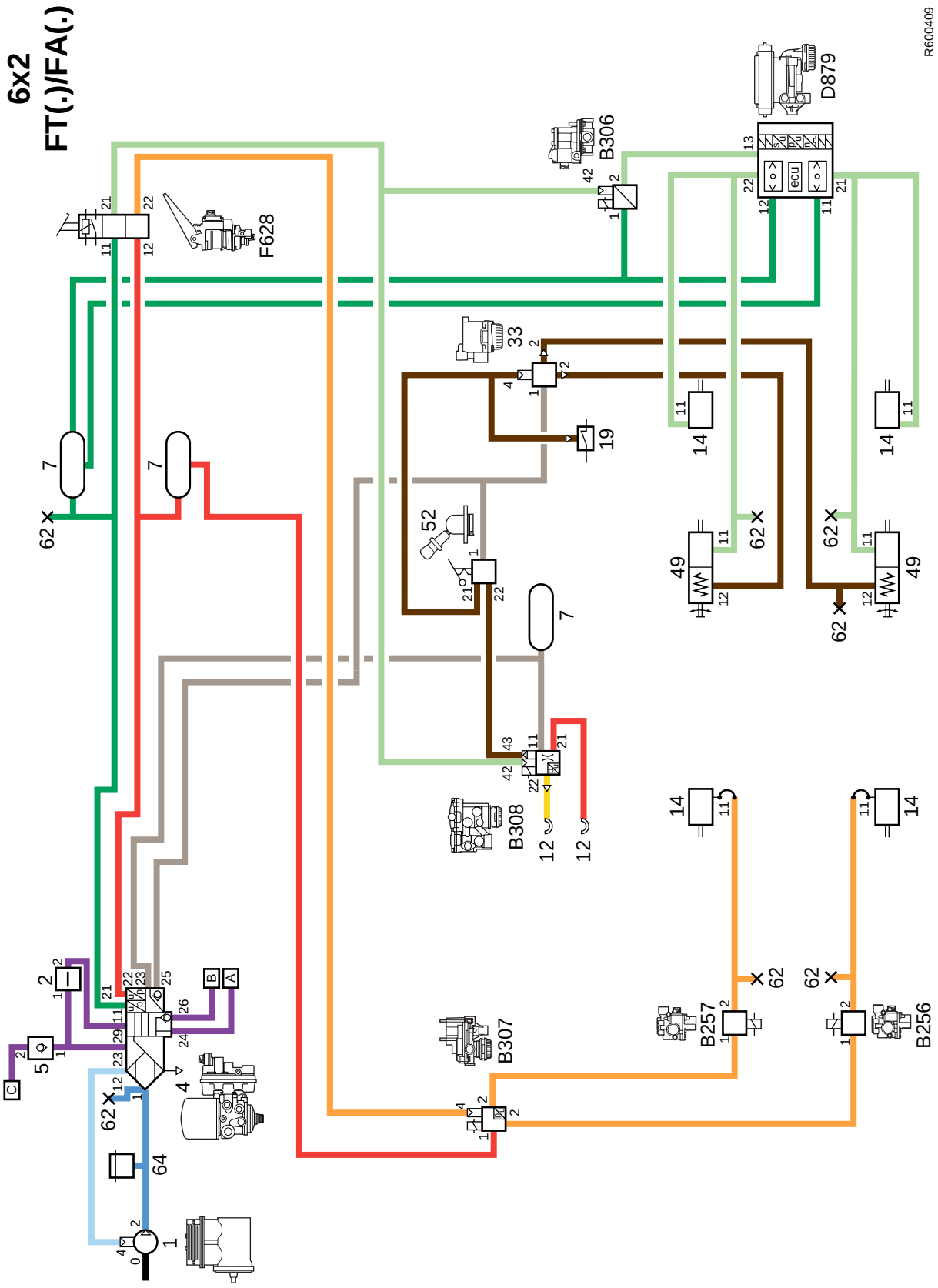
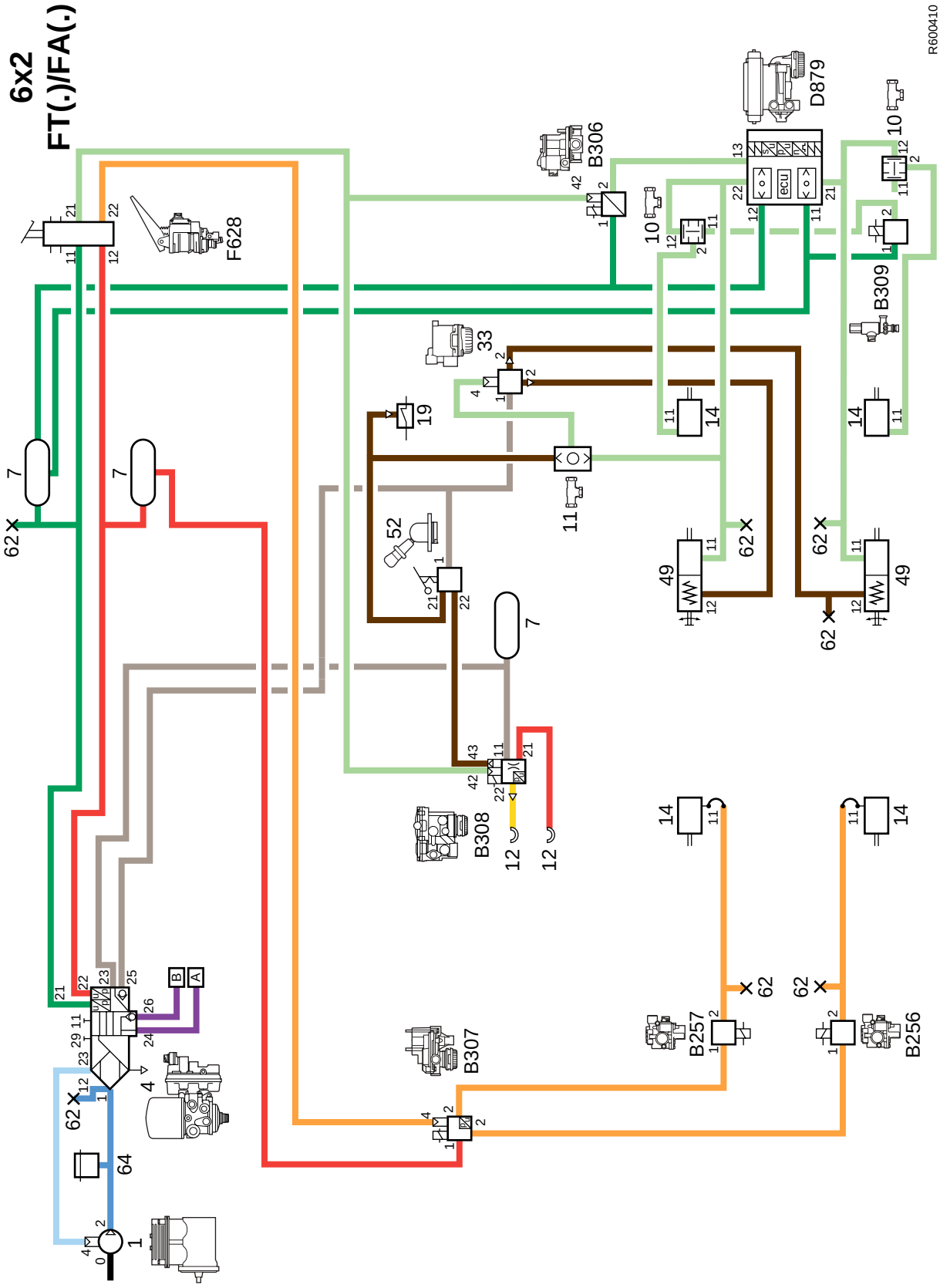
Brake diagram R600409



Brake diagram R600410



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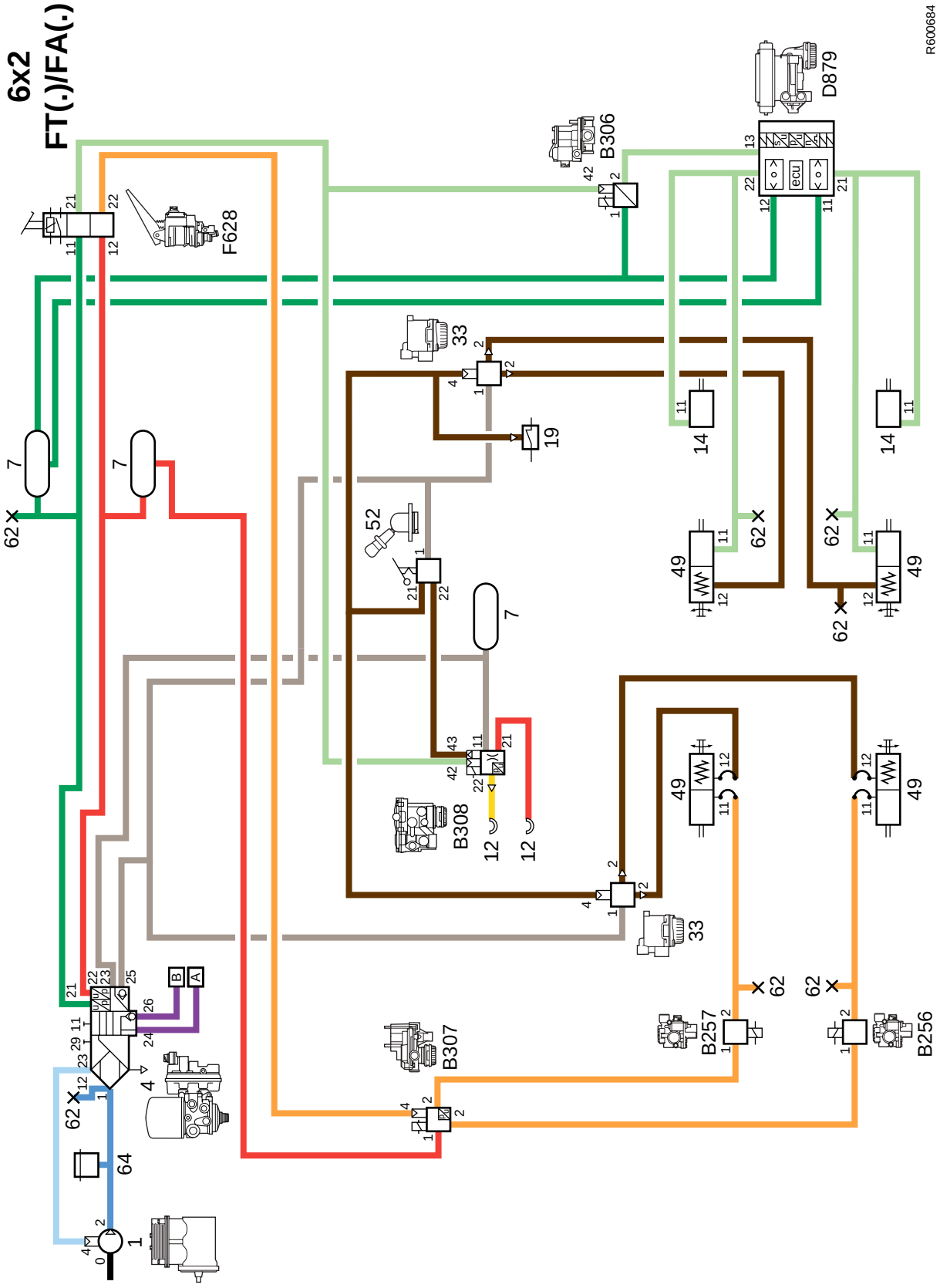
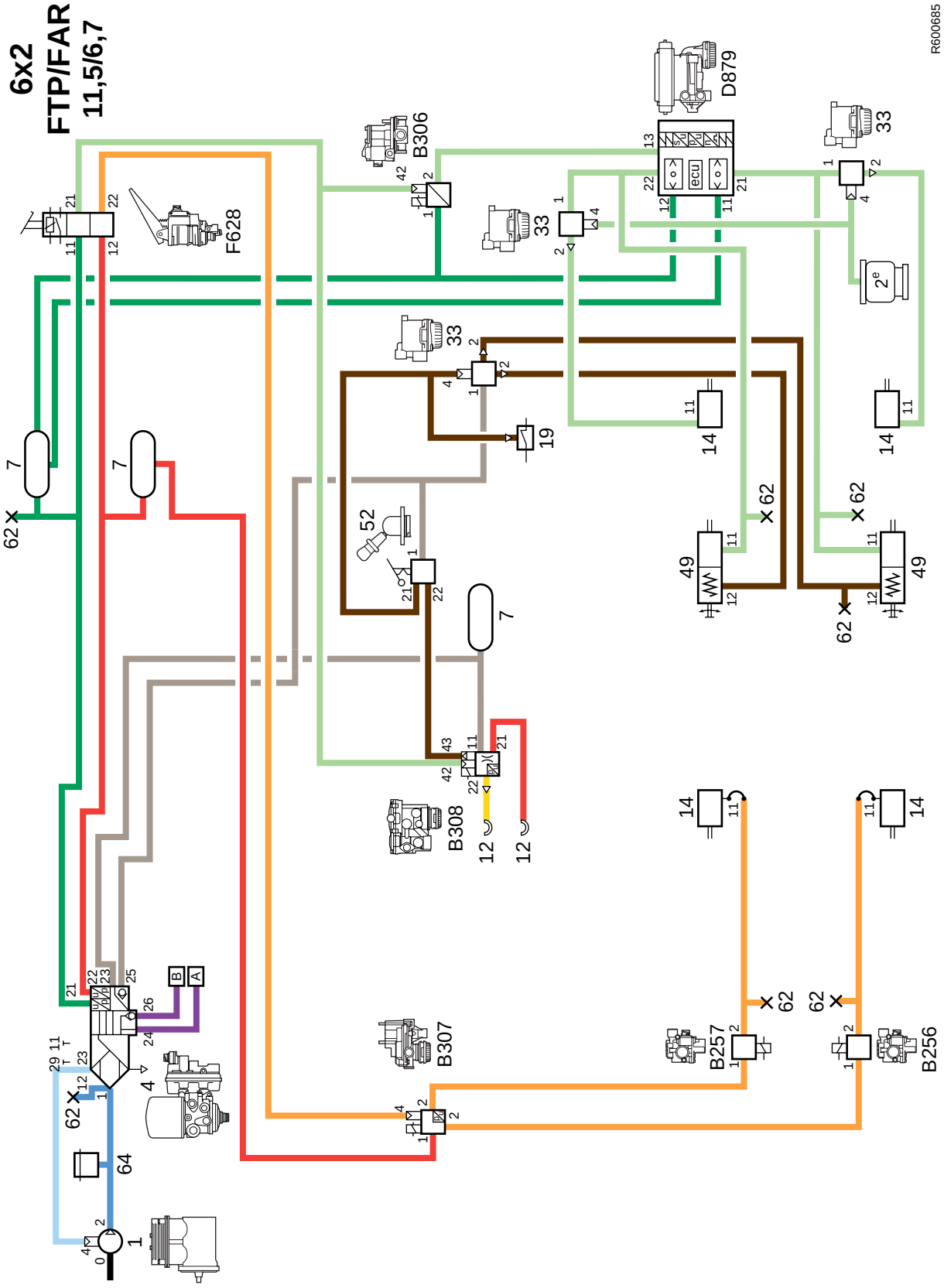
Brake diagram R600684



Brake diagram R600685



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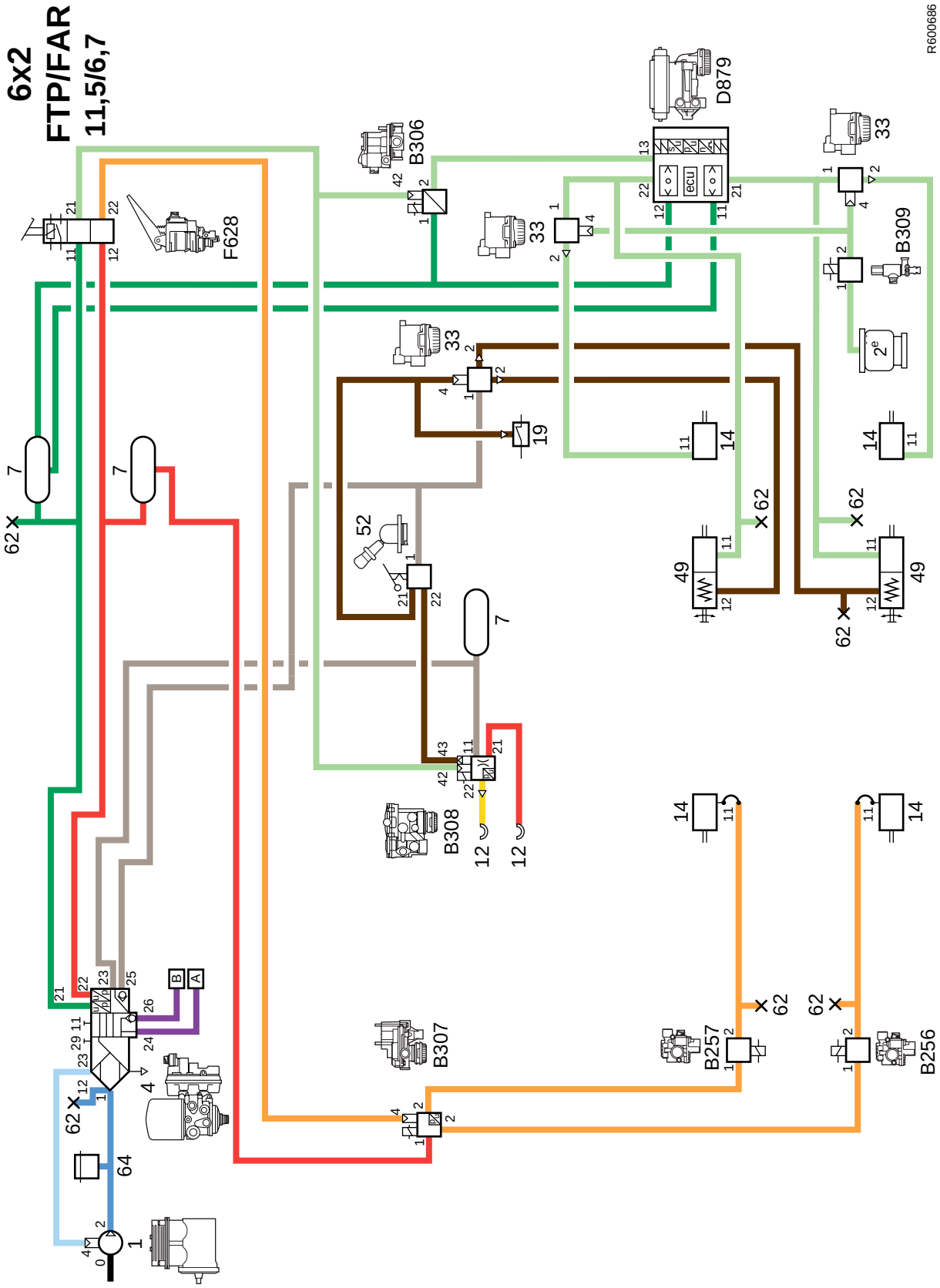
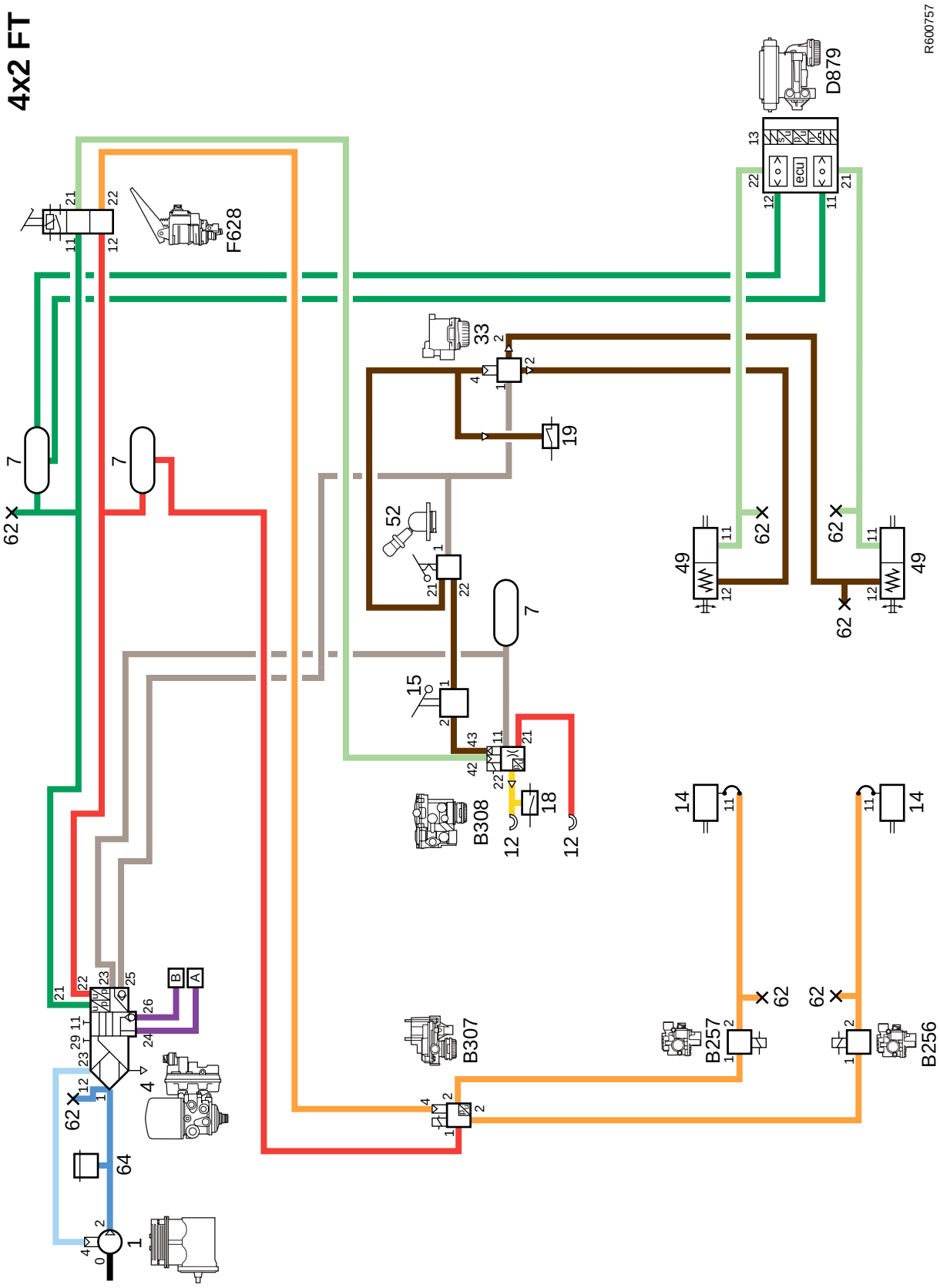
Brake diagram R600686



Brake diagram R600757



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3. EBS-2 BRAKE SYSTEM BRAKE DIAGRAMS

3.1 LEGEND, EBS BRAKE SYSTEM BRAKE DIAGRAMS

Component no.	Description
1	Compressor
2	Pressure relief valve (with full flow-back)
4	Air supply unit A = connection point + reservoir, auxiliary consumers B = connection, ECAS, rear axle + AS Tronic C = connection, ECAS, front axle
5	Non-return valve
7	Air reservoir
10	Two-way valve (switch to lowest pressure)
11	Two-way valve (switch to highest pressure)
12	Coupling head
14	Brake cylinder
15	Independent trailer brake
18	Brake light switch
19	Parking brake low-pressure switch
33	Relay valve
49	Spring brake cylinder
52	Parking brake valve with trailer control
53	Parking brake valve without trailer control
62	Emergency filler/test/tyre pump connection
64	Safety valve
B256	ABS valve, left front axle
B257	ABS valve, right front axle
B306	Redundancy valve
B307	Front axle modulator
B308	Trailer control valve
B309	ASR cut-off valve
D978	Rear axle modulator
F628	Foot brake valve

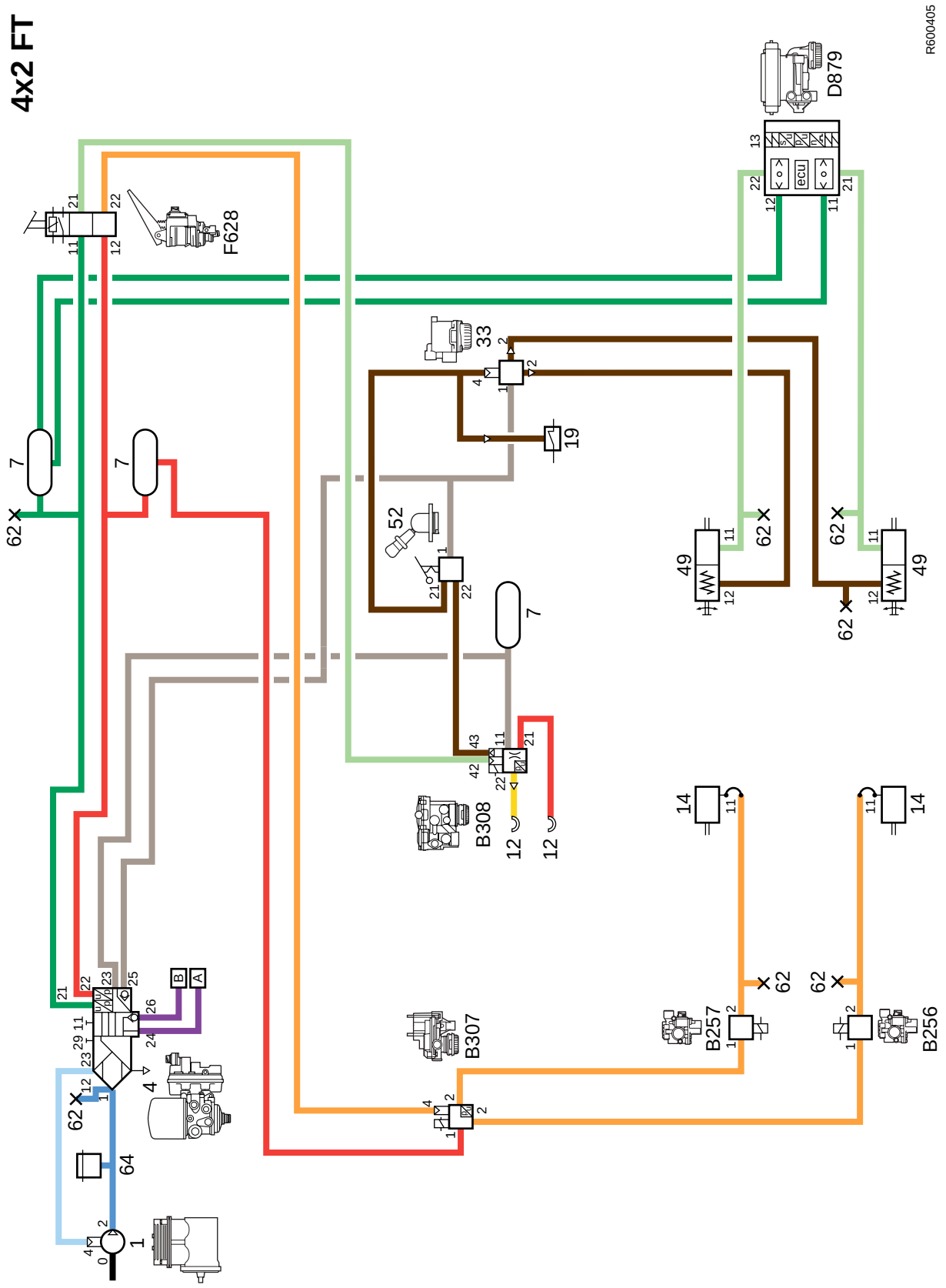
Note:
- Two-way valve (10) only fitted on 6x2 vehicles with ASR.
- Two-way valve (11) only fitted on vehicles with brake drums on the rear axle.
- Redundancy valve (B306) not fitted on 4x2 vehicles, FT version.
- ASR cut-off valve (B309) only fitted on 6x2 vehicles with ASR.

3.2 EBS-2 BRAKE SYSTEM BRAKE DIAGRAMS

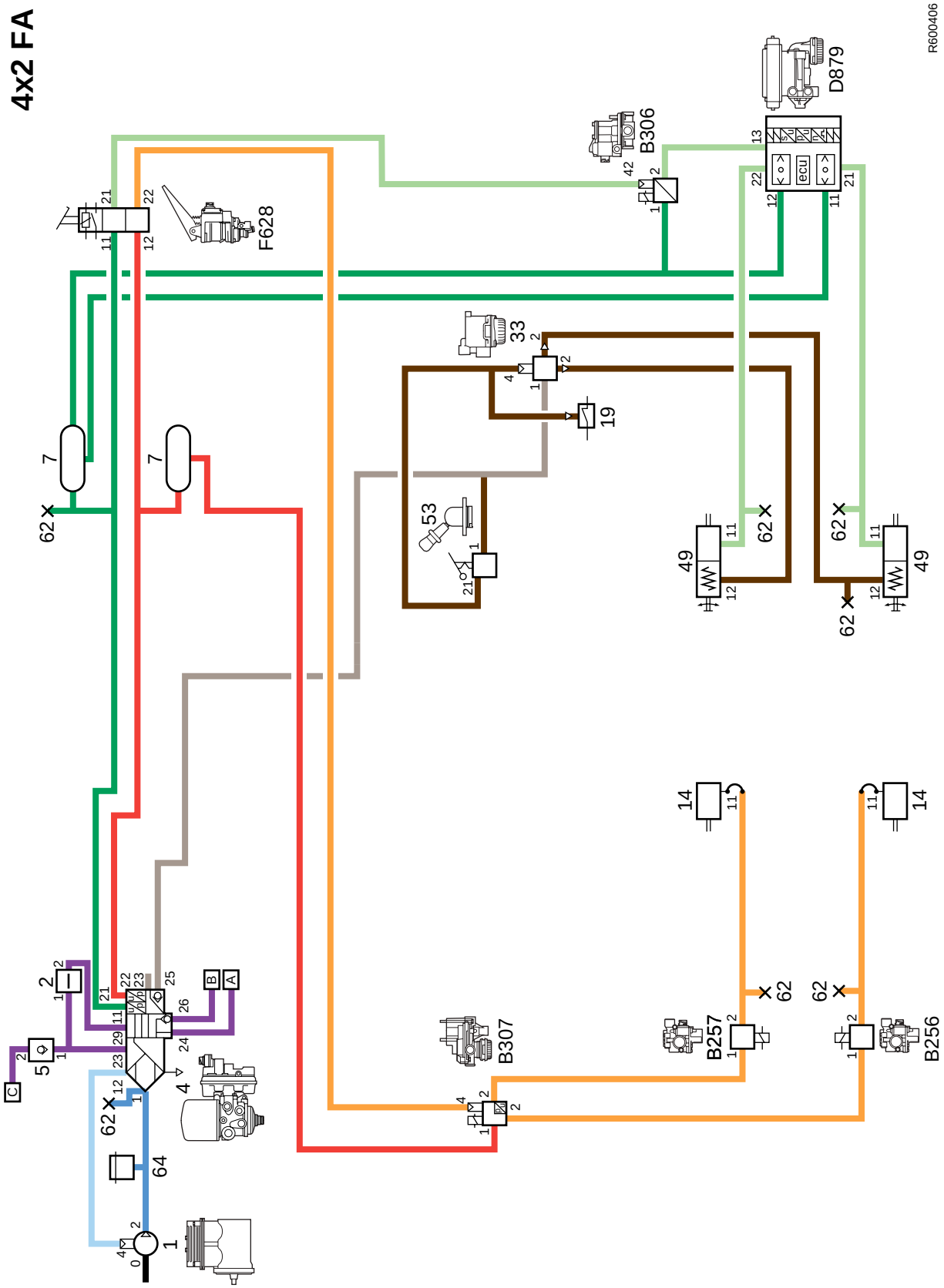
Brake diagram no.	Vehicle version
R600834	4x2 vehicle, FT version: - With trailer connection - With disc brakes on the rear axle
R600835	4x2 vehicle, FA version: - Without trailer connection - With disc brakes on the rear axle - With air-sprung front axle
R600836	4x2 vehicle, FA version: - With trailer connection - With drum brakes on the rear axle
R600837	6x2 vehicle, FT(.) /FA(.) version: - With trailer connection - With disc brakes on the rear axle - With ASR
R600838	6x2 vehicle, FT(.) /FA(.) version: - With trailer connection - With disc brakes on the rear axle - Without ASR
R600839	6x2 vehicle, FT(.) /FA(.) version: - With trailer connection - With drum brakes on the rear axle - With ASR
R600840	6x2 vehicle, FT(.) /FA(.) version: - With trailer connection - With disc brakes on the rear axle - Without ASR - Situation with spring brake cylinder on front axle
R600841	6x2 vehicle, FTP/FAR version with axle load ratio 11.5/6.7: - With trailer connection - With disc brakes on the rear axle - Without ASR
R600842	6x2 vehicle, FTP/FAR version with axle load ratio 11.5/6.7: - With trailer connection - With disc brakes on the rear axle - With ASR
R600843	4x2 vehicle, FT version - With trailer connection - With disc brakes on the rear axle - With independent trailer brake

3

Brake diagram R600834



Brake diagram R600835



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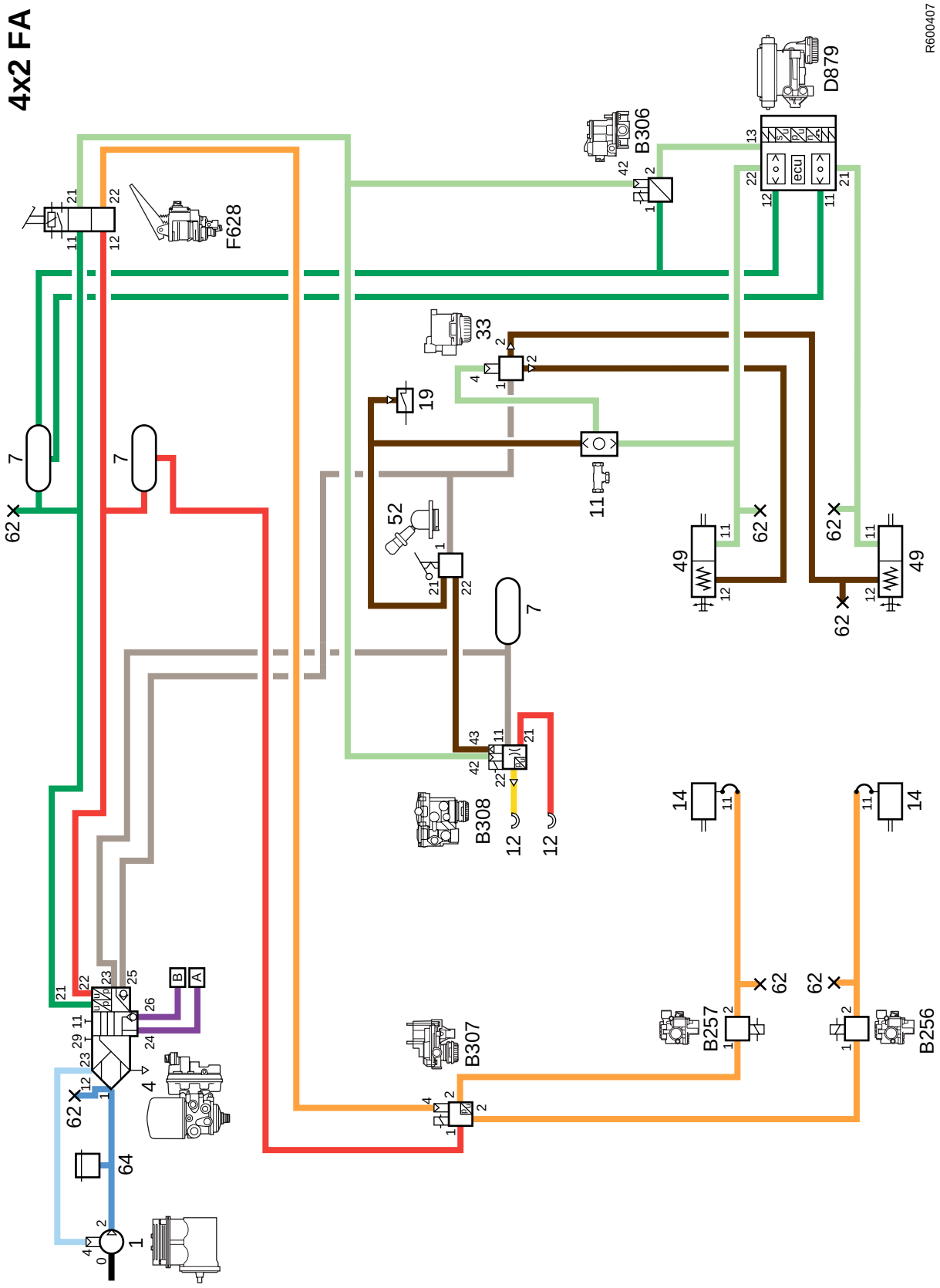
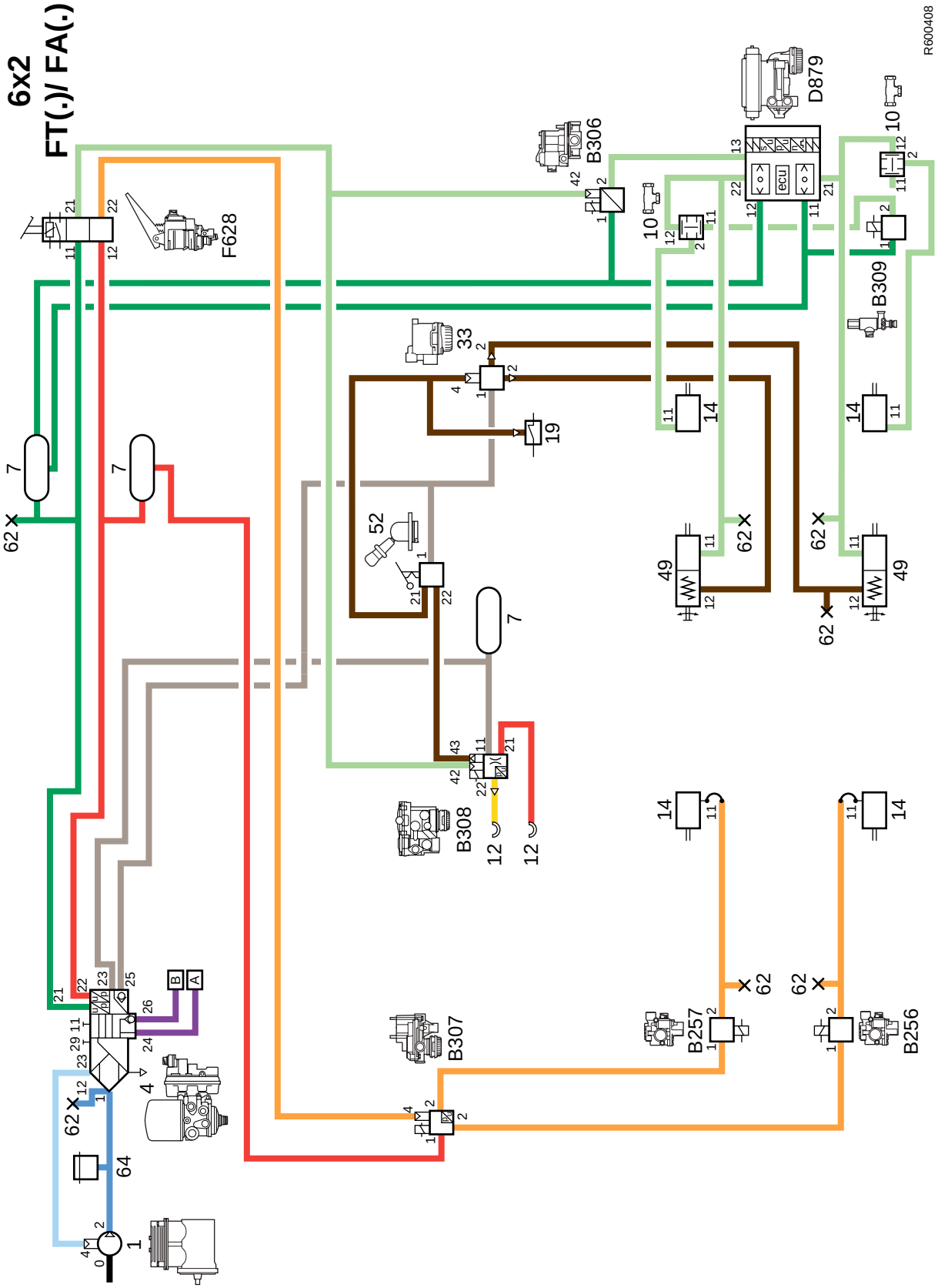
Brake diagram R600836



Brake diagram R600837



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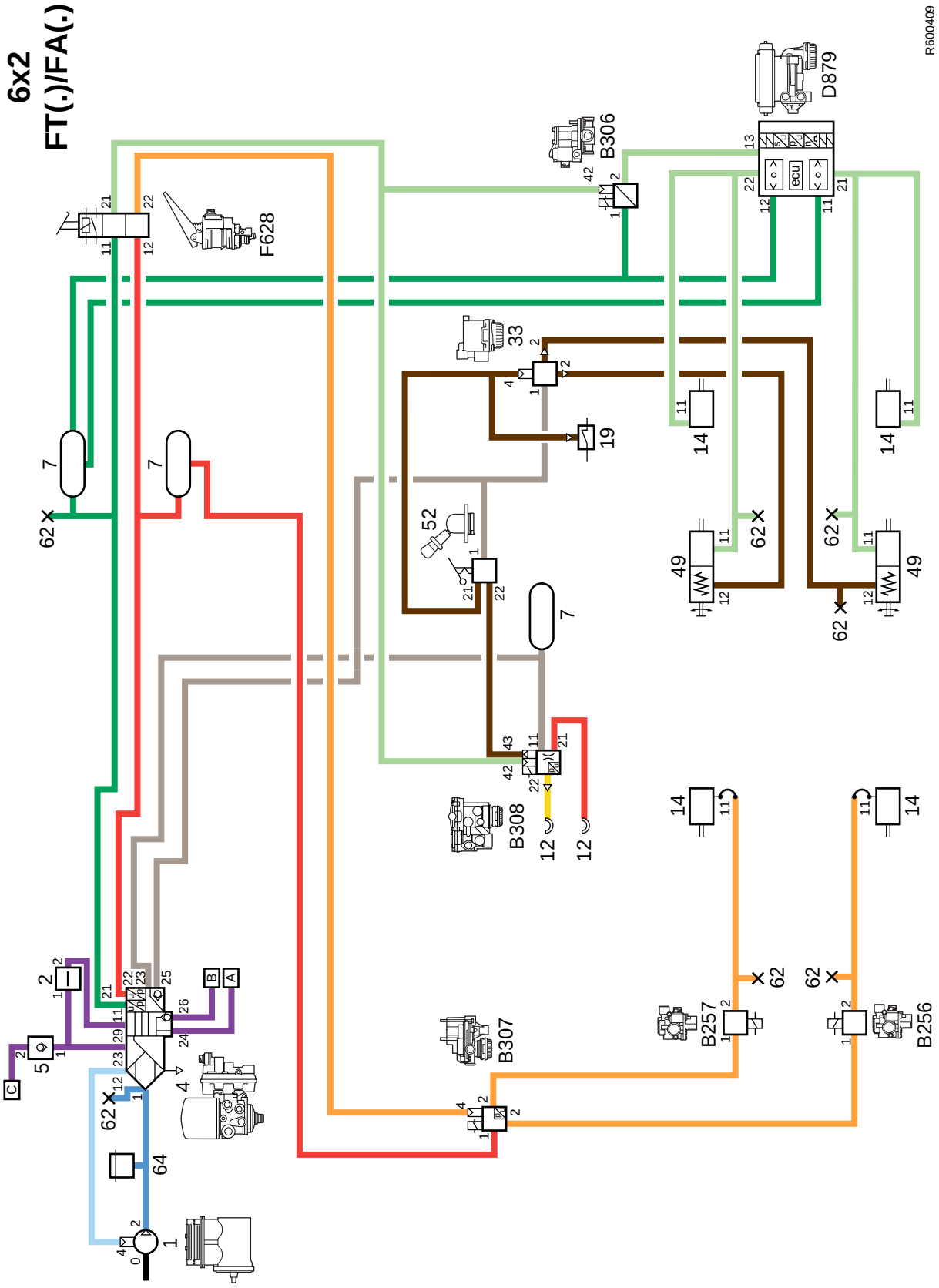
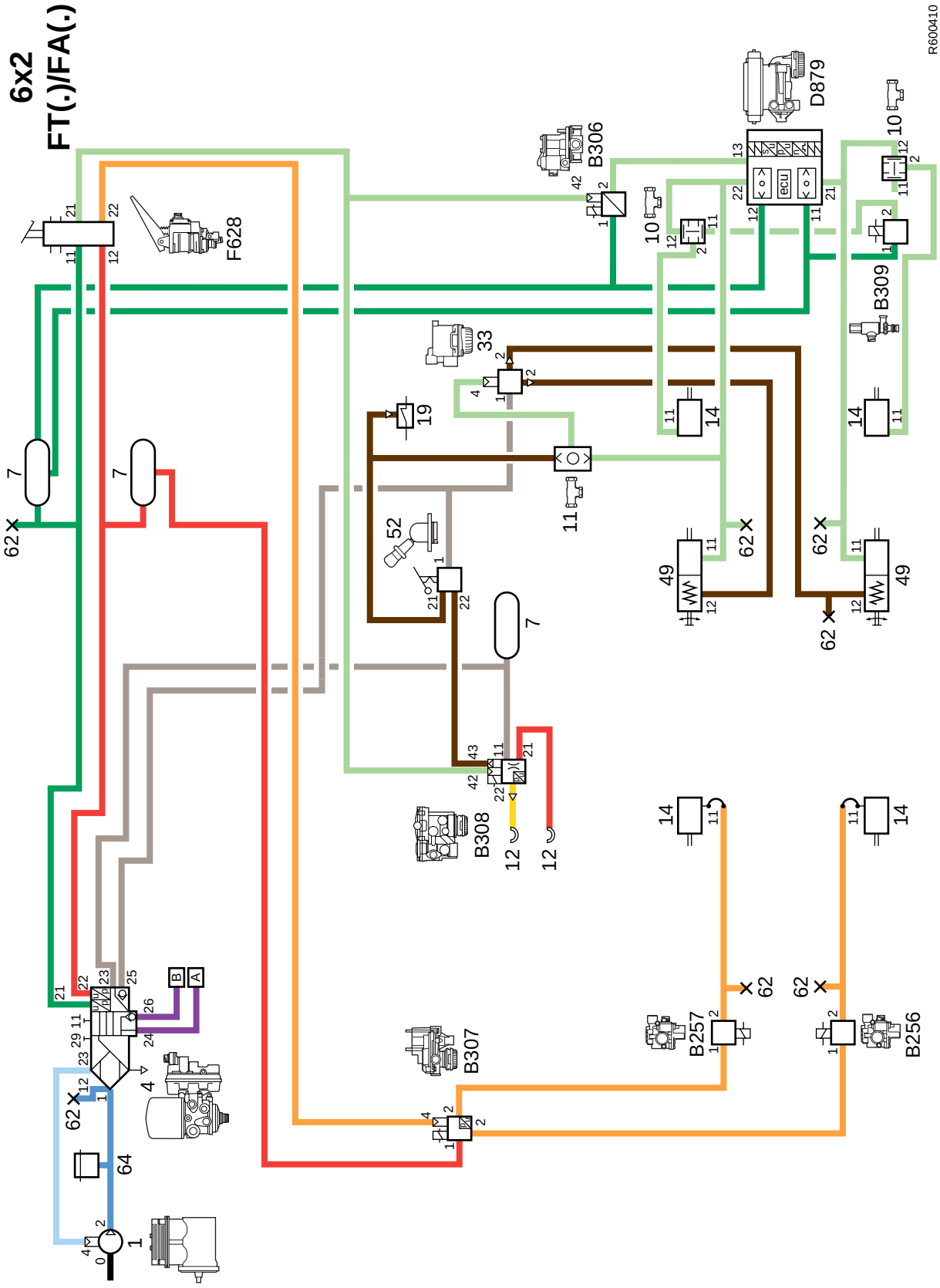
Brake diagram R600838



Brake diagram R600839



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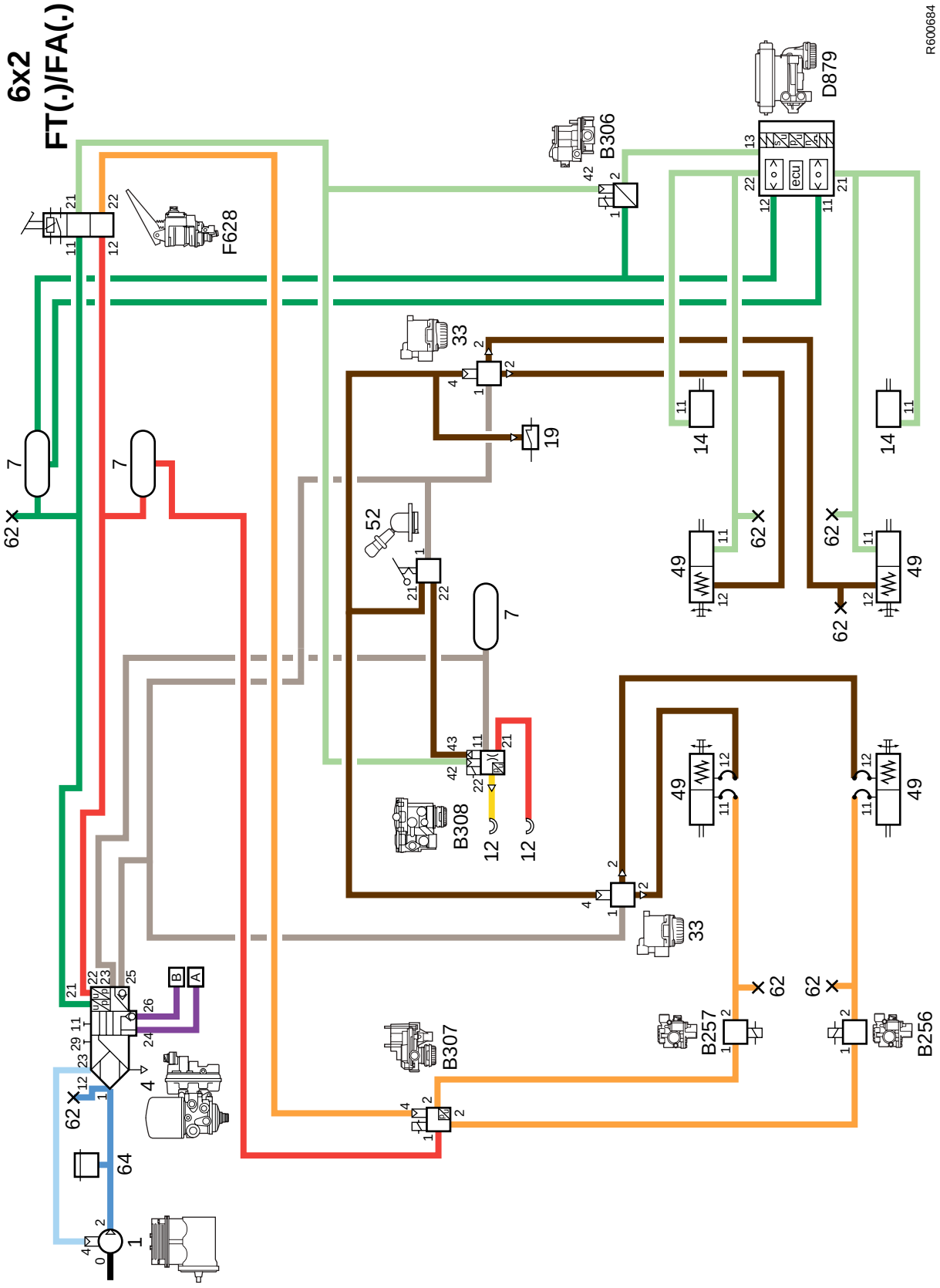
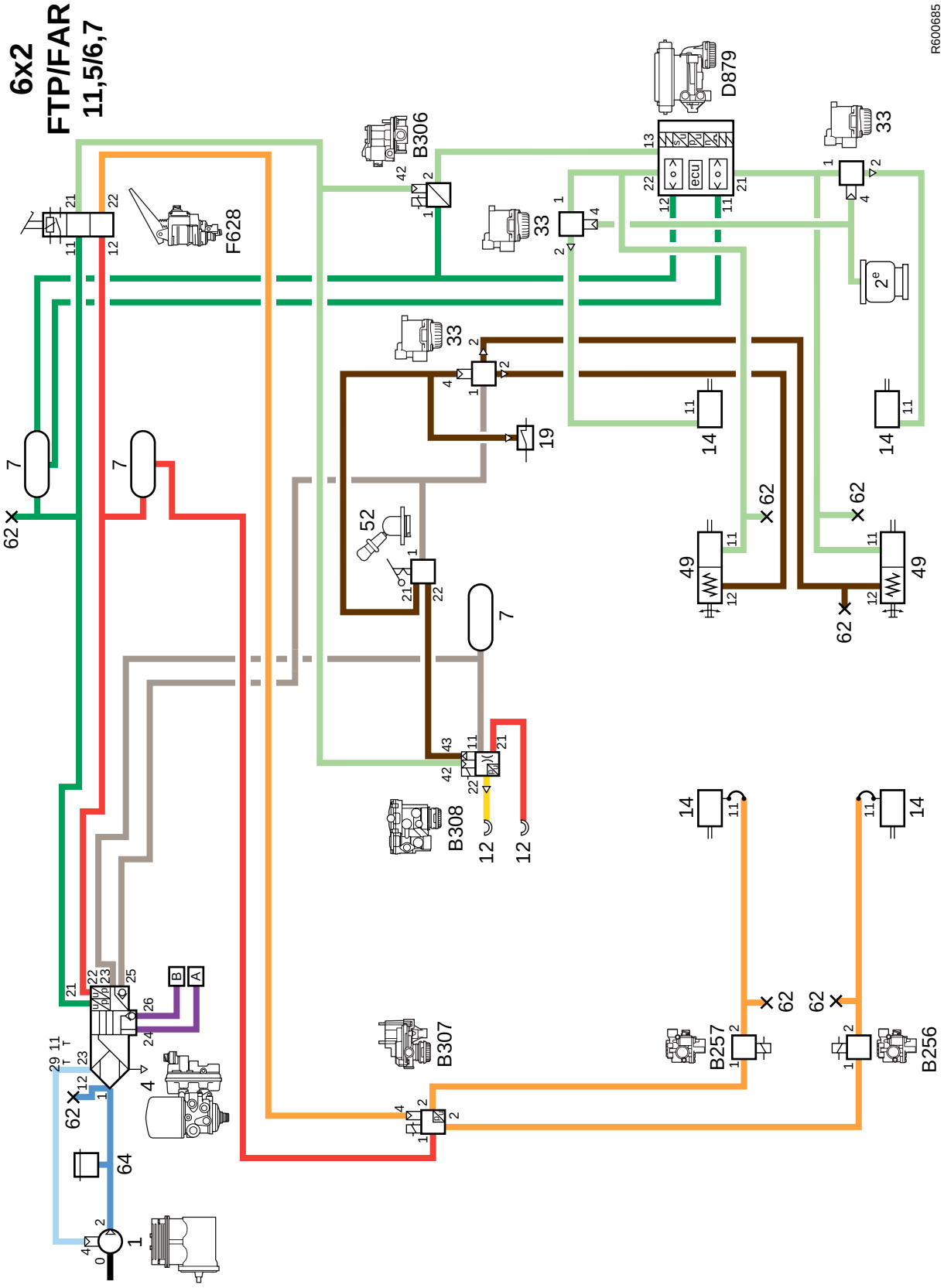
Brake diagram R600840



Brake diagram R600841



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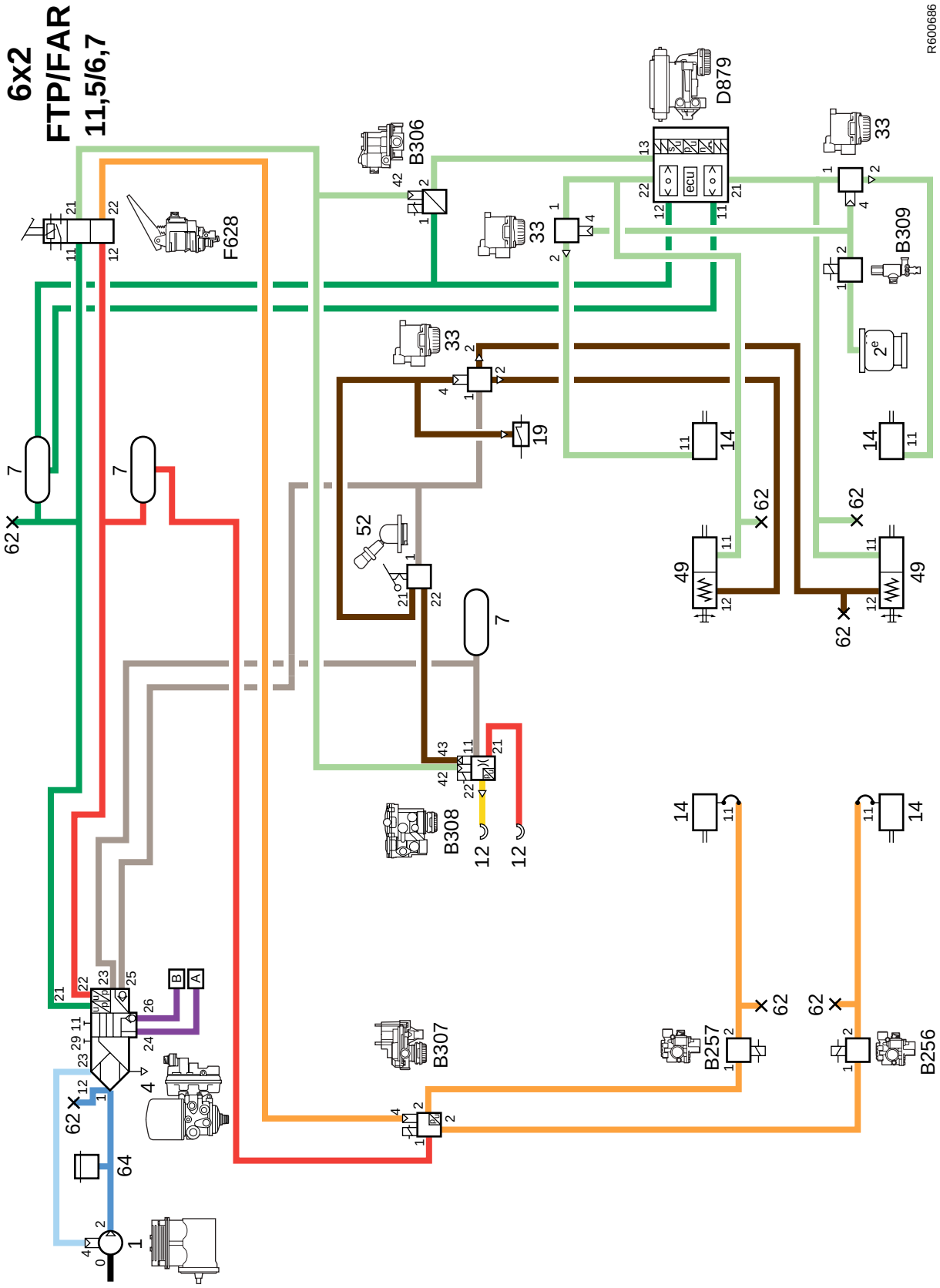
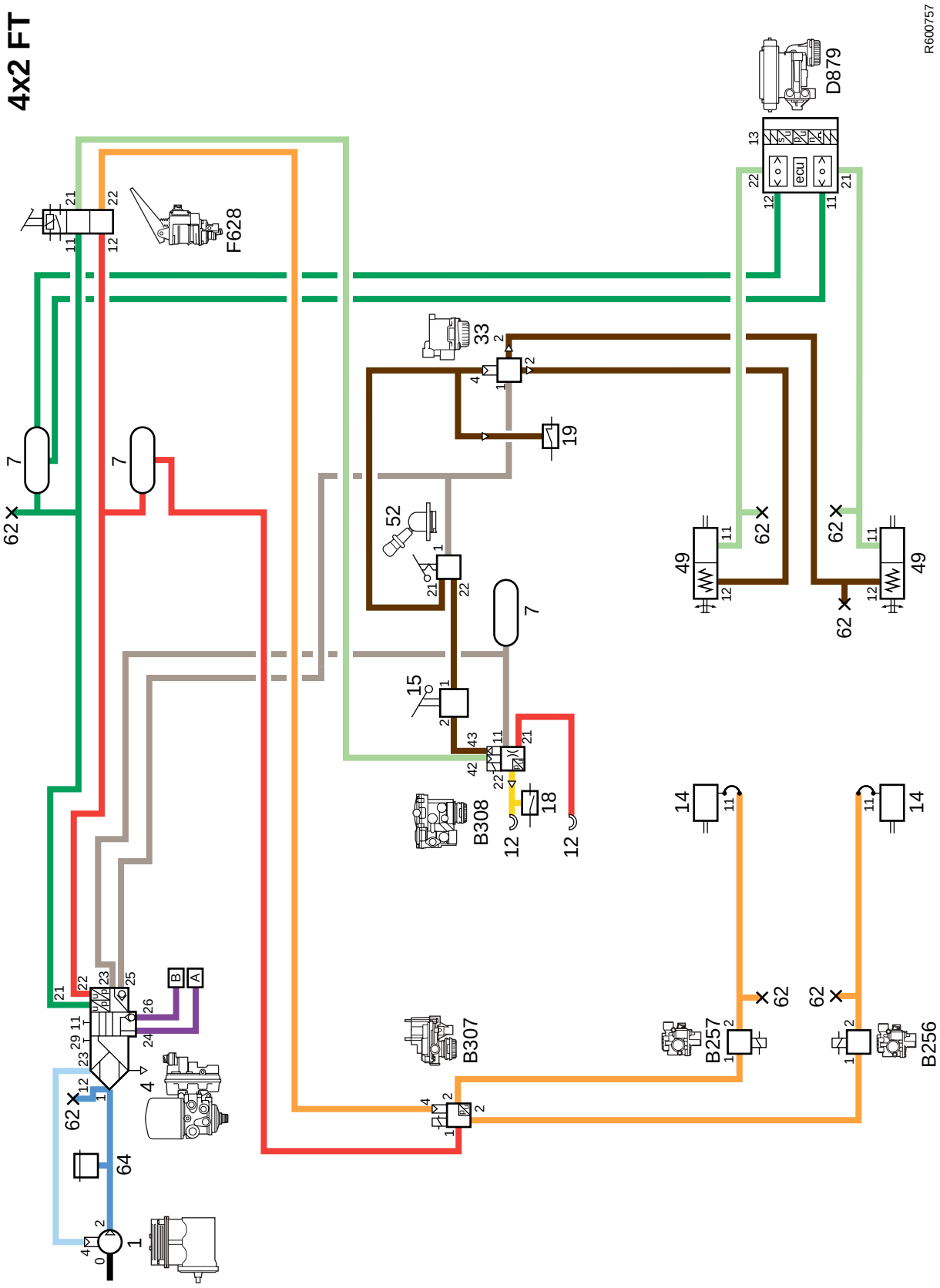
Brake diagram R600842



Brake diagram R600843



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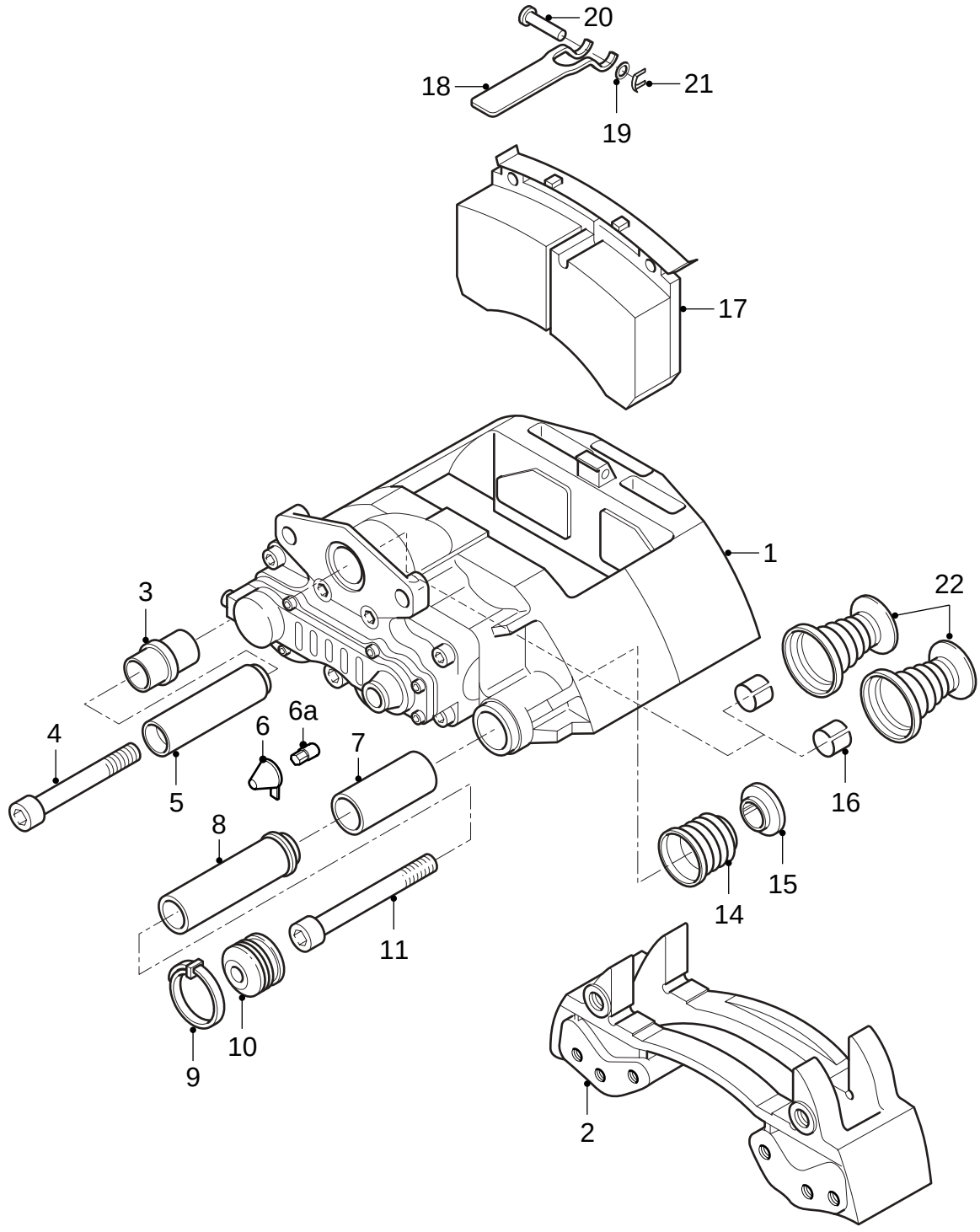
1. GENERAL

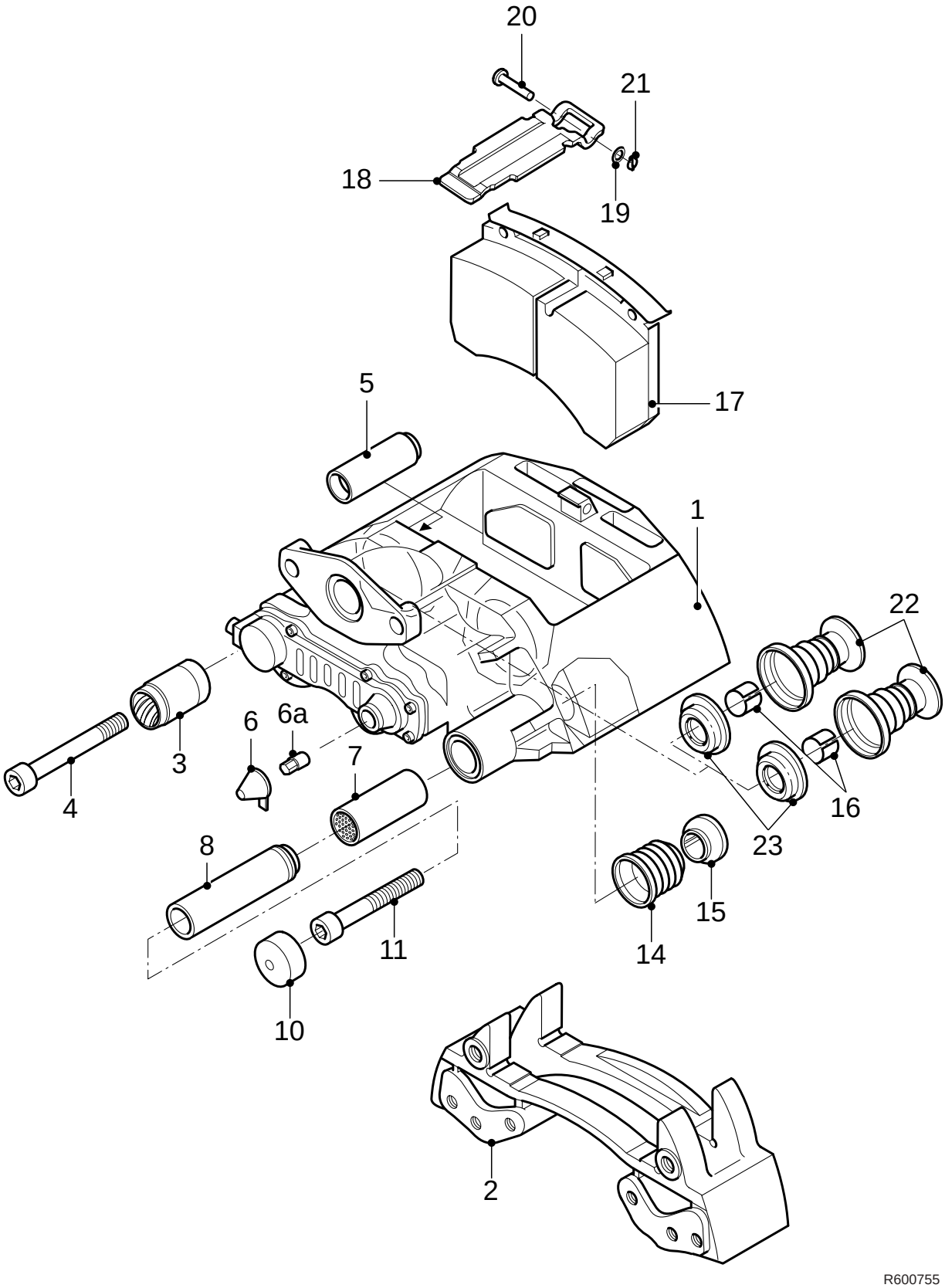
1.1 OVERVIEW DRAWING, KNORR SB7000 DISC BRAKE CONSTRUCTION



R600746

Legend
1 Brake saddle
2 Brake saddle carrier
3 Rubber bearing bush
4 Socket head screw
5 Guide sleeve
6 Cap
7 Copper bearing bush
8 Guide sleeve
9 Clamping strip
10 Bellows
11 Socket head screw
14 Bellows
15 Washer
16 Bearing bushes
17 Brake pad
18 Attachment bracket
19 Lock washer
20 Pin
21 Retainer clip
22 Thrust pieces with bellows

1.2 OVERVIEW DRAWING, KNORR SN7000 DISC BRAKE CONSTRUCTION



R600755

Legend
1 Brake saddle
2 Brake saddle carrier
3 Rubber bearing bush
4 Socket head screw
5 Guide sleeve
6 Cap
6a Adapter
7 Copper bearing bush
8 Guide sleeve
10 Protective cover
11 Socket head screw
14 Bellows
15 Washer
16 Bearing bushes
17 Brake pad
18 Attachment bracket
19 Lock washer
20 Pin
21 Retainer clip
22 Thrust pieces with bellows
23 Sealing rings

4

2. DESCRIPTION OF COMPONENTS

2.1 COMPRESSOR

***CF*65 series**
The compressor is a single-cylinder design of 225 cm^3 with a water-cooled cylinder head. The compressor is mounted on the left side of the engine against the flywheel housing.
The compressor is driven via a gear wheel from the camshaft gear on the flywheel side of the engine.

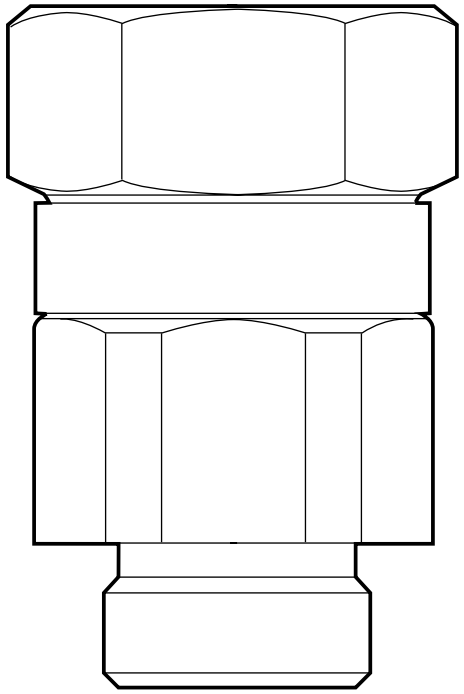
***CF*75/85 series**
The compressor is a two-cylinder design of 440 cm^3 with a water-cooled cylinder head. The compressor is mounted on the right side of the engine against the timing gear case.
The compressor is driven by the camshaft gear via a gear wheel.

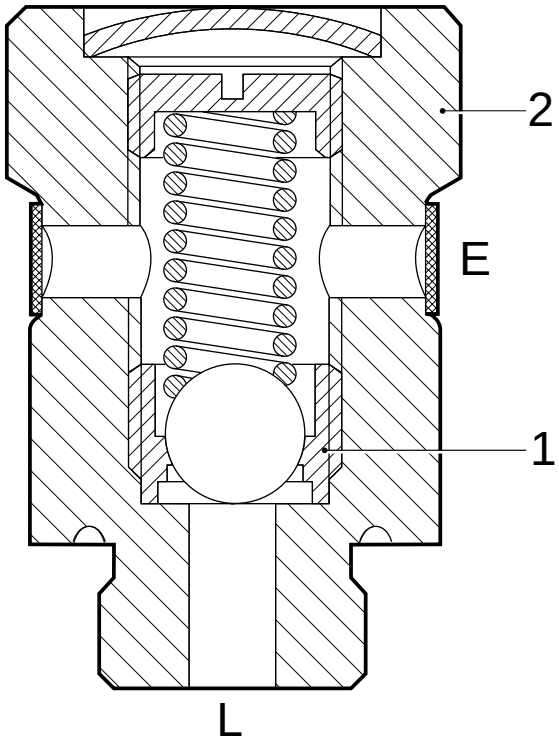
The compressor has a so-called energy-saving function.
When the air-pressure system has reached the set pressure, the pressure regulator in the air dryer will send a pressure signal back to the compressor head via port 23.
In the compressor head, a plunger operates two valves which connect the inlet and exhaust valves inside the compressor head.
The compressed air is then constantly pumped internally from one cylinder to the other.
This energy-saving function has a positive effect on the engine efficiency.
If the pressure regulator switches off to fill up the air-pressure system, the plunger will move the two valves into their initial position, making it possible for the compressor to supply pressure again.

2.2 SAFETY VALVE

Purpose
The purpose of the safety valve is to limit the pressure build-up to a given value.

Operation
The compressor air enters at L and arrives at spring-loaded ball 1. When the pressure exceeds the pre-set value, the ball will be lifted from its seat. The excess air is vented to the atmosphere via bores E.
When the pressure drops below the pre-set value, the ball will close again.

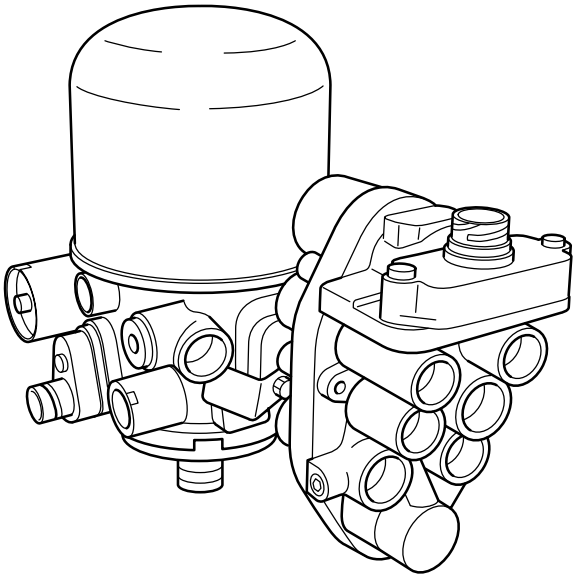




R600050

2.3 AIR SUPPLY UNIT

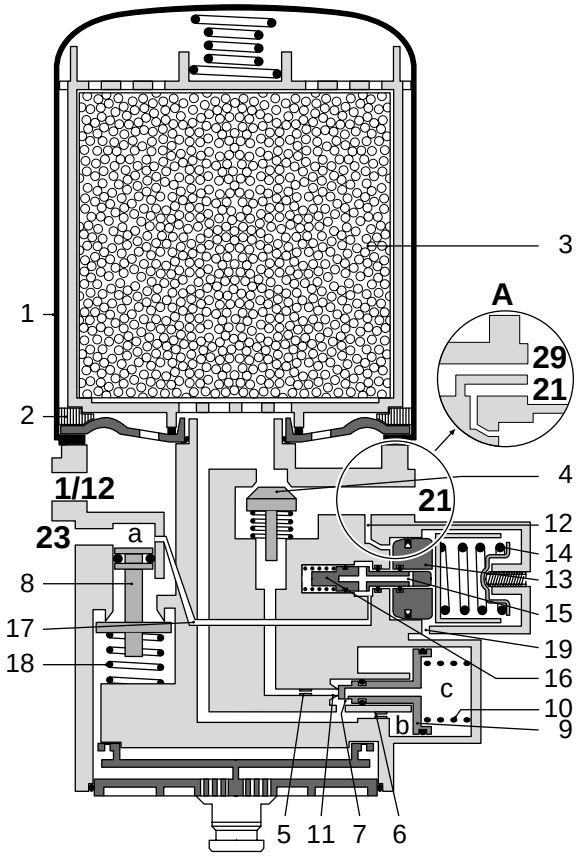
Purpose
The air supply unit is a combination of an air dryer, pressure regulator and four-circuit safety valve and has the following functions:
- removing water, oil and other foreign matter from the air, even before they enter the brake system;
- setting the system pressure by means of a built-in pressure regulator;
- limiting the pressure build-up to a given value;
- splitting the brake system into four circuits and, should one circuit fail, protecting the other circuits against running empty.



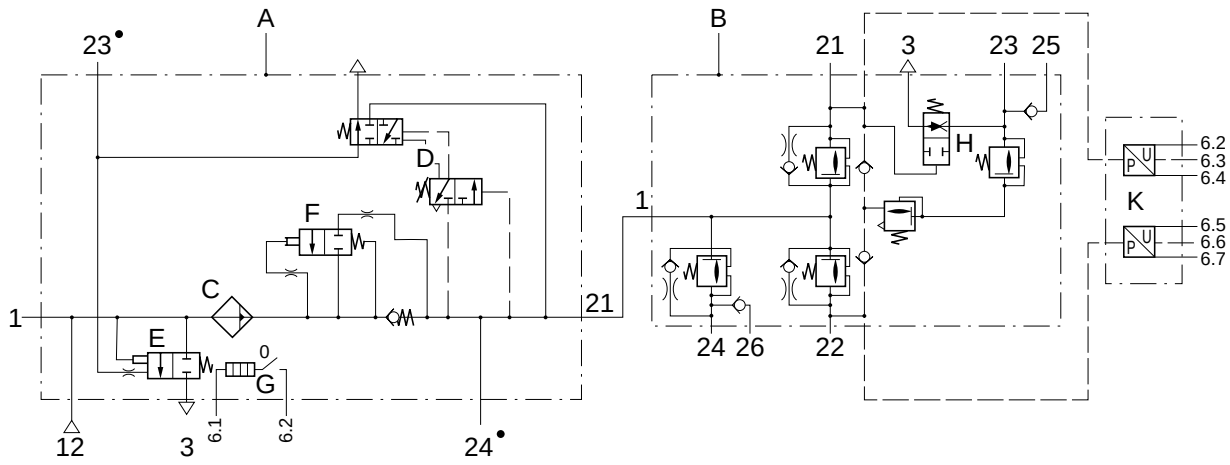
R600359

Operation, air dryer

Filling the system
The air supplied by the compressor reaches the air dryer via connection point 1/12. In the filter element (1), the air passes through the coarse filter (2), which sieves out the oil and dirt particles.
In addition, the air condenses against the cool wall of the element. Subsequently, the air flows through filter grains (3), which extract the water vapour from the air. The air thus dried flows via non-return valve 4 to connection point 21.



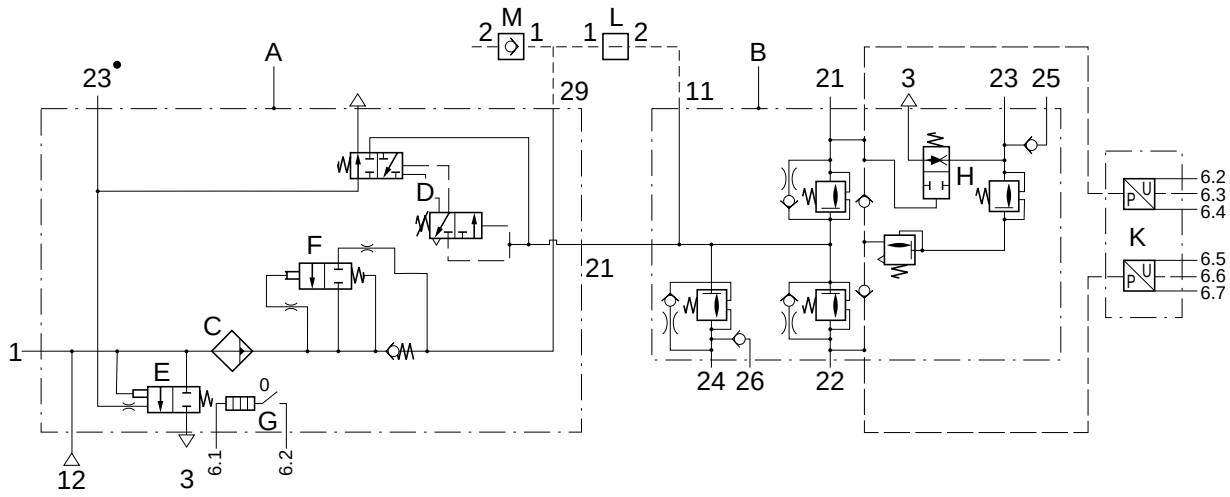
R600457



R600580

4

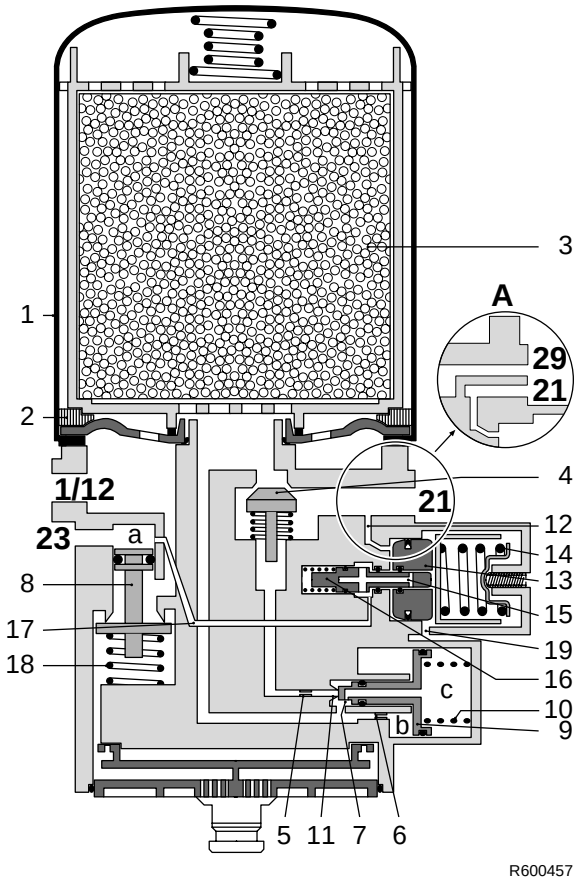
Version with air-sprung front axle:
The dried air flows to connection 29 rather than 21. The air then flows to an external non-return valve (M) (air-sprung front axle supply) and to a pressure relief valve (L). If sufficient pressure has built up in the front axle air springs, the pressure relief valve will be opened and air will flow back via connection 11 and connection 21 to the pressure control valve (D) and the four-circuit protection valve.



R600581

Operation, pressure regulator
The pressure increasing during filling is returned to the built-in pressure regulator via bore 12. When the pre-set cut-out pressure is reached, the control piston (13) is moved to the right against the pressure of spring 14. This releases bore 15 in pin 16. The system pressure will enter chamber ‘a’ above blow-off valve 8 via bore 17, opening the blow-off valve (8) against the pressure of the spring 18. The pressure in chamber ‘a’ will also be fed to the compressor head via connection point 23. This goes to no-load so that no more air will be supplied.

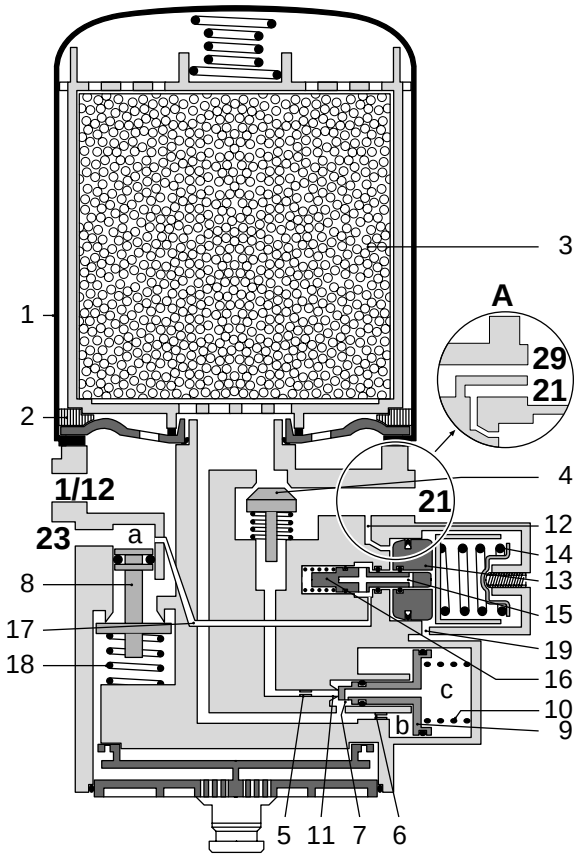
If the pressure in the brake system drops to the cut-in pressure due to air consumption, the control piston (13) will move to the left and shut bore 15 in pin 16. This bore, and therefore channel 17 and chamber ‘a’, will be vented via bore 19. The blow-off valve (8) is closed and the signal to the compressor head falls away. The compressor will now again build up the pressure in the air system.



Regenerating
A regeneration tank is no longer necessary, because the air inside the circuits is used.

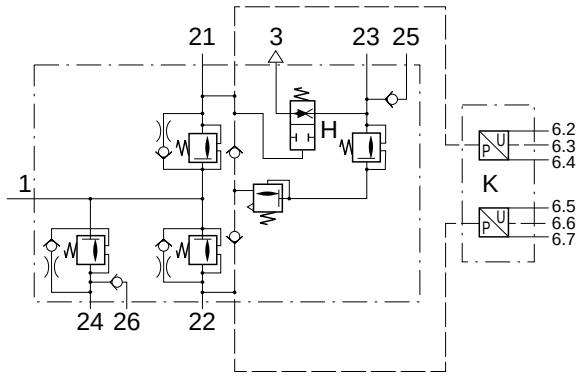
A built-in pneumatic time switch controls the regeneration process:
- throttle 5 determines the amount of air
- throttle 6 determines the length of time.

Via throttle 6, air is admitted to chamber ‘b’ and air is also admitted to chamber ‘c’ via bore 7 in piston 9. On cut-out by the pressure regulator, blow-off valve 8 is opened and chamber ‘c’ is vented via bore 7. Piston 9 is moved to the right against the pressure of spring 10 as a result of the difference in pressure between chambers ‘b’ and ‘c’. This releases the piston 9 from its seat (11) and air from the system will flow in the opposite direction through the filter element via throttle 5. At the same time, pressure is reduced in chamber ‘b’ via throttle 6. The piston (9) moves to the left until it abuts the seat (11). Regeneration is now complete.



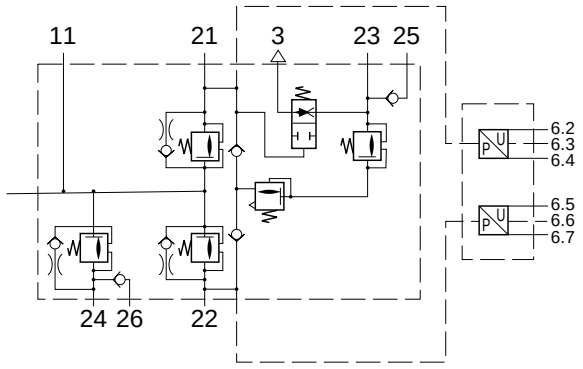
Operation, four-circuit safety valve
The air supply enters at connection 1 (connection 11 on models with air-sprung front axle). From there, the air flows to the built-in overflow valves of circuits 1, 2 and 4.

As soon as the valve of circuit 1 and/or circuit 2 opens, the air will be able to flow through to circuit 3, the trailer vehicle brake and parking brake circuit. For reasons of safety, a built-in flow-back function empties circuit 3 when the pressure in circuit 1 is too low. This is done to enable the emergency brake function to be activated.



R600476

model with leaf-sprung front axle



R600477

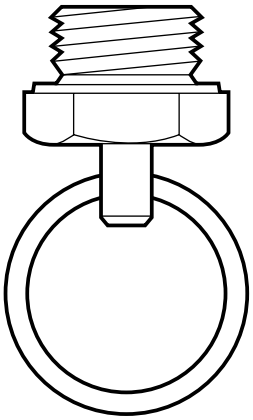
model with air-sprung front axle

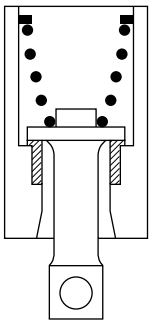
2.4 WATER BLOW-OFF VALVE

Purpose
The purpose of the water blow-off valve is to enable any condensate in the air reservoir or air pipes to be drained and, if necessary, to vent the system.

Operation
The valve is kept closed by the spring and the reservoir pressure. By pushing the pin sideways, the valve is lifted off the seat, allowing condensate and compressed air to escape. When the pin is released, the valve is closed.

Check that no other components are present under the blow-off plug, as these could get fouled during the blow-off process.

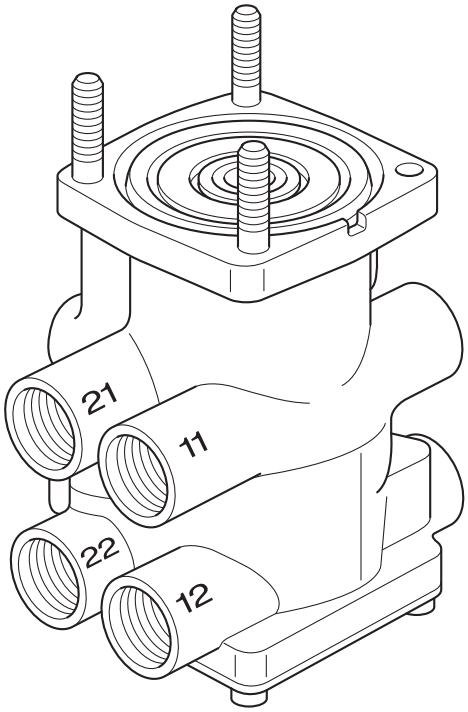




R600046

2.5 FOOT BRAKE VALVE

Purpose
The purpose of the foot brake valve is to allow sensitive aeration and venting of both service brake circuits, independently of each other.



R600379

Operation
The foot brake valve consists of an upper section (circuit 1) and a lower section (circuit 2); both have a connection point for the reservoir pipe (11 and 12 respectively) and a connection point for the brake line (21 and 22 respectively). If the pedal is depressed, push rod 1, spring retainer 2 and rubber graduating spring 3 will exert force on graduating piston 4. The graduating piston moves downwards, closes off exhaust 5 and opens inlet 10. The supply pressure at connection point 11 flows via chamber A and connection 21 to the brake cylinders of circuit 1.
At the same time, compressed air flows via bore D into chamber B above graduating piston 7, which is forced downwards as a result. Exhaust 9 is closed and inlet 8 opened. Via chamber C and connection 22, the supply pressure at connection 12 flows to the brake cylinders in circuit 2.

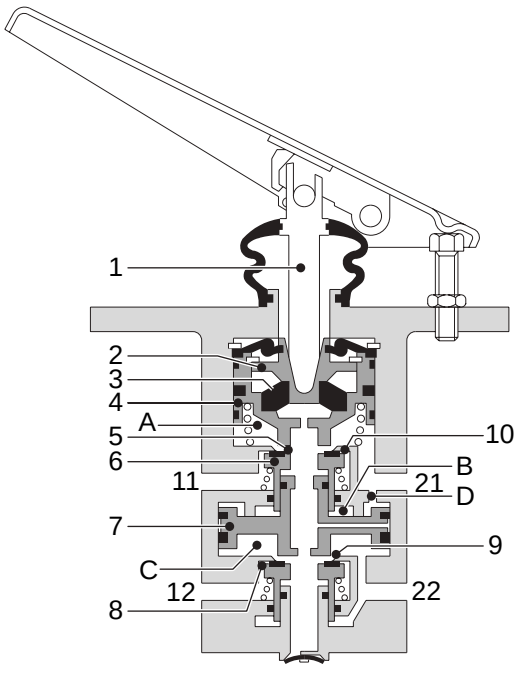


Fig.2

R600748

The pressure being built up in chamber A is also applied to the underside of graduating piston 4, which is forced upwards against the pressure of the rubber graduating spring (3), until a state of balance is achieved. In this state of equilibrium, both exhaust 5 and inlet 10 are closed. In the same way, a state of balance is achieved in circuit 2.
As the pedal is depressed further, the cycle described above will be repeated, thus enabling the brakes to be applied in stages, until the maximum braking force has been applied. If the pedal force is reduced, the rubber graduating spring (3) will slacken so that graduating pistons 4 and 7 move upwards. The brake lines are vented and the pressure in the brake cylinders will fall correspondingly. If a leak occurs in the lower circuit (circuit 2), the upper circuit will operate as described above. If a leak occurs in the upper circuit, no compressed air will flow to chamber B above graduating piston 7. Piston 4 should now be depressed by the pedal deep enough for the underside of piston tube 6 to come into contact with graduating piston 7. The adjustment is done in the same way as described above. Graduating piston 7 is fitted with two O-rings, to ensure a thorough and safe separation between the two circuits. The space between these two seals is connected to the venting system. A leak can be heard immediately as the blowing-off sound of the foot brake valve during braking.

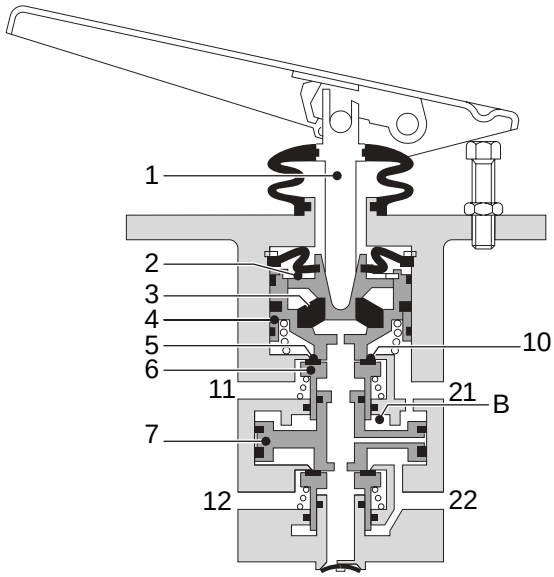


Fig.3

R600749

2.6 RELAY VALVE

Purpose
The purpose of the relay valve is to allow fast aeration and venting of the spring brake cylinders and brake cylinders, shortening the brake reaction/release time.

Note:
The hysteresis of the relay valve used for the parking brake is greater and therefore is **not** suitable for use in the service brake.

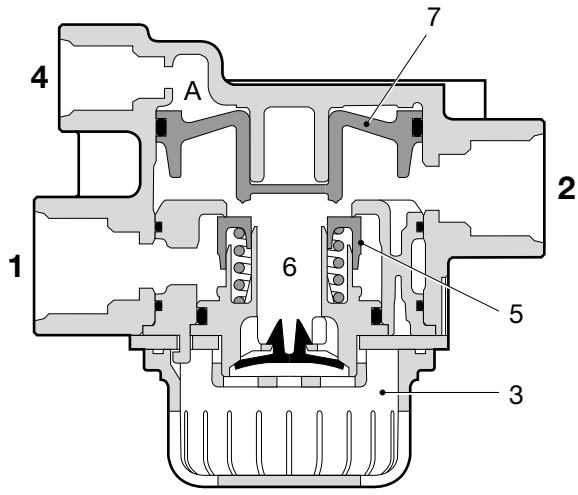
The air reservoir is connected to connection point 1. When connection point 4 is pressureless, inlet 5 is closed and exhaust 6 opened. The brake chambers connected to connection point 2 are now vented.

When compressed air passes through connection point 4 into chamber ‘a’ above piston 7, the piston is forced downwards. Outlet 6 is closed and inlet 5 opened. The compressed air now passes from the air reservoir to the brake chambers.

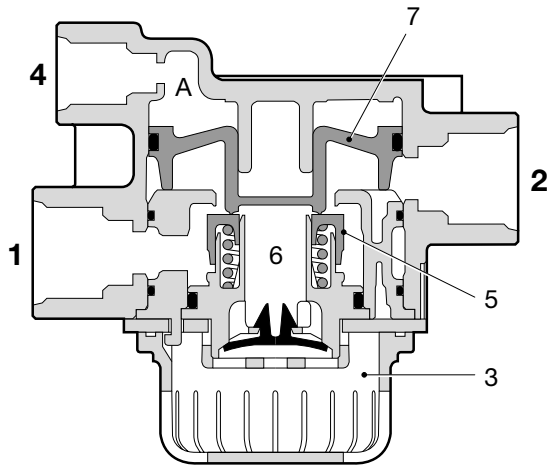
A state of balance is achieved when the pressures on both sides of piston 7 are equal. Then, both the outlet and the inlet are closed.

When the pressure in connection point 4 and consequently in chamber ‘a’ drops, piston 7 is forced upwards. Inlet 5 is closed and outlet 6 opened and as a consequence the brake chambers are blown off through vent opening 3.

The rubber flap in opening 3 prevents dirt from entering, whilst providing a large opening for air to be blown off.



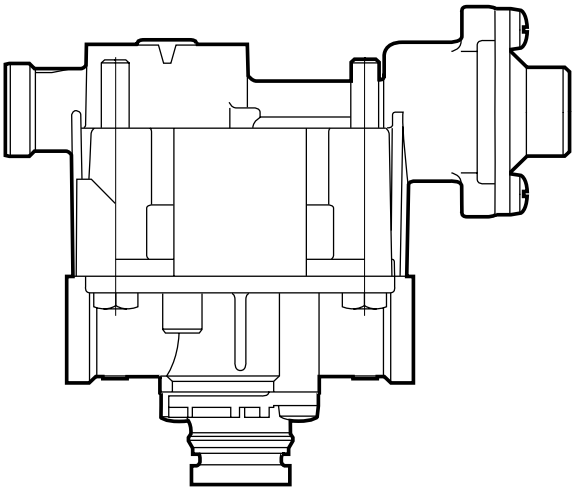
R600490



R600491

2.7 EMPTY/LOAD RELAY VALVE

Purpose
The purpose of this valve is to adjust the brake pressure to the front axle depending on the output pressure from the ALR valve of the rear axle.

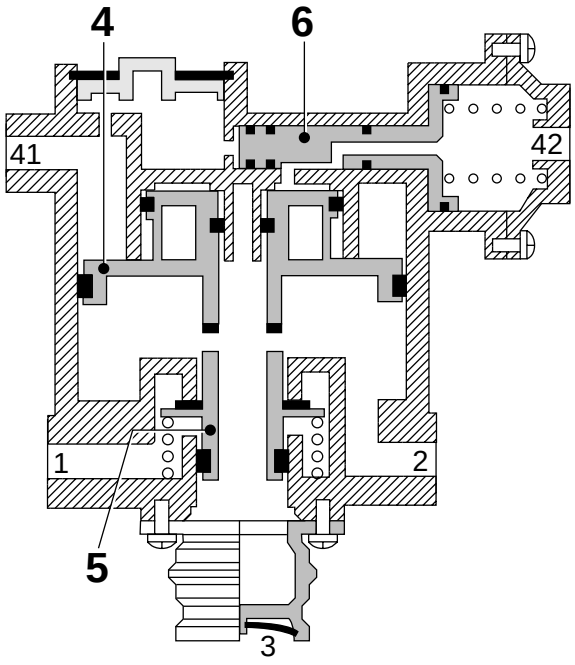


R600049

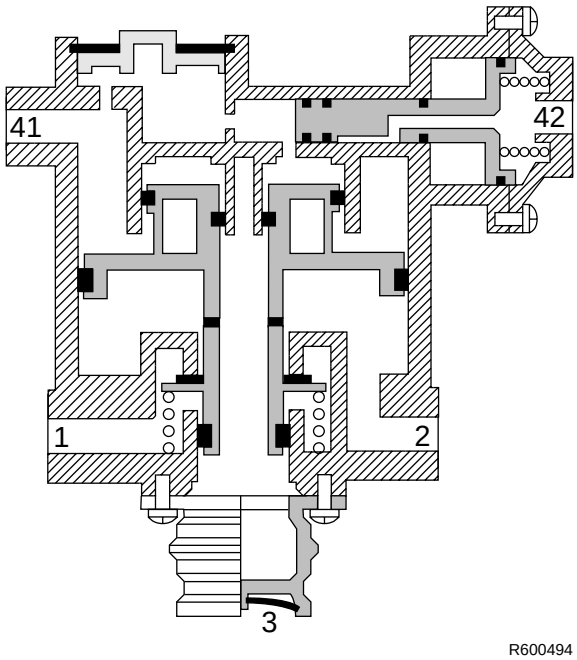
Empty/load relay valve
In rest position, relay piston 4 is in its upper position and connecting point 2 (brake cylinders on front axle) is vented via connecting point (3).

When the foot brake is applied, the relay piston is forced downwards via connecting point 41, thus opening valve 5. At connecting point 2 pressure is built up until a set value is reached. The relay piston (4) is then once again forced upwards, until there is a state of equilibrium. Air has also entered simultaneously at connecting point 42 (ALR valve). This will force piston 6 to the left. Through a bore in piston 6 the pressure now also reaches the central surface of the relay piston (4). This pressure will depend on the loading of the rear axle. As a consequence, the output pressure of this valve is in part dependent on the brake pressure of the rear axle.
The input pressure at connecting point 41 is also applied to the left-hand side of piston 6, via two openings. If no pressure enters via connecting point 42, due to a fault, piston 6 will be forced to the right. The pressure at connecting point 41 will now also reach the central surface of the relay piston (4). In this situation, the valve simply operates as a relay valve, and will no longer reduce.

When the foot brake is released, the pressure at connection points 41 and 42 will disappear. The relay piston (4) will be forced upwards by the pressure beneath it, thus opening the vent.



R600493

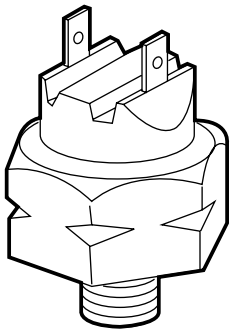


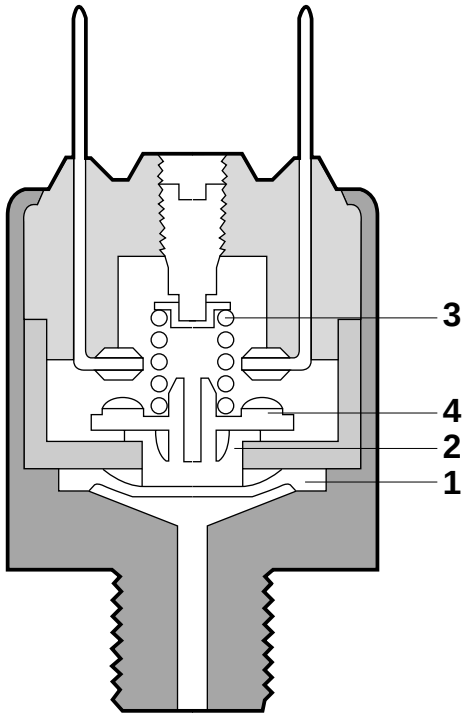
R600494

2.8 BRAKE LIGHT SWITCH

Purpose
The purpose of the brake light switch is to operate the brake lights when braking.

Operation
The brake light switch is mounted in the air pipe in a conventional brake system, and in an EBS system in the foot brake valve (see brake diagrams).
The brake light switch consists of a diaphragm (1) with a fixed core (2), which in rest position is kept in its lower position by a spring (3).
In the rest position, the spring also forces movable contact 4 downwards. As soon as the brakes are applied, pressure beneath the diaphragm forces the diaphragm with the fixed core upwards, against the pressure of the spring. The movable contact also moves upwards, and the switch is activated.
If the pressure beneath the diaphragm falls away, spring 3 ensures that the initial position is restored. The switch must be installed in a vertical position, with the terminals uppermost.

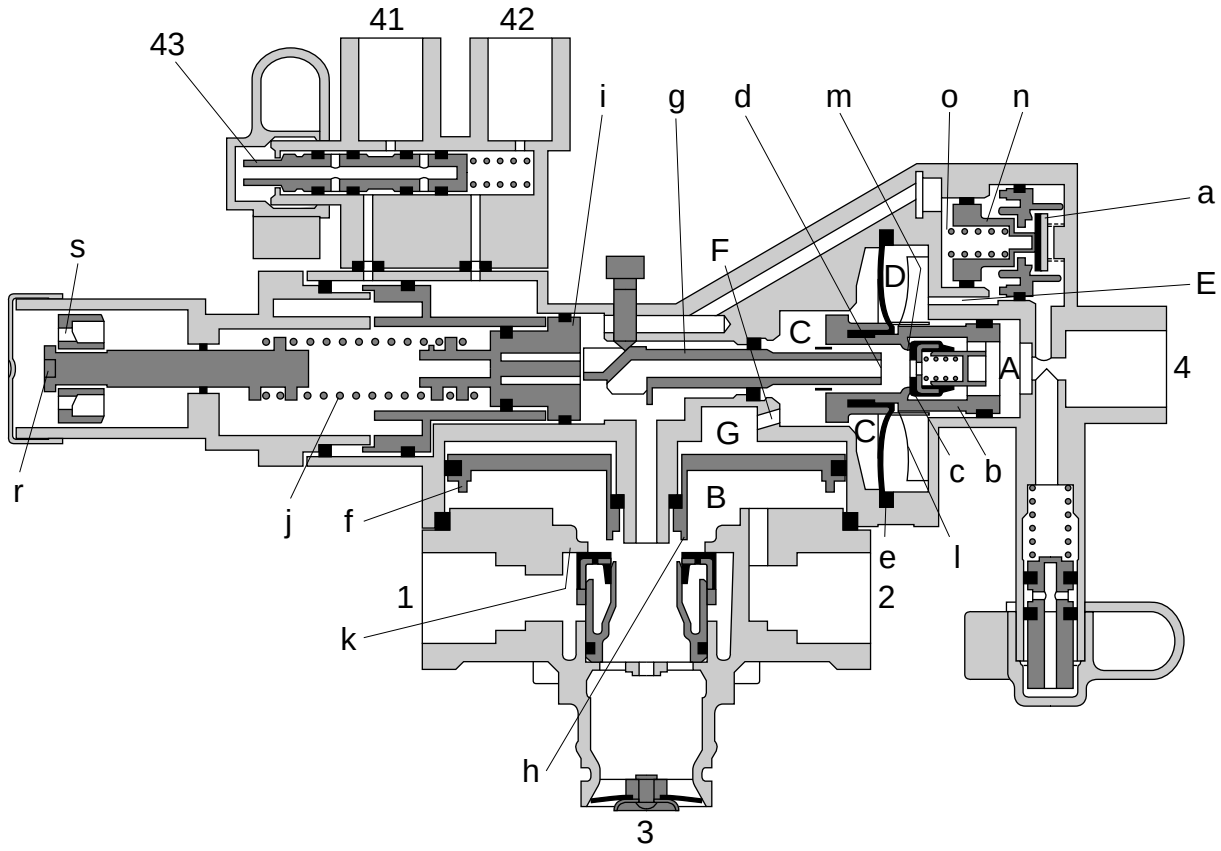




R 600105

2.9 LOAD SENSING VALVE, AIR SUSPENSION

Purpose
Automatic control of the braking force is dependent on the pressure in the bellows and therefore on the load condition of the vehicle. Thanks to the integrated relay valve, the brake cylinders are aerated and vented quickly.



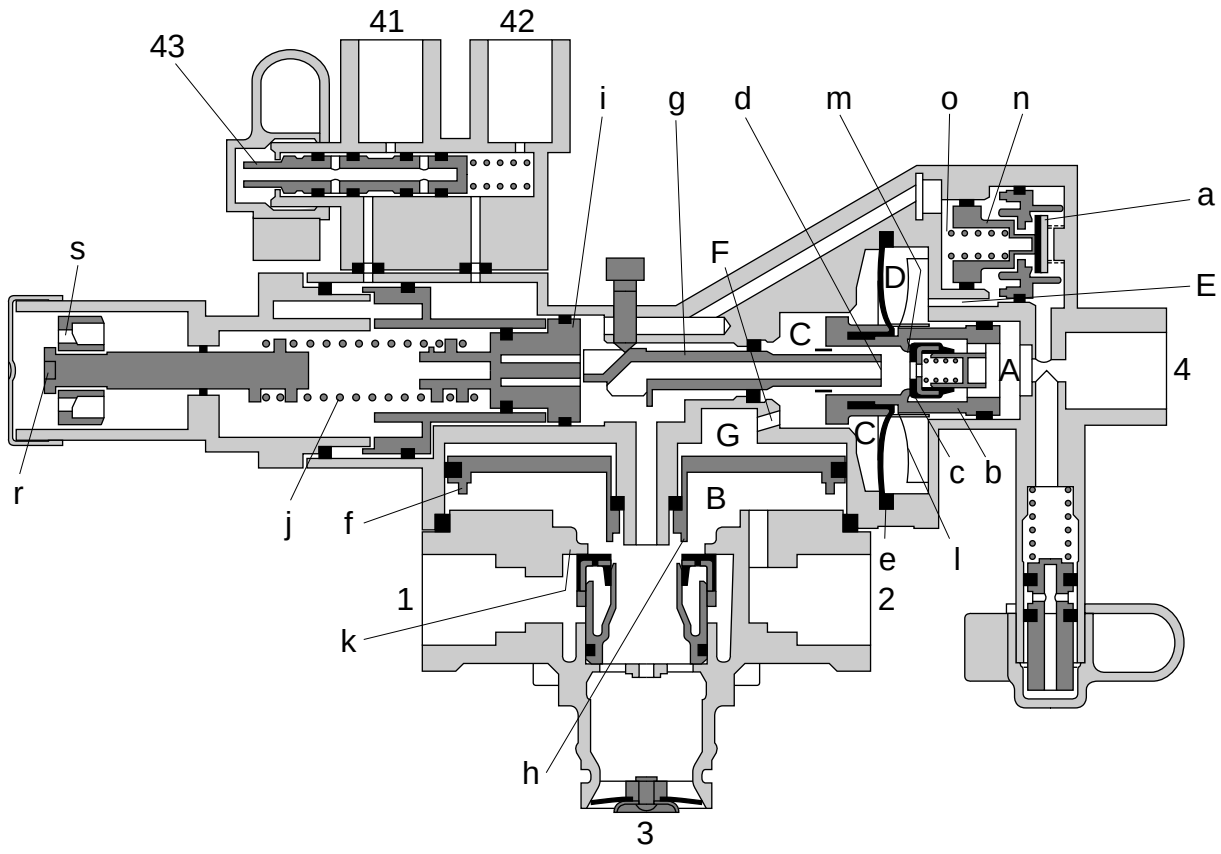
R600455

Operation
The control valve is activated by the pressure of the left and right bellows via connection points 41 and 42. The actuated piston (i) that moves against the pressure of spring 'j' brings the tappet (g) to a position that corresponds to the load condition. The arithmetic average of the bellows pressure on the left and right is the determining factor in this.

The compressed air provided by the foot brake valve flows via connection point 4 into chamber A, pushing piston ‘b’ to the left. Outlet ‘d’ is closed and inlet ‘m’ is opened, causing compressed air to enter chamber C to the left of diaphragm ‘e’. Relay piston ‘f’ is operated via duct F and chamber G.
At the same time, compressed air flows through the open valve (a) and duct E into chamber D to the right of diaphragm ‘e’. Due to this control, the output pressure at partial load and low control pressures is increased (to max. 1.4 bar). If the control pressure increases further, piston ‘n’ is moved to the left against the pressure of spring ‘o’ and valve ‘a’ closes.

As pressure builds up in chamber G, relay piston ‘f’ is pressed downwards. Outlet ‘h’ closes and inlet ‘k’ opens. The air at connection point 1 now flows to the brake cylinders via connection point 2.

Now pressure will start to build up in chamber B under relay piston ‘f’. As soon as this pressure is somewhat higher than that in chamber G, the piston is pushed upwards and closes inlet ‘k’. When piston ‘b’ is moved to the left, the vanes (l) attached to it will gradually loosen the diaphragm (e) from the fixed vanes in the fan housing. As a result, the effective diaphragm surface will gradually increase. As soon as the force of the air to the left of the diaphragm exceeds that to the right, piston ‘b’ will move to the right. The inlet (m) will be closed and a set position is reached.



R600455

The position of tappet ‘g’, which depends on the position of piston ‘i’, is indicative of the effective diaphragm surface and therefore of the output brake pressure.
The position of tappet ‘g’ determines to what extent piston ‘b’ must be moved with the vane disc (l) to allow the valve to build up pressure. Due to this movement, the effective surface of the diaphragm will alter.
In full-load position, this surface and that of piston ‘b’ are equally large. The control pressure at connection point 4 is therefore let through (ratio 1:1) to chambers C and G. The output pressure at 2 will now equal the control pressure at connection point 4.

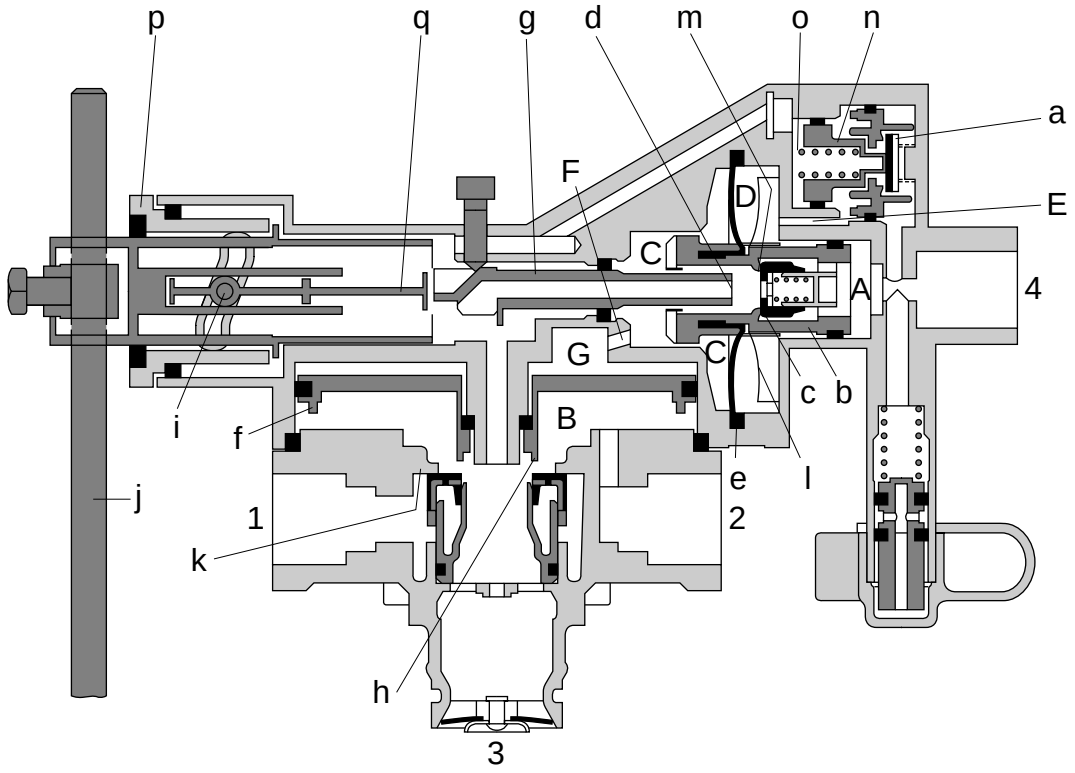
If the pressure at connection point 4 decreases, the pressure in chamber C will push piston ‘b’ to the right. Vent ‘d’ will open and the pressure in chambers C and G will fall. The relay piston will be pushed up due to the pressure still present in chamber B causing vent ‘h’ to open. The pressure at connection point 2 will now fall via vent 3.

A stop bolt in front of tappet ‘g’ ensures that this valve can always provide the minimum brake pressure, if the bellows pressure delivered falls below the minimum effective pressure due to a fault. The factory setting of this bolt must not be changed.

The simulation connection (43) is for checking the operation of the valve. By connecting an air hose to it, the bellows will be pneumatically closed, allowing the valve to be operated with a random test pressure.

2.10 LOAD SENSING VALVE, LEAF SUSPENSION

Purpose
Automatic control of the brake force depends on the deflection of the springs and therefore on the loading condition of the vehicle. Thanks to the integrated relay valve, the brake cylinders are aerated and vented quickly.



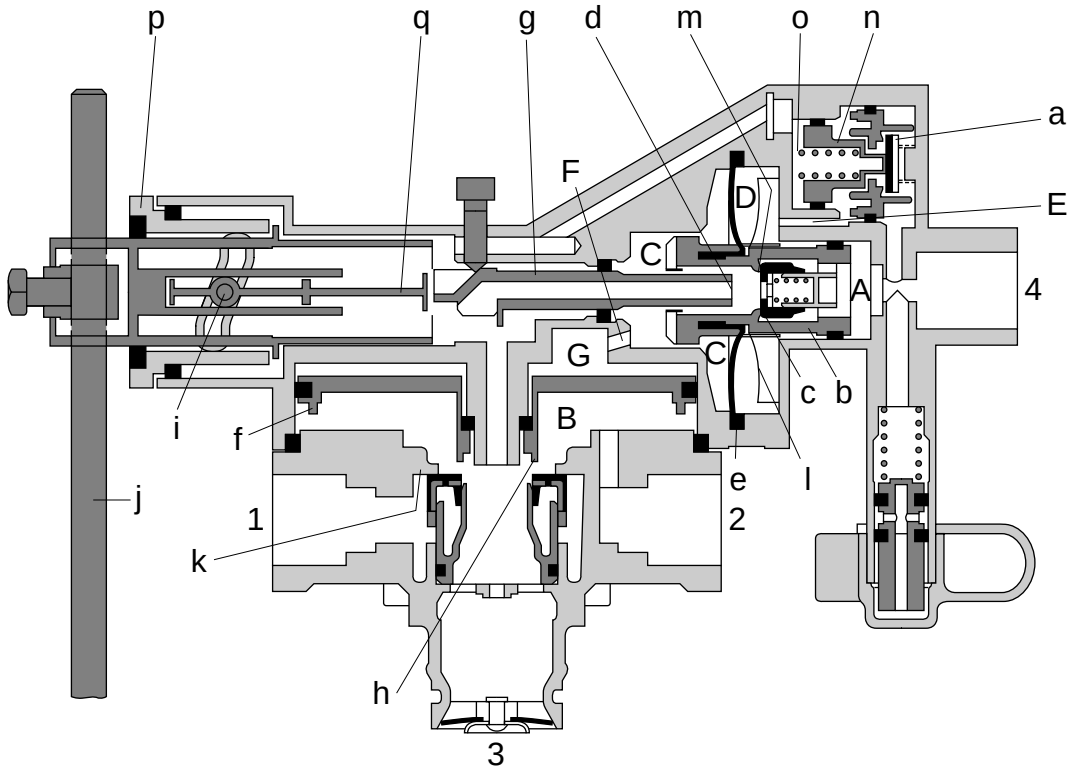
R600456

Operation
The control valve is attached to the chassis and connected to the rear axle by means of a rod. With unloaded vehicles, the distance between the regulator and the axle is largest and the lever (j) points fully downwards. When the vehicle is loaded, this distance decreases and the lever moves upwards, towards full load position.
Pin ‘i’ rotates with the lever and moves to the right via the control groove in bearing cover ‘p’ as a result. Rod ‘q’ brings the tappet (g) in a position that corresponds with the loading condition.

The compressed air provided by the foot brake valve flows via connection point 4 into chamber A, pushing piston ‘b’ to the left. Outlet ‘d’ is closed and inlet ‘m’ is opened, causing compressed air to enter chamber C to the left of diaphragm ‘e’. Relay piston ‘f’ is operated via duct F and chamber G.
At the same time, compressed air flows through the open valve (a) and duct E into chamber D to the right of diaphragm ‘e’. Due to this control, the output pressure at partial load and low control pressures is increased (to max. 1.4 bar). If the control pressure increases further, piston ‘n’ is moved to the left against the pressure of spring ‘o’ and valve ‘a’ closes.

As pressure builds up in chamber G, relay piston ‘f’ is pressed downwards. Outlet ‘h’ closes and inlet ‘k’ opens. The air at connection point 1 now flows to the brake cylinders via connection point 2.

Now pressure will start to build up in chamber B under relay piston ‘f’. As soon as this pressure is somewhat higher than that in chamber G, the piston is pushed upwards and closes inlet ‘k’.



R600456

When piston ‘b’ is moved to the left, the vanes (l) attached to it will gradually loosen the diaphragm (e) from the fixed vanes in the fan housing. As a result, the effective diaphragm surface will gradually increase. As soon as the force of the air to the left of the diaphragm exceeds that to the right, piston ‘b’ will move to the right. The inlet (m) will be closed and a set position is reached.

The position of tappet ‘g’, which is dependent on the position of lever ‘j’, is indicative of the effective diaphragm surface and therefore of the output brake pressure.
The position of tappet ‘g’ determines to what extent piston ‘b’ must be moved with the vane disc (l) to allow the valve to build up pressure. Due to this movement, the effective surface of the diaphragm will alter.

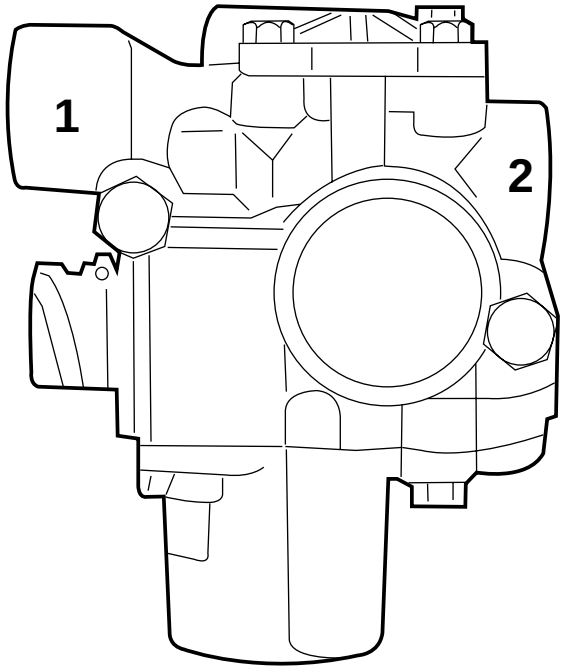
In full-load position, this surface and that of piston ‘b’ are equally large. The control pressure at connection point 4 is therefore let through (ratio 1:1) to chambers C and G. The output pressure at 2 will now equal the control pressure at connection point 4.

If the pressure at connection point 4 decreases, the pressure in chamber C will push piston ‘b’ to the right. Vent ‘d’ will open and the pressure in chambers C and G will fall. The relay piston will be pushed up due to the pressure still present in chamber B causing vent ‘h’ to open. The pressure at connection point 2 will now fall via vent 3.

A stop bolt in front of tappet g ensures that this valve can always provide the minimum brake pressure if lever ‘j’ is in too low a position due to a fault. The factory setting of this bolt must not be changed.

2.11 ABS VALVE

The ABS valve must keep the pressure constant in the brake chamber during an ABS control, or decrease the pressure in the brake chamber regardless of the pressure leaving the foot brake valve.
If the ABS valve is not operative, it has no function and the input pressure at connecting point 1 is the same as the output pressure at connecting point 2 to the brake chamber.

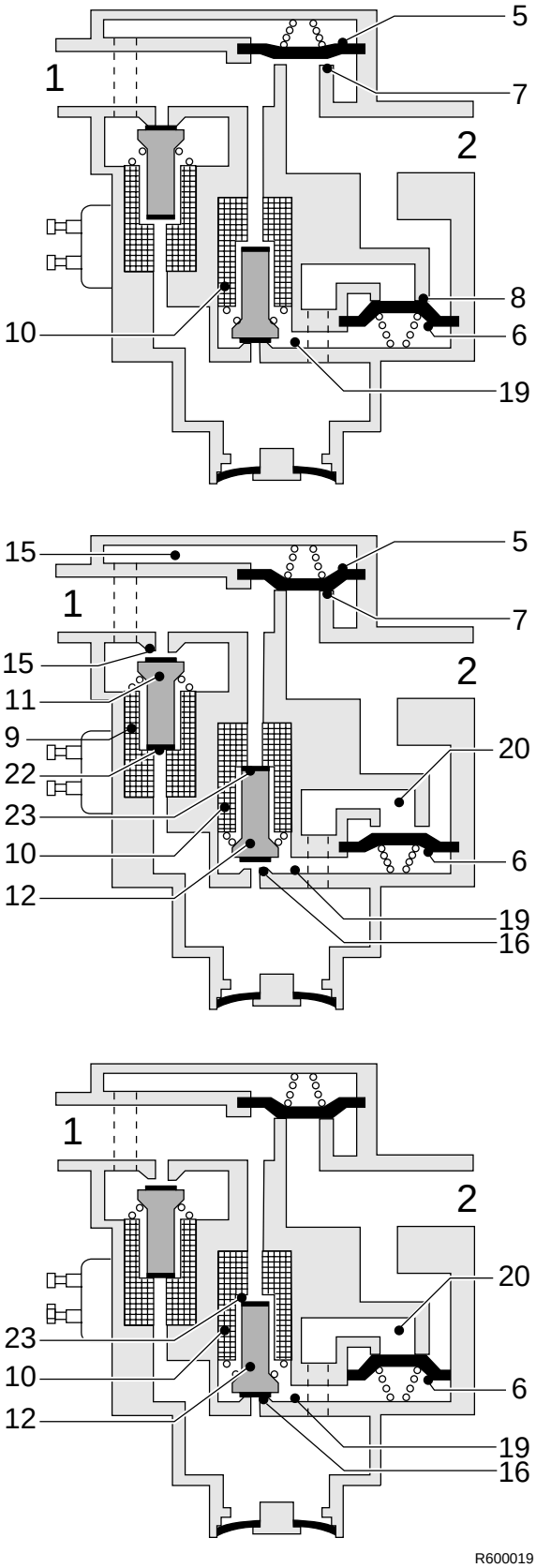


R600264

Increasing pressure at connecting point 2
Input pressure at connection point 1 coming from the foot brake valve will lift diaphragm 5 from the seat (7), causing the brake pressure via connection point 2 to be guided to the brake chamber.
The input pressure will also be guided through a bore past the magnet coil (10) in chamber 19 under diaphragm 6, causing diaphragm 6 to form a seal on seat 8. This will close connection point 2 from the vent.

Reducing pressure at connecting point 2
By activating magnet coil 9, solenoid valve 11 will open bore 15 and close bore 22. As a result, input pressure enters chamber 15 above diaphragm 5 via a bore. Diaphragm 5 seals against seat 7, so that no more pressure can build up.
By activating the magnet coil 10 at the same time, bore 16 opens and bore 23 closes.
By opening bore 16, the pressure under diaphragm 6 can be reduced via the vent. The pressure in the brake chamber can now escape via connection point 2, chamber 20 and an internal bore to the vent.

Maintaining pressure at connecting point 2
By deactivating magnet coil 10, the input pressure can be guided via a bore past magnet coil 10 into chamber 19 under diaphragm 6, thus sealing off diaphragm 6.
The pressure in the brake chamber can now no longer be guided to the vent via chamber 20. This keeps the pressure in the brake chamber constant.



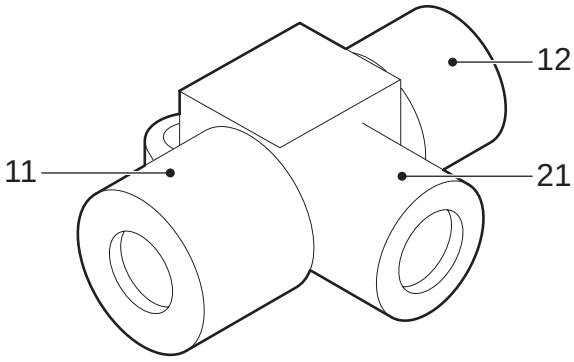
R600019

2.12 TWO-WAY VALVE

This valve is used in drum brakes as a double-check valve, that is to say a safety measure so that the maximum service brake and parking brake cannot operate the wheel brakes at the same time.

Purpose
The purpose of this valve is to let through unchanged the highest of two submitted pressure signals.

Operation
When pressure is applied to one of the entrances or if the pressure on one entrance is higher than on the other, the little piston will shut off the other entrance and the air can leave the valve unhindered via the entrance again.
No connection can be established between the two inlets.



R600747

4

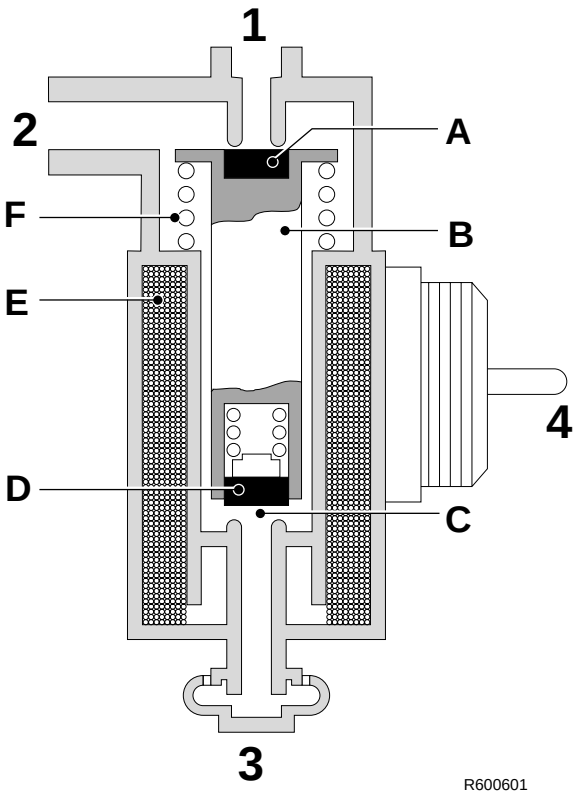
2.13 ASR SOLENOID VALVE

The ASR valve serves to transfer supply pressure to the ABS valve during an ASR differential brake control. Depending on the slip, the ABS valve will control the brake pressure to the respective brake chamber.
The ASR-valve is a simple electropneumatic valve, which is normally closed, that transfers air pressure when it is electrically energised.
The energising is controlled by the ABS/ASR electronic unit.

Note:
The vent (3) must always point downwards.

If coil E of the ASR valve is energised, core B will move down against the pressure of spring F. Seal A will now open connecting point 1, so that supply pressure can leave the valve via connecting point 2. Opening C and therefore vent 3 are also closed as core B moves downwards.

When coil E is no longer energised, core B will move upward under the influence of spring F. This action will close connecting point 1 and open opening C. Connecting point 2 is now connected to vent 3.

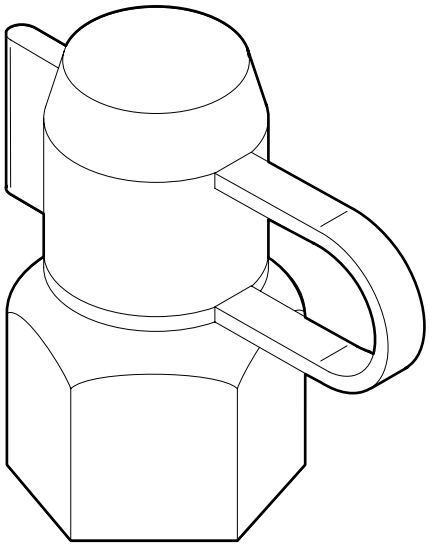


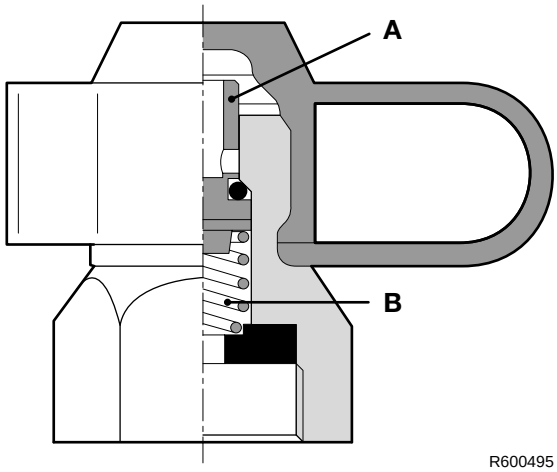
2.14 EMERGENCY FILLING/TEST CONNECTION

In various places in the brake system there are test connections for carrying out inspections and adjustments. A pipe leads from point 24 of the air dryer to the rear left of the cab. There is a test connection here that can be used as an emergency filling/tyre pump connection.

Note:
With a leaf-sprung front axle this test connection is on point 11 of the air dryer.

If a pipe is connected to the test connection, screwing in the union will lift the spring-loaded valve (A) from its seat, opening the supply. If the union is removed, the valve is pushed onto its seat by spring B, closing the supply.

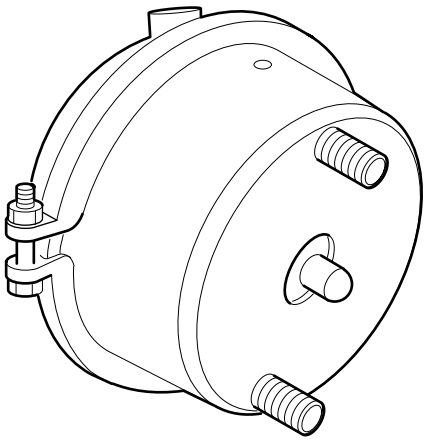


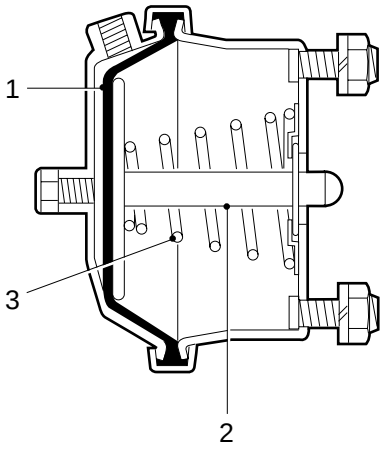


2.15 BRAKE CYLINDER

Purpose
The purpose of the brake cylinder is to apply the brake shoes or pads to the brake drum/disc.

Operation
When the foot brake valve is operated, compressed air is admitted at the pressure side of diaphragm 1. Diaphragm 1 and push rod 2 are pushed outwards against the pressure of the spring. As a result, the brake shoes are forced against the brake drum via a lever mechanism. The air on the other side of the diaphragm can escape via vent holes and the clearance around the push rod.
When the brakes are released, coil spring 3 will force the push rod and the diaphragm back to their initial position.
When the brakes are released, the brake cylinder will always draw in ambient air on the non-pressure side. When the brakes are released the push rod should return fully to its initial position. The triggering pressure should not exceed 0.5 bar.


R600505



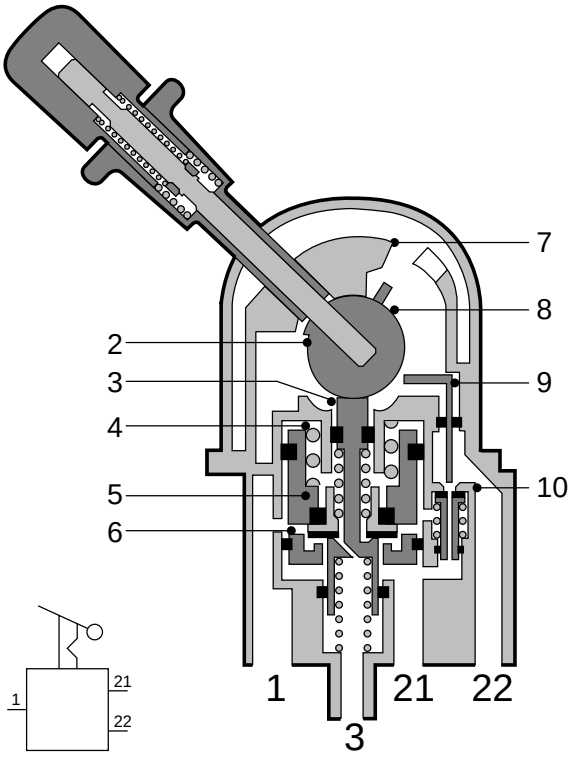
R600506

2.16 PARKING BRAKE VALVE

PARKING BRAKE VALVE WITH TRAILER CONNECTION AND TEST POSITION

Purpose
The parking brake valve enables simultaneous, controlled operation of both the parking brake system of the truck and the trailer vehicle brakes.

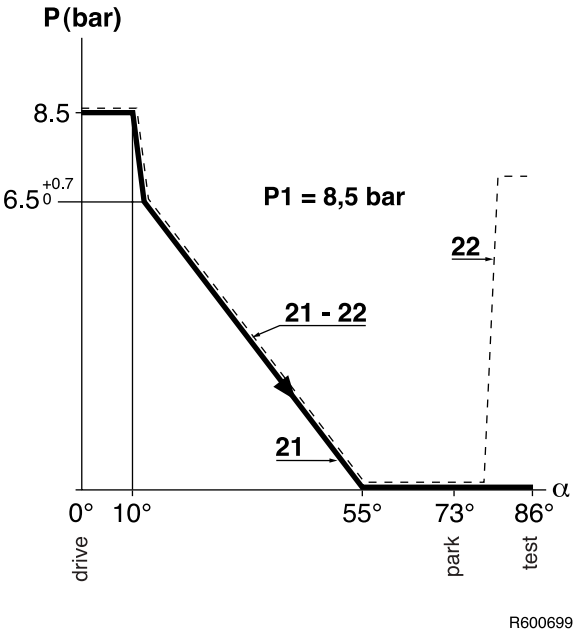
Operation
The parking brake valve has 3 positions:
1. driving
2. parking
3. test



Driving
With the handle in the driving position, there is a through connection in the valve for the supply pressure (connection point 1) to the connection points for spring brake cylinders 21 and trailer vehicle 22. The vent is now closed.
The output pressure at connection points 21 and 22 is now approx. 8.5 bar (see graph).

Emergency braking
If the handle is pulled a little backwards against the spring pressure, tappet 3 will move downwards via eccentric 2. The chamber at connection point 21 can now be vented and as a result the pressure at connection point 21 will drop. Via the bore in valve 10 the pressure at connection point 22 will also drop. Spring 4 forces piston 5 down until valve 6 comes into contact with the seal collar of tappet 3. A state of equilibrium has now been achieved.

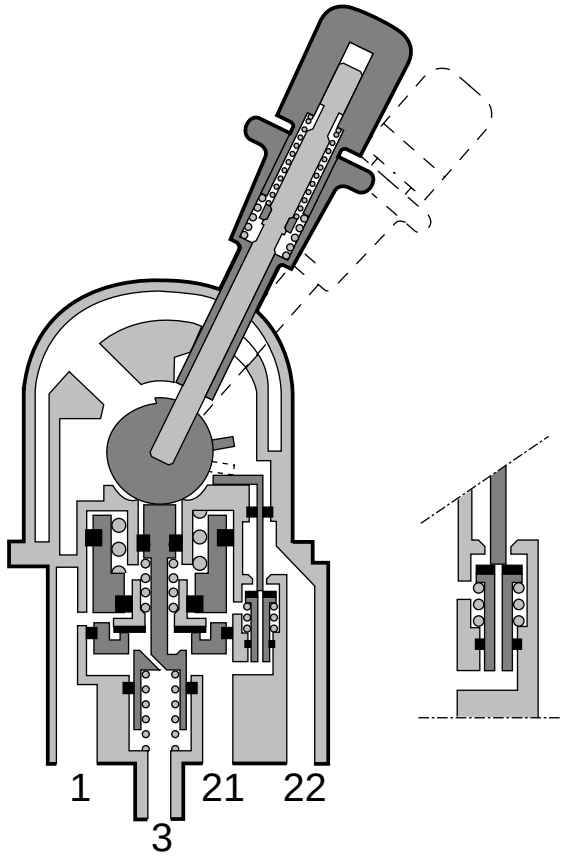
When the handle is moved against stop 7, the vent will remain open, so that the spring brakes and the trailer vehicle brakes will be applied to their maximum (max. emergency-brake position).



Parking
When the handle is pulled past stop 7, it is locked in position.
Connection points 21 and 22 will remain pressureless, so that the spring brakes and the trailer vehicle brakes are still applied to their maximum.

Test
When the handle is moved beyond the parking position, cam 8 will move tappet 9 downwards, causing the bore in valve 10 to be closed and the valve to be lifted from its seat.
The supply pressure can now be passed to connection point 22, via a bore in piston 5. As a result, the trailer vehicle brakes will be released.
Connection point 21 remains vented, so that the spring brakes keep the parking brake shoes applied.
The combination is now braked only by the force exerted by the spring brake cylinders on the truck. It can now be checked whether the combination remains motionless when the trailer vehicle brakes are not applied. When the handle is released, it will automatically return to the parking position.

Releasing the brakes
When the handle is once again moved fully forwards, tappet 3 will move upwards, seat against valve 6 and push the valve from its seat in piston 5. As a result, the supply pressure can reach connection points 21 and 22.

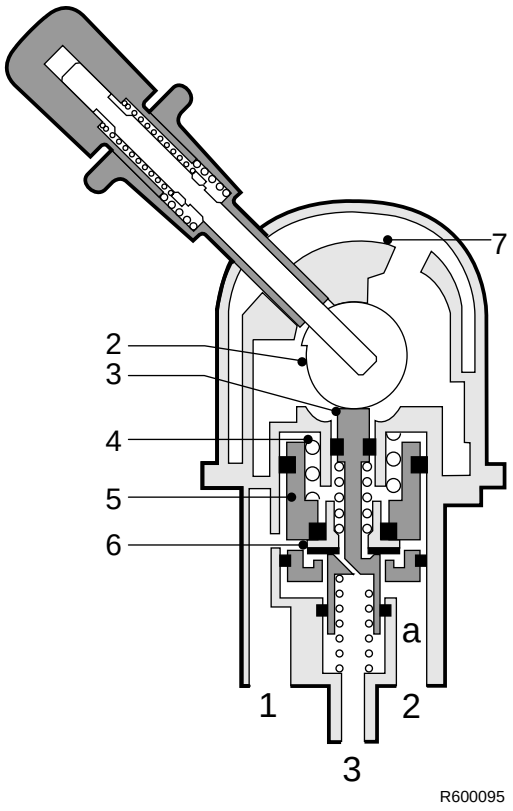


PARKING BRAKE VALVE WITH TRAILER CONNECTION WITHOUT TEST POSITION

Note:
Application depends on the country of use.

Purpose
The parking brake valve enables simultaneous, controlled operation of both the parking brake system of the truck and the trailer vehicle brakes.

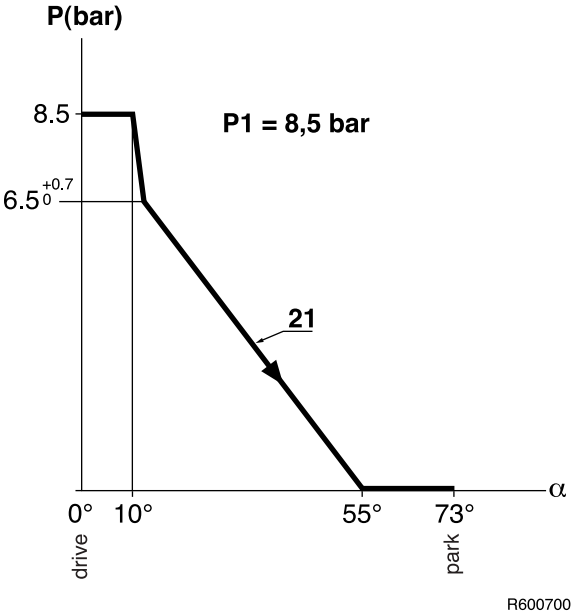
Operation
The parking brake valve has 2 positions:
1. driving
2. parking



Driving
With the handle in the driving position, there is a through connection in the valve for the supply pressure (connection point 1) to the connection points for spring brake cylinders 21 and trailer vehicle 22. The vent is now closed.
The output pressure at connection points 21 and 22 is now approx. 8.5 bar (see graph).

Emergency braking
If the handle is pulled a little backwards against the spring pressure, tappet 3 will move downwards via eccentric 2. The chamber at connection point 21 can now be vented and as a result the pressure at connection point 21 will drop. Via the bore in valve 10 the pressure at connection point 22 will also drop. Spring 4 forces piston 5 down until valve 6 comes into contact with the seal collar of tappet 3. A state of equilibrium has now been achieved.

When the handle is moved against stop 7, the vent will remain open, so that the spring brakes and the trailer vehicle brakes will be applied to their maximum (max. emergency-brake position).



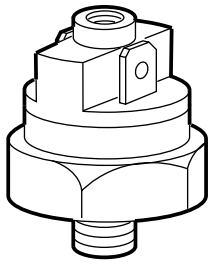
Parking
When the handle is pulled past stop 7, it is locked in position.
Connection point 21 is still pressureless.
Connection point 22 is connected to the reservoir connection via a bore in piston 5 and valve 10, which has been pushed from its seat by tappet 9. The combination is now braked only by the force exerted by the spring brake cylinders on the truck.

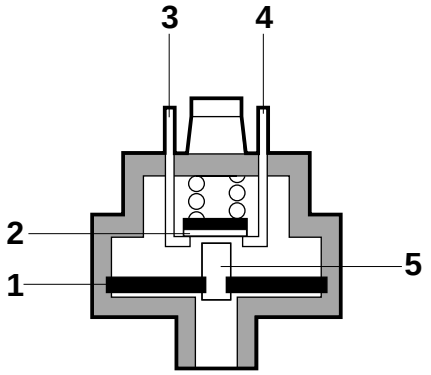
Releasing the brakes
When the handle is once again moved fully forwards, tappet 3 will move upwards, seat against valve 6 and push the valve from its seat in piston 5. As a result, the supply pressure can reach connection points 21 and 22.

2.17 LOW-PRESSURE SWITCH

Purpose
The purpose of the low-pressure switch is to switch off the warning lights when a pre-set pressure is reached.

1. Diaphragm
2. Switch
3. Contact
4. Contact
5. Thrust pin





R 600106

Operation
If the pre-set pressure in the air pipe is reached, the existing connection of both contacts 3 and 4 is cut off by diaphragm 1. If the pressure falls below the pre-set value, both contacts are connected again.

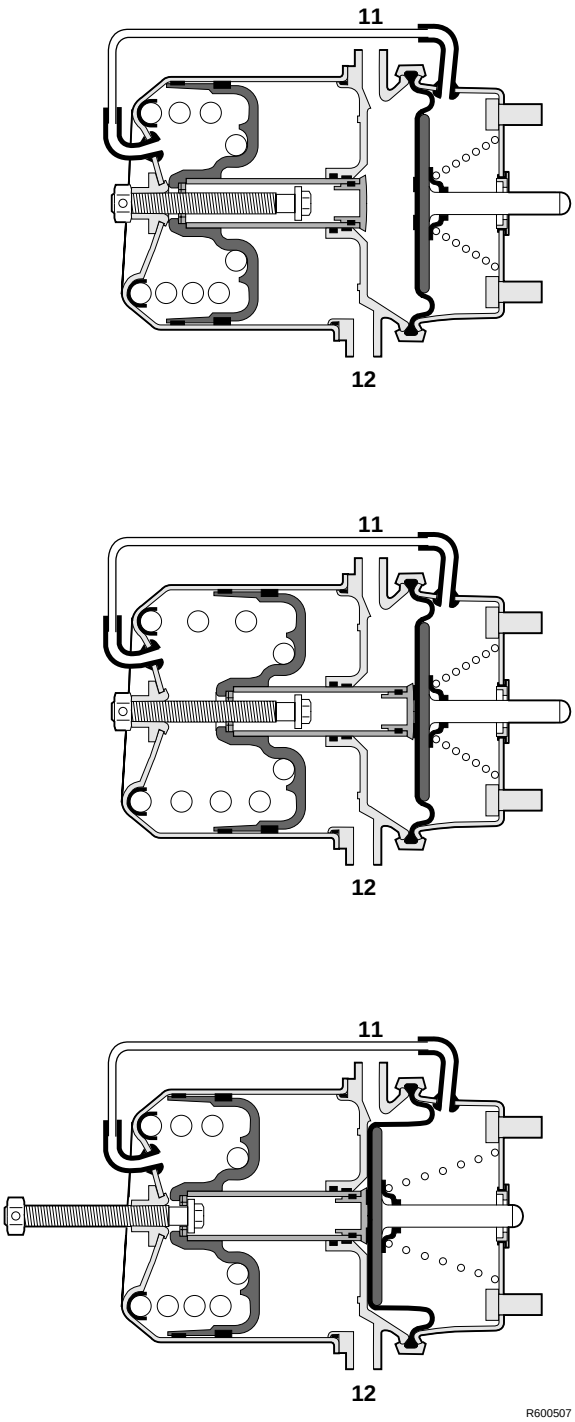
2.18 SPRING BRAKE CYLINDER

Purpose
The purpose of the spring brake cylinder is to force the brake pads/shoes against the disc/drum when the service or parking brake is operated.

Operation, spring brake cylinder
The spring brake cylinder consists of two parts: a part for the service brake, which is designed as a normal brake cylinder, and a part for the parking brake, being a spring brake cylinder.

Normal position during driving.
The air reservoirs must be at a safe pressure before you start driving. If this is not the case, a warning signal (e.g. a buzzer) will be transmitted.
If this pressure is admitted to the spring brake cylinder, the piston will compress the powerful spring. The push rod is no longer under load and will go into the non-braked position due to the operation of the spring, etc.

Service brake
Because the brake cylinder and the spring brake cylinder are separate, the spring brake cannot affect the operation of the service brake.
When the service brake is applied, the powerful spring continues to be compressed, while there is air pressure on the diaphragm of the brake cylinder. When the foot brake valve is operated, the compressed air passes through connection point 11 into the chamber behind the diaphragm. The diaphragm with push rod is pushed out against the spring pressure.
The air on the other side of the diaphragm can escape via vent holes. When the brakes are released, the spring forces the push rod and the diaphragm back into their original position.

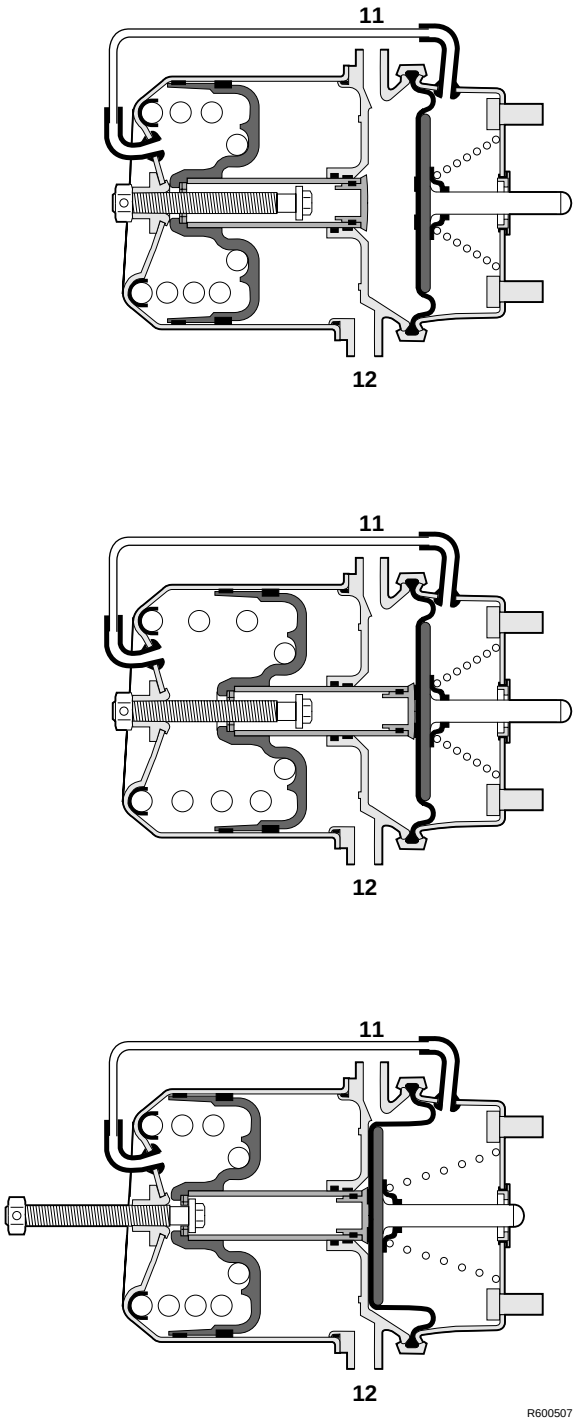


Parking brake
Connection point 12 is vented.
The powerful spring then forces the piston with the piston tube against the diaphragm, so that the push rod is forced outwards. Here, use is made of the continuously available energy of the compressed, powerful spring.

Release tool, spring brake cylinder with unscrewable release bolt
If, due to a failure, no compressed air is available in the spring brake cylinder, the vehicle brakes are automatically applied.
But it must still be possible to tow the vehicle.
The spring brake cylinder is therefore fitted with a release bolt at the rear. By turning this bolt anticlockwise using a spanner, the powerful spring will be compressed.
As the bolt is provided with a thrust bearing, the torque required is not more than 20 - 40 Nm.
Do not use a pneumatic spanner for this purpose.

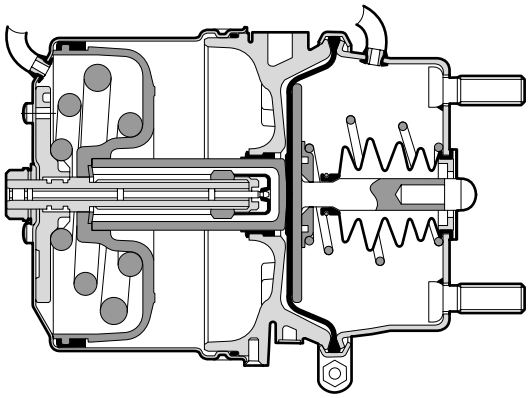
Because the spring brakes have been released mechanically, the parking brake can no longer be applied.

Once the failure has been remedied and sufficient compressed air is available, the control valve can be used to again admit air into the spring brake cylinder.
The release bolt should then be screwed back in with the spanner and tightened to the specified torque. See “Technical data”. The pressure in the spring brake cylinder circuit should be at least 6.5 bar.

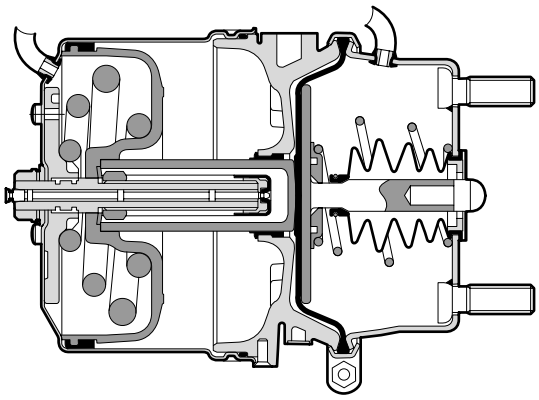


4

Release tool, spring brake cylinder with control pin
By turning this bolt anticlockwise using a spanner, the powerful spring will be compressed.
As the bolt is provided with a thrust bearing, the torque required is not more than 20 - 40 Nm.
As soon as the releasing bolt is rotated, a control pin appears from the centre of the releasing bolt. As this spring brake cylinder has an internal screw mechanism, the releasing bolt will not protrude during rotation.
Do not use a pneumatic spanner for this purpose.


R600482

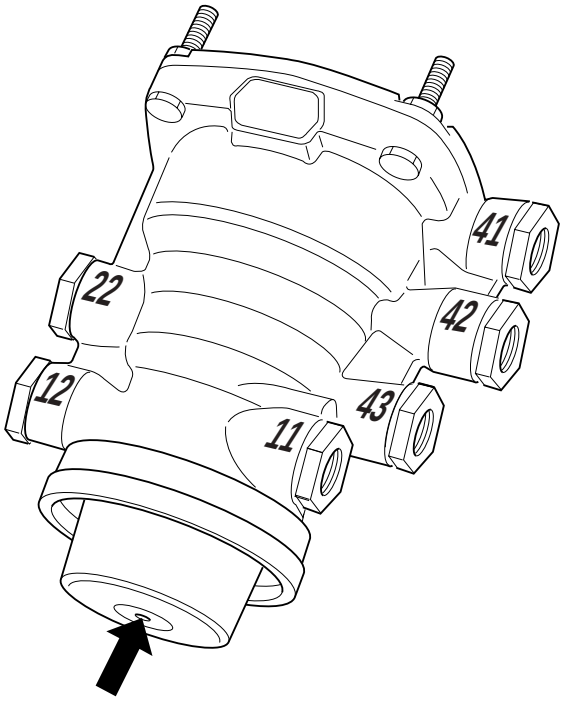
Because the spring brakes have been released mechanically, the parking brake can no longer be applied.


R600483

Once the failure has been remedied and sufficient compressed air is available, the control valve can be used to again admit air into the spring brake cylinder.
The release bolt should then be screwed back in with the spanner and tightened to the specified torque. See “Technical data”. The control pin will slide back inside when the releasing bolt has been fully returned. The pressure in the spring brake cylinder circuit should be at least 6.5 bar.

2.19 TRAILER VEHICLE CONTROL VALVE

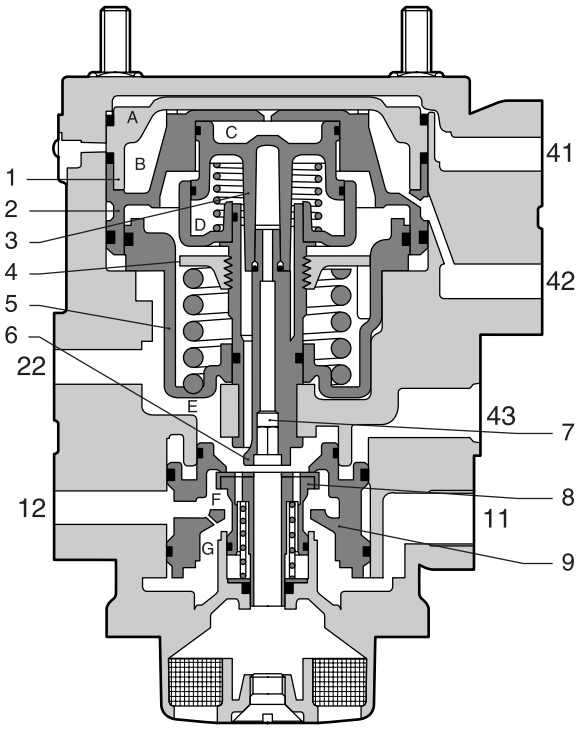
Purpose
The purpose of the trailer vehicle control valve is to pass on the brake commands from the truck to the trailer vehicle.



R600335

Operation

Driving
Connection point 11 is connected with a reservoir and connection point 43 with the parking brake valve. Both are pressurised and in a state of equilibrium. The service coupling head communicates with the ambient air via connecting point 22, valve 8 and the vent with damper.



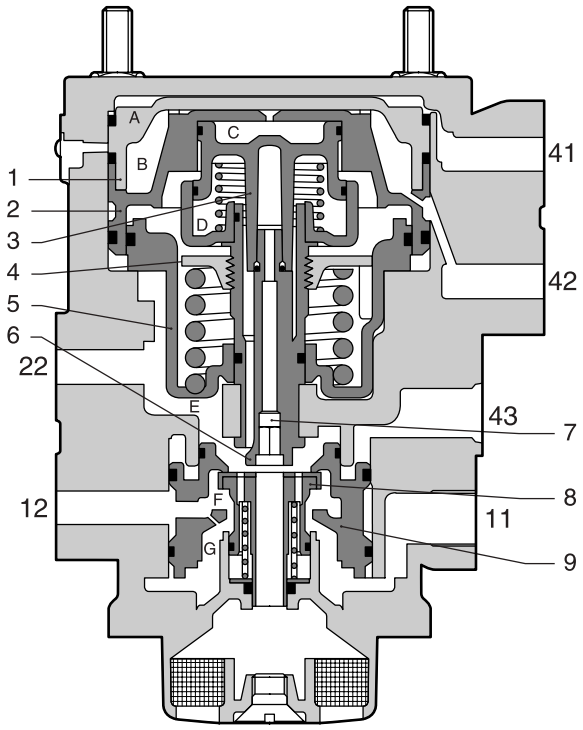
R600340

Braking with the service brake

Pressure build-up
Circuit 1, connection point 41, and circuit 2, connection point 42, are pressurised by the foot brake valve.
This pushes down the pistons (1 and 2), causing valve 8 to close the outlet and open the inlet.
The supply pressure at connection point 11 can now flow via valve 8 to connection point 22, (yellow) trailer service coupling head, and will cause the drawn vehicle to brake.

Adjusting
When a pre-set output pressure has been reached at connection point 22, this pressure will once again force the piston (5) upwards, thus closing valve 8.
There is now a state of balance between the input pressure at connection point 41 and the output pressure at connection point 22.

Releasing
When the foot brake valve is released, the input pressure at connection points 41 and 42 falls away. Pistons 1 and 2 are pushed upwards by the spring under spring retainer 4.
As a result, valve 8 is closed and the outlet opened, linking connection point 22 with the vent.



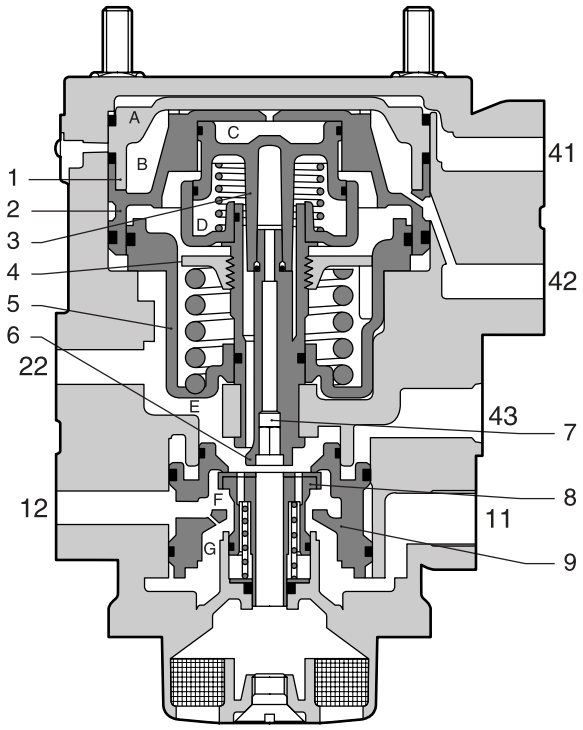
R600340

Brake pressure advance

Pressure build-up
If the foot brake valve is used to build up pressure at connection points 41 and 42, the output pressure at connection point 22 will also move piston 5 upwards, closing valve 8. There is now a state of balance between the input pressure at connection point 41 and the output pressure at connection point 22.

Change
If adjusting screw 6 is turned clockwise, for example, spring retainer 4 will be moved downwards, further compressing the spring underneath it. Therefore, if the operating pressure at connection points 41 and 42 remain the same, a higher adjusting pressure will be needed under piston 5. This adjusting pressure is also on the yellow coupling head.

This increase of service pressure to the trailer vehicle in relation to the brake pressure from the truck is called brake pressure advance.
For the setting procedure, see “Inspection and adjustment”.

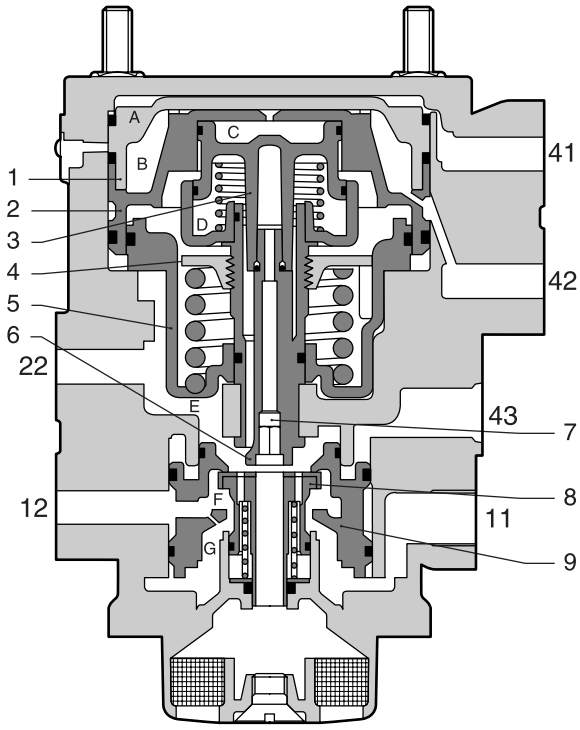


R600340

Emergency brake
When the parking brake valve is moved into the locking position, connection point 43 will be gradually vented.
Piston 9 moves upwards and valve 8 is opened. Depending on the drop in pressure at connection point 43, a pressure build-up will occur at connection point 22. When a pre-set value has been reached, valve 8 will close so that a state of equilibrium is achieved.

Parking brake
When the parking brake valve is in its maximum position, i.e. the position at which the lever is blocked, connection point 43 is vented. As a consequence, there is still an output pressure at connection 22.

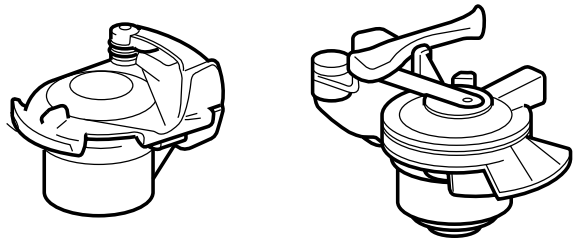
Protection against breakage of service line
During braking pressure will be built up on connection point 22. The air needed for this is supplied from connection point 11.
If the service line is broken, pressure will not build up in chamber E, which will cause piston 9 to move up and close against the bottom of valve 8. The supply from connection point 11 stagnates, causing pressure to be delivered from connection point 12.
The pressure in the reservoir pipe drops and the trailer vehicle brakes are applied.



R600340

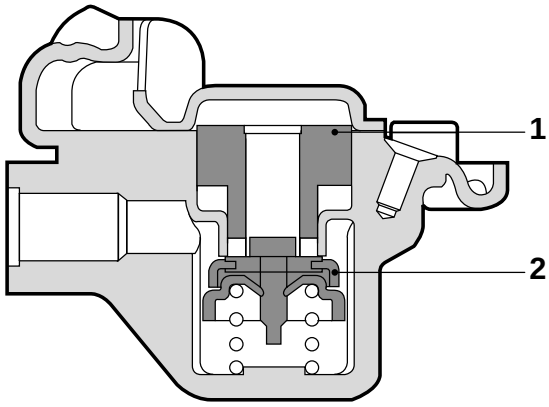
2.20 COUPLING HEAD

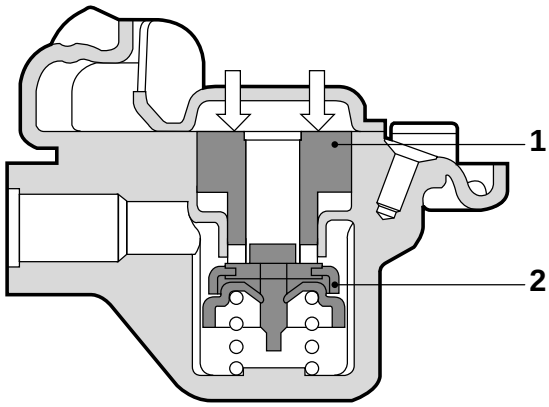
Application
With spring-loaded valve. Fitted in the dual-circuit brake system of versions with trailer connections.
If these automatic coupling heads are applied, there is no need for an air cock.



Purpose
Connecting the air brake system of the tractive unit with that of the trailer vehicle.

Operation
Spring-loaded valve 2 in the coupling head ensures that the system is isolated from the ambient air.
When coupling, turn the counter head until the claws of the two heads rest against the stop under the locking plates. This will prevent the coupling head from disengaging spontaneously.
Because the two sealing rings (1) are pressed against each other, the spring-loaded valve remains open so that an air-tight connection is achieved. When the heads are uncoupled, the spring-loaded valve will seal off the pipe on the tractive unit.
The coupling head is equipped with a safety cam. This is to prevent different coupling heads being coupled to one another.
If no trailer vehicle is hooked up, the cover of the coupling head must be closed, to avoid fouling.



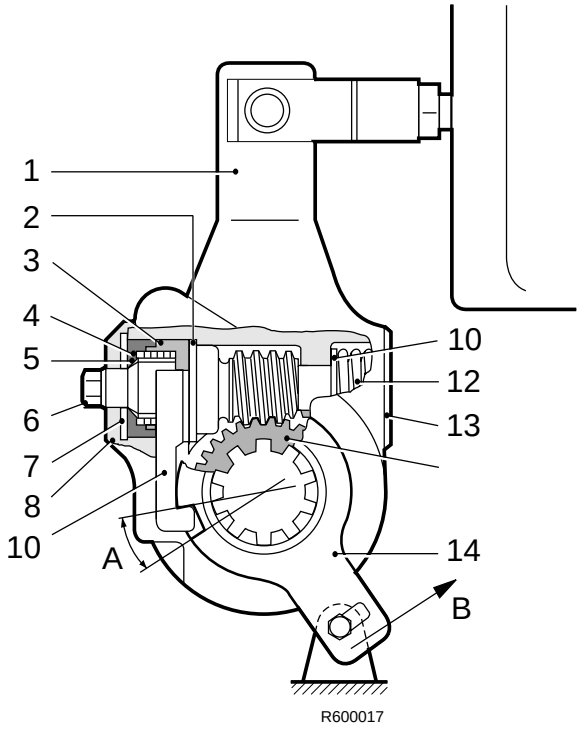


R600101

2.21 AUTOMATIC BRAKE ADJUSTER

Purpose
The purpose of the automatic brake adjuster is to automatically compensate for any excessive play between the brake lining and the brake drum caused by brake lining wear. As a result, the cylinder travel during braking remains more or less constant.

1. Housing
2. Bearing
3. Pinion of overrunning clutch
4. Spring of overrunning clutch
5. Conical ring of overrunning clutch
6. Worm shaft
7. Pivot bearing
8. Screw cap
9. Gear
10. Rack
11. Spring retainer
12. Spring
13. Screw cap
14. Control plate



Angle A: the angle corresponding to the basic brake stroke.

Operation
Lining wear causes extra clearance between lining and drum. This is adjusted during the return stroke of the brake adjuster.
The brake cylinder stroke is composed of the following three components:

- the basic brake stroke, which corresponds to the normal clearance between lining and drum;
- the additional stroke, which corresponds to the additional clearance between lining and drum due to lining wear;
- the elastic stroke due to the elasticity of drum, lining, shoes and brake camshaft.

Basic brake stroke
The basic brake stroke is determined by the notch in control plate 14, which is attached to the axle housing. In the rest position, the rack should rest against the upper edge of the notch. When the stroke exceeds angle A, the adjusting system is activated. Angle A corresponds to the normal stroke.

Additional stroke
If the normal stroke is exceeded, the lower edge of the notch of the control plate forces rack 10 upwards. As a result, pinion 3 is turned.
An overrunning clutch, consisting of spring 4 and conical clutch 5, has been fitted between the pinion and worm shaft 6, which permits free turning in this direction.

During the return stroke, the rack is pulled downwards by the upper edge of the notch. The pinion now turns in the opposite direction, so that the overrunning clutch drives worm shaft 6 and the brake is adjusted.

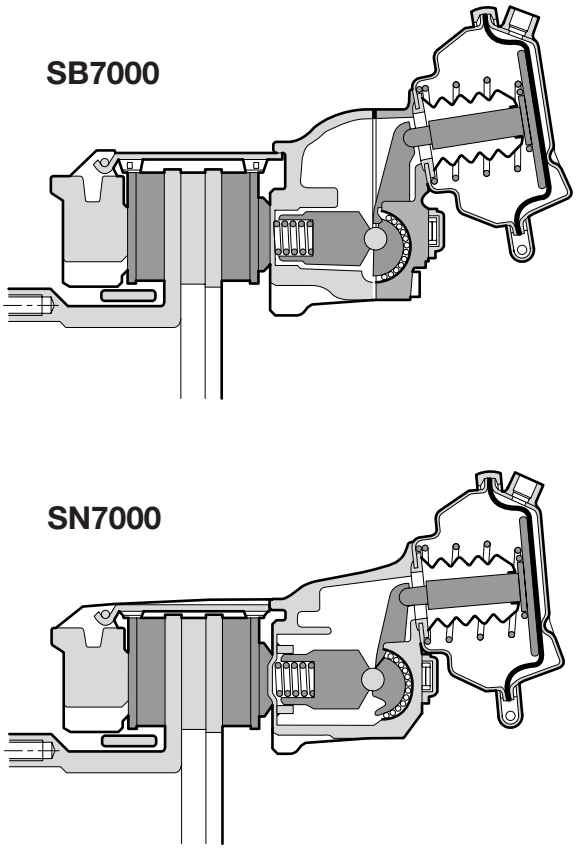
Elastic stroke
During the elastic part of the stroke, the considerable force transmitted pushes worm shaft 6 axially against spring 12. This will cause the worm shaft to become disengaged from the conical clutch.
As a result, the conical clutch will be able to turn freely over a certain distance during the return travel, until clutch and worm shaft are re-engaged, without driving the worm shaft. From that moment, any rotation of the pinion will once again adjust the length of stroke. As a result of this construction, the elasticity of the component involved will not be instrumental in adjusting the stroke.

2.22 DISC BRAKE

Variants
The disc brake construction consists of the brake disc and the brake calliper. There are two variants of this construction:

- Knorr SB7000, recognisable by the divided housing between the brake cylinder and the brake pad holder and the rubber sleeve.
- Knorr SN7000, recognisable by the undivided housing between the brake cylinder and the brake pad holder and the steel cap.

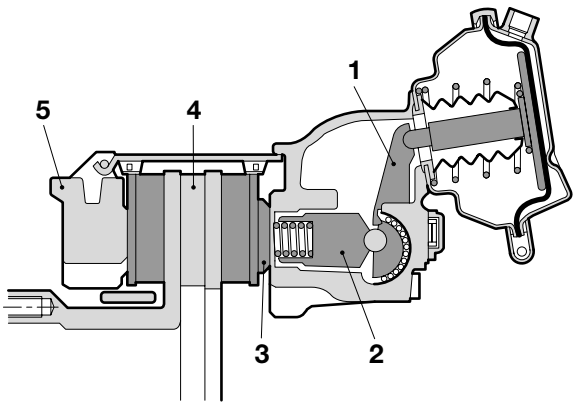
The Knorr SN7000 construction used on all disc-brake front axles and on air-sprung rear axles. On leaf-sprung rear axles the Knorr SB7000 construction is used. Operation of the two variants is identical. Only overhauling and the parts of the brake calliper differ.



R600707

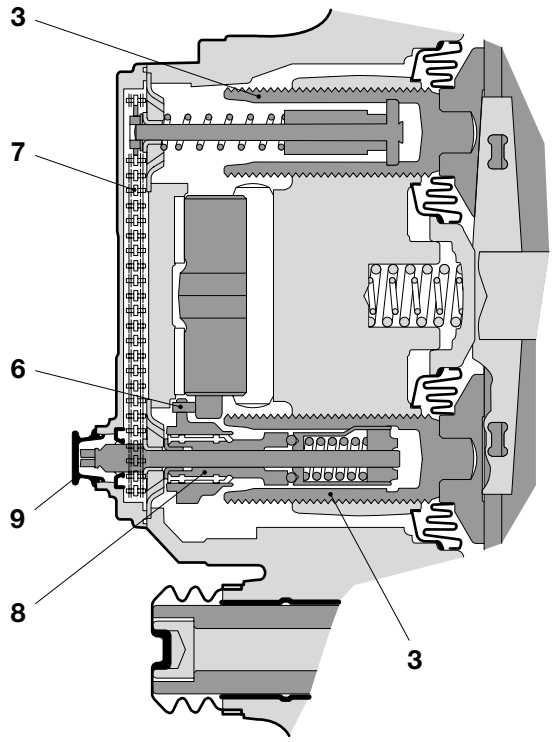
Operation
Brakes
This disc brake works using a pneumatic brake chamber or spring brake cylinder.

If the brake is applied, the brake cylinder push rod presses against the eccentrically mounted lever (1).
Via bridge 2 and threaded bushes 3, the brake pad is pressed against the brake disc (4) at two points on the inside.
Due to the reaction force (F2) at the eccentric, the floating brake saddle (5) will also press the opposite brake pad with the same force (F2).



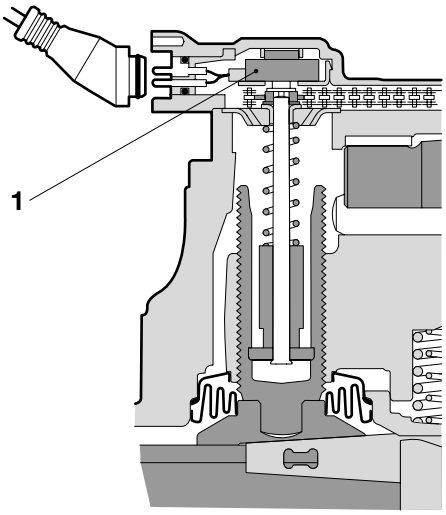
R600486

Adjusting
One of the two threaded bushes (3) is equipped with the mechanics for automatic adjustment of the play between the brake pads and brake disc.
This adjuster and the eccentric have teeth (6) that engage each other.
If the play is too great, the adjuster (8) will be rotated by these teeth the next time the brakes are applied, so that the play will be reduced.
Under normal conditions, the adjuster will push against the brake pad before rotation can take place. However, if rotation does take place, it will be absorbed by a slip coupling.
The rotation of the adjuster is transferred by means of a chain (7) to the other adjuster.
By removing a rubber cap (9) where the automatic adjuster is located, a hexagon is revealed. Using a ring spanner, the play can be manually set by adjusting this hexagon.



R600487

Wear indicator
The wear sensor, which is fitted on the adjustment mechanism of the brake calliper, contains a series connection of a resistor and a switch (1). The switch is normally closed and the circuit has a resistance equal to the value of the resistor. When the brake pads are worn, the circuit is interrupted.
This is the signal for the VIC system to activate the 'brake pad wear' warning symbol on the instrument panel.



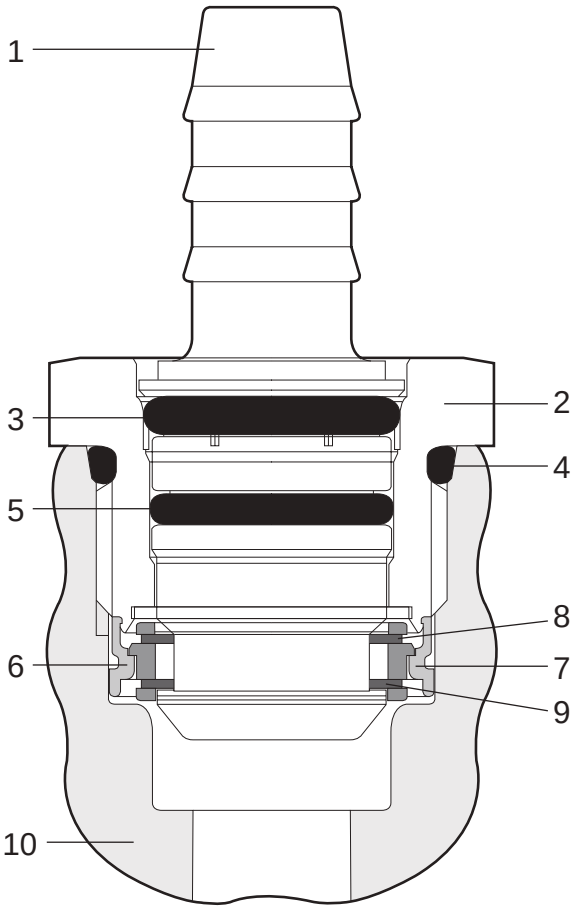
R600488

2.23 QUICK-RELEASE COUPLING

The VOSS 232 quick-release coupling consists of two parts, i.e.:
- plug with hose coupling (1)
- socket (2)

The plug (1) has two O-rings. The upper O-ring (3) makes sure of pre-tension and protects against dirt entering the system. The lower O-ring (5), like O-ring 4 between the socket and valve, has a sealing function.

The socket has a circlip (7), containing two retainer clips (8 and 9). This circlip with retainer clips is held in place by a sleeve (6).



R600365

CONTENTS

5

1. SAFETY INSTRUCTIONS

1.1 SAFETY INSTRUCTIONS

Always observe the local safety and environmental regulations.

If the parking brake is deactivated when working on the vehicle, place chocks in front of and behind the wheels to prevent the vehicle from moving.

The substances and auxiliary substances (to be) used may constitute a direct or indirect health hazard. For that reason, always wear protective clothing and protective equipment (e.g. goggles, gloves) to prevent inhalation, skin contact, etc.

Use only the specified special tools.

Parts of threaded connections have to be clean and free of lubricants before use

Check the correct operation of the vehicle, and the brake system in particular if work has been carried out on it, before handing over the vehicle to the user

5

5

2. INSPECTION AND ADJUSTMENT

2.1 INSPECTION, COMPRESSOR CAPACITY

1. Bring the engine up to operating temperature.

2. For a vehicle with air suspension, the chassis should be at the normal driving height.

3. Put chocks in front of and behind the rear-axle wheels to prevent the vehicle from moving.

4. Position the parking brake in the driving position.

   Note:
   If, when draining the air reservoirs, they appear to hold an excessive quantity of oil, check the condition of the compressor and check the compressor for the presence of carbon deposits in the compressor pipes.

5. Bleed the entire brake system.

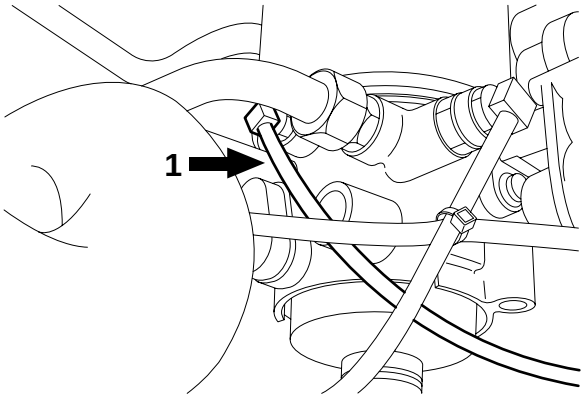
6. The capacity test requires that a completely empty system should be at operating pressure within 5 minutes, at an engine speed of 0.6 x maximum engine speed.

2.2 INSPECTING THE COMPRESSOR LINE

Remain at a safe distance from rotating and/or moving components.

Note:
If excessive values are measured, the inside of the air-dryer housing and the silencer on the bleed vent should first be cleaned. Then repeat the inspection.

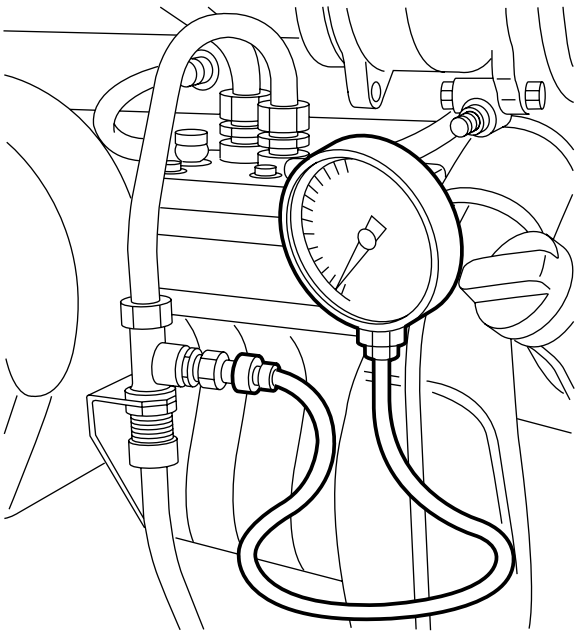
1. Bring the engine up to operating temperature.
2. Bleed the system to a pressure below the cut-in pressure of the pressure regulator.
3. Remove the compressor control pipe (1) which is connected to connection point (23) of the air dryer. Then seal the opening at connection point (23).
4. Build up pressure in the brake system (pressure regulator must cut out).
5. When the engine is not running, remove the safety valve from the compressor pipe and replace it with a test nipple.



R600521

6. Connect a pressure gauge (measuring range 0 - 16 bar) to the test nipple.
7. Start the engine and run it at maximum engine speed.
8. The pressure gauge should indicate a pressure below 2 bar **with the pressure regulator switched off**. If the measured pressure exceeds the value indicated, the compressor line should be cleaned or replaced.

   Note:
   If the pressure measured is too high, this indicates that there are excessive carbon deposits in the compressor pipe. The cause could be poor condition of the compressor (oil consumption).



R600249

9. Run the engine at idling speed.

10. Bleed the brake system until the cut-in pressure of the pressure regulator has been reached and switch off the engine.
The indicator on the pressure gauge should not drop rapidly. If necessary, check the system for leaks. Pay special attention to the compressor line and the compressor.

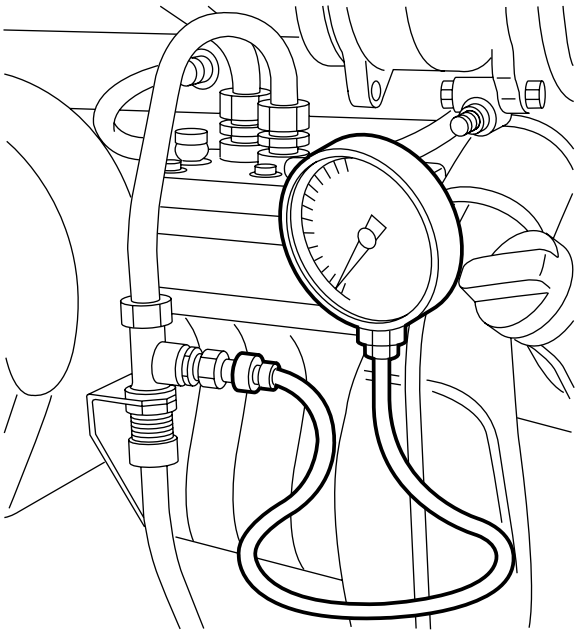
11. Fit the safety valve.

12. Fit the compressor control pipe to connection point (23) of the air dryer.

2.3 INSPECTION, COMPRESSOR CONTROL

Remain at a safe distance from rotating and/or moving components.

1. Bring the engine up to operating temperature.
2. Bleed the system until the pressure is below the cut-in pressure. See "Technical data".
3. Connect a pressure gauge (test range 0 - 16 bar) to the test nipple of the tyre filling connection.
4. Start the engine.
5. When the **pressure regulator cuts out (blows off)**, the pressure gauge should fall to approximately 0 bar.



R600249

2.4 INSPECTION AND ADJUSTMENT, FOOT BRAKE VALVE

Inspection, foot brake valve

1. Connect a pressure gauge to a brake chamber of the front axle (in front of the empty/load valve, if present).
2. Connect a pressure gauge in front of the load sensing valve.
3. Pressurise the system.
4. Depress the brake pedal a few times, alternately quickly and slowly, until the end stop is reached. Check if there is a discrepancy between both gauge readings (discrepancy maximum 0.3 bar).
5. When the brake pedal is gradually depressed, both circuits should not show larger pressure increases than 0.3 bar.
6. When the foot brake valve is completely depressed, both gauges should indicate the reservoir pressure.
7. When the brake pedal is not depressed, the pressure gauges should not indicate any pressure.

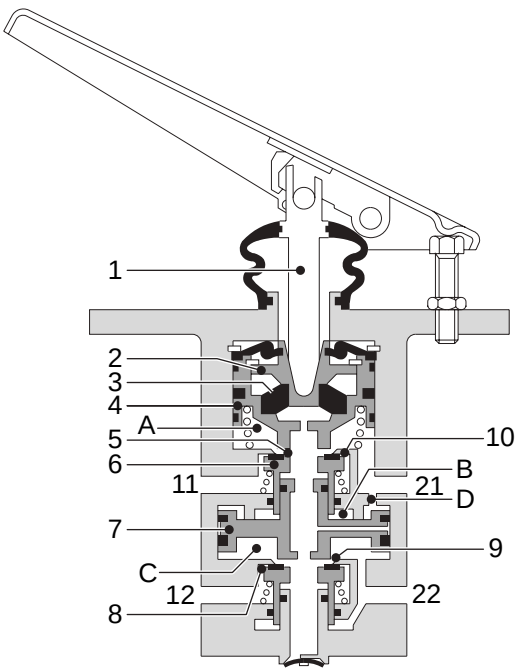


Fig.2

R600748

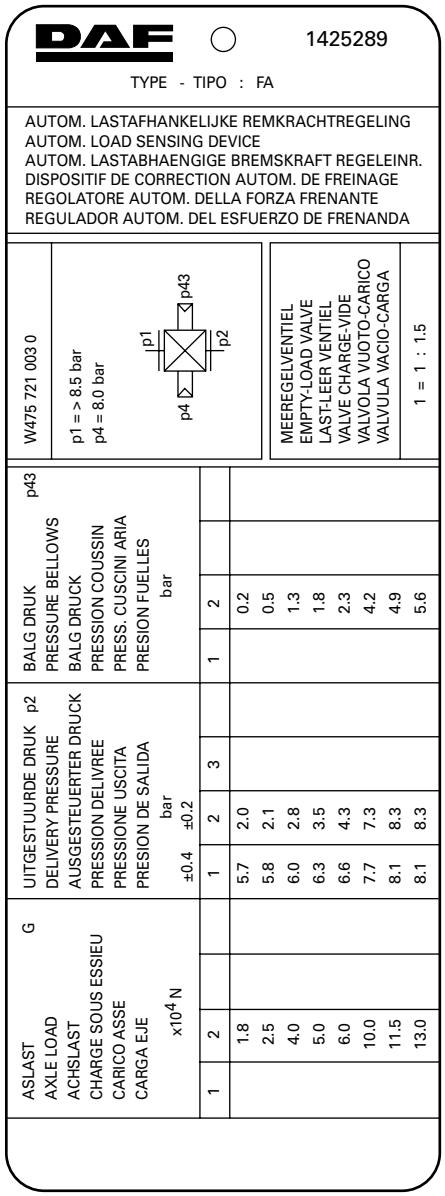
Adjusting the foot brake valve

1. Check whether the brake pedal can be fully depressed. When fully depressed, the pedal should not touch the floor mat. This is especially important if circuit 1 were to fail. More pedal travel will then be needed to achieve full pressure at circuit 2.
2. The stop bolt should be adjusted in such a manner that there is noticeable play between bolt and pedal.

2.5 INSPECTION AND ADJUSTMENT, LOAD SENSING VALVE, AIR SUSPENSION

Explanatory notes on instruction plate
This plate is mounted on the rear door pillar on the left-hand side of the vehicle. The information on the instruction plate relates to the axle loads, the delivery pressures and bellows pressures, following the sequence of the axles beneath the vehicle.

Therefore, "1" refers to the (first) front axle, "2" to the next following axle, etc.
If the vehicle is fitted with a relay valve in the front axle brake circuit, the box beneath the valve illustration will be blank. Throughout the column, a value of 8.1 bar has been filled in for "delivery pressure p2" under axle "1".
If the vehicle is equipped with a control valve instead of the relay valve mentioned, the box will contain a pressure ratio, e.g."i = 1 : 1,5".
The "delivery pressure p2" of axle "1" then indicates variable readings.
These values can be used to check the brake pressure values of the front axle and to carry out the inspection/adjustment below at the same time. To do this, connect a pressure gauge to the test connection of one of the front axle brake cylinders.



R600472

Inspection/adjustment

1. Check that the correct valve has been fitted (see instruction plate).

2. Connect a pressure gauge (4) to the test connection close to connection 1/4 on the load sensing valve (input pressure).

3. Connect a pressure gauge (2) to the test connection on one of the brake cylinders (service brake connection) of the rear axle.

4. Connect a pressure gauge (43) with a pressure-reducing valve to the simulation connection near connections (41) and (42) of the load sensing valve (= simulated adjustable bellows pressure).

5. Make sure that the reservoir pressure is higher than 8.5 bar throughout the testing process.

6. Set the simulated bellows pressure to its **second lowest** value, as indicated on the instruction plate.

7. Depress the brake pedal until pressure gauge (4) indicates a pressure of 8 bar.

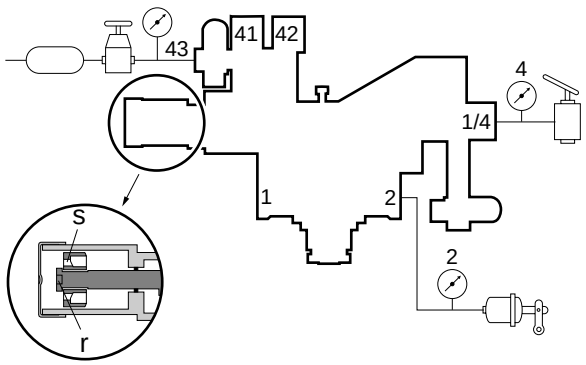
8. Read the brake pressure of the rear axle on pressure gauge (2) and check that this brake pressure matches the one listed on the instruction plate in the table under "delivery pressure p2" to the rear axle.

9. If the measured value is not correct, depressurise connection (43) and, using the special cam spanner (DAF No. 1329464) turn the adjusting nut(s):
   - braking pressure too high: unscrew the adjusting nut
   - braking pressure too low: screw in the adjusting nut.

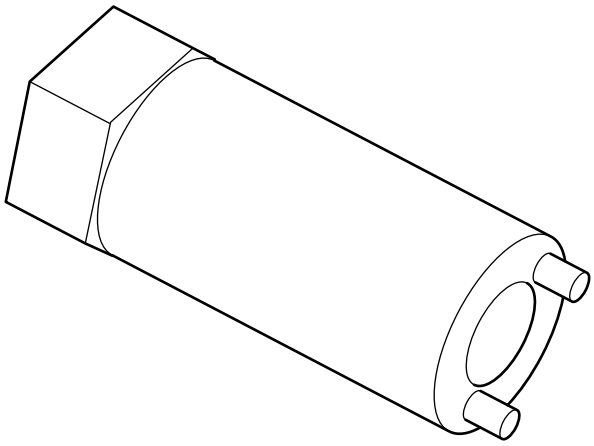
   Note:
   When depressurising the simulation connection (pressure gauge 43), the air hose must remain connected to prevent the (actual) bellows pressure from accidentally activating the valve.
   The small socket head screw in the centre of the valve must not be adjusted.

10. Repeat the procedure described in point 6 until the measured braking pressure value is within the tolerance limits.

11. Set the simulated bellows pressure to its second **highest** value, as indicated on the instruction plate.



R600473


R600478

12. Depress the brake pedal until pressure gauge (4) indicates a pressure of 8 bar.

13. Read the pressure gauge (2) and check that this braking pressure matches the pressure indicated in the table on the instruction plate.

14. If the measured reading is not correct, depressurise connection (43) and turn the adjusting bolt (r) using a Torx screwdriver:
    - braking pressure too high: screw in the adjusting bolt
    - braking pressure too low: unscrew the adjusting bolt.

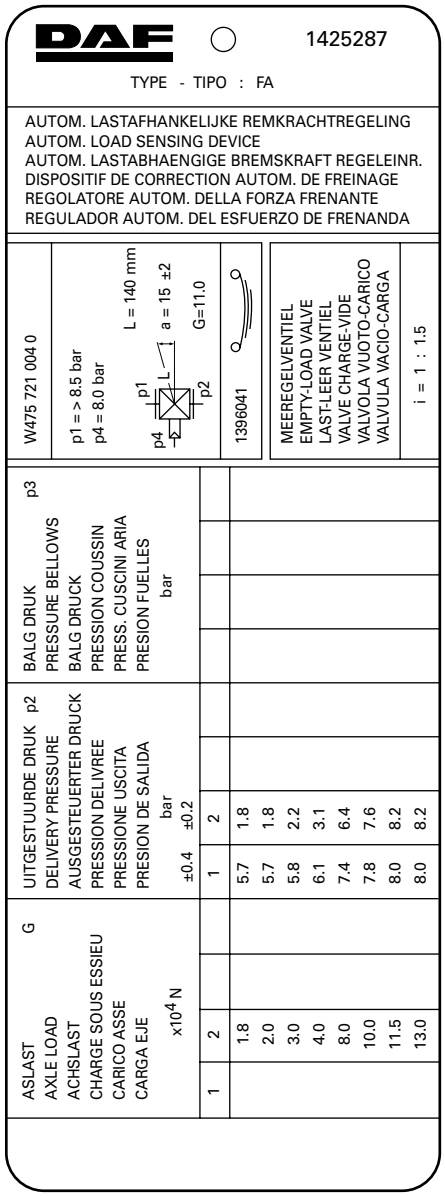
    Note:
    When depressurising the simulation connection (pressure gauge 43), the air hose must remain connected to prevent the (actual) bellows pressure from accidentally activating the valve.
    The small socket head screw in the centre of the valve must not be adjusted.

15. If the adjusting bolt (r) has been turned, repeat the procedure from point 6.

2.6 INSPECTION AND ADJUSTMENT, LOAD SENSING VALVE, LEAF SUSPENSION

Explanatory notes on instruction plate

This plate is mounted on the rear door pillar on the left-hand side of the vehicle. The data on axle loads and delivery pressures are listed on the instruction plate in the sequence of the axles beneath the vehicle. Therefore, "1" refers to the (first) front axle, "2" to the next following axle, etc. If the vehicle is fitted with a relay valve in the front axle brake circuit, the box beneath the valve illustration will be blank. Throughout the column, a value of 8.1 bar has been filled in for "delivery pressure p2" under axle "1".
If the vehicle is equipped with a control valve instead of the relay valve mentioned, the box will contain a pressure ratio, e.g."i = 1 : 1.5".
The "delivery pressure p2" of axle "1" then indicates variable readings.
These values can be used to check the brake pressure values of the front axle and to carry out the inspection/adjustment below at the same time. To do this, connect a pressure gauge to the test connection of one of the front axle brake cylinders.



R600479

Inspection/adjustment

1. Measure the weight plus load of the rear axle(s).

2. Check the attachment of the control lever and its ease of operation.

3. Check whether the correct valve and the correct springs have been fitted (for information, see the instruction plate).

4. Check the length of the control lever (see "L" on the instruction plate).

5. Connect a pressure gauge (4) to the test connection near connection 1/4 on the load sensing valve (input pressure).

6. Connect a pressure gauge (2) to the test connection on one of the brake cylinders (service brake connection) of the rear axle.

7. Make sure that the reservoir pressure is higher than 8.5 bar throughout the testing process.

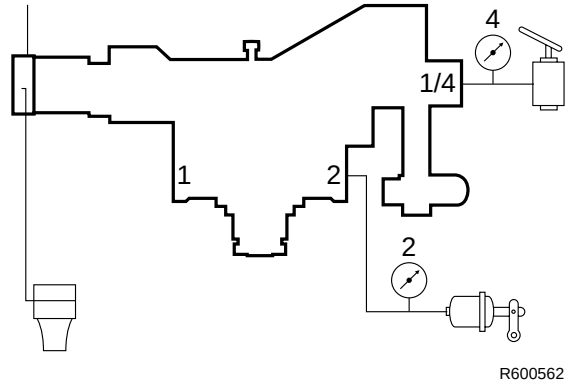
8. Depress the brake pedal until pressure gauge (4) indicates a value of 8 bar.

9. Read the brake pressure of the rear axle from pressure gauge 2 and check that this value matches the one listed on the instruction plate in the table under "delivery pressure p2" to the rear axle.

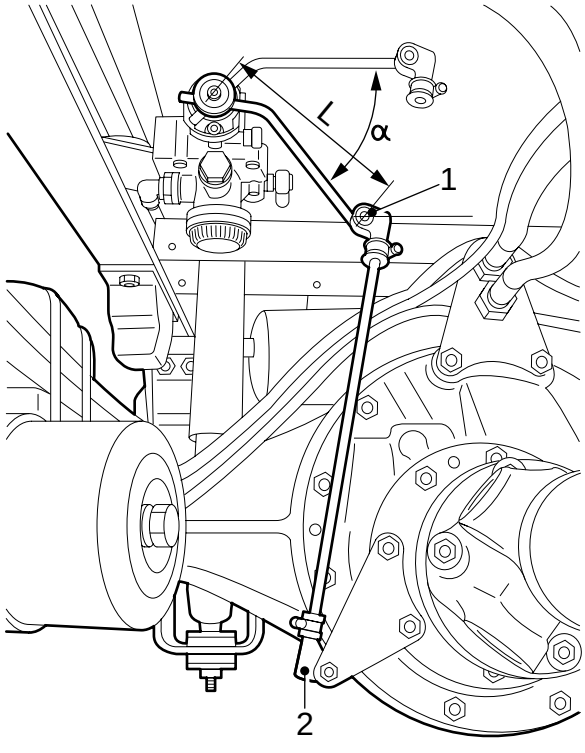
10. Correct, if necessary, the brake pressure by moving the rubber sleeve (1) in relation to the vertical connecting rod. On **no account** change the length L of the (horizontal) control lever.

11. Dismantle the ball coupling (2) and move the control lever towards maximum load. Check that the delivery pressure is now allowed through (almost) without reduction.

    Note:
    The small socket head screw in the centre of the valve must not be adjusted.



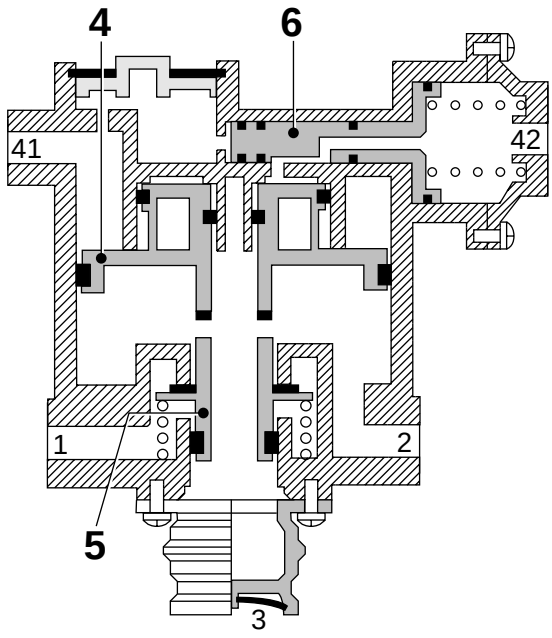
R600562



R600781

2.7 INSPECTION EMPTY/LOAD RELAY VALVE

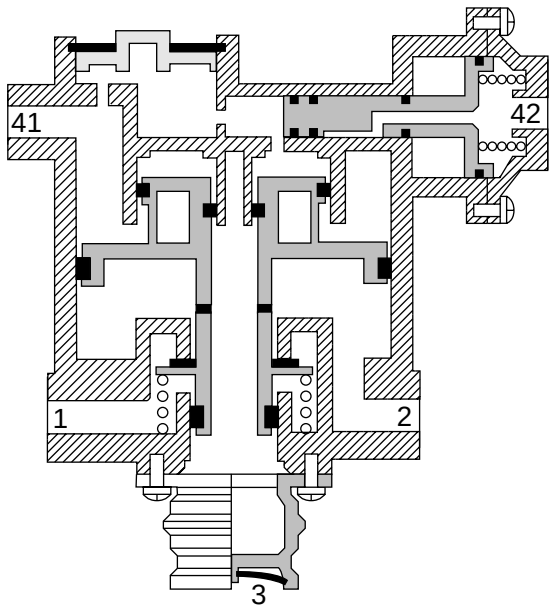
1. Using a T-piece, connect a pressure gauge to connecting point (41).
2. Connect a pressure gauge to the test connection on one of the brake chambers of the front axle.
3. Connect a pressure gauge to the test connection on one of the brake chambers of the rear axle.
4. Pressurise the system.



R600904

Testing when empty

1. Set the load sensing valve to the empty position.
2. Slowly depress the brake pedal.
   The pressure on the front axle should rise gradually, not in jumps.
   The pressure on the front axle will rise less quickly than that on connecting point (41).
   (With an empty vehicle, the difference will be greater than with a partially loaded vehicle).



R600905

Testing when fully loaded

1. Set the load sensing valve to the full-load position.

2. Slowly depress the brake pedal.
   The pressure on the front axle should rise gradually, not in jumps.
   The pressure on the front axle will rise as quickly (approx. 0.2 bar) as that on connection point (41). It must be possible to approximate the system pressure.

Inspection when faulty

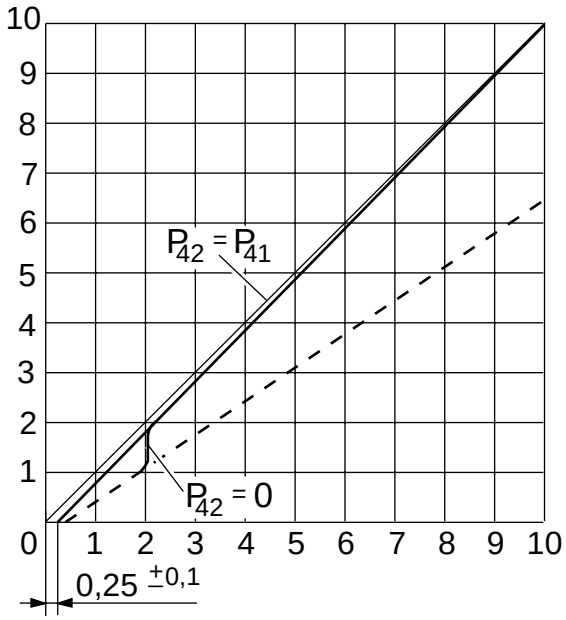
1. Disconnect the pipe to connecting point (42) and plug off the pipe.

2. Repeat point 8.

3. Set the load sensing valve as specified.

4. Reconnect the pipes to points (41) and (42) in the original manner.

5. Remove the pressure gauges.



R600906

Inspection, output pressure to the front axle

1. Measure the rear axle load.

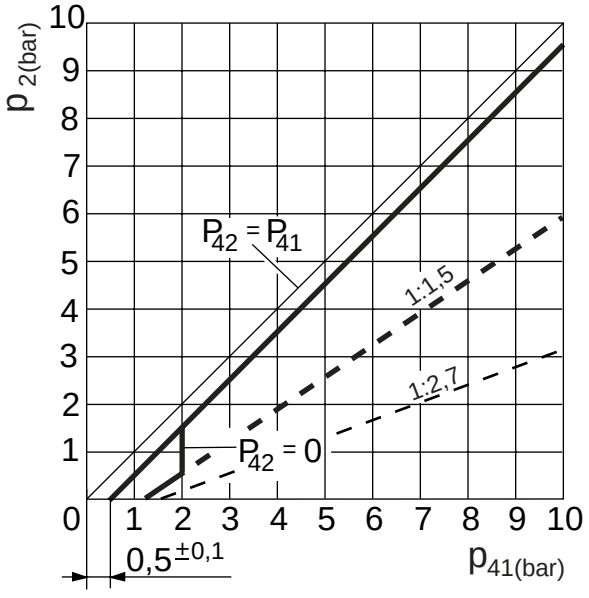
2. Check the load sensing valve setting.

3. Connect a pressure gauge to the test connection for the load sensing valve (input pressure) and a pressure gauge to the test connection on the brake cylinder of the front axle.

4. Make sure that the reservoir pressure exceeds 6.5 bar.

5. Depress the brake pedal until the pressure gauge on the test connection of the load sensing valve reads 6 bar, and read off the braking pressure on the pressure gauge of the front axle.

6. Compare this value with the data in the table attached to the door pillar.

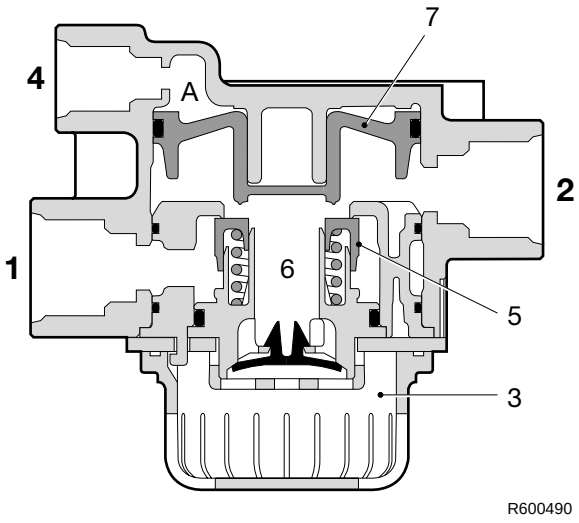


R600745

2.8 INSPECTING THE RELAY VALVE

Inspecting the relay valve

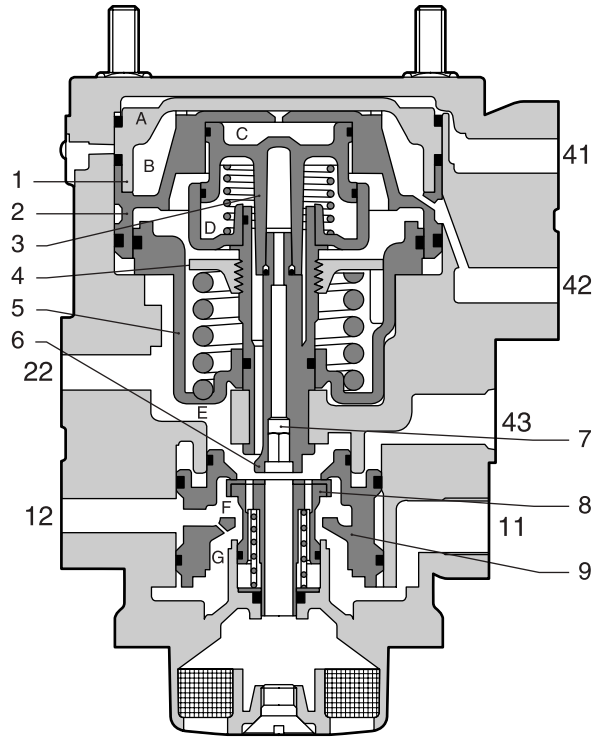
1. Connect a pressure gauge to connecting point (4) of the relay valve.
2. Connect a pressure gauge to connecting point (2) of the relay valve.
3. Pressurise the system.
4. Depending on the position of the relay valve in the brake system, slowly activate the service brake or parking brake.
5. The pressure in the pressure gauge connected to connection point (4) must now increase to approx. 0.8 bar (the increased parking brake actuating pressure) or 0.5 bar (service brake), without there being any noticeable pressure on connection point (2). From this point, the pressures in both pressure gauges must increase identically. The pressure on the gauge connected to point (2) should not rise in jumps. Both gauges should indicate a value corresponding to the graph. See "Technical data".



5

2.9 INSPECTION, TRAILER VEHICLE CONTROL VALVE

1. Ensure there is sufficient system pressure.
2. Check whether air is escaping via the bleed vent.
3. Depress the brake pedal, and again check for leaks.
4. Disconnect the pipe at connecting point (42) and plug off this pipe.
5. Depress the brake pedal, and check for pressure build-up in the service pipe (see "Technical data").
6. Reconnect the pipe.
7. Repeat the last three points, but now for connecting point (41).
8. Operate the parking brake: pressure should build up in the service pipe (see "Technical data").
9. Operate the parking brake to the stop, and lock the lever: the service pipe should once again become pressureless.
10. Simulate a leak in the service pipe, and depress the brake pedal; within two seconds, the outflow of air from the leak should slow down considerably.



R600340

2.10 INSPECTION AND ADJUSTMENT, ADVANCE IN TRAILER VEHICLE CONTROL VALVE

Inspection, braking pressure advance in trailer vehicle control valve

Note:
The pressure ratio between prime mover and drawn vehicle is 10 : 8 (10 bar system pressure for prime mover and 8 bar system pressure for drawn vehicle).

This means that if no braking pressure advance is applied, at an input pressure of 3 bar at connection point (41), the output pressure at connection point (2) is equal to (3 x 8): 10 = 2.4 bar.

If a braking pressure advance of 0.6 bar is now applied, the output pressure at connection point (2) should be 2.4 + 0.6 = 3.0 bar.

1. Connect a pressure gauge (1) to the test connection for the load sensing valve and a pressure gauge (2) to the service coupling head.

2. Depress the brake pedal until the input pressure (measured at pressure gauge 1) is 3 bar. The reading at pressure gauge (2) should now be 3.0 bar. This equals 0.6 bar braking pressure advance.

3. If the braking performance of the trailer vehicle (provided it is in good condition) is poorer than that of the prime mover, the advance may be increased by several tenths of a bar.

Adjusting the advance in trailer vehicle control valve

Note:
The pressure at which the readings are taken must always be built up. If the specified pressure is exceeded, bleed off sufficient air, and once again allow the pressure to build up.

1. Remove the plug.

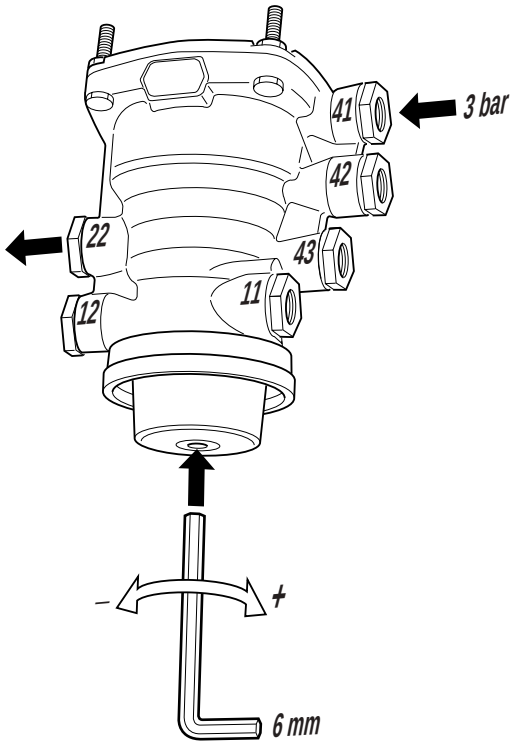
   Note:
   Make sure that the valve is not operated when the advance is adjusted.

2. Using a 6mm Allen key, turn the central section (7) anti-clockwise or clockwise to decrease or increase the advance respectively.

3. Measure the advance again.

4. Repeat these actions until the required advance is reached.

5. Re-fit the plug.



R600341

2.11 INSPECTION, PARKING BRAKE VALVE

Parking brake valve with trailer control and test position

1. Ensure there is sufficient system pressure.

2. Connect pressure gauges to connection point (43) of the trailer control valve and to connection point (12) of a spring brake cylinder.

Inspecting the driving position

1. Place the parking brake valve in the driving position. Both pressure gauges must now indicate a pressure of approx. 8.5 bar. This is the limiting pressure of the pressure limiting valve.

Inspecting the emergency brake

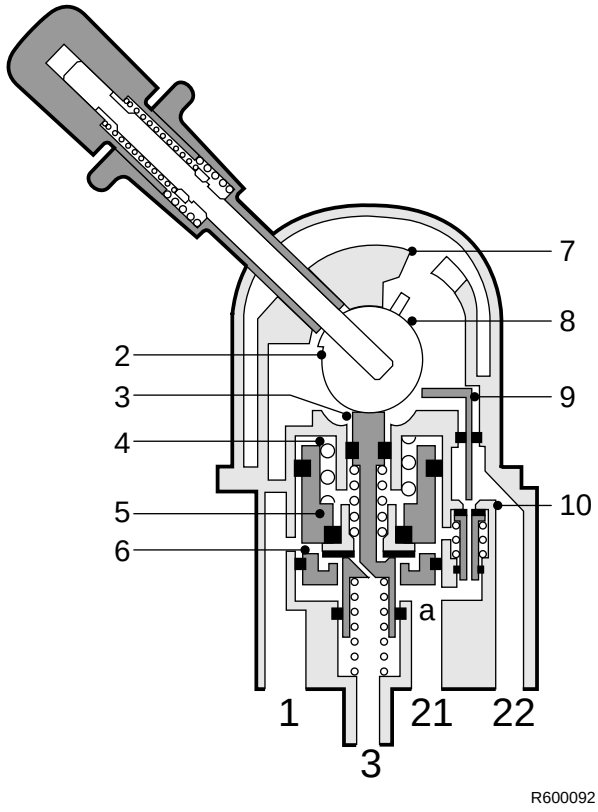
1. Move the parking brake valve slowly towards the parking position. Both pressure gauges should now gradually fall to 0 bar (with the exception of the first 10° angular displacement. See graph in "Technical data").

Inspecting the parking position

1. In the parking position, both pressure gauges should read 0 bar.

Inspecting the test position

1. Place the parking brake valve in the parking position, depress the handle, and move it to the test position. The pressure gauge at connection point (43) of the trailer vehicle control valve should read approx. 8.5 bar. The pressure gauge on the connection point of the spring brake cylinder should read 0 bar.



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Parking brake valve without trailer control

1. Ensure there is sufficient system pressure.

2. Connect a pressure gauge to connection (12) of a spring brake cylinder.

Inspecting the driving position

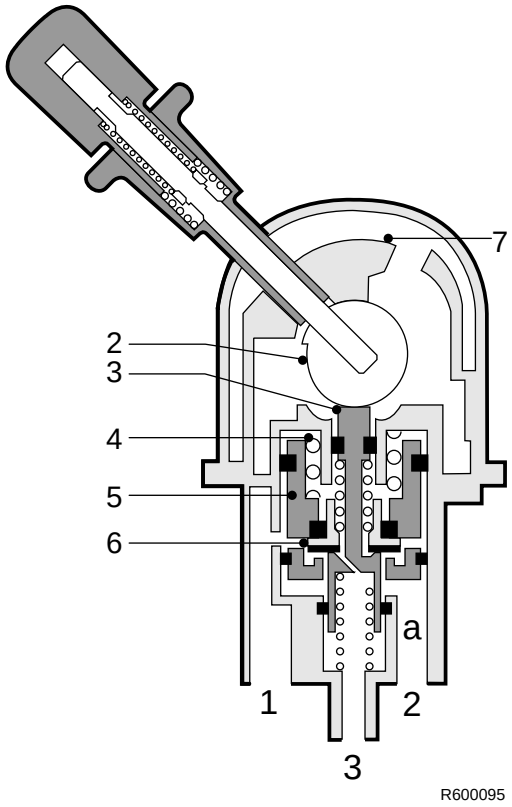
1. Place the parking brake valve in the driving position. The pressure gauge must now indicate a pressure of approx. 8.5 bar (see graph in "Technical data").

Inspecting the emergency brake

1. Move the parking brake valve slowly towards the parking position. The pressure gauge should now gradually fall to 0 bar (with the exception of the first 10° angular displacement. See graph in "Technical data").

Inspecting the parking position

1. In the parking position, the pressure gauge should read 0 bar.



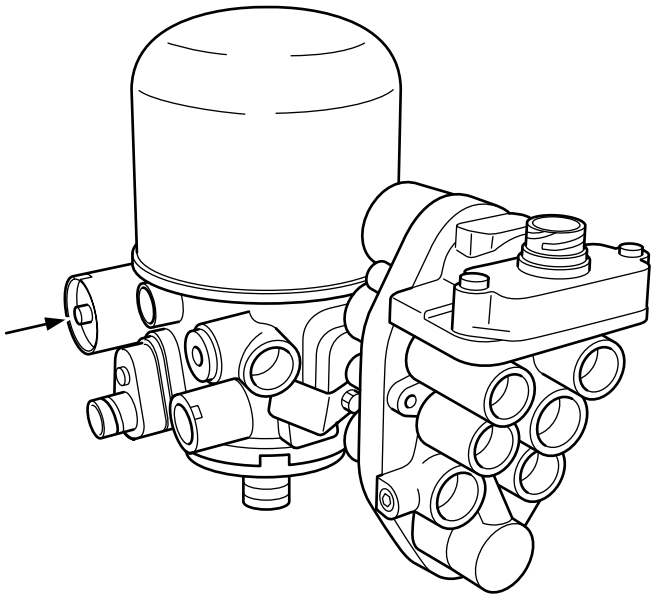
2.12 CHECK AND ADJUST INPUT AND OUTPUT PRESSURES OF THE AIR SUPPLY UNIT

Inspecting the cut-out pressure

1. Connect a pressure gauge to the central drain/filler connection.
2. Pressurise the air system.
3. Check that the pressure regulator cuts out at the correct reading.
4. If this is not the case, adjust the value using the screw on the air dryer (see arrow) as follows:

Adjusting the cut-out pressure

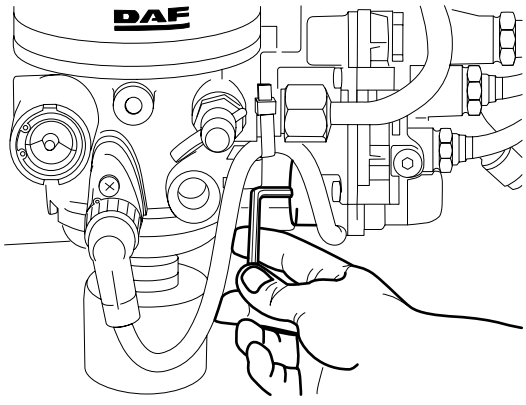
1. If the cut-out pressure is too low, tighten the adjusting screw a little so that the cut-out pressure becomes too high.
2. Ensure that the pressure regulator is switched on. If it is switched off, let some air escape through a reservoir until the system pressure falls beneath the cut-in pressure.
3. Pressurise the air system to a little over 10 bar.
4. Unscrew the adjusting screw until the pressure regulator cuts out (see "Technical data").
5. Check the cut-out pressure in the way mentioned above (see "Technical data").



R600480

Adjusting trailer vehicle system pressure

1. Fit a pressure gauge to the trailer supply connection (red connection).
2. Build up pressure in the brake system (air dryer should blow off).
3. Check the pressure (see "Technical data").
4. If necessary, adjust the pressure by turning the adjusting screw.



R600652

2.13 CHECK AIR DRYER REGENERATION FUNCTION IN THE AIR SUPPLY UNIT

Air dryer regeneration function

1. Pressurise the air system (pressure regulator should cut out).
2. Switch the engine off.
3. The regeneration air should escape via the vent opening of the air dryer, for approximately 20 seconds.

2.14 CHECK THE 4-CIRCUIT SECURITY VALVE OF THE AIR SUPPLY UNIT

Check pressure build-up on circuits 1, 2, 3 and 4

1. Lower the pressure in the system to 0 bar.
2. Connect pressure gauges to circuits 1, 2, 3 and 4.
3. Pressurise the circuits using the compressor (engine speed approx. 1000 rpm).
4. The pressure in circuits 1, 2 and 4 will gradually increase. Once the opening pressure of circuit 3 has been reached (see "Technical Data"), the pressure in circuit 3 will increase.
5. If no more pressure builds up (cut-out pressure reached), the supply pressure in circuits 1, 2, 3 and 4 must meet the stipulated value (see "Technical Data").

Checking circuit 1

1. Turn off the engine and simulate a leak in circuit 1.
2. The pressure in circuit 2 and 4 may not fall below the specified closing pressure of circuit 1. See "Technical data".

Checking circuit 2

1. Make sure the leak in circuit 1 is remedied and pressurise the system again.
2. Turn off the engine and simulate a leak in circuit 2.
3. The pressure in circuit 1 and 4 may not fall below the specified closing pressure of circuit 2. See "Technical data".

Checking circuit 3

1. Make sure the leak in circuit 2 is remedied and pressurise the system again.
2. Turn off the engine and simulate a leak in circuit 3 for the trailer circuit (connection point 23).
3. The pressure in circuit 1.2 and 4 may not fall below the specified closing pressure of circuit 3. See "Technical data".
4. The pressure in circuit 3 for the parking brake circuit (connection point 25) must remain secured by the check valve.

Checking circuit 4

1. Make sure the leak in circuit 3 is remedied and pressurise the system again.
2. Turn off the engine and simulate a leak in circuit 4.
3. The pressure in circuit 1 and 2 may not fall below the specified closing pressure of circuit 4. See "Technical data".

Checking circuit 3 flow-back function

1. Make sure the leak in circuit 4 is remedied and pressurise the system again.
2. Turn off the engine and simulate a leak in circuit 1.
3. The pressure in circuit 3 for the trailer circuit (connection point 23) will decrease to 0 bar when the pressure in circuit 1 has reached the activation pressure for the flow-back function. See "Technical data".

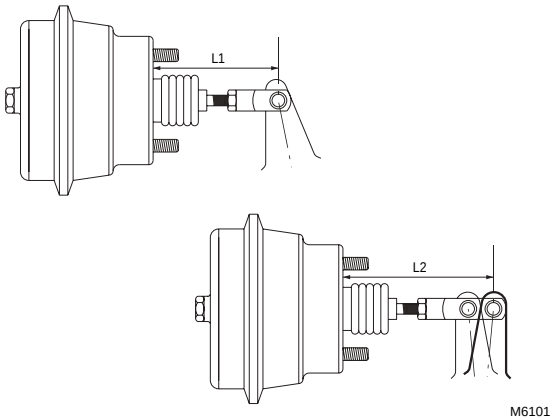
2.15 INSPECTING THE AUTOMATIC SLACK ADJUSTER

Inspection, slack adjuster travel

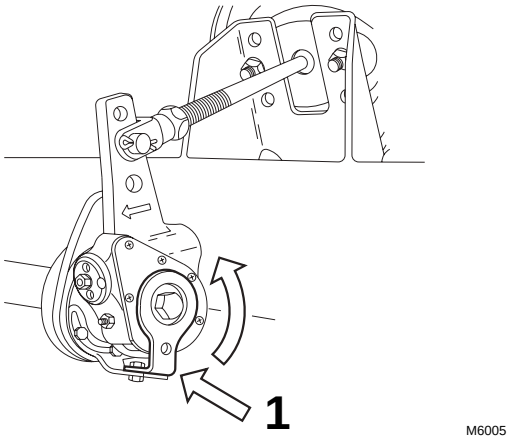
1. Measure the basic setting L1.

2. Measure the position when the brakes are applied, L2 (minimum brake system pressure 6 bar).

3. Calculate the brake travel L3.
   See "Technical data". If the brake travel differs from the specified value, take the following action:
   - Check whether the control plate (1) is locked in respect of the fixed bracket.
   - If not, turn the control plate as far as possible (until the internal stop is felt) in the direction in which the slack adjuster is moved during braking.
   - Fix the control plate in this position using the attachment nut on the fixed bracket.
   - Check the internal slip using a torque wrench.



M6101



M6005

Inspection, internal slip

1. Make certain that there is sufficient pressure in the reservoirs (6.5 bar minimum).

2. Release the parking brake.

3. Fit a torque wrench on the hexagonal adjusting bolt and turn anti-clockwise.
   For the permitted value, see "Technical data".
   If the specified reverse torque is **not** reached, but the worm shaft already turns at a **lower** value, the slack adjuster should be replaced.

Checking automatic slack adjuster for 09N044 axle

1. Check that the free travel in the slack adjuster lever from a position of rest to touching the brake shoes is between 12 and 16 mm, measured level with the locking pin. If the value differs from this, the slack adjuster should be turned back anti-clockwise until the correct travel is obtained.

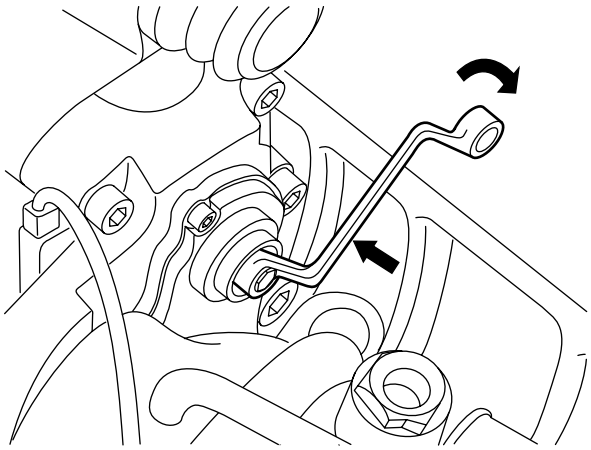
2. When turning back the slack adjuster check that it makes a clicking noise.

3. When operating the brake, check that the adjuster is functioning properly. This can be done by fitting a ring spanner onto the adjusting bolt. The spanner should make a turn when the foot brake is operated.
If it does not, the slack adjuster must be replaced.

2.16 INSPECTING THE DISC BRAKE AUTOMATIC SLACK ADJUSTER

1. Place chocks in front of and behind the wheels to prevent the vehicle from moving.
2. Put the parking brake in the driving position.
3. Remove the wheel.
4. Remove the covering cap from the slack adjuster.
5. Fit a ring spanner on the adapter and turn the hexagonal adjusting bolt together with the adapter anti-clockwise (2 - 3 clicks).

   Note:
   Never turn the hexagonal adjusting bolt without using an adapter. The adapter is a torque safety and will break off when the torque is too high. Without the use of an adapter the mechanics in the brake calliper may become damaged when the torque is too high, so that replacement of the brake calliper may be necessary.
6. Leave the ring spanner on the adapter and depress the brake pedal 5 to 10 times at an output pressure of 2 bar.
7. Check that the ring spanner makes a clockwise turn every time the pedal is depressed. The turns of the ring spanner must decrease in line with the clearance.
8. After the inspection, lightly grease the sealing cap and replace it on the slack adjuster. See "Technical data".



R600468

2.17 INSPECTION, BRAKE DRUMS

For reasons of preservation, brake drums of new vehicles must be cleaned with a cleaning agent.

The brake drums must be lifted using a hoist. This is because there is a risk of limbs getting trapped.

Always be careful when braking with new brake drums and brake linings.

A brake drum which is thermally overloaded will show heat cracks. These heat cracks will become larger and deeper the longer the drum is used. Thermal stress will thus increase the formation of cracks.

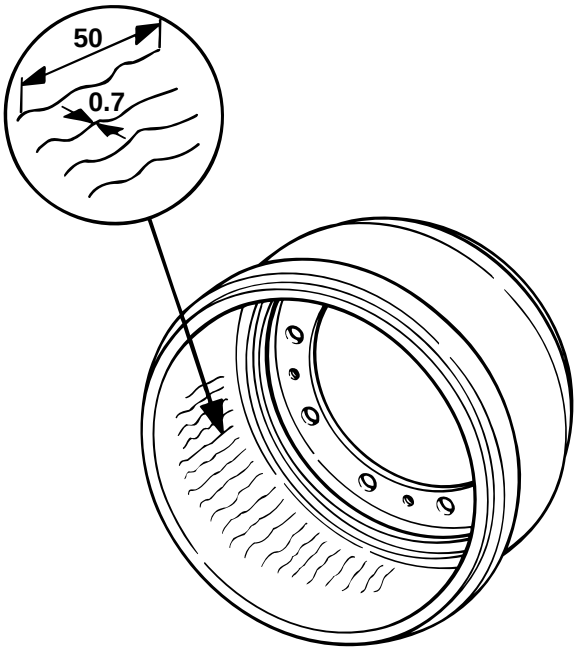
Thermal stress may be caused by:
- poor braking force distribution
- seized brakes
- jammed brake shafts or brake cylinders
- insufficient clearance between brake lining and brake drum with new brake linings
- continuous application of the service brake whilst driving.

Cracks that are permissible must be capable of being removed when the drum is reconditioned. See "Technical data".
If the cracks cannot be completely removed during reconditioning of the brake drums, accelerated brake lining wear can be expected. If the brakes are once again thermally overloaded, the edges of the cracks will rise again, which will result in premature wear of the lining, due to abrasion.

A brake drum may also show burns and local hardened spots, also caused by high temperatures.
Where the structure of the brake drum material has changed, these burns must be removed by reconditioning and grinding.
If the spots cannot be removed, braking will always be accompanied by vibrations.
The brake linings will always first show rough wear grooves at the respective spots.

A brake drum may be used until the internal diameter has reached the maximum value. See "Technical data".

As soon as this diameter is exceeded, the brake drum must be replaced.



R 6 00 128

Reconditioning of brake drums
If the lathe tool comes into contact with large or deep hardened spots, listen for grating noises.

If a grating noise is heard, the brake drum must be ground in order to obtain a perfectly round wearing surface.

If the brake drum has been reconditioned, fit an oversize brake lining, and turn it on the lathe.

2.18 INSPECTION, DRUM LININGS

In the case of separated brake linings, the words "remnokzijde" and "draaipuntzijde" are marked on the side of the lining. (This does not apply to the 09N044 leading rear axle.) The brake lining marked "remnokzijde" should be attached to the brake cam. The brake lining marked "draaipuntzijde" should be attached to the pivoting point.

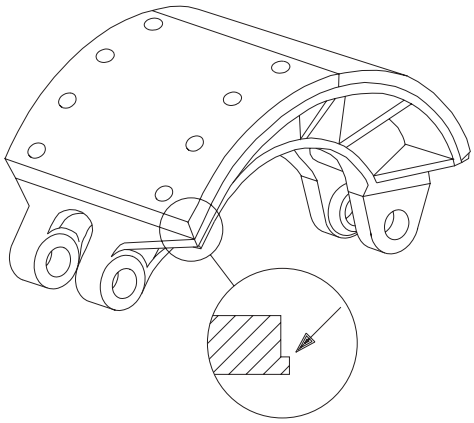
For the types of brake linings, see "Technical data".

Always fit the same type of brake linings to a vehicle.

- When the brakes are applied, kinetic energy is converted into heat.
- Brake linings may be subjected to very high temperatures.
- A brake lining must work effectively in a very wide temperature range. This means that the coefficient of friction should as far as possible be independent of temperature.
- The brake lining must also have a long service life.
- The brake lining must be unaffected by weather conditions, and should produce as little noise as possible.
- Excessive heat may cause changes to the wearing surface of the brake drum.

Brake lining (including brake shoes) inspection points:
- braking performance after running in
- glazing
- moisture absorption (oil absorption)
- lining wear
- heat cracks
- corrosion
- swelling

Brake linings should be renewed when they have been contaminated by oil or grease, or when the lining is worn down to approx. 1 mm above the rivet head, or to the wear indicator. The thickness can be measured via the inspection holes in the back plates.

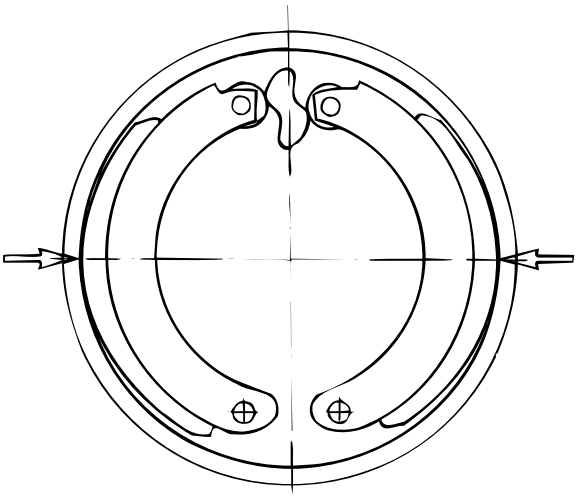


M6002

Corrosion
Brake shoes may exhibit considerable corrosion, as a result of excessive ageing and the action of moisture on the assembly face.

Incorrect bearing surface
The surface is no longer smooth. The lining no longer has a sufficient mounting surface at the edges of the rivet recess and ruptures during riveting. The lining could be released from the shoe and lifted. As a result, the clearance between lining and drum decreases or disappears completely.
Even when the brakes are not applied, the temperature of the brake increases and, as a result, heat cracks may occur in the bearing surface of the brake drum.

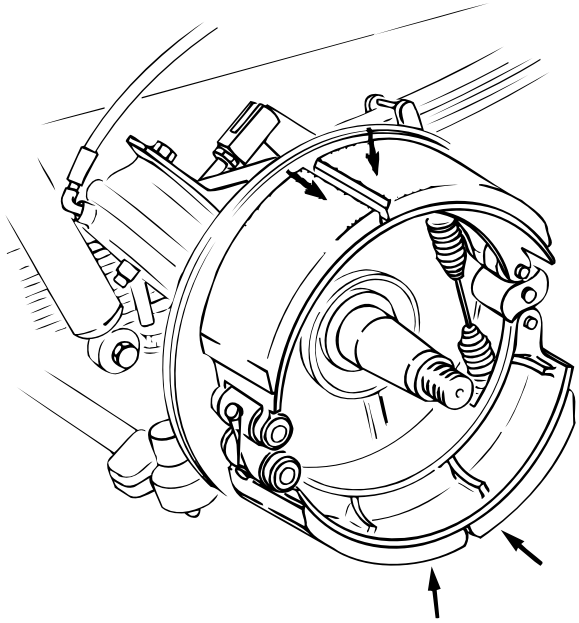
Bearing pattern
When turning the brake lining, the lining will bear on the radius of the drum with the entire brake surface. Such a bearing pattern guarantees the best possible breaking performance from the beginning. The turning of the brake lining may be carried out on a brake lining lathe, or with a special dummy back plate on a special lathe. The bearing pattern of the brake lining can be improved by turning the brake lining to a diameter which is max. 1.0 mm smaller than the drum diameter. So, in the case of a brake drum diameter of 420 mm the brake lining should be turned to a max. diameter of 419 mm.



R600129

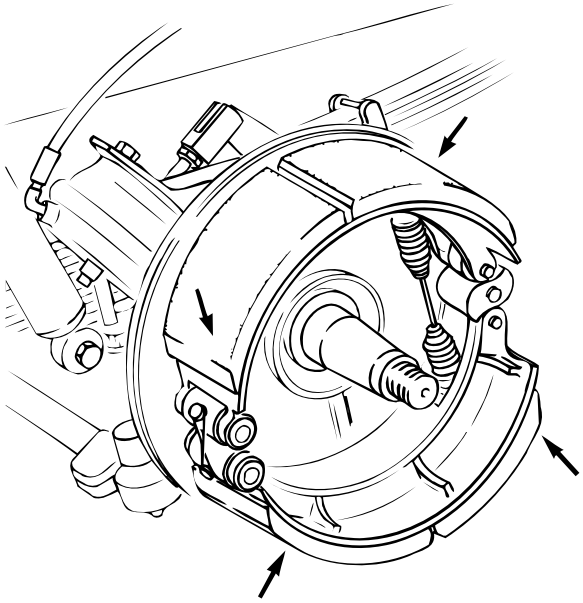
Wheel brake with modified lining diameter (see drawing)
The lining will bear on the centre of the lining length first, after which the bearing pattern is extended from the centre towards the ends. This will prevent an (unduly) heavy self-servo action during the running-in period.

The brake lining must be turned gradually; i.e. not too much lining material should be removed in one operation.
If this instruction is not followed, the lathe tool will bend and be inclined to lift the leading brake shoe of the brake cam. The initial bearing pattern will then not be at its best.
It is not necessary to turn "clean" the entire surface. It is sufficient to touch 75% of the surface with the lathe tool.



R600130

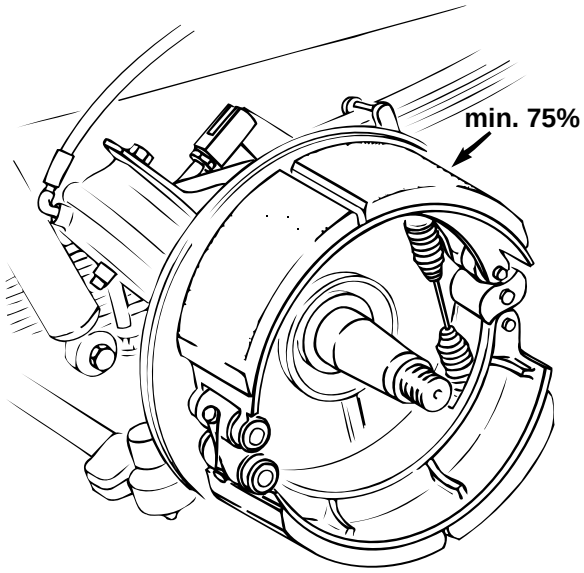
A wheel brake lining with insufficient bearing surface
The ends of the brake lining are still free. As a result, the load on the smaller brake lining surface will be considerably heavier at the same press-on force. As a result, the lining will be squeezed; the temperature will increase and there will be accelerated lining wear, until the braking surface is eventually correct.
In the case of reconditioned brake drums, it is recommended that a new lining should be turned to the radius of the brake drum after it has been fitted.



R600131

Glazing of brake linings
"Glazing" is the slow deterioration of the brake lining's coefficient of friction. This is caused by very light braking. Assessment of the braking surface is very difficult.
Glazing only rarely occurs with modern linings. The wearing surface of the lining collects small particles of materials having lubricant properties. Generally, these particles are removed by braking hard a view times, or by turning the lining. This creates a new wearing surface.

The stability of the coefficient of friction may vary considerably, depending on the quality of the lining.
It is therefore vital that original brake linings be used at all times.

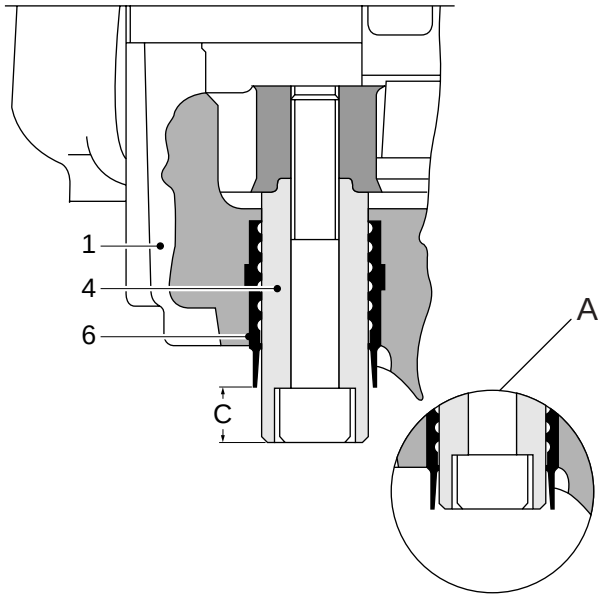


R600132

2.19 INSPECTION, BRAKE PADS

Inspecting Knorr SB7000 brake pads
With wheels fitted:

If the guide sleeve (4) no longer protrudes (C) from the guide bush (6) but is flush with it (detail A), the brake pad thickness must be inspected with the wheels removed. See "Technical data".



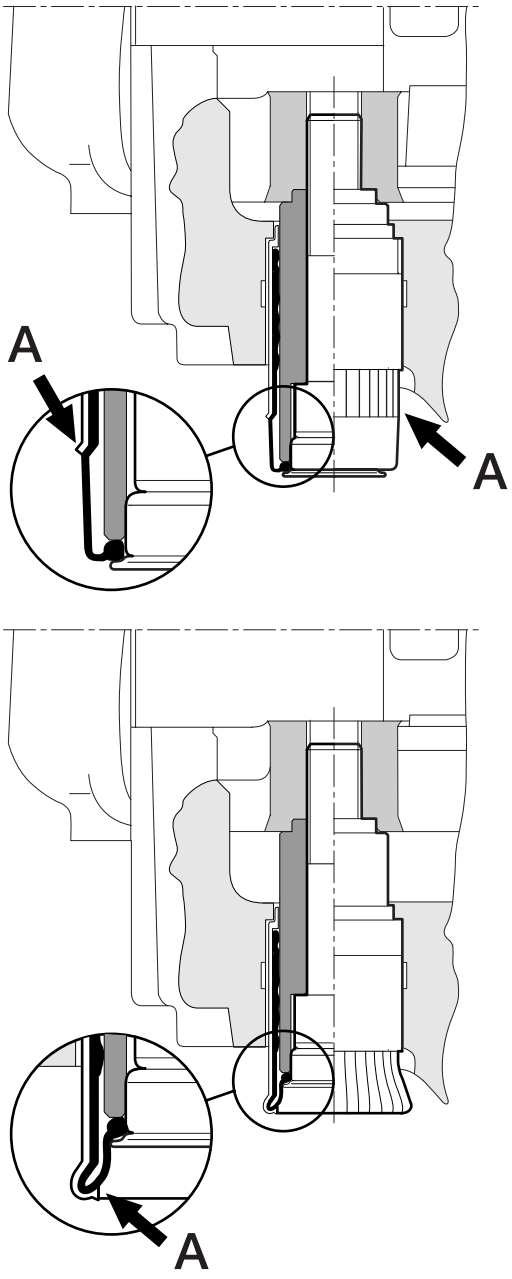
R600481

Inspecting Knorr SN7000 brake pads
With wheels fitted:

The brake pad thickness can be checked on the basis of the position of the guide bush relative to the rubber bush.

At maximum brake pad thickness the rubber cover is stretched. Wear of the brake pads and movement of the brake calliper along the guide bushes will cause the rubber cover to roll up.

As soon as the transition from the ribbed section of the rubber cover to the smooth section (A) starts to roll inward, the brake pad thickness is to be checked with the wheels removed. See "Technical data".



R600730

2.20 INSPECTION, BRAKE DISCS

1. Remove the wheels.

2. Measure the disc thickness at different points to find the thinnest measurement. Compare the reading with the technical data. See "Technical data".

3. Check the brake discs for signs of wear. See "Technical data".

   Note:
   The brake discs may be turned. See "Technical data".

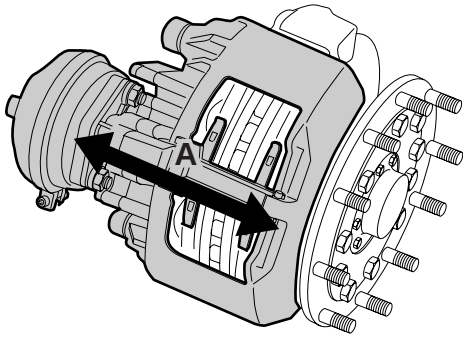
2.21 INSPECTION, BRAKE CALLIPER PLAY

Inspection of the free movement of the brake calliper guide over the brake calliper carrier is the most important thing. That is why initially a simple inspection is carried out on the vehicle of the axial movement of the brake calliper when it is fitted.

General inspection

1. Push and pull the brake calliper back and forth several times in the axial direction (A). This requires considerable effort.

2. Check the play of the brake calliper in the axial direction (A). See "Technical data". If the measured play is incorrect or the brake calliper cannot be moved along the guide bushes, it must be checked in more detail as follows.



R600708

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Inspection of sliding ability

1. Remove the brake pads.

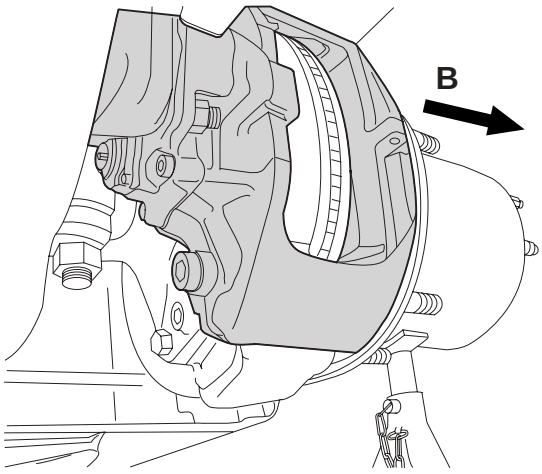
2. Turn the thrust pieces back completely using the adjusting bolt and the adapter.

3. Clean the guide bushes where they are accessible.

4. Check whether the brake calliper can be moved by hand along the full distance (more than 25 mm) (so without the use of tools).

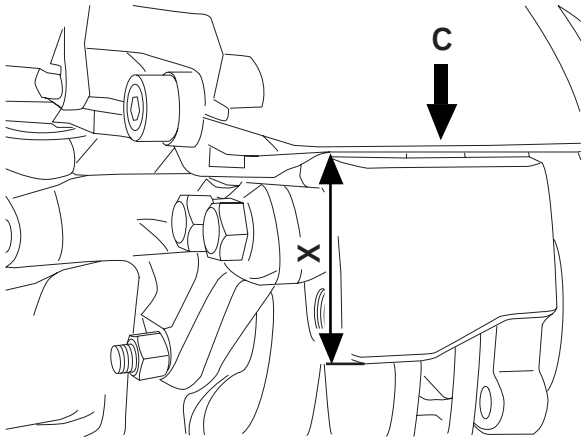
Inspecting guide bush bearing play

1. Pull the brake calliper as far as possible towards the outside of the vehicle (B).



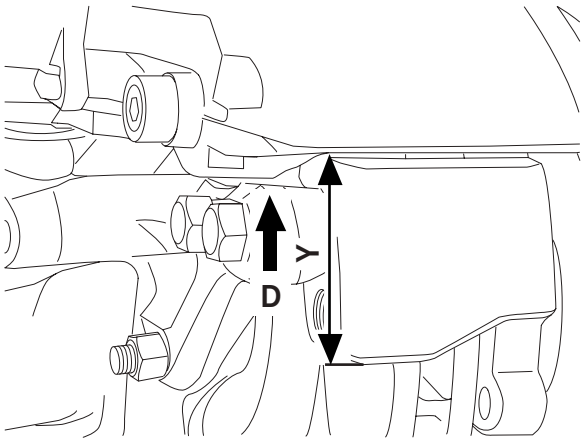
R600709

2. Push the brake calliper as far as possible towards the brake calliper support (C).
3. Measure the distance "X".



R600710

4. Push the reversed brake calliper as far as possible towards the brake calliper support (D).
5. Measure the distance "Y".
6. Calculate the difference between the measured distances, "Y" - "X" (see "Technical data").
7. Fit the brake pads.



R600711

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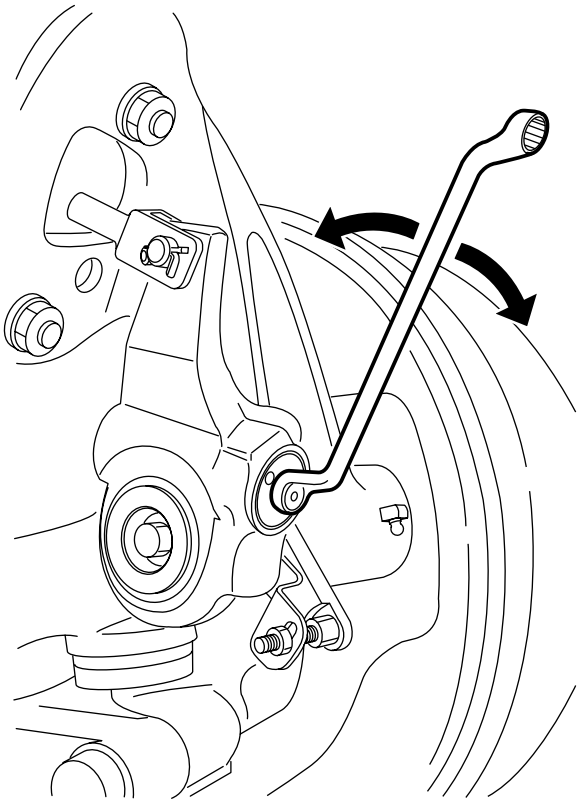
2.22 BRAKE ADJUSTMENT, DRUM BRAKE VERSION

Set the brakes by turning the hexagonal adjusting bolt clockwise.

Turn the adjusting bolt until the brake lining abuts the brake drum.
Then turn the adjusting bolt back (90° - 120°) until the bake lining is just free of the brake drum.

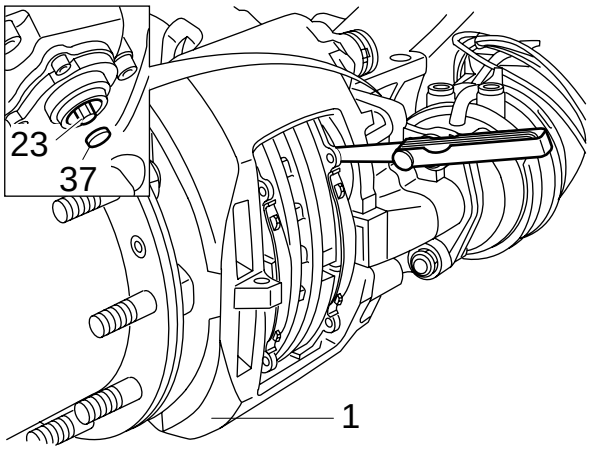


R600253

2.23 BRAKE ADJUSTMENT, DISC BRAKE VERSION

1. Position a feeler gauge between the rear of the brake pad and one of the thrust pieces of the brake calliper to check the play. Compare the measured value (see "Technical data").
2. If the play is not correct, it needs to be adjusted. Remove the covering cap from the slack adjuster.
3. Fit a ring spanner on the adapter and turn the hexagonal adjusting bolt together with the adapter anti-clockwise until there is ample clearance between the brake pads and the brake disc.

   Note:
   Never turn the hexagonal adjusting bolt without using an adapter. The adapter is a torque safety and will break off when the torque is too high. Without the use of an adapter the mechanics in the brake calliper may become damaged when the torque is too high, so that replacement of the brake calliper may be necessary.
4. Position a feeler gauge with the correct thickness between the brake pad and the thrust piece of the adjuster with the hexagonal adjusting bolt. See "Technical data".
5. Turn the hexagonal adjusting bolt clockwise with the ring spanner and the adapter until the feeler gauge just fits. Remove the feeler gauge.
6. Apply the brake a number of times so that the play can set.
7. Release the brake. Now it should be possible to turn the hub by hand.
8. Position a feeler gauge between the rear of the brake pad and one of the thrust pieces of the brake calliper to check the play. Compare the measured value (see "Technical data").
9. After the inspection, lightly grease the sealing cap and replace it on the slack adjuster. See "Technical data".



R600463

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2.24 INSPECTION, AIR TIGHTNESS

Air tightness
If the brake system of a vehicle has been charged to the maximum pressure, it should generally be possible to drive the vehicle away after a period of 16 hours of uninterrupted standstill, without first having to charge the brake system to sufficient operating pressure.
This implies a maximum pressure drop of approx. 0.4 bar per hour at normal system pressure.

Note:
Always connect auxiliary consumers and accessories to circuit 4.

3. REMOVAL AND INSTALLATION

3.1 REMOVAL AND INSTALLATION, QUICK-RELEASE COUPLING

When disconnecting pipes and/or quick-release couplings, ensure that the relevant connection has first been made pressureless.

Removing the quick-release coupling

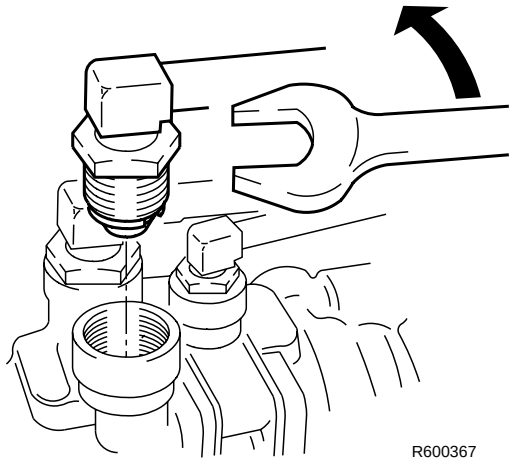
1. Loosen the socket using an open-end spanner.
2. Remove the socket and the pipe connector from the valve as an assembly.

Installing the quick-release coupling

1. Check the bore in the valve for dirt and clean the bore as necessary.

   Note:
   If the plug is not removed from the socket, the quick-release coupling (plug and socket) can be re-fitted as an assembly. The socket does **not** then have to be replaced.

2. Apply brake grease to the O-ring.
3. Tighten the socket to the specified torque. See "Technical data".


R600367

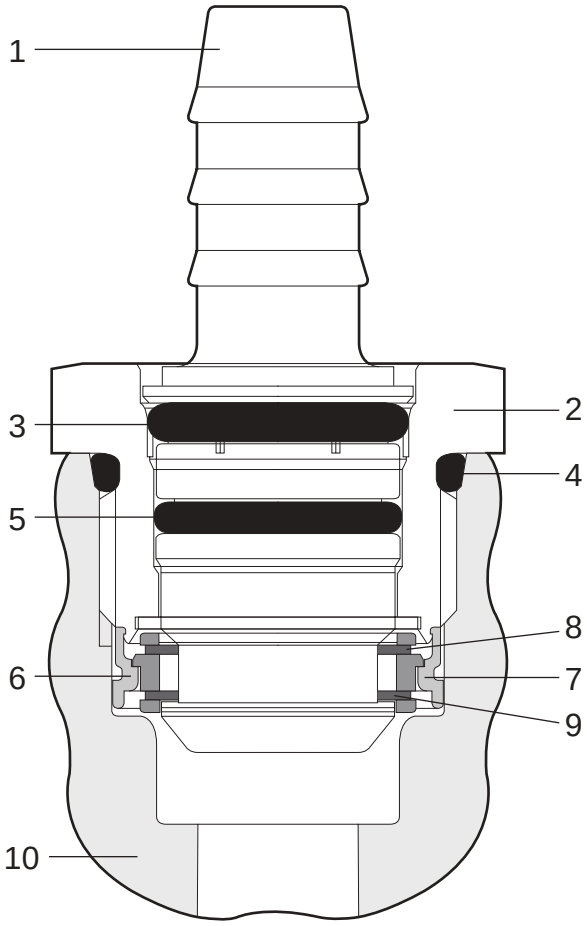
3.2 REMOVAL AND INSTALLATION, PLUG FROM/IN SOCKET

When disconnecting pipes and/or quick-release couplings, ensure that the relevant connection has first been made pressureless.

Removal, plug from socket

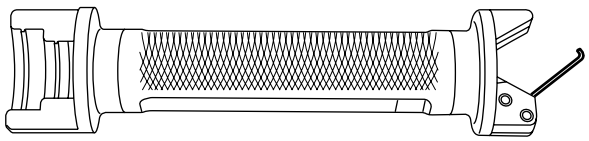
1. Remove the quick-release coupling from the valve.

   Note:
   Make sure that the plug (1) is not damaged when removing the sleeve (6), retainer clips (8) and (9) and circlip (7).



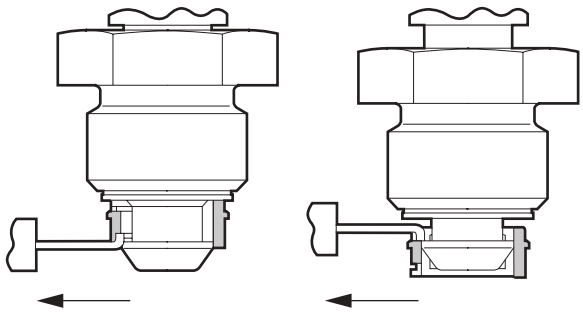
R600365

2. Remove the sleeve using the special tool (DAF no. 1329459).



R600404

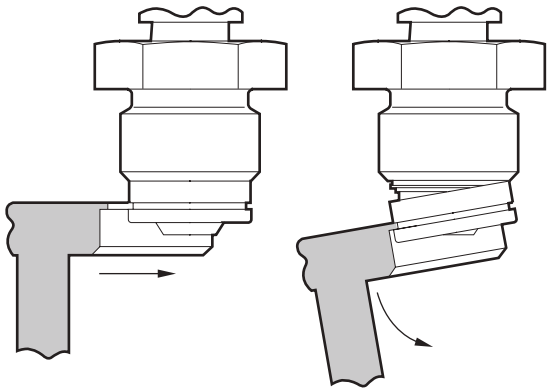
3. Remove the two retainer clips and the circlip using the special tool (DAF no. 1329459).



R600369

4. Remove the plug from the socket.

If the plug is removed from the socket, the socket must always be replaced. It is supplied complete with retainer clips, circlips and sleeve.



R600368

Installation, plug in socket

1. Check the bore in the valve for dirt and clean the bore as necessary.

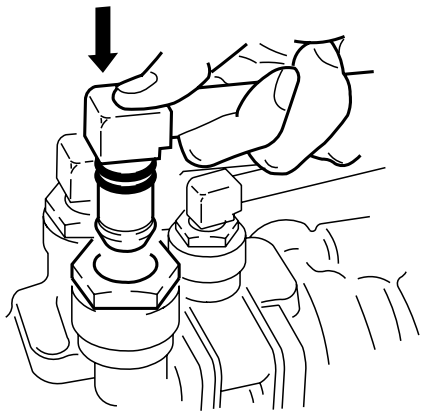
If the plug is removed from the socket, the socket must always be replaced. It is supplied complete with retainer clips, circlips and sleeve.

2. Fit a new socket in the valve and tighten it to the specified torque. See "Technical data".

3. Check the O-rings of the plug for damage and replace as necessary.

4. Fit the plug in the socket and check that the connection is fully locked by pulling it upwards.

Note:
If the connection is not fully locked, the upper O-ring of the plug is still visible. If there is pressure, there will also be an audible escape of air.



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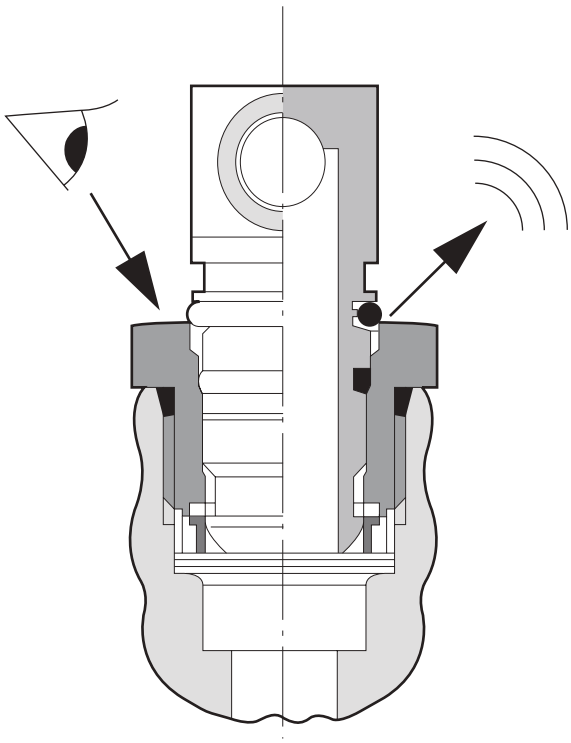


R600366

3.3 REMOVAL AND INSTALLATION OF PIPE ON PIPE CONNECTOR

When disconnecting pipes and/or quick-release couplings, ensure that the relevant connection has first been made pressureless.

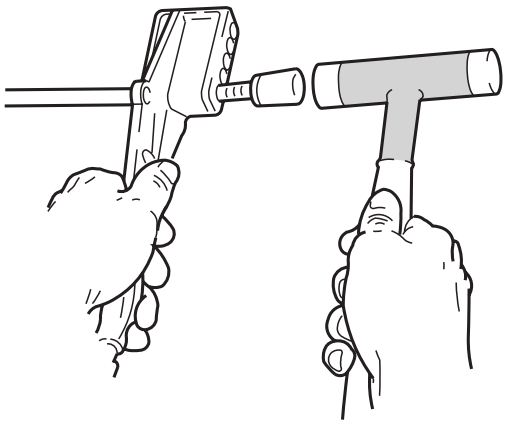
Removal of pipe on pipe connector

1. Remove the plug from the socket.
2. Cut the pipe at right angles just in front of the pipe connector.

   Note:
   When removing the remainder of the pipe, do not use any sharp objects. This is to avoid damaging the pipe connector. Damage to the pipe connector could result in leakage. Remove the remainder of the pipe using heat or the "cutting point" of a soldering iron.

Installation of pipe on pipe connector

1. Check that there are no burrs in the pipe.
2. Check the pipe connector for damage.
   If the pipe connector is damaged, the pipe connector and socket must be replaced.
3. Check that the pipe connector is clean and grease-free.
4. Fit the plastic cap onto the plug to prevent it from being damaged during installation.
5. Using the special tool (DAF no. 0694829) and a plastic hammer, attach the pipe to the pipe connector.



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3.4 REMOVAL AND INSTALLATION, BRAKE CYLINDER

Removing disc brake cylinder

1. Remove the compressed air connection to the brake cylinder.

2. Take the attachment nuts off the brake cylinder and remove it.

Fitting disc brake cylinder

1. Fit the brake cylinder onto the support and tighten the attachment nuts to the specified torque. See "Technical data".

2. Connect the air pipe.

Removing drum brake cylinder

1. Turn the brakes back until there is no more tension on the yoke pin.

2. Remove the split pin and the yoke pin.

3. Remove the compressed air connection to the brake cylinder.

4. Take the attachment nuts off the brake cylinder and remove it.

Fitting drum brake cylinder

1. Fit the brake cylinder onto the support and tighten the attachment nuts to the specified torque. See "Technical data".

2. Insert the yoke pin and split pin.

3. Connect the air pipe.

4. Adjust the brakes. See "Inspection and adjustment".

3.5 REMOVAL AND INSTALLATION, SPRING BRAKE CYLINDER

Removal, spring brake cylinder on drum brake

1. Place chocks in front of and behind the wheels and ensure that there is sufficient system pressure (> 7.5 bar).

2. Place the parking brake valve in the "Driving" position. Unscrew the release bolt in the spring brake cylinder with a 24-mm spanner as far as possible (anti-clockwise).

3. Place the parking brake valve in the "Parking" position and disconnect the two air pipes from the spring brake cylinder.

4. Remove the yoke pin from the yoke and the brake lever.

5. Remove the attachment nuts and take the spring brake cylinder from the support.

Installation, spring brake cylinder on drum brake

1. Fit the spring brake cylinder onto the support and tighten it to the specified torque. See "Technical data".

2. Pass the yoke pin through the yoke and the brake lever. The bracket should be flat (tolerance < 0.4 mm).

3. Connect the air pipes:
connection point (11); service brake,
connection point (12); parking brake,

4. Pressurise the air reservoirs and put the parking brake valve in the "Driving" position. Turn the release bolt all the way in and tighten it to the specified torque. See "Technical data".

5. Check the connections for leakage.

Removal, spring brake cylinder on disc brakes

Note:
Prevent dirt from entering the disc brake construction and cover the opening.

1. Place chocks in front of and behind the wheels and ensure that there is sufficient system pressure (> 7.5 bar).

2. Put the parking brake valve in the "Driving" position (provide sufficient system pressure: + 6 bar). Unscrew the release bolt in the spring brake cylinder with a 24-mm spanner as far as possible (anti-clockwise).

3. Place the parking brake valve in the "Parking" position and disconnect the two air pipes from the spring brake cylinder.

4. Remove the attachment nuts and take the spring brake cylinder from the support.

Installation, spring brake cylinder on disc brakes

1. Fit the spring brake cylinder onto the support and tighten the attachment nuts to the specified torque. See "Technical data".

2. Connect the air pipes:

3. Put the parking brake valve in the "Driving" position (provide sufficient system pressure: approx. 6 bar). Turn the release bolt all the way in and tighten it to the specified torque. See "Technical data".

4. Check the connections for leakage.

3.6 REMOVAL AND INSTALLATION, AUTOMATIC SLACK ADJUSTER

Disc brakes

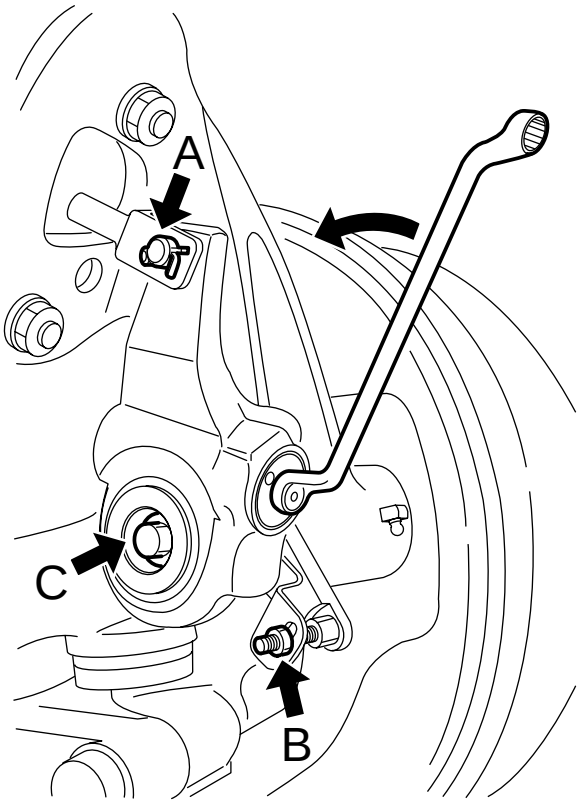
Note:
The automatic slack adjuster of the brake calliper should not be removed. If defective, the brake calliper should be replaced.

Drum brakes

Removal, automatic slack adjuster

1. Pressurise the system to at least 7.5 bar.
2. Support the axle, and place chocks in front of and behind the wheels of the other axle.
3. Set the parking brake to the "Driving" position.
4. Completely unscrew the spindle of the spring brake cylinder.
5. Turn the brakes back completely by turning the hexagonal adjusting bolt counter-clockwise. During this operation, clicks will be heard.
6. Remove the split pin and yoke pin (A).
7. Remove attachment nut (B) from the control plate.
8. Turn the hexagonal adjusting bolt anti-clockwise, so that the slack adjuster is released from the yoke.
9. Remove attachment bolt (C) with the retaining plate and adjusting rings.
10. Remove the slack adjuster.

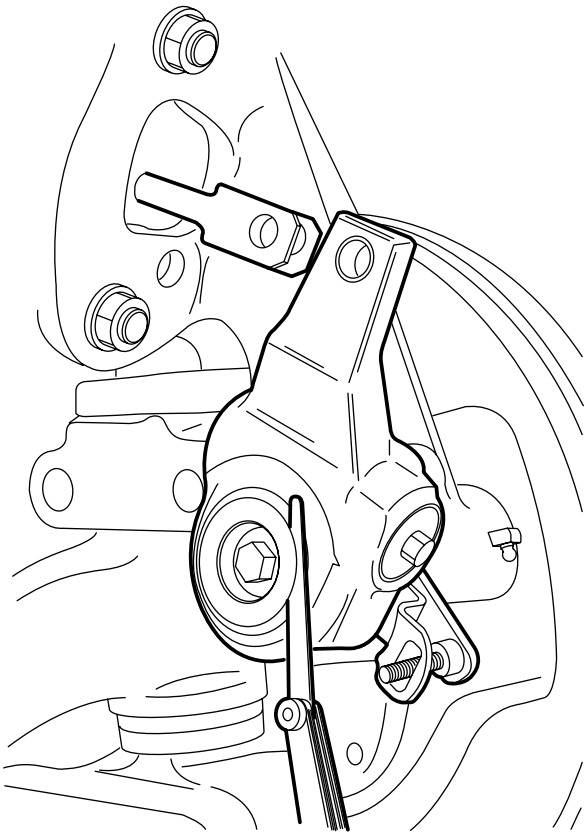
    Note:
    It is possible that during the installation of the slack adjuster the brake camshaft will be pushed inwards. This can be prevented by fitting a bolt in the brake camshaft, so that during installation of the slack adjuster the brake camshaft can be held in position.



R600141

Installation, automatic slack adjuster

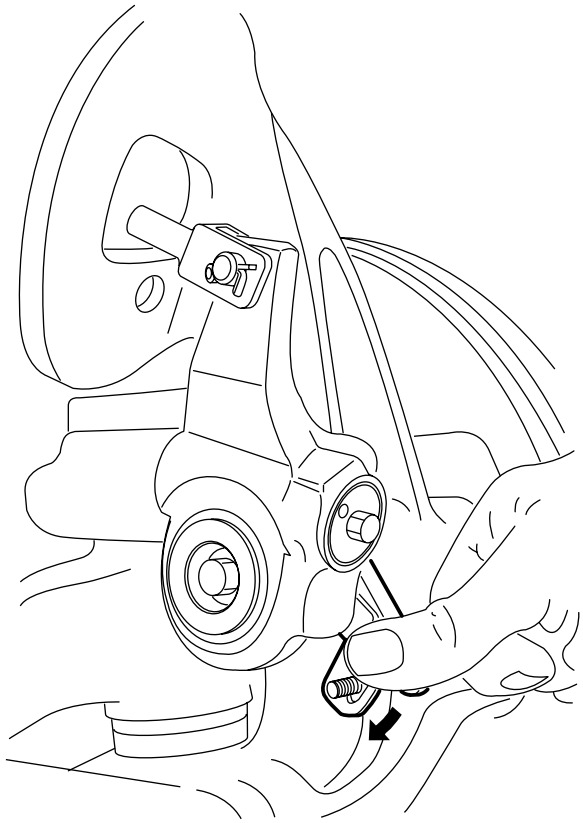
1. Check the splines of the brake camshaft for damage and wear, and re-grease them.
2. Fit the spacer so that the slack adjuster is in line with the yoke.
3. Slide the slack adjuster onto the brake camshaft. Note the arrow indicating the direction of rotation during braking.
4. Turn the hexagonal adjusting bolt clockwise until the holes in it and the yoke engage.
5. Insert the yoke pin with split pin.
6. Lubricate the attachment bolt with Loctite and fit the bolt with the retaining plate.
7. Check the axial play of the slack adjuster. See "Technical data". Check that the control plate can still be moved.



R600142

8. Turn the control plate as far as possible (until the internal stop is felt) in the direction in which the slack adjuster is moved during braking. Fix the control plate in **this** position using the attachment nut on the fixed bracket.

9. Adjust the brakes. See "Inspection and adjustment".

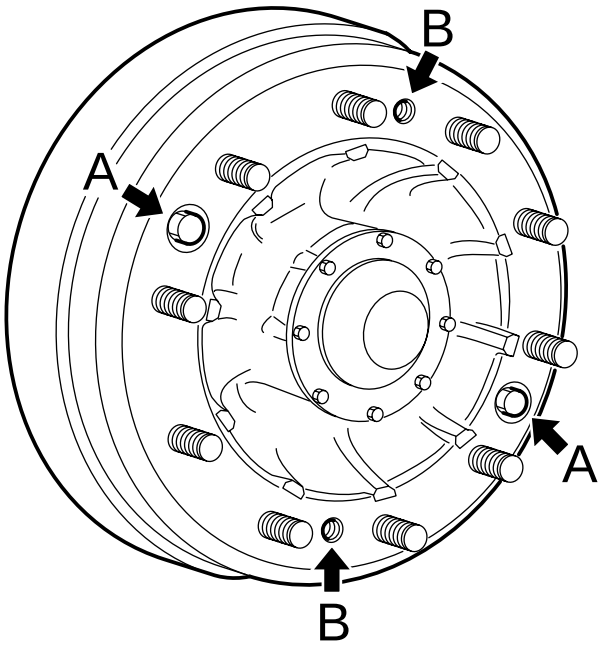


R600143

3.7 REMOVAL AND INSTALLATION, BRAKE DRUM

Removal, brake drum

1. Pressurise the air system.
2. Place chocks in front of and behind the wheels of an axle on which you are not working.
3. Release the parking brake by means of the parking brake valve or by removing the release bolts from the spring brake cylinders.
4. Turn the automatic slack adjuster back completely.
5. Unscrew the wheel nuts.
6. Jack up the axle in question.
7. Support the axle with stands.
8. Remove the wheels.
9. Remove the two attachment bolts (A) from the brake drum.
10. Insert two jack screws in the threaded holes (B).
11. **Note:**
    Never use a pneumatic tool for tightening the jack screws.
    Tighten them evenly by hand. This brings the brake drum to pressure. Use a copper punch to work the brake drum from the hub.
    Use lifting gear to remove the brake drum.



R600144

Installation, brake drum

1. Clean the fitting edge of the brake drum and the wheel rim with a steel wire brush.
2. Then smear the fitting edge lightly with grease. This grease layer should prevent the brake drum from rusting tight.
3. Remove the jack screws from the brake drum.
4. Fit the brake drum using the lifting gear.
5. Fit two wheel nuts opposite one another.
6. Tighten these wheel nuts evenly until the brake drum is correctly on the hub.
7. Remove the wheel nuts.
8. Fit the attachment bolts for the brake drum.

9. Fit the wheels and wheel nuts and tighten the nuts evenly, in the correct order. See group 7 of the workshop manual.

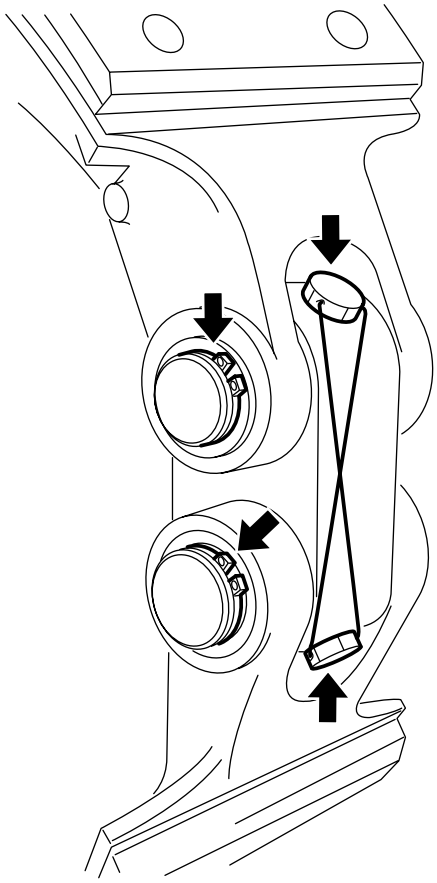
10. Adjust the brakes. See "Inspection and adjustment".

11. Remove the jack and chocks from the rear wheels. If the spring brake cylinder was mechanically released, the release bolt should be screwed back in and tightened to the specified torque. See "Technical data". The pressure in the spring brake cylinder circuit should be at least 5 bar.

3.8 REMOVAL AND INSTALLATION, BRAKE SHOES 1354, 1355T REAR AXLE

Removal, brake shoes

1. Remove the brake drum.
2. Remove the circlips, felt rings and sealing rings from one side of the brake shoe.
3. Remove the lock bolts or lock studs from the anchor pins.



R600145

4. Remove the anchor pins.

5. First remove the bottom brake shoe by moving it outwards from the anchor pin holes.

6. Unhook the return spring, and remove the upper brake shoe.

Installation, brake shoes

1. Clean all parts.

2. Lubricate the anchor pins, cam rollers and contact surfaces of the brake shoes with Copaslip.

3. Fit the return spring in the brake shoes.

4. First fit the upper brake shoe in position, then the lower shoe.

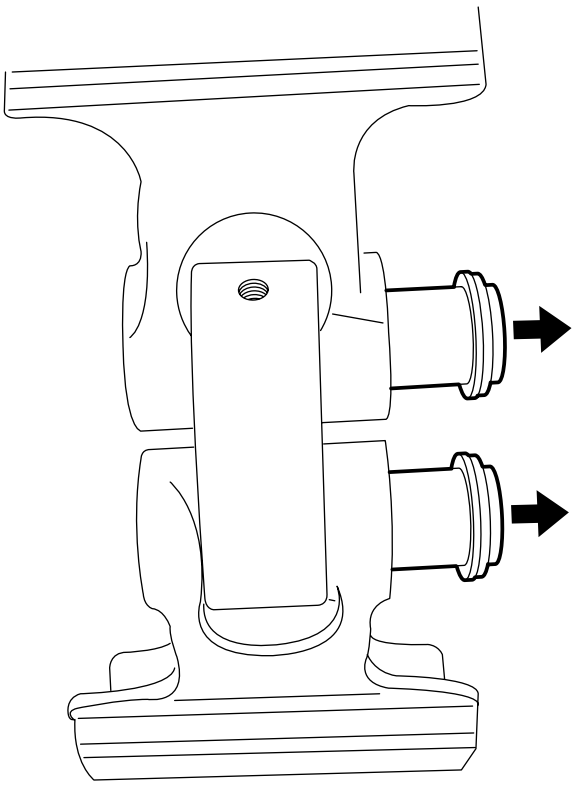
5. Remove the anchor pins. Ensure that the flattened section is placed beneath the bore in the back plate.

6. Fit the felt ring, sealing ring and circlip to the anchor pin.

7. Lock the anchor pins with the locking screw and fit the locking wire, or lock the anchor pins using a stud.

8. Fit the dust plates.

9. Fit the brake drum.

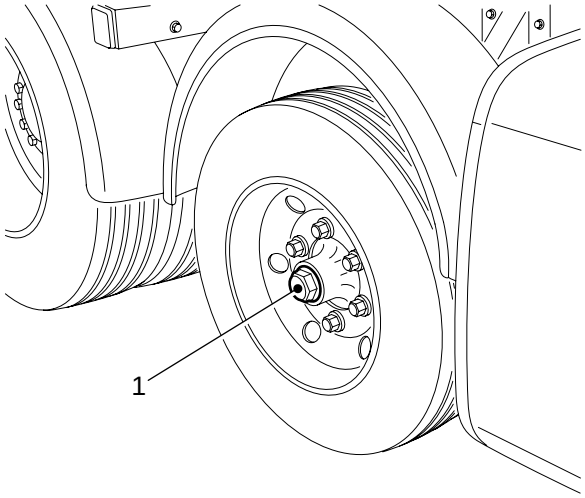


R600146

3.9 REMOVAL AND INSTALLATION, BRAKE SHOES FOR 09N044 LEADING REAR AXLE

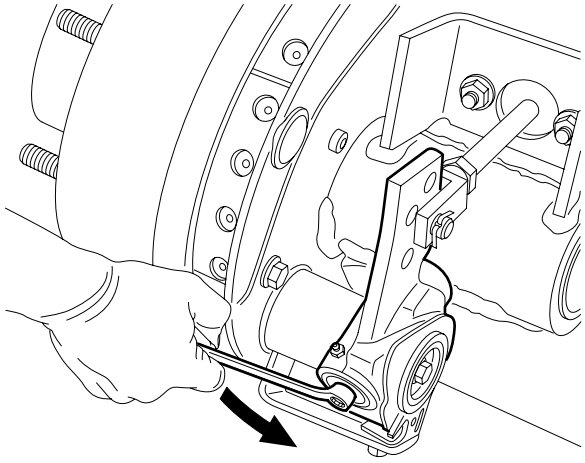
Removing brake shoes for 09N044 leading rear axle

1. Remove the hub cap.



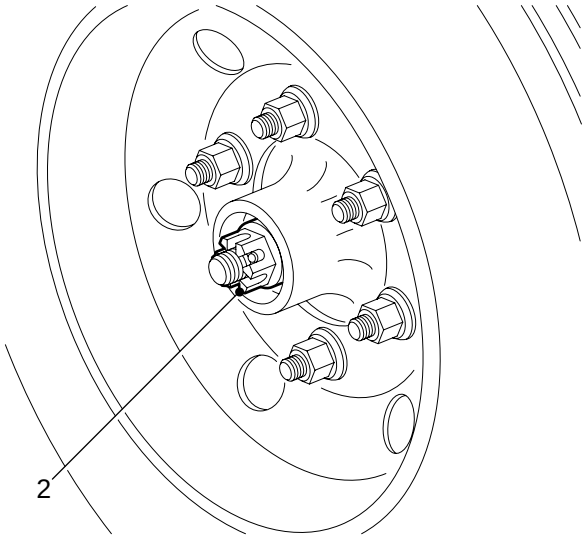
R600636

2. Turn the brake shoes back.



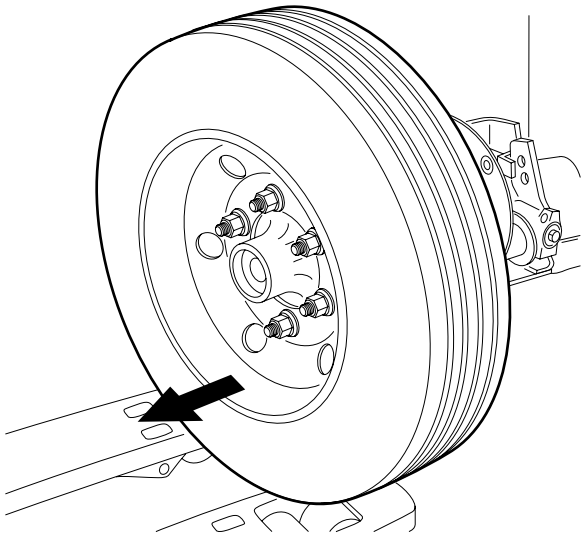
R600637

3. Remove the locking pin and the hub nut (2).



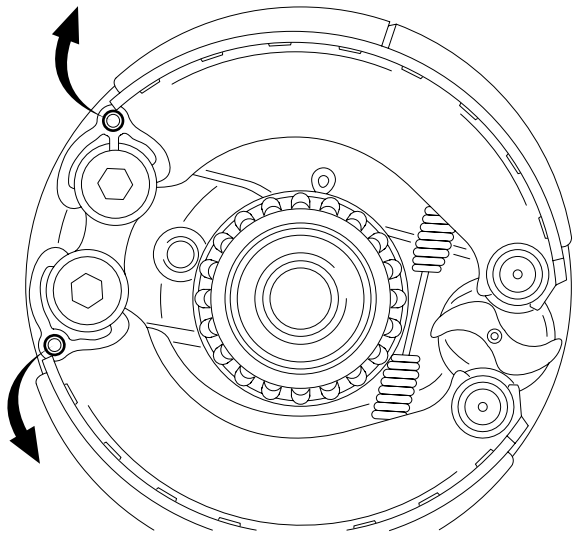
R600638

4. Remove the wheel with the brake drum. Use a wheel lift to do this.



R600633

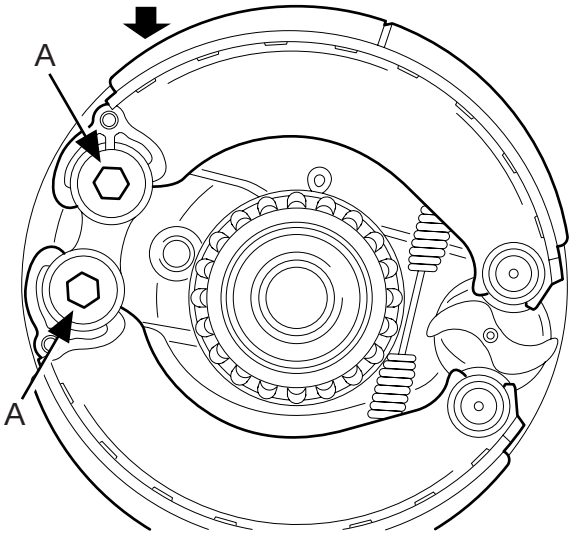
5. Remove the two brake shoes by detaching them from both pivot points.
6. Remove the spring.



R600634

Installing brake shoes for 09N044 leading rear axle

1. Fit the spring between the two brake shoes.
2. Fit the two brake shoes and press them over the pivot points.
3. Fit the wheel and the brake drum. Before re-fitting, check the condition of the brake drum and the bearing.
4. Install the hub nut, adjust the wheel bearing play and install the hub cap.



R600635

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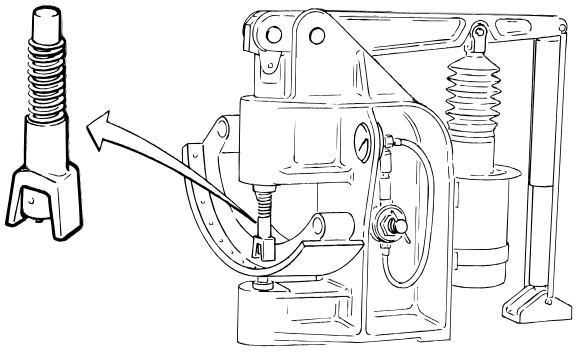
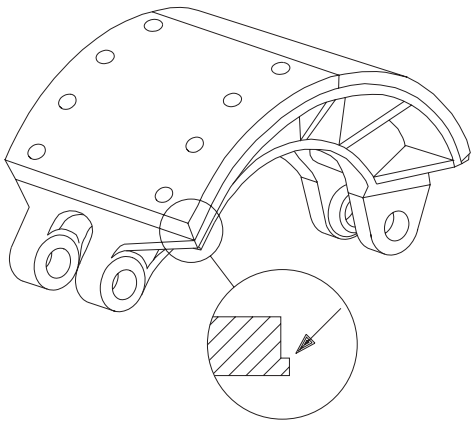
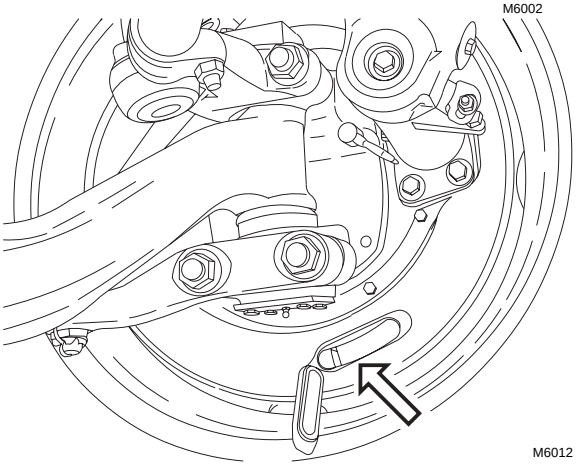
3.10 INSTALLATION, BRAKE LINING ON BRAKE SHOE

A brake lining should be riveted correctly with a riveting machine, to prevent damage such as cracks in the rivet surface. For that reason, always use the specified rivets. Use the special tool (DAF no. 1240000) for riveting the brake lining.


R600133

1. Replace the brake lining when it has worn down to the wear indicator or to approximately 1 mm above the rivet head. The thickness can be measured via the inspection holes in the back plates. The brake lining should also be replaced if oil or grease has worked into it.

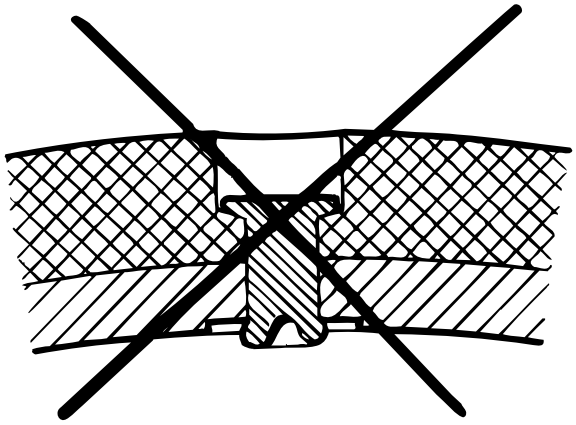

M6002


M6012

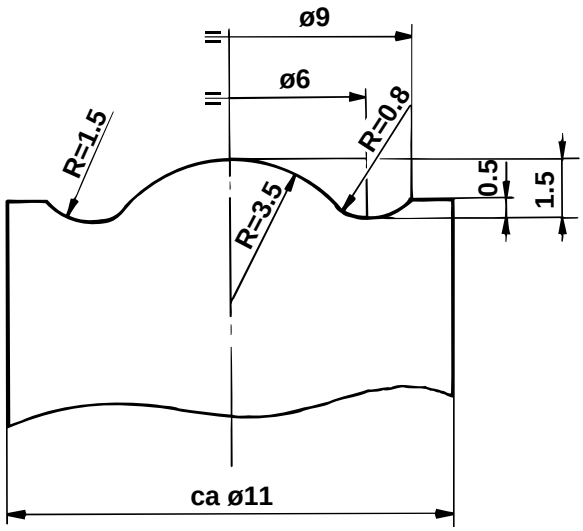
2. Check that the inside diameter of the lining is the same as the outside diameter of the brake shoe, by fitting them together. The hole pattern of both parts must also be exactly identical.

3. Both lining and brake shoe must be thoroughly clean. If required, use a steel wire brush to clean them. Check whether the brake shoe surface is even and un-deformed. Grind down any raised edges around the holes. The holes in the brake shoe must not become damaged or too big as a result of careless removal of old rivets.

4. The riveting punch must have a diameter of approx. 11 mm (= the outside diameter of the closed collar) and it must have the correct shape.



R600137



R600135

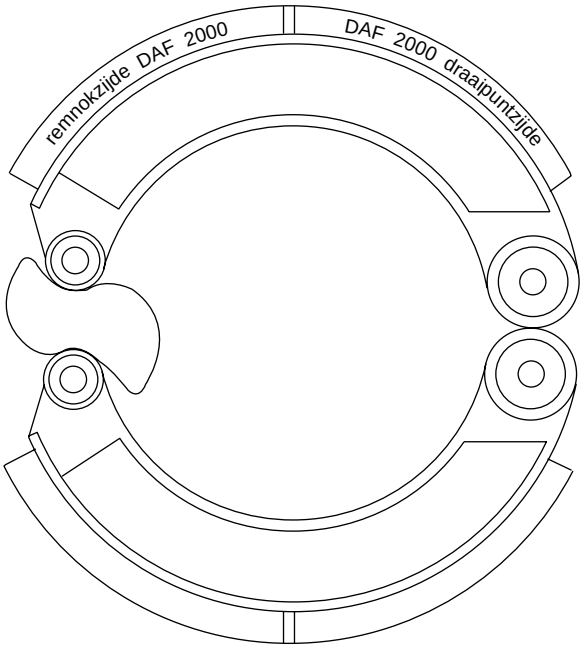
Riveting

1. Place the lining on the brake shoe. If the linings are so marked, mount the "draaipuntzijde" marking at the pivoting end of the brake shoe and the "remnokzijde" marking at the camshaft end of the shoe.

   Note:
   If these markings are not there, mount the thin side of the lining at the pivoting end and the thick side of the lining at the camshaft end.

2. Start riveting at the two holes in the centre of the lining. Make sure that the holes in the lining and the brake shoe are exactly in line with each other and that the lining is well bedded down onto the shoe. (Use one or more clamps.)

3. Set the riveting machine at a moderate riveting force. This should be approx. 20,000 N.

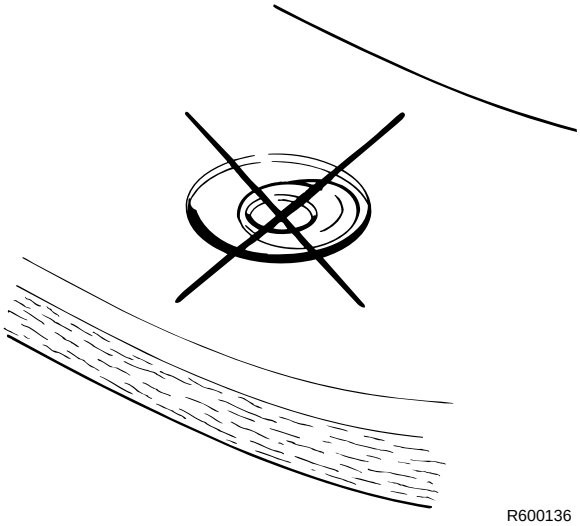


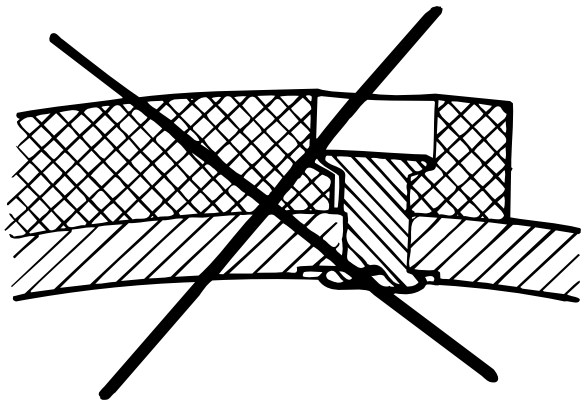
R600147

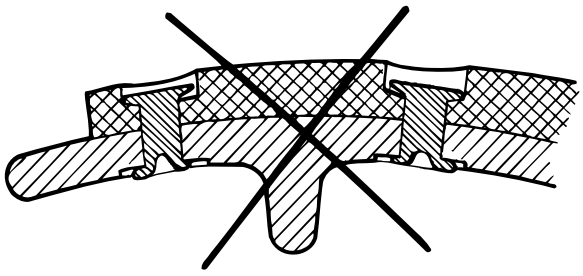
4. Place the upper punch carefully in position and gradually increase the force (this will result in the upsetting of the rivet shank i.e. filling the hole, and the formation of a collar on the shank).

5. Check the joints made for the following points:
   - the collar formed on the shank must be uniform all round and not flattened on one side. If this is not the case:
   - the holes in the lining and brake shoe are not in line.
   - the brake shoe was not held level during the riveting process.
   - the rivets are wrong.
   - there must be no cracks in the collar formed on the shank of the rivet. If cracks are present, the clamping force was too high.
   - the newly formed collar must abut the brake shoe closely. Mark the halves again if this is not the case.
   - the head of the rivet must not be forced to one side in the lining. This can be checked, for example, with the depth measurement part of a calliper gauge or visually by the asymmetrically formed collar on the shank. If the head of the rivet has been forced to one side in the lining, the holes in the lining and the brake shoe are out of alignment or the brake shoe was not held level during the riveting process.

6. Check the brake lining for cracks around the rivet head. If this is the case, the riveting force was too high or the hole drilled in the brake lining was too small. To prevent the appearance of cracks, the diameter of the hole in the lining must be approx. 0.5 mm larger than the hole in the brake shoe.


R600136


R600134


R600138

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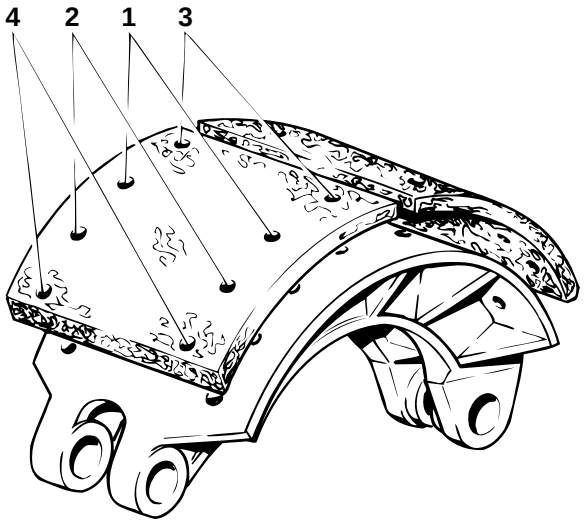
7. If the joint is found to be in order, continue to rivet the lining. Make sure that the lining is pressed firmly against the shoe at each riveting point. Work from the centre towards the ends, alternately from one end to the other. Follow this procedure for each set of two rivets. This will ensure that the lining is evenly bedded down over the entire length.



R600139

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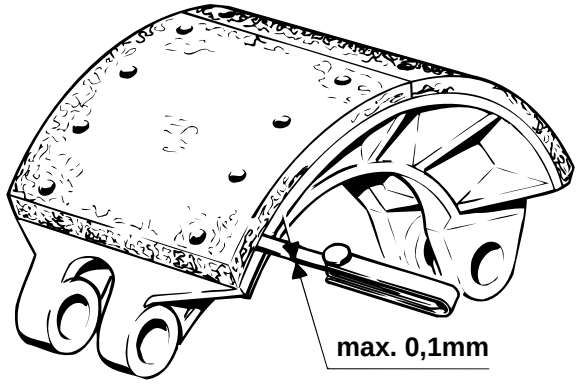
Checking the riveted joints

1. Now check all the riveted joints in the manner described, and use a feeler gauge to measure any play between lining and brake shoe. At the side this play may not exceed 0.1 mm with mechanical air brakes.
   - It must not be possible to slide the feeler gauge further than the first row of rivets.
   - At the end of the lining, the play up to the first row of rivets must not exceed 0.1 mm in the case of mechanical air brakes.
   - No play at all is allowed for a distance of 5 mm around the rivets.

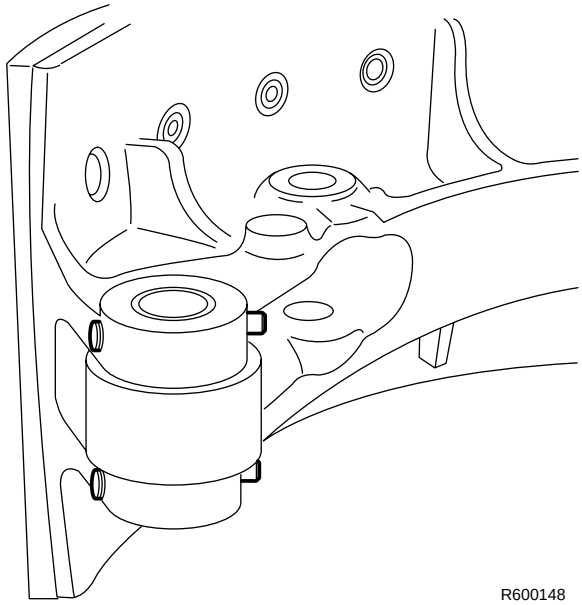


R600140

3.11 REMOVAL AND INSTALLATION, BRAKE SHOE BEARING

Anchor pin bearing

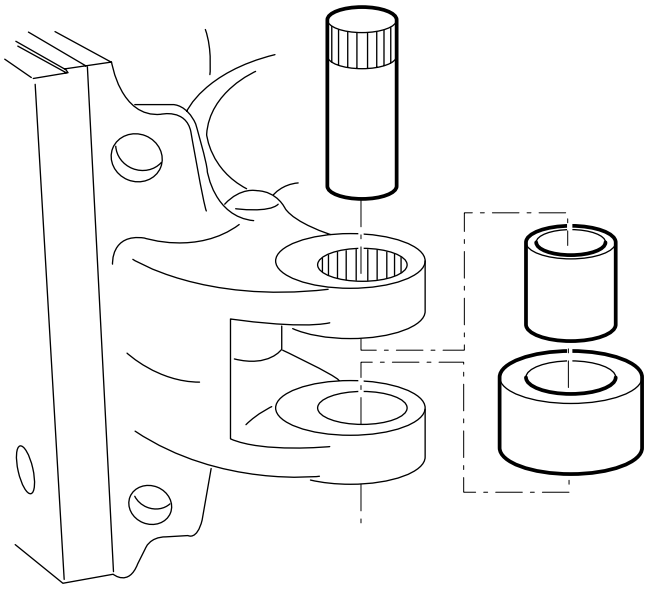
1. Remove the brake shoes.
2. Force the new bearing bushes into the brake shoe. Check whether the anchor pins can rotate in the new bearing bushes.
3. Fit the brake shoes.



R600148

Cam roller bearing
The spindles for the roller brake cams can be locked in two ways:
- locking by means of a spindle and two spring pins.
- locking by means of spindle with knurled edge.

For the model of the spindle with knurled edge, the following should be remembered:
- The first time the spindle with the knurled edge is fitted is during production.
  The spindle may be fitted a maximum of **THREE TIMES** on one side of the brake shoe. Every time it is **REINSTALLED**, a mark must be made on the brake shoe with a centre point.
  Two centre points indicate that the spindle must be fitted in the **REVERSE** direction the next time.
  Here too, the spindle may not be fitted more than three times.
  After the spindle is fitted three times on the other side of the brake shoe, the brake shoe **MUST** be renewed.



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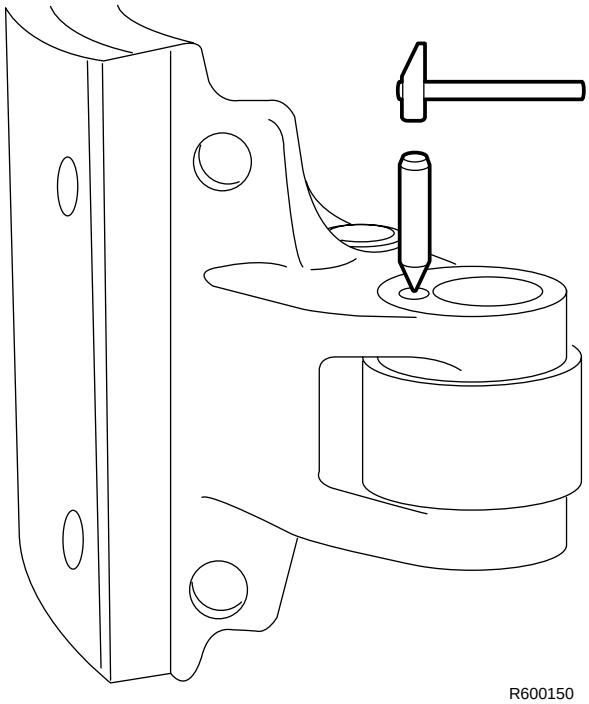


R600150

Removal, cam roller bearing
1. Remove the brake shoes.
2. If fitted, remove the spring pins.
3. Force the spindle from the brake shoe.
   For the version with the knurled edge, force the spindle from the shoe in such a way that the knurled edge is not forced through the entire brake shoe.

Installation, cam roller bearing
1. Check the brake shoe, spindle and cam roller for damage. Replace if necessary.
2. Force the new bearing bush into the cam roller.
3. Force the spindle into the brake shoe with the cam roller. For the version with the knurled edge, mark the spindle as indicated in this chapter.
4. Fit the brake shoes.

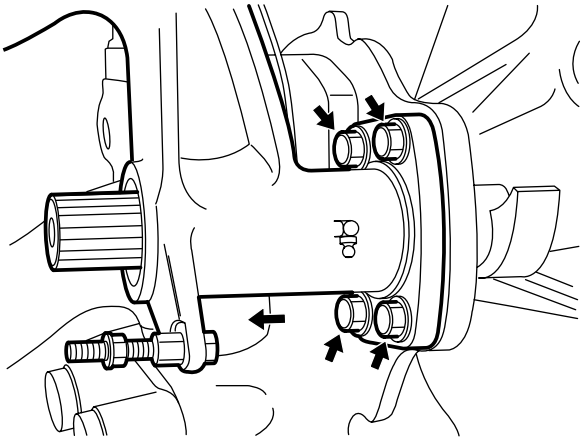
3.12 REMOVAL AND INSTALLATION, BRAKE CAMSHAFT

Removal, brake camshaft

1. Remove the brake shoes.
2. Remove the automatic slack adjuster.
3. Disconnect the air pipe to the brake cylinder.
4. Remove the attachment bolts from the brake cylinder bracket.
5. Slide the brake cylinder bracket complete with the brake cylinder from the brake camshaft. Support the brake camshaft during this process.
6. Remove the brake camshaft from the back plate.
7. Check the brake camshaft. The curve against which the rollers run should not be worn or damaged.

Installation of the brake camshaft

1. Before fitting, first clean all parts and lubricate them with Copaslip.
2. Check the seals in the bracket. If necessary, replace.
3. Insert the brake camshaft with the shim through the back plate, and slide the brake cylinder bracket complete with brake cylinder over the brake camshaft.
4. Attach the brake cylinder bracket.
5. Check the radial play. This must be minimal. If necessary, replace the bearing bushes.
6. Fit the brake shoes.
7. Fit the automatic slack adjuster.



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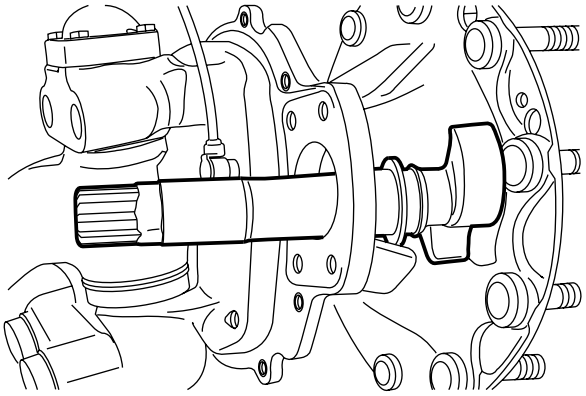


R600152

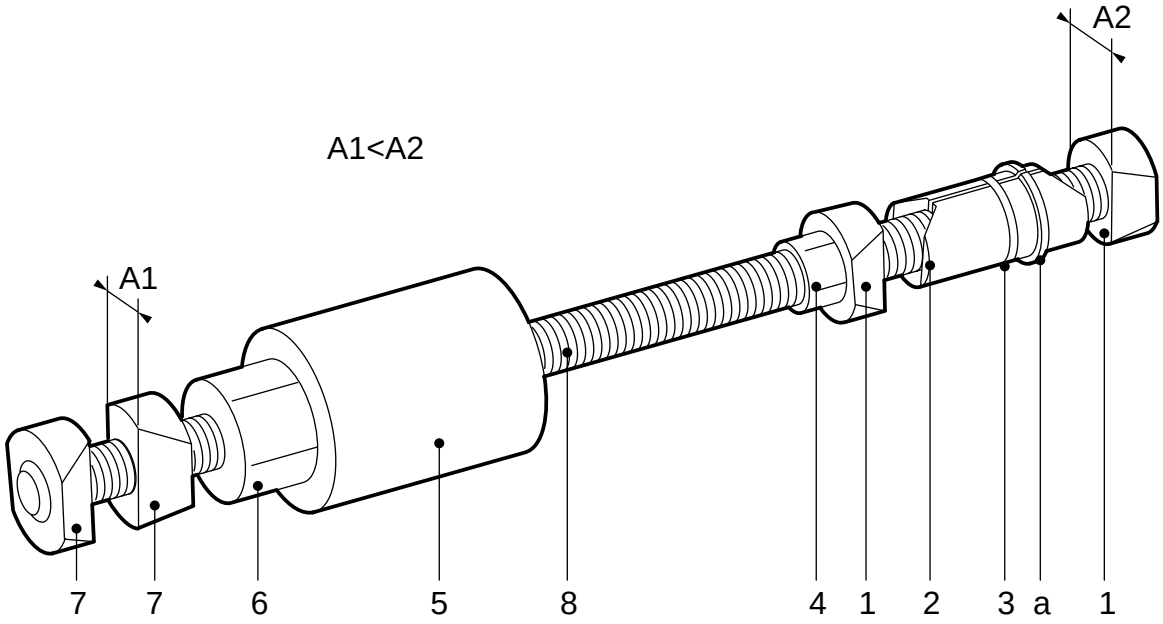
3.13 REMOVAL AND INSTALLATION, BRAKE CAMSHAFT BEARING.

Removal, brake camshaft bearing

1. Remove the brake camshaft.

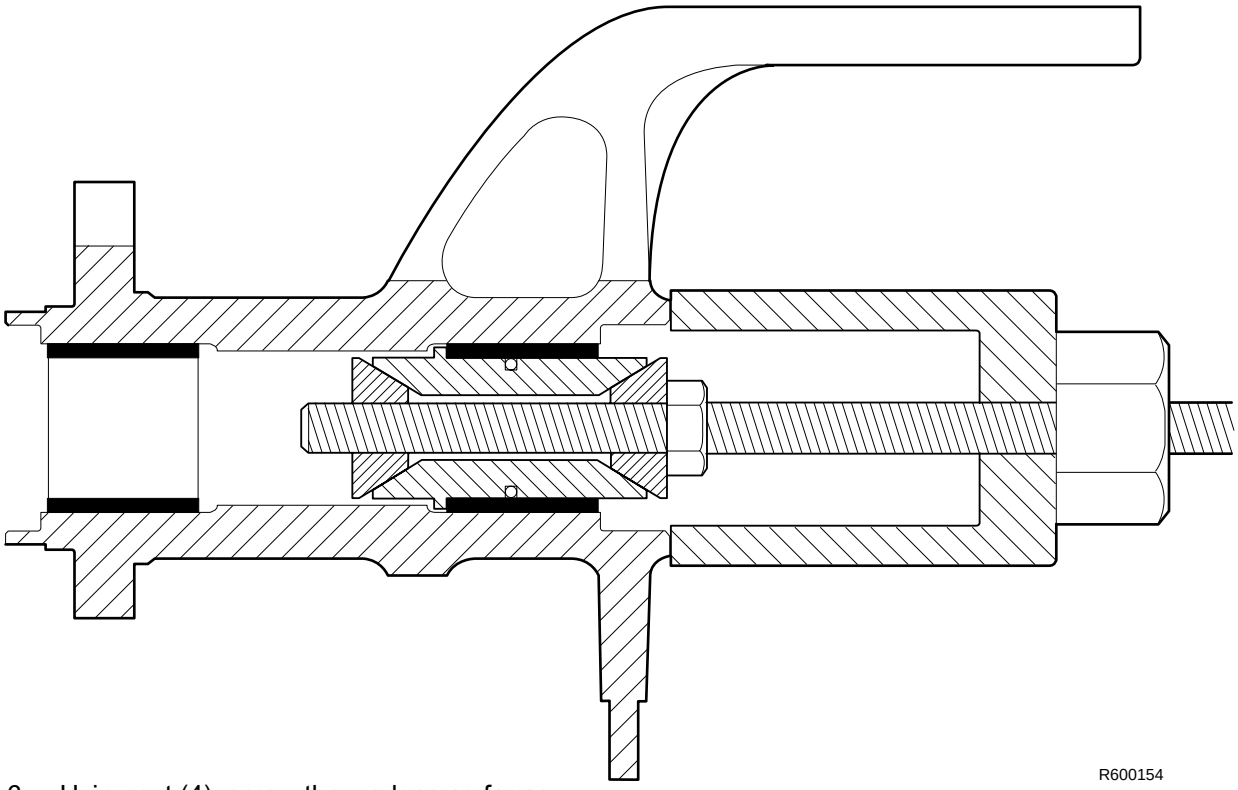
2. Remove the oil seals from the brake cylinder bracket. These must always be replaced.

3. Use the special tool (DAF no. 0694794) for removing the brake camshaft. Determine the correct set of wedges for each bearing bush, and fit them on the puller.



4. Move the loose wedge (1) back so that the halves of the pulling piece (2), which are kept together by the O-ring, are joined.

5. Place the puller in the brake cylinder bracket, so that shoulder (a) is behind the bearing bush. When working on the front axle, ensure that the shoulder engages with the recess between the bearing bush and the brake cylinder bracket.



R600154

6. Using nut (4), screw the wedges as far as possible inwards. Tighten the nut finger-tight.

7. Place the spacer sleeve (5) against the brake cylinder bracket and screw nut (6) until the bearing bush is pulled out of the bracket. Ensure that the contact faces of nut (6), the spacer sleeve (5) and the threaded spindle (8) are sufficiently lubricated.

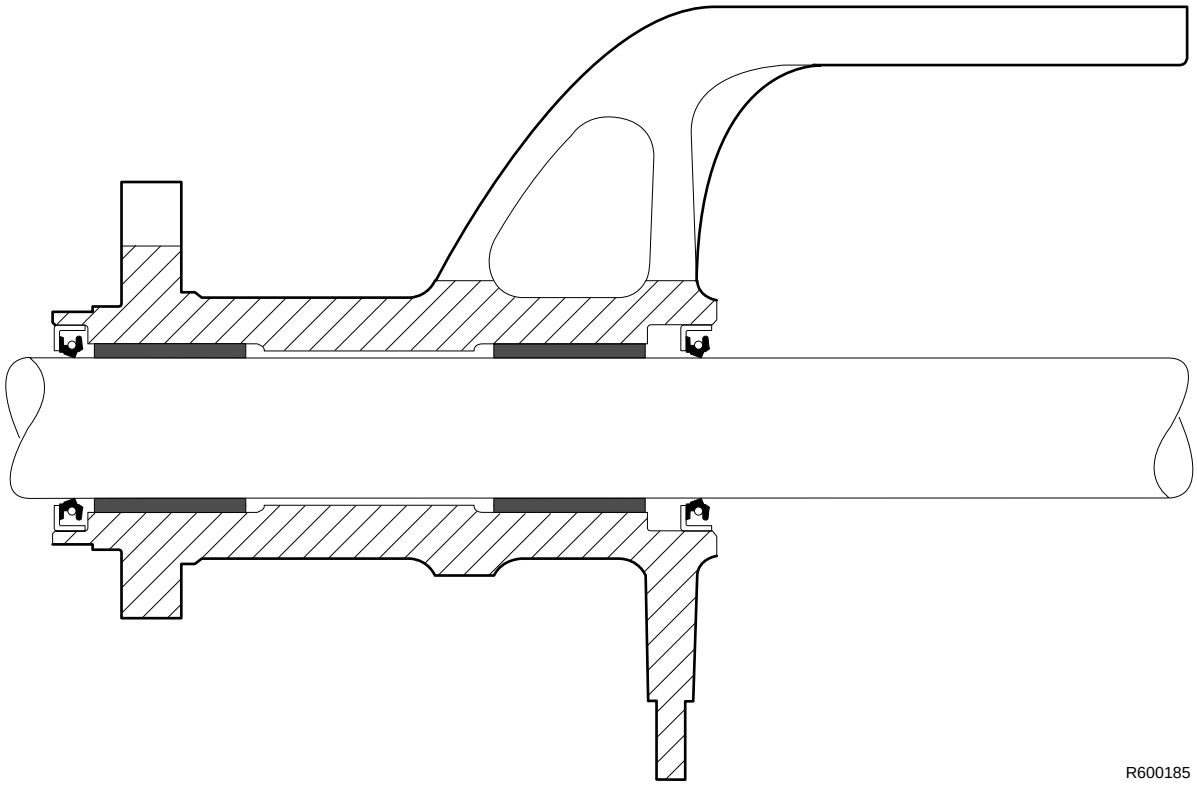
Installation, brake camshaft bearing

1. Check the brake cylinder bracket for damage. If necessary, replace.

2. Check whether the lubricating nipple is open, so that the bearings can be lubricated with grease from the automatic lubrication system.

3. Fit the bearing bushes using the special tool (DAF no. 1310421).

4. Check the brake camshaft for smooth operation. If necessary, ream the bushes. Play between spindle and bush 0.1 to 0.2 mm.



5

5. Fit the oil seals.

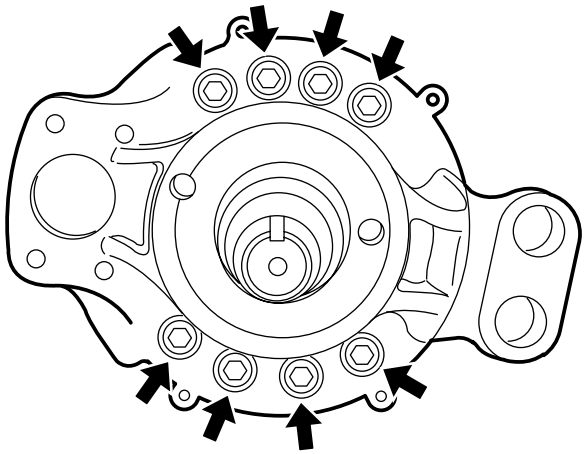
   Note:
   The oil seal on the wheel brake end should form a seal, whilst the oil seal on the slack adjuster end should be able to discharge grease from the bracket.

6. Fit the brake camshaft.

3.14 REMOVAL AND INSTALLATION, BRAKE BACK PLATE IN DRUM BRAKES

Removal, brake back plate

1. Remove the brake drum.
2. Remove the brake shoes.
3. Remove the automatic slack adjuster.
4. Remove the brake camshaft.
5. Remove the hub.
6. Remove the brake back plate.



R600156

Installation, brake back plate

1. Clean the contact surfaces of the brake back plate and the spindle, and let these surfaces dry for approx. 20 minutes before installing the back plate. Thoroughly clean all other parts.
2. Fit the back plate.
3. Fit the hub.
4. Fit the brake camshaft.
5. Fit the brake shoes.
6. Fit the brake drum.
7. Fit the automatic slack adjuster.

5

3.15 REMOVAL AND INSTALLATION, BRAKE BACK PLATE IN DISC BRAKES

Removal, brake back plate

1. Remove the brake calliper.
2. Remove the brake calliper carrier.
3. Remove the hub (and brake disc).
4. Remove the brake back plate.

Installation, brake back plate

1. Clean the contact surfaces of the brake back plate and the spindle, and let these surfaces dry for approx. 20 minutes before installing the back plate. Thoroughly clean all other parts.
2. Install the brake back plate and tighten the attachment bolts to the specified torque. See "Technical data".
3. Install the hub (and brake disc).
4. Fit the brake calliper carrier.
5. Fit the brake calliper.

3.16 REMOVAL AND INSTALLATION, COMPRESSOR CYLINDER HEAD GASKET

Always replace the gaskets when carrying out repairs.

Removing the cylinder head gasket

1. Drain some of the coolant.
2. Remove the suction line.
3. Remove the delivery line.
4. Remove the coolant connections.
5. Remove the cylinder head bolts.
6. Remove the cylinder head assembly.

Installing the cylinder head gasket

1. Thoroughly clean all parts.
2. Check whether there are any remnants on the piston in the compressor.
3. Install the head gasket. Use studs if necessary to ease installation.
4. Install the valve housing including the inlet plates and spring plates.
5. Install the valve housing gasket and the cylinder head.
6. Install the cylinder head bolts and tighten to the specified torque, starting from the centre bolt. See "Technical data".
7. Install the suction line.
8. Install the delivery line.
9. Connect the coolant connections.
10. Fill the cooling system.
11. Check the operation of the compressor. See "Inspection and adjustment".

3.17 REMOVAL AND INSTALLATION, AIR DRYER FILTER ELEMENT

Note:
To be certain that the air dryer is functioning properly, the air reservoirs should regularly be checked for condensation.

If repeatedly more than the normal amount of water is drained off, the filter element will have to be replaced.

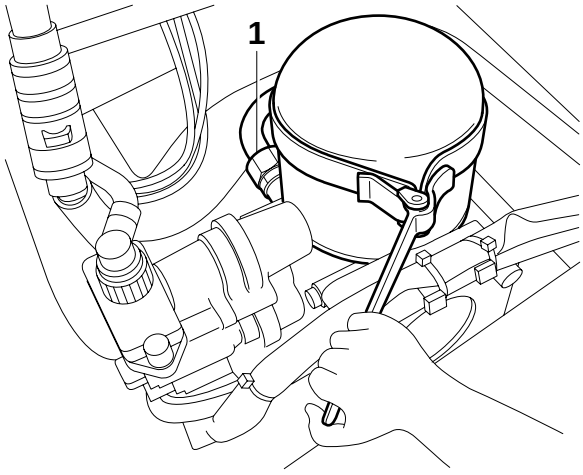
Under normal circumstances the element must be replaced at least once per year.

Removing air dryer filter element

1. Bleed the air dryer by allowing it to regenerate or by loosening the compressor pipe (1), so that the interior of the air dryer is depressurised.
2. Remove the filter element by turning it anti-clockwise using a filter strap spanner.
3. The filter element should be disposed of as if it were an oil filter.
4. Clean the air dryer internally.
5. Check the air dryer threaded connection (2) for damage and then lubricate it sparingly with grease.

Installing the air dryer filter element

1. Lubricate the sealing ring of the new filter element sparingly with grease.
2. Fit the filter element by manually tightening it until the sealing ring abuts. Then tighten the filter element by hand (approx. 1 turn).
3. Fasten the compressor line (1).
4. Pressurise the system and then check the air dryer for air leaks.
5. Fill in the date on the sticker with a waterproof felt pen by which the filter element must be replaced (max. 1 year after fitting).



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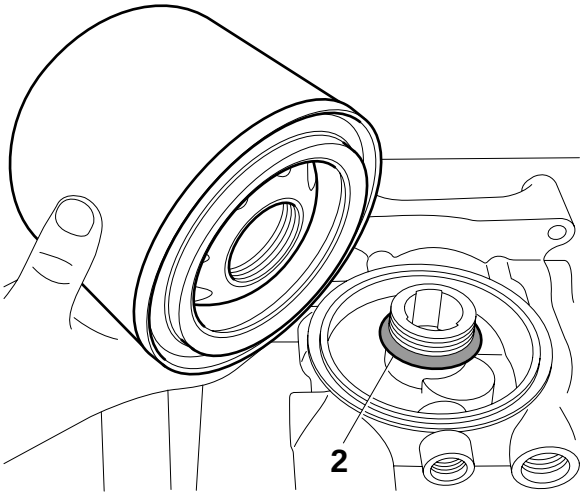

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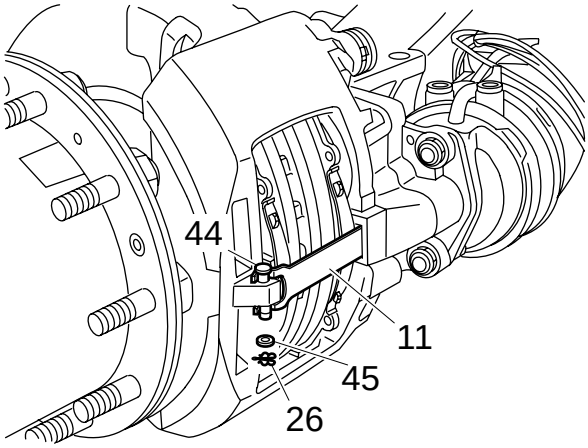
3.18 REMOVAL AND INSTALLATION, BRAKE PADS

Make sure no fingers get trapped between the brake calliper and the brake calliper carrier during and following removal of the brake pads. Always take hold of the brake calliper on the outside.

Removing the brake pads

1. Apply the parking brake.
   If the respective axle has spring brake cylinders, place chocks in front of and behind the wheels of another axle and release the parking brake.
2. Remove the wheels in question.
3. Remove the hairpin spring (26) and washer (45) from the yoke pin (44) of the locking strip (11).
4. Press the strip on and remove the yoke pin (44).
5. Check the strip for corrosion; replace if necessary.
6. Remove the sealing cap (37).
7. Using a ring spanner and the adapter, turn the hexagonal bolt (23) anti-clockwise until the brake pads (12) can be removed (a clicking noise can be heard).

   Note:
   Never turn the hexagonal adjusting bolt without using an adapter. The adapter is a torque safety and will break off when the torque is too high. Without the use of an adapter the mechanics in the brake calliper may become damaged when the torque is too high, so that replacement of the brake calliper may be necessary.
8. Remove the brake pads.



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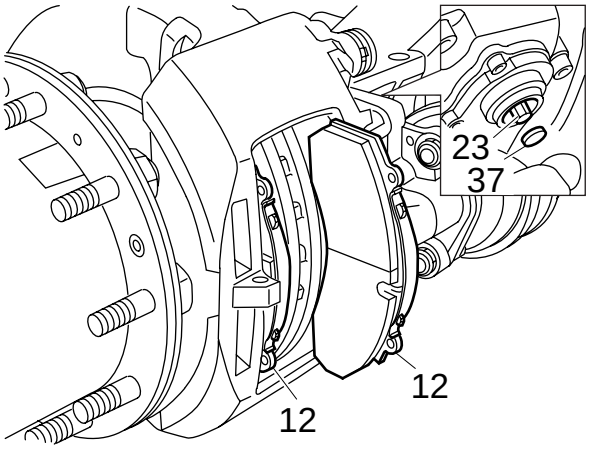


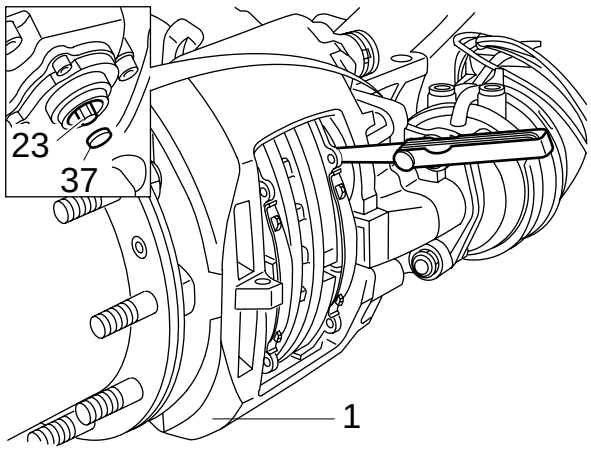
R600462

Note:
If the brake pads have wear end indicators, they must be removed at the same time as the brake pads, including accessories.

Installing the brake pads

1. Check the brake calliper play.
   See "Inspection and adjustment".

2. If necessary, turn the hexagonal adjusting bolt (23) back completely, using the adapter.
3. Clean the brake pad seats.
4. Check all brake calliper seals (guide bushes, thrust pieces).
5. Shift the brake calliper (1) towards the wheel side.
6. Fit the outer brake pad.
7. Shift the brake calliper towards the brake cylinder side.
8. Fit the inner brake pad.
9. Separate the inner brake pad from the thrust pieces.
10. Position a feeler gauge with the correct thickness between the brake pad and the thrust piece of the adjuster with the hexagonal adjusting bolt. See "Technical data".
11. Turn the hexagonal adjusting bolt clockwise with the ring spanner and the adapter until the feeler gauge just fits. Remove the feeler gauge.
12. Check the play between the end of the brake pads and the brake calliper carrier (see "Technical data"). If the play is too small, material must be ground off the steel plate of the brake pad. If the play is too large, the brake pads and/or brake carrier must be replaced.
13. Vet de afdichtdop licht in (zie hoofdgroep "Technische gegevens") en plaats deze terug op de remsteller.
14. Fit the locking strip (11).
15. Press the strip and fit the yoke pin.
16. Fit the washer (45) and the hairpin spring (26) on the yoke pin (44).
17. Apply the service brake once and check that the hub can move freely. If necessary, increase the play.
18. Put the wheels back on.



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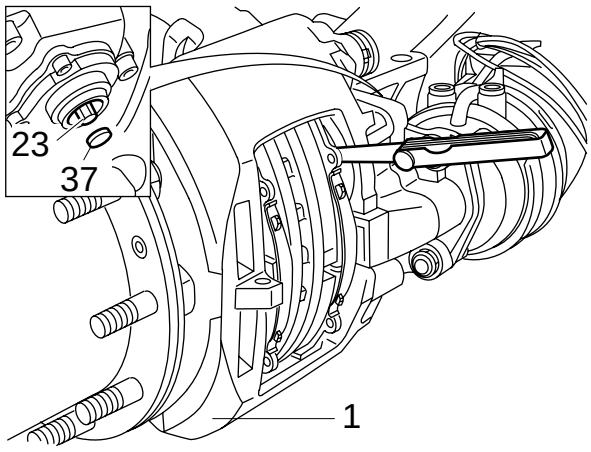

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3.19 REMOVAL AND INSTALLATION, BRAKE DISC

Removal, brake disc

1. Remove the hub.

2. Remove the locking plates.

3. Remove the spring plates between the disc and hub and tap the disc from the hub using a copper hammer.
   If the disc does not come free from the hub, it can be removed by placing it on an old brake drum and pushing it off the hub using a press.

Installation, brake disc

1. Remove dirt and corrosion from the contact surfaces of the brake disc and hub.

2. Position the brake disc on the hub.

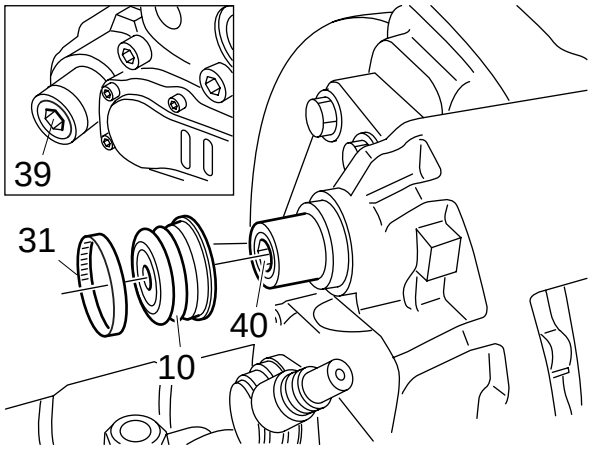
3. Fit the spring plates and tighten them to the specified torque. See "Technical data".

3.20 REMOVAL AND INSTALLATION, KNORR SB7000 BRAKE CALLIPER

Make sure no fingers get trapped between the brake calliper and the brake calliper carrier during and following removal of the brake pads and when a new brake calliper is installed. Always take hold of the brake calliper on the outside.

Removing the brake calliper

1. Remove the brake pads.
2. Remove the brake cylinder.
3. Remove the plug for the brake pad wear indicator.
4. Remove the clamping strap (31) and the rubber bellows (10).

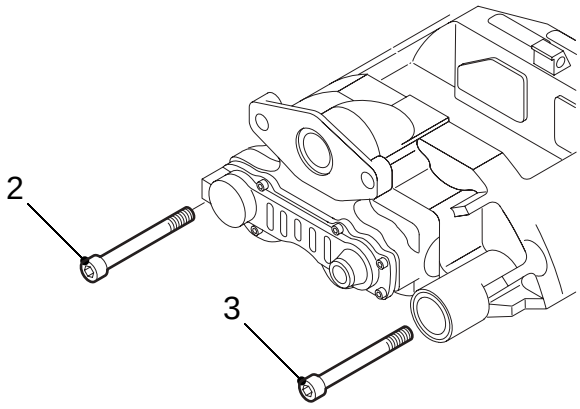


R600466

5. Remove the Allen screws (2) and (3).
6. Remove the brake calliper.

Fitting the brake calliper

1. Clean all parts and check for damage. The sliding surfaces of moving parts must be clean and undamaged.
2. Position the brake calliper on the brake calliper carrier.



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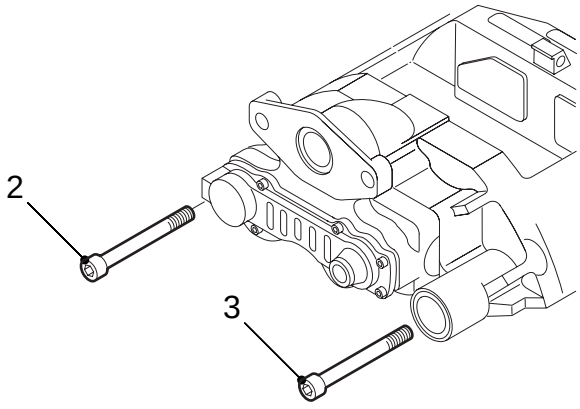
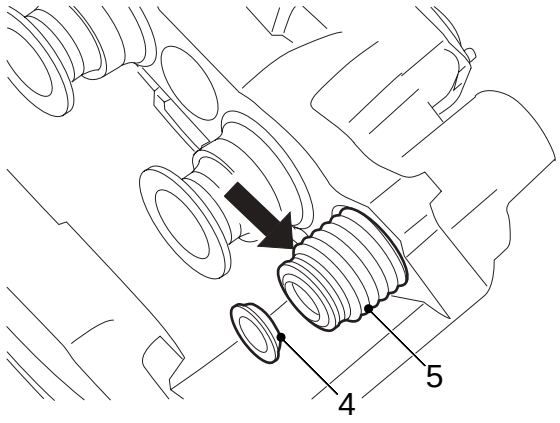
3. Fit the two Allen screws (2) and (3) and tighten them to the specified torque. See "Technical details". Do not re-use these screws. Always use new screws which have locking compound applied.



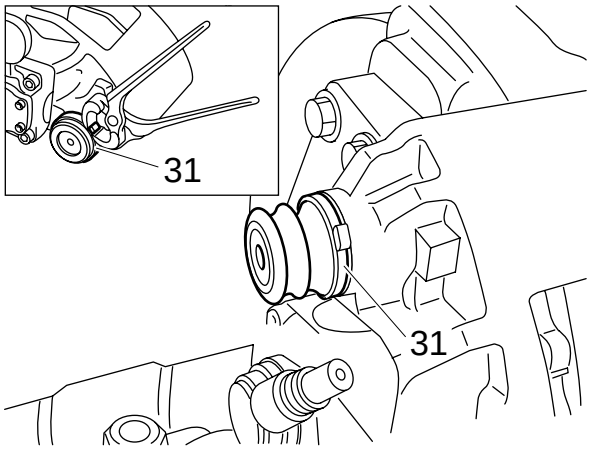
R600720

4. Check that the brake calliper can move freely.
5. Check that the bellows (5) and the ring (4) of the guide bush are properly in place on the inside of the brake calliper.



R600721

6. Check that the automatic adjustment is working properly.
7. Fit the bellows (10) and clamping strap (31). Check the bellows for proper sealing.
8. Fit the brake pads.
9. Fit the plug for the brake pad wear indicator.
10. Fit the brake cylinder.

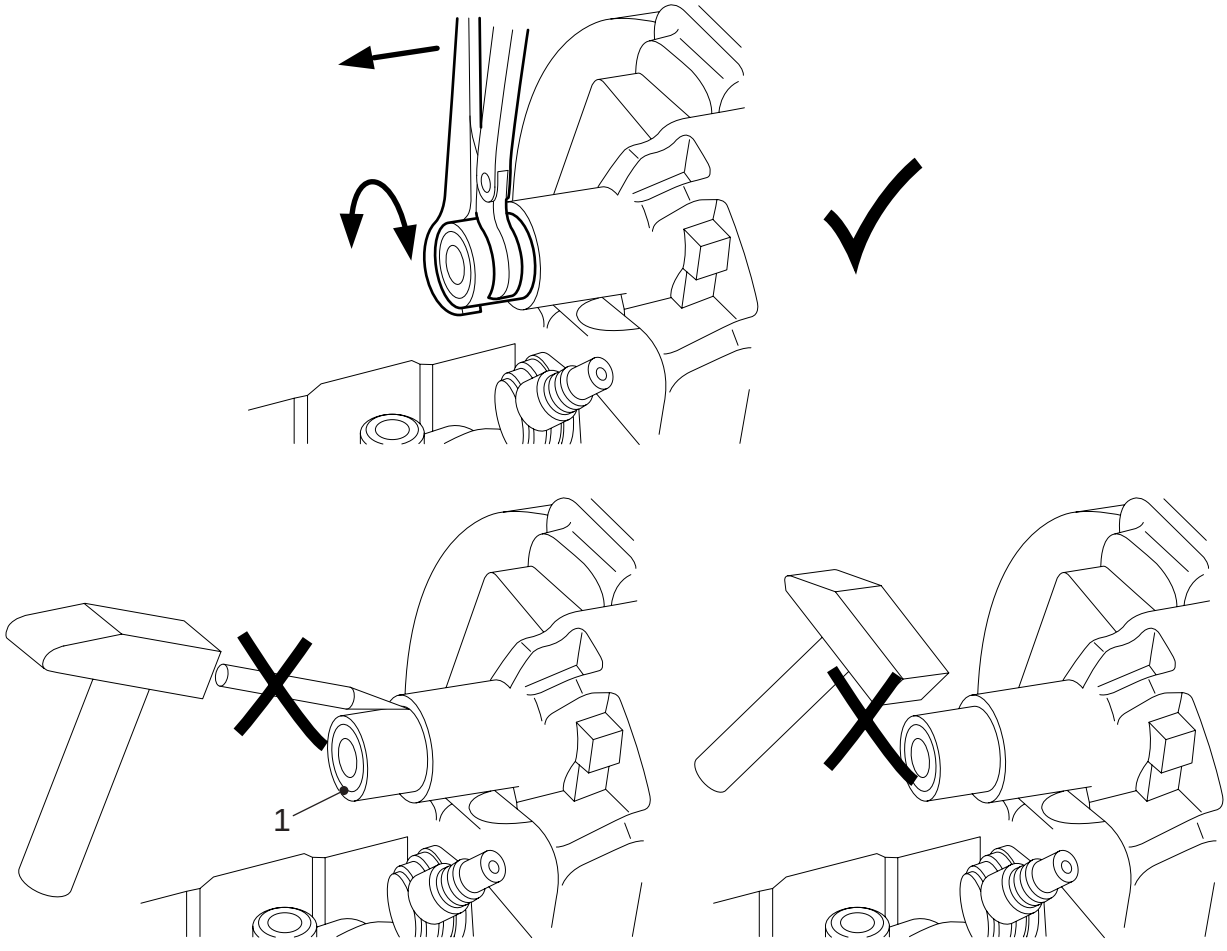


R600467

3.21 REMOVAL AND INSTALLATION, KNORR SN7000 BRAKE CALLIPER

Make sure no fingers get trapped between the brake calliper and the brake calliper carrier during and following removal of the brake pads and when a new brake calliper is installed. Always take hold of the brake calliper on the outside.

Removing the brake calliper



R600765

1. Remove the brake pads.
2. Remove the brake cylinder.
3. Remove the plug for the brake pad wear indicator.
4. Remove the steel cap (1) from the brake calliper. When doing this, do not use force and avoid damage to the brake calliper. If in particular the internal part of the brake calliper is damaged this may result in the movable guide of the brake calliper no longer working. The steel cap must not be re-used.

5. Remove the Allen screws (2) and (3).

6. Remove the brake calliper.

Fitting the brake calliper

1. Clean all parts and check for damage. The sliding surfaces of moving parts must be clean and undamaged.

2. Make sure that the guide pin in the bronze bearing bush is positioned in such a way that the rubber bellows is compressed on the inside.

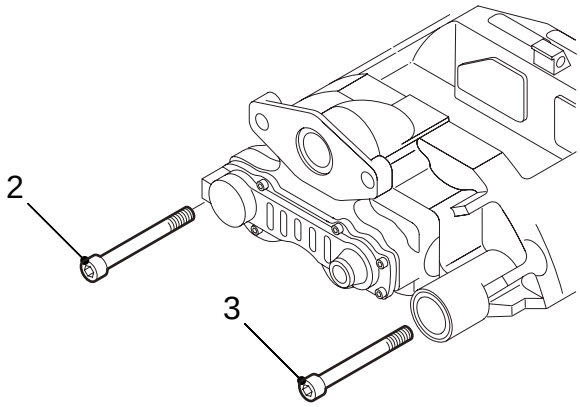
3. Position the brake calliper on the brake calliper carrier.

4. Fit the two Allen screws (2) and (3) and tighten them to the specified torque. See "Technical details". Never re-use these screws. Always use new screws which have locking compound applied.

5. Check that the brake calliper can move freely.

6. Check that the bellows (5) and the ring (4) of the guide bush are properly in place on the inside of the brake calliper.

7. Check that the automatic adjustment is working properly.



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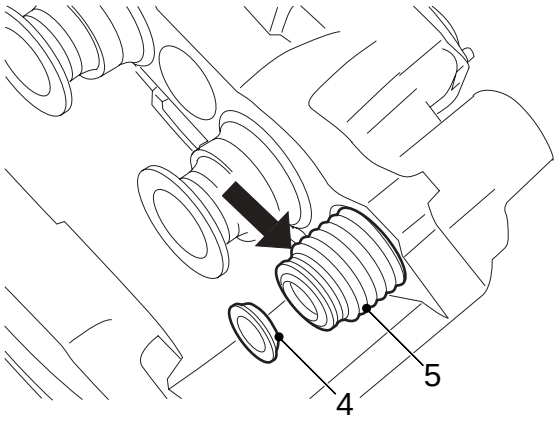

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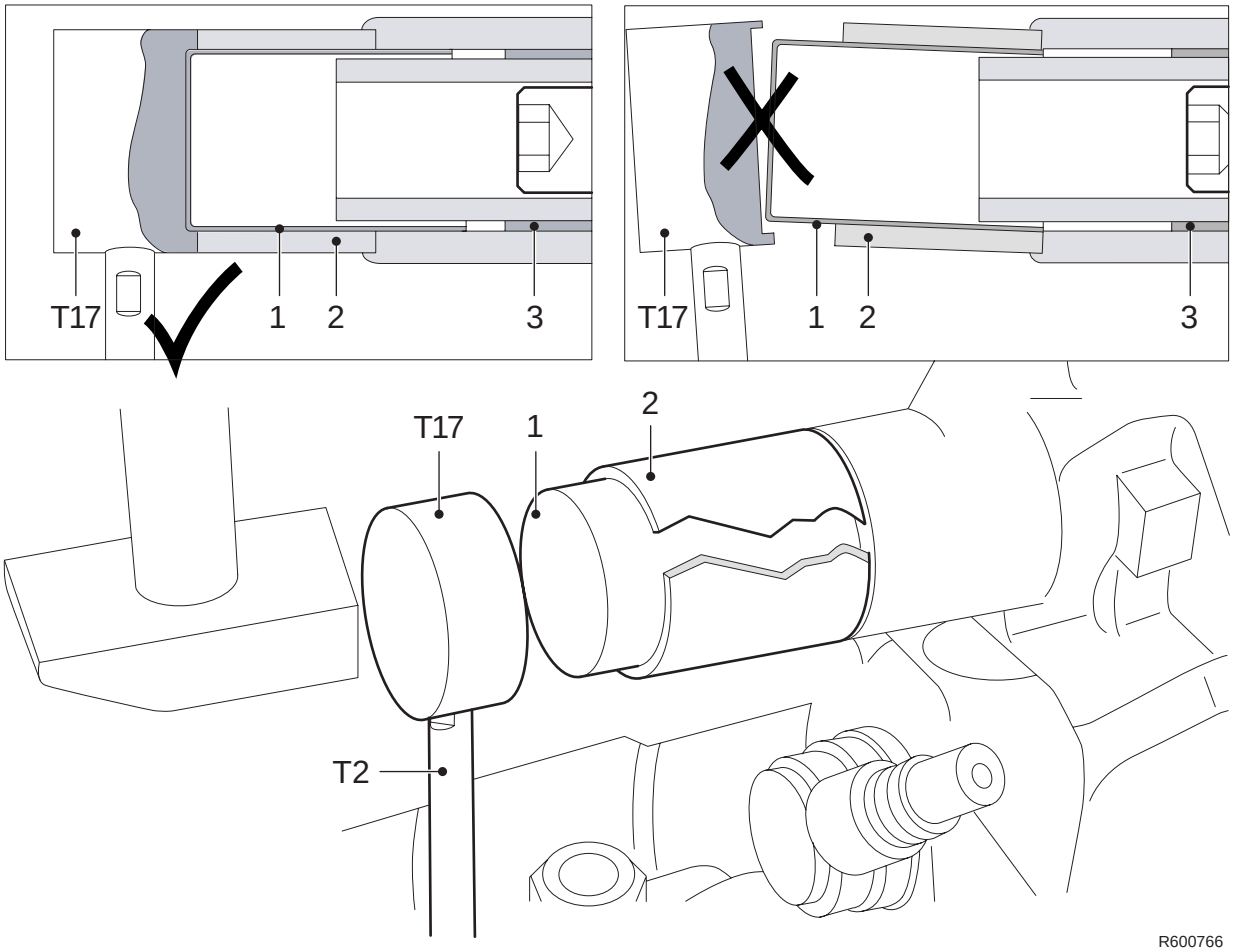


8. Assemble a punch from the special tool set (DAF no. 1329495) by means of T2 (only the handle) and T17.

9. Clean the bore in the brake calliper and manually fit a new, clean steel cap (1).

10. Slide the press-in tool (2), special tool (DAF no. 1453140), over the steel cap.

11. Using a hammer and the assembled punch, knock the steel cap as far as the stop in the brake calliper.

12. Fit the brake pads.

13. Fit the plug for the brake pad wear indicator.

14. Fit the brake cylinder.

3.22 REMOVAL AND INSTALLATION, BRAKE CALLIPER CARRIER

Removing brake calliper carrier

1. Remove the brake calliper.

2. Remove the attachment bolts from the brake calliper carrier.

3. Remove the brake calliper carrier.

Fitting the brake calliper carrier

1. Clean the brake calliper carrier and the contact surfaces of the stub axle or brake back plate. Pay particular attention to the threaded holes and sliding surfaces of the brake pads.

2. Fit the brake calliper carrier against the stub axle or brake back plate.

3. Fit the attachment bolts and tighten to the specified torque. See "Technical data".

   Note:
   Starting in production week 2002-25, the attachment of the brake calliper against the stub axle (front axles) may have been changed on models with disc brakes. Five bolts are now used instead of six bolts. The bolt hole for the "6th bolt" is then still fitted in the brake calliper carrier, but not in the stub axle.

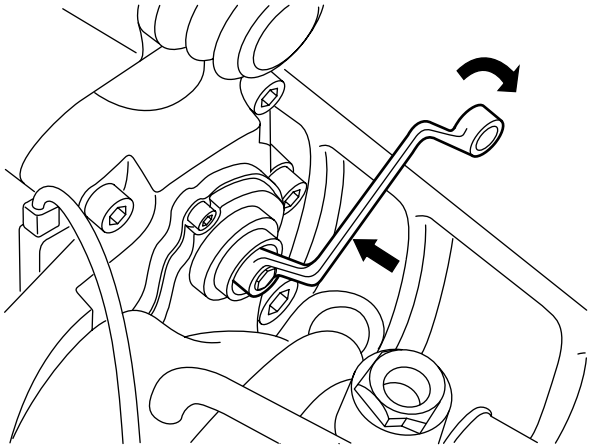
3.23 REMOVING AND INSTALLING BELLOWS WITH KNORR SB7000 BRAKE CALLIPER THRUST PIECE

Removing bellows with SB7000 brake calliper thrust piece

1. Using the hexagonal adjusting bolt, unscrew the thrust pieces as far as is necessary to gain access to the bellows.

   Note:
   Unscrew the thrust pieces a maximum of 30 mm. Do not screw them completely out of the brake calliper, as the brake calliper assembly would then have to be replaced.

   Note:
   Never turn the hexagonal adjusting bolt without using an adapter. The adapter is a torque safety and will break off when the torque is too high. Without the use of an adapter the mechanics in the brake calliper may become damaged when the torque is too high, so that replacement of the brake calliper may be necessary.



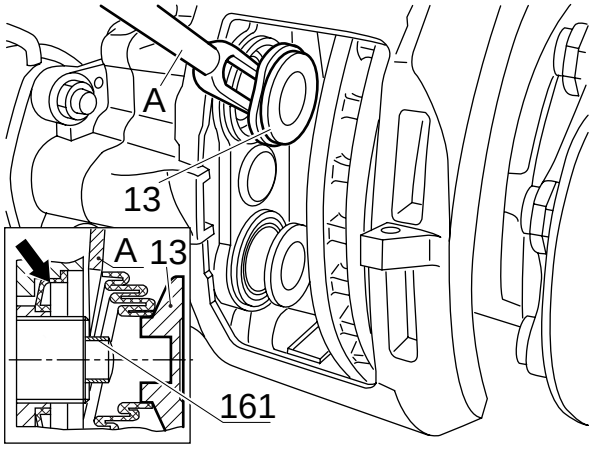
R600468

2. Using a screwdriver, ease the bellows behind the thrust piece out of the brake calliper.

   Note:
   Do not insert the screwdriver too deeply into the brake calliper. This could damage the seat of the inner seal of the thrust pieces. These cannot be replaced and the brake calliper would then have to be replaced.

3. Press the thrust pieces (13) off the adjusters with the disassembly fork (A), special tool set (DAF no. 1329494).

4. Remove the bearing bushes (161) from the thrust pieces.

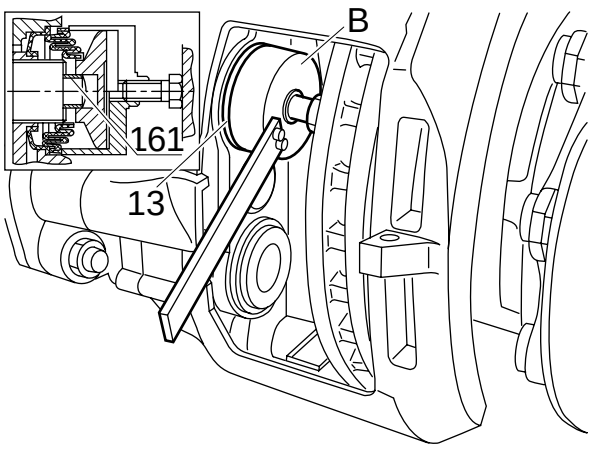


R600469

Fitting bellows

Note:
Do not screw the adjusters entirely out of the brake calliper, as the entire brake calliper would then have to be replaced.

1. Check the screw thread in the adjusters.
2. Grease the screw thread of the adjusters. See "Technical data".
3. Screw the adjusters back into the brake calliper.
4. Fit new bearing bushes (161) on the adjusters.
5. Fit the thrust pieces and bellows (13) on the adjusters.
6. Using the pressure tool and a pin from the special tool set (DAF no. 1329494) (B), press the bellows into its seat.
7. Turn the pressure tool (B) round and press the thrust pieces (13) onto the adjusters.



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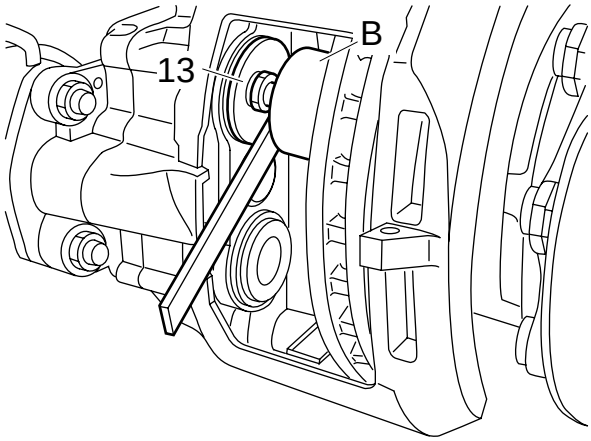
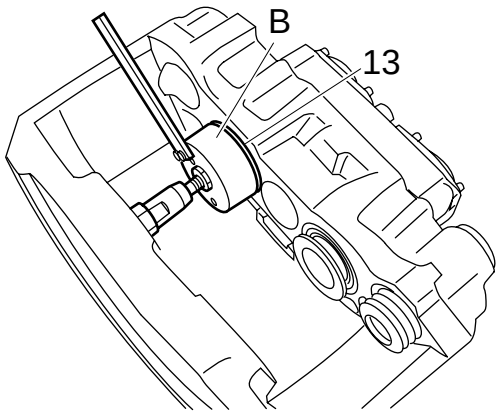


R600465

Note:
The operations described above can also be performed if the brake calliper has been removed. In that case an additional pin (8) from the special tool set (DAF no. 1329494) must be used, since the brake disc cannot be used for support.



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3.24 REMOVING AND INSTALLING BELLOWS WITH KNORR SN7000 BRAKE CALLIPER THRUST PIECE

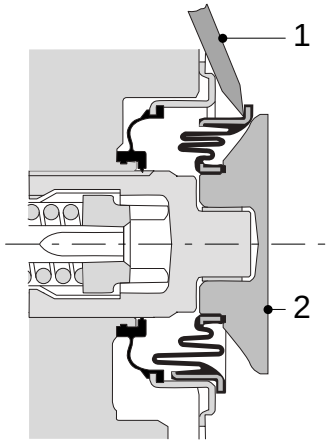
Removing bellows with SN7000 brake calliper thrust piece

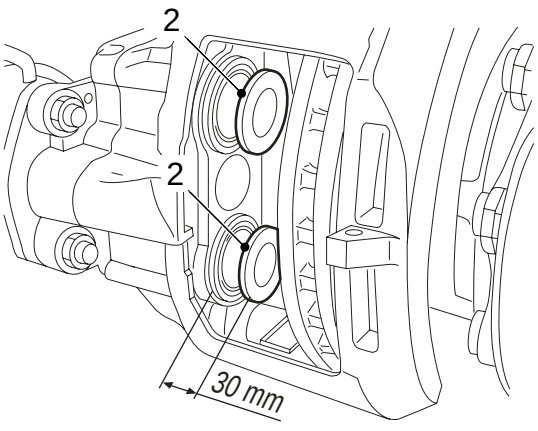
1. Using the hexagonal adjusting bolt, unscrew the thrust pieces as far as is necessary to gain access to the bellows.

   Note:
   Unscrew the thrust pieces a maximum of 30 mm. Do not screw them completely out of the brake calliper, as the brake calliper assembly would then have to be replaced.

   Note:
   Never turn the hexagonal adjusting bolt without using an adapter. The adapter is a torque safety and will break off when the torque is too high. Without the use of an adapter the mechanics in the brake calliper may become damaged when the torque is too high, so that replacement of the brake calliper may be necessary.

2. Using a screwdriver (1), ease the bellows behind the thrust piece (2) out of the brake calliper.





R600713

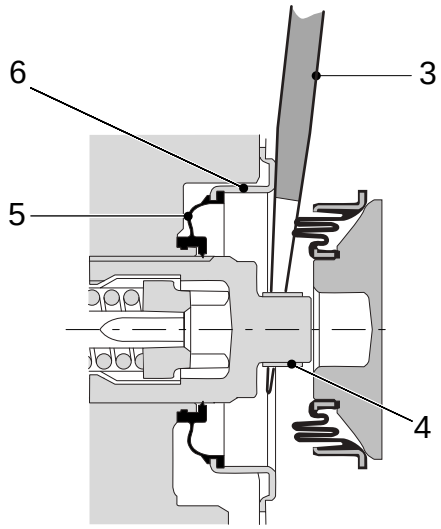
Note:
Do not insert the screwdriver (3) too deeply into the brake calliper. This could damage the seat (6) of the inner seal (5) of the thrust pieces. These cannot be replaced and the brake calliper would then have to be replaced.

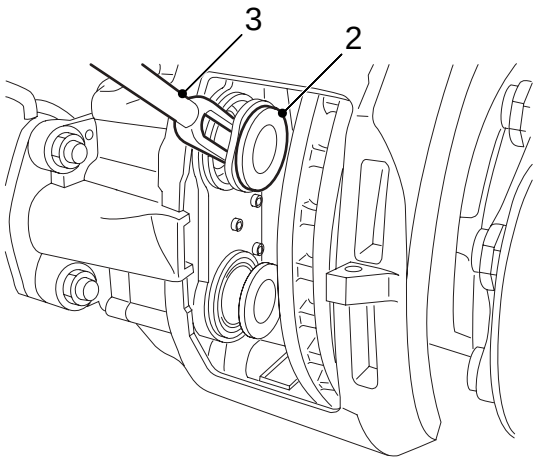
3. Press the thrust pieces (2) off the adjusters with the disassembly fork (3), special tool set (DAF no. 1329495).

4. Remove the bearing bushes (4) from the thrust pieces.

Note:
If the bellows of the thrust piece is replaced, the inner seal must also always be replaced.

5. Place a brake pad in the brake calliper on the outside so that the adjusters cannot be screwed out of the brake calliper at the next check. Place a 70-mm-thick spacer (self-made) if the brake calliper has been removed from the axle.





R600714

6. Screw the adjuster about 30 mm out of the brake calliper and check the thread of the adjuster for dirt, corrosion and damage.

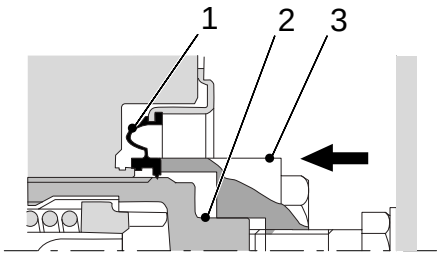
7. Screw the adjuster all the way back into the brake calliper.

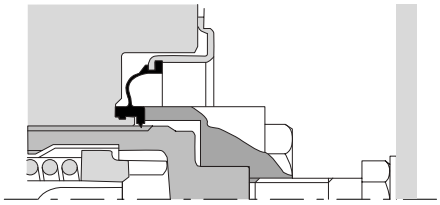
8. Using a screwdriver, ease the inner seal out of the brake calliper.

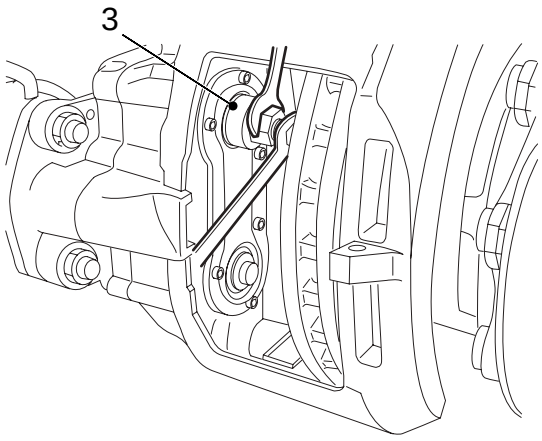
Fitting bellows with SN7000 brake calliper thrust piece

1. Clean the adjuster.

2. Fit the new inner seal (1) on the adjuster.







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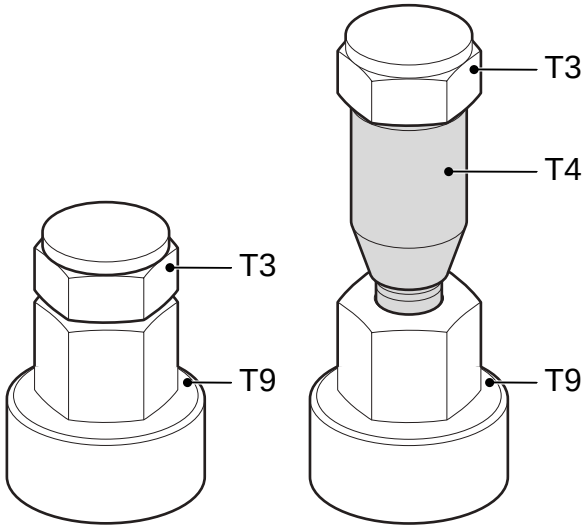
3. Assemble the press from (3) the special tool set (DAF no. 1329495), by means of T3 and T9. If the brake calliper has been removed, T4 must be screwed in between.

4. Using the assembled press (3), push the inner seal (1) onto the adjuster (2).

5. Check that the inner seal is seated correctly by rotating the adjuster 4 or 5 turns out of the brake calliper using the hexagonal adjusting bolt. The inner seal must not turn with it.

6. Grease the screw thread of the adjusters. See "Technical data".

7. Screw the adjusters back into the brake calliper.



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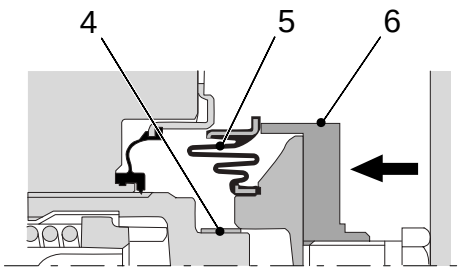
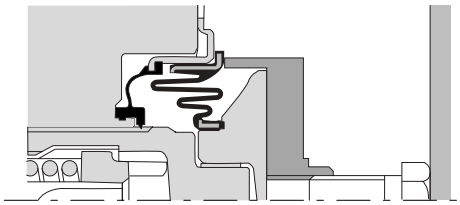
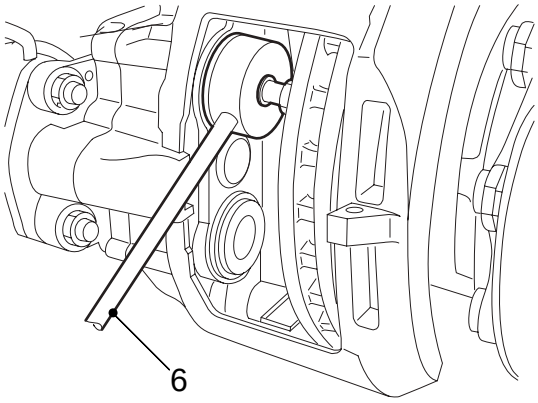
8. Fit new bearing bushes (4) on the adjusters.

9. Fit the thrust pieces and bellows (5) on the adjusters.



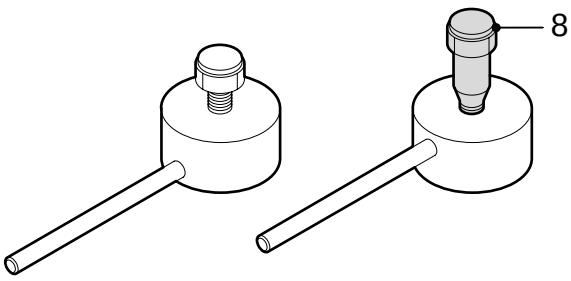


5



R600716

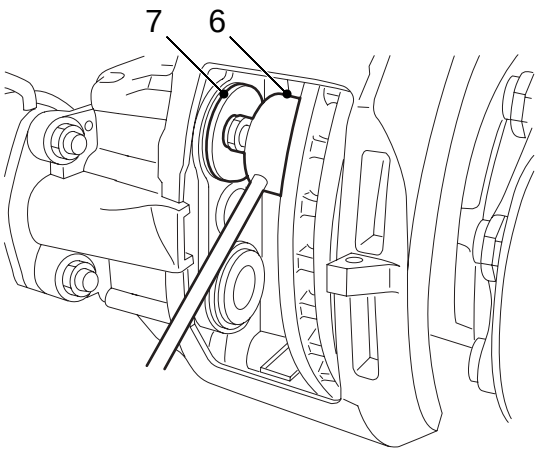
10. Assemble the press (6) from the special tool set (DAF no. 1329495), by means of T1, T2 and T3. If the brake calliper has been removed, T4 (8) must be screwed in between.



R600718

11. Using the pressure tool (6), push the bellows (5) into its seat.

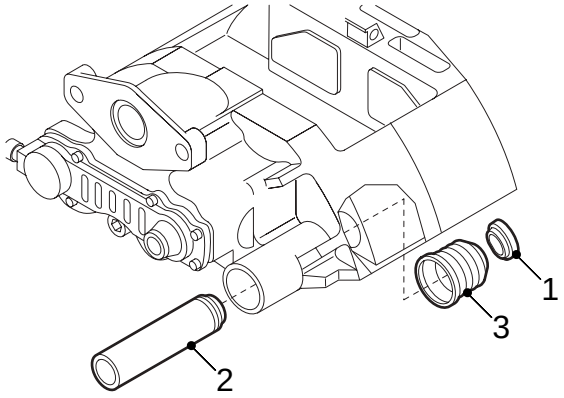
12. Turn the pressure tool (6) round and press the thrust pieces (7) onto the adjusters.



3.25 REMOVING AND INSTALLING BRONZE BEARING BUSH OF KNORR SB7000 BRAKE CALLIPER

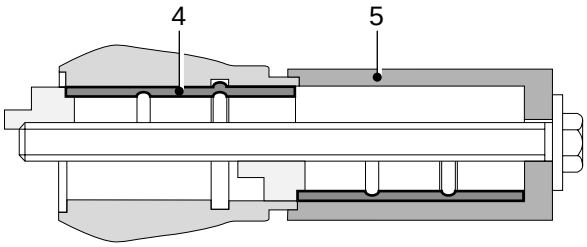
Removing bronze bearing bush

1. Remove the brake calliper.
2. Remove washer (1).
3. Remove guide bush (2).
4. Remove the bellows (3).



R600723

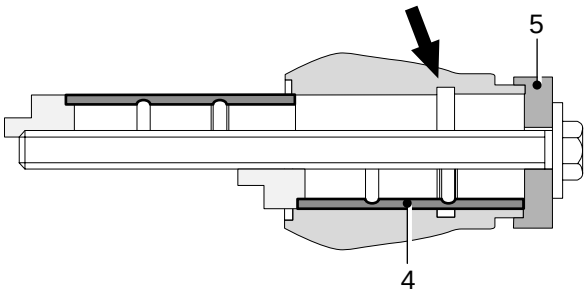
5. Remove the bronze bearing bush (4) using a bearing bush extractor (5), special tool set (DAF no. 1329494).
6. Clean the bearing bush bore.



R600727

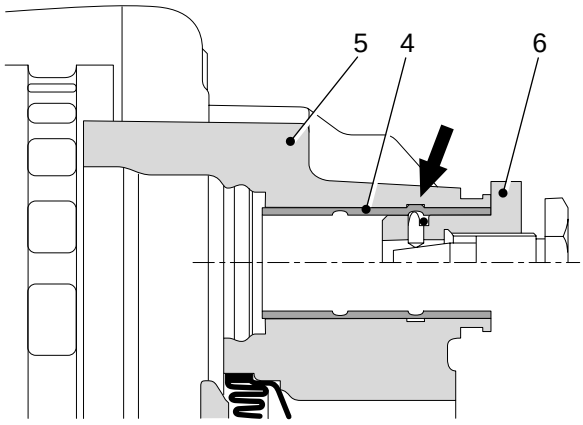
Fitting bronze bearing bush

1. Fit the new bronze bearing bush (4) using bearing bush extractor 5, special tool set (DAF no. 1329494).



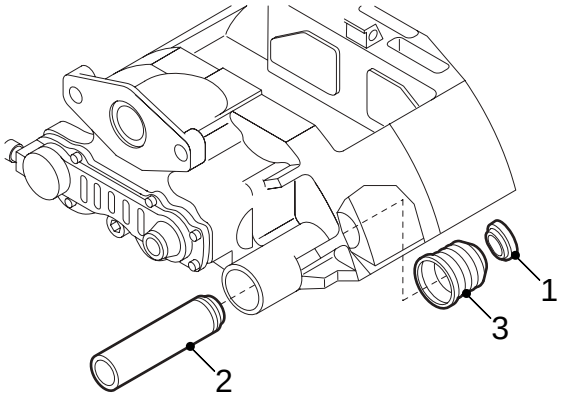
R600728

2. Lock the bearing bush (4) in the brake calliper (5) using a locking tool (6), special tool set (DAF no. 1329494). After the first locking operation, release the locking tool, rotate 60° and lock normally.
3. Check the bearing bush for burrs.
4. Apply lubricant to the bearing bush. See "Technical data".



R600726

5. Fit the bellows (3).
6. Install the guide bush (2).
7. Install the washer (1).

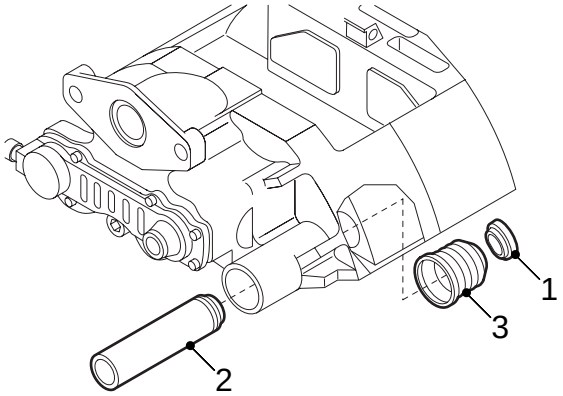


R600723

3.26 REMOVING AND INSTALLING BRONZE BEARING BUSH OF KNORR SN7000 BRAKE CALLIPER

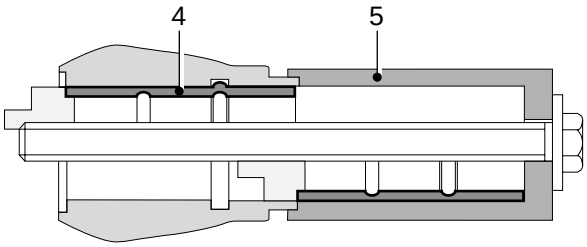
Removing bronze bearing bush

1. Remove the brake calliper.
2. Remove washer (1).
3. Remove guide bush (2).
4. Remove the bellows (3).



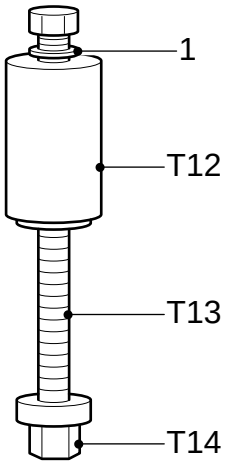
R600723

5. Remove the bronze bearing bush (4) using a bearing bush extractor (5), special tool set (DAF no. 1329495).



R600727

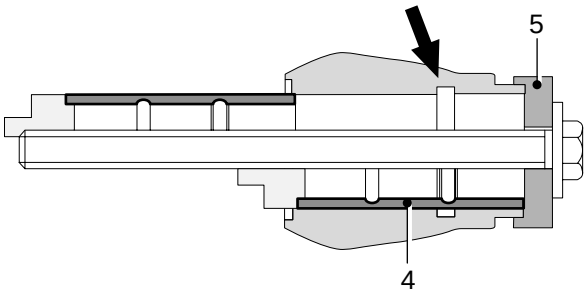
6. To do this, use the assembly of T14, T13, T12 and a washer (1).
7. Clean the bearing bush bore.



R600759

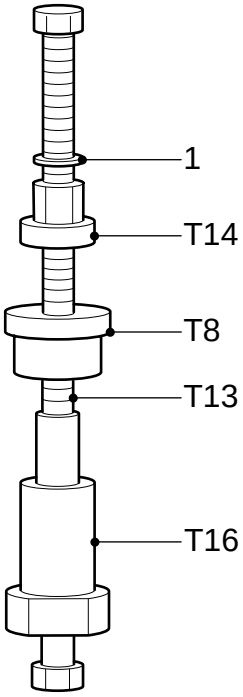
Fitting bronze bearing bush

1. Fit the new bronze bearing bush (4) using bearing bush extractor (5), special tool set (DAF no. 1329495).

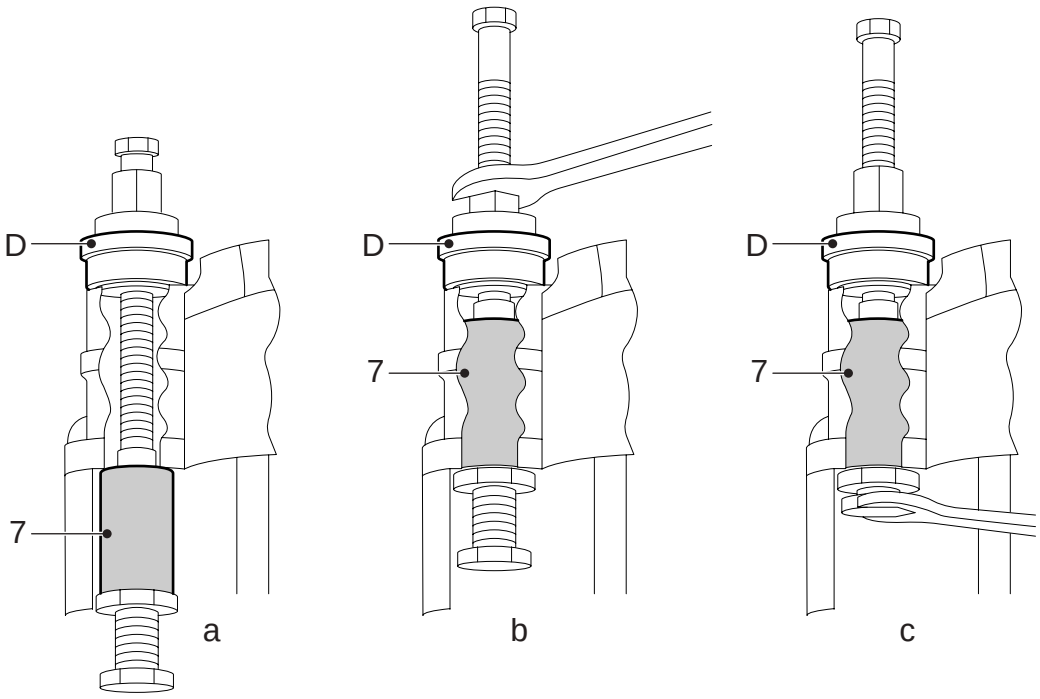


R600728

2. To do this, use the assembly of T16, T13, T8, T14 and a washer (1).

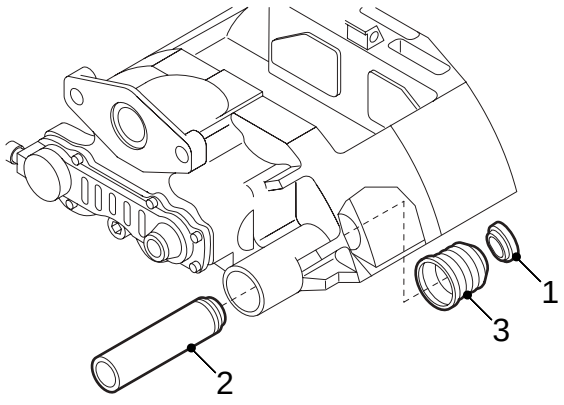


R600760



R600758

3. Tighten the brass nut (T14) of the bearing bush extractor (D) as far as the stop so as to push in the bronze bush (7) (a, b). Then tighten the steel bolt of T16 as far as the stop so as to lock the bronze bush (c). Loosen the steel bolt of T16 by 20 mm axially, rotate the tool T16 by 60° and tighten the steel bolt of T16 as far as the stop (c). Remove the bearing bush extractor (D).
4. Check the bearing bush for burrs.
5. Apply lubricant to the bearing bush. See "Technical data".
6. Fit the bellows (3).
7. Install the guide bush (2).
8. Install the washer (1).

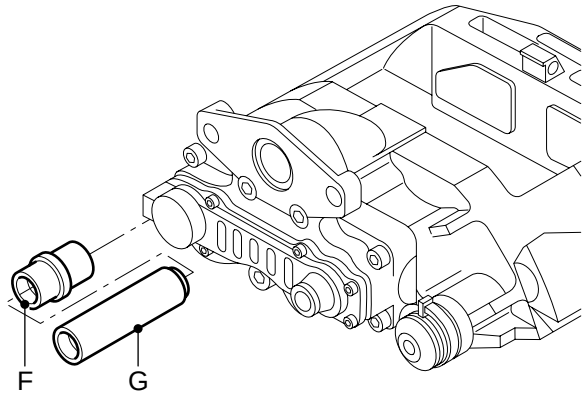


R600723

3.27 REMOVING AND INSTALLING RUBBER BEARING BUSH OF KNORR SB7000 BRAKE CALLIPER

Removing Knorr SB7000 rubber bearing bush

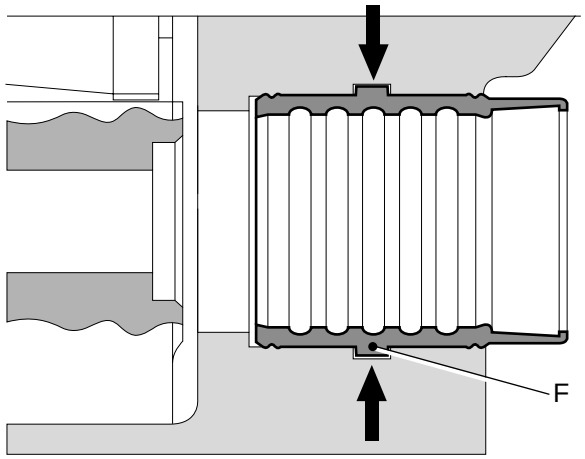
1. Remove the brake calliper.
2. Remove the guide bush (G).
3. Remove the rubber bearing bush (F).
4. Clean the bearing bush bore.



R600599

Fitting Knorr SB7000 rubber bearing bush

1. Apply lubricating grease to the inside and outside of the rubber bearing bush. See "Technical data".
2. Fit the rubber bearing bush to the brake calliper.
3. Slide the bearing bush into the brake calliper so far that the collar (F) of the bearing bush is flush in the groove.
4. Fit the guide bush.
5. Fit the brake calliper.

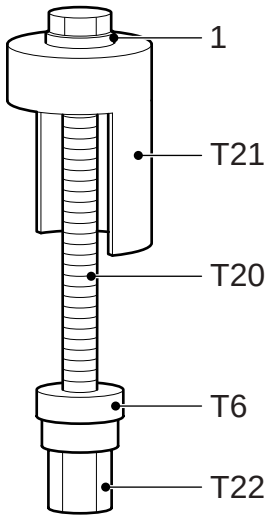


R600600

3.28 REMOVING AND INSTALLING RUBBER BEARING BUSH OF KNORR SN7000 BRAKE CALLIPER

Removing Knorr SN7000 rubber bearing bush

1. Remove the brake calliper.
2. Remove the guide bush.
3. Clean the bearing bush and the bearing bush bore.
4. Assemble the press-out tool from the special tool set (DAF no. 1329495) by means of parts T22, T6, T20, T21 and a washer (1).

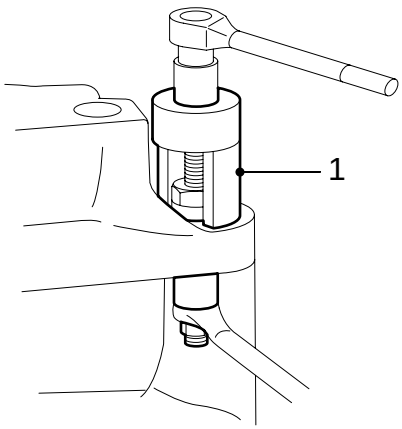


R600763

5. Using the press-out tool (1), push the bearing bush out of the brake calliper by retaining T22 and screwing T20 in.

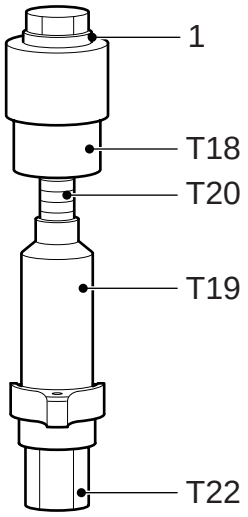
Fitting Knorr SN7000 rubber bearing bush

1. Clean the bearing bore in the brake calliper and, if necessary, protect the surface against corrosion by means of zinc spray.



R600729

2. Assemble the press-in tool from the special tool set (DAF no. 1329495) by means of parts T22, T19, T20, T18 and a washer (1).



R600762

3. Fit the rubber bearing bush (2) on the press-in tool (1) and push the bearing bush into the brake calliper. Hand-tighten T22. Make sure that the press-in tool is vertical on the contact surface (A) of the brake calliper by adjusting the small socket head screw (3).

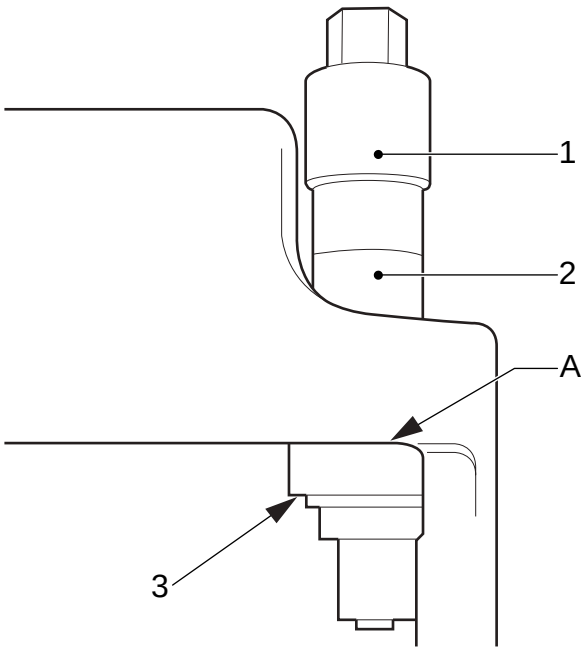
4. Push the rubber bearing bush in using T20 and retain T22 with a spanner. Tighten T20 to the specified torque. See "Technical data". If the required tightening torque is higher or lower than the specified value, the brake calliper must be replaced.

5. Check that the metal outer ring of the bearing bush is secure in the brake calliper.

6. Apply lubricating grease in the bearing bush. See "Technical data".

7. Fit the guide bush.

8. Fit the brake calliper.

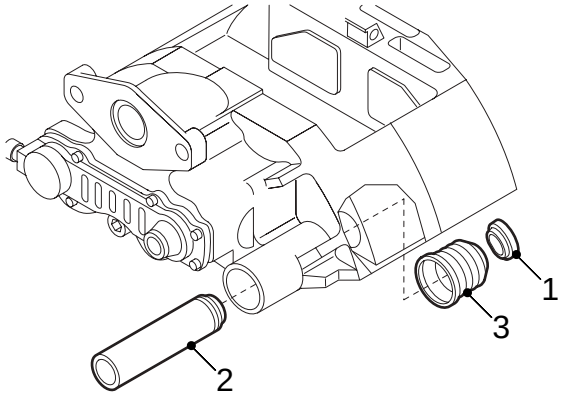


R600764

3.29 REMOVING AND INSTALLING BELLOWS OF BRONZE BEARING BUSH OF KNORR SB7000 BRAKE CALLIPER

Removing bellows of bronze bearing bush

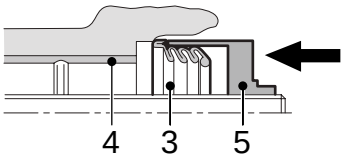
1. Remove the brake calliper.
2. Remove washer (1).
3. Remove the guide bush (2).
4. Remove the bellows (3).

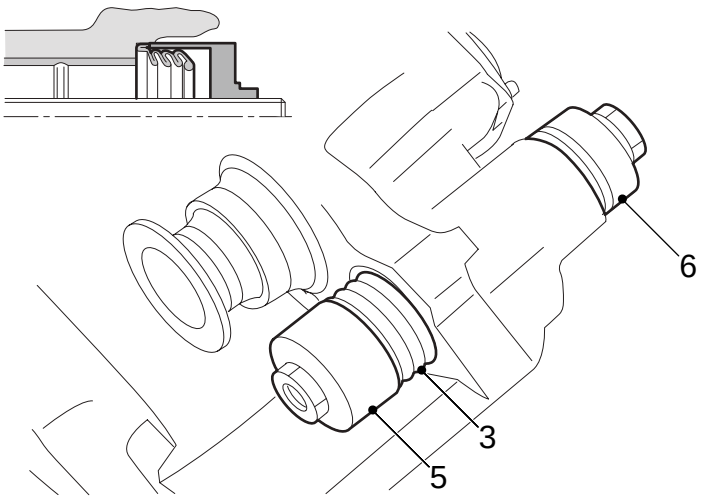


R600723

5

Fitting the bellows of the guide bush





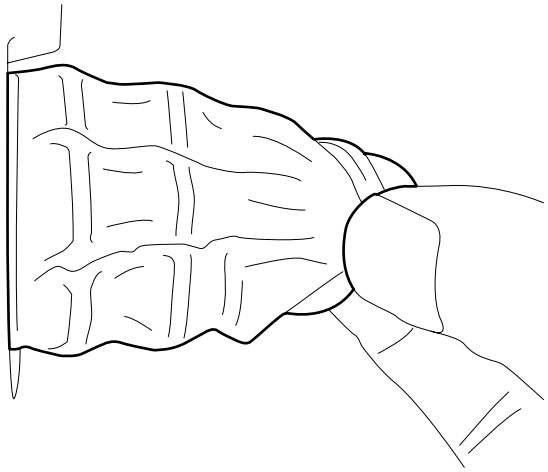
R600724

1. Clean the bronze bearing bush (4) in the brake calliper.
2. Check the bronze bearing bush for damage and dirt.
3. Place a new bellows (3) in the sleeve (5) of the special tool set (DAF no. 1329494).

4. Place the special tool and bellows in the bore of the brake calliper. Hand-tighten the press (6).

5. Push the bellows into the brake calliper by turning the press bolt clockwise. Remove the press.

6. Check the bellows fastening by pulling it outwards by hand. Damage is not permitted.



R600725

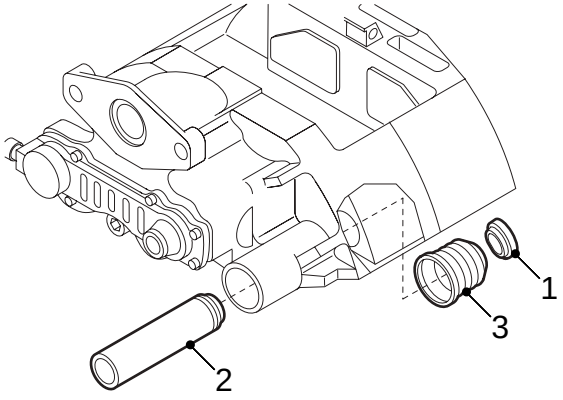
7. Apply lubricating grease to the bronze bearing bush and guide bush. See "Technical data".

8. Install the guide bush (2).

9. Install the washer (1).

10. Check that the guide bush moves freely in the brake calliper.

11. Fit the brake calliper.

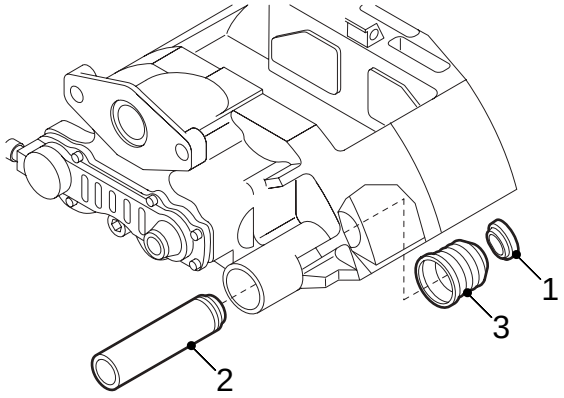


R600723

3.30 REMOVING AND INSTALLING BELLOWS OF BRONZE BEARING BUSH OF KNORR SN7000 BRAKE CALLIPER

Fitting the bellows of the guide bush

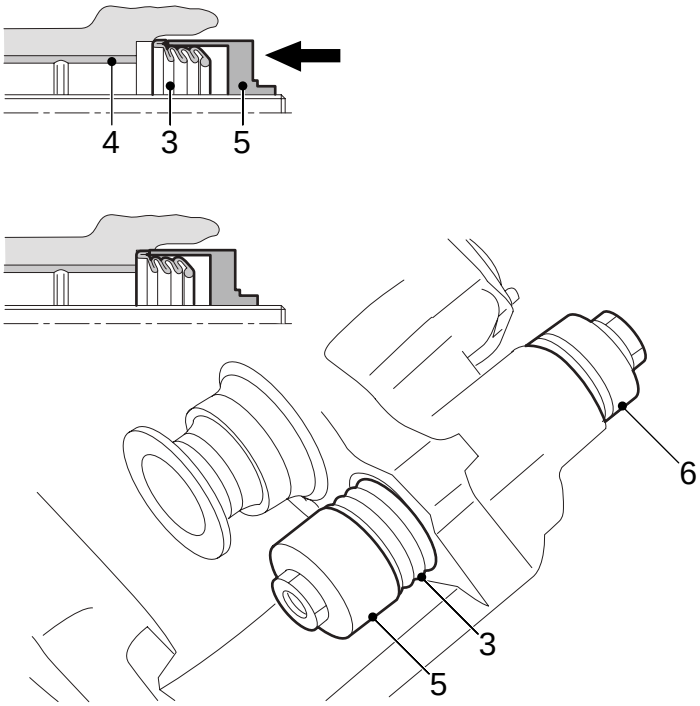
1. Remove the brake calliper.
2. Remove washer (1).
3. Remove the guide bush (2).
4. Remove the bellows (3).



R600723

5

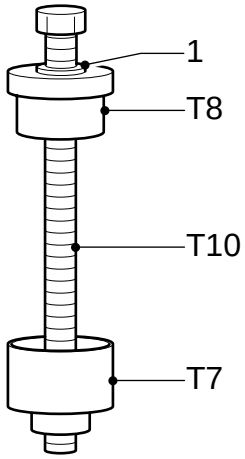
Fitting the bellows of the guide bush



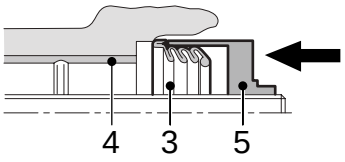
R600724

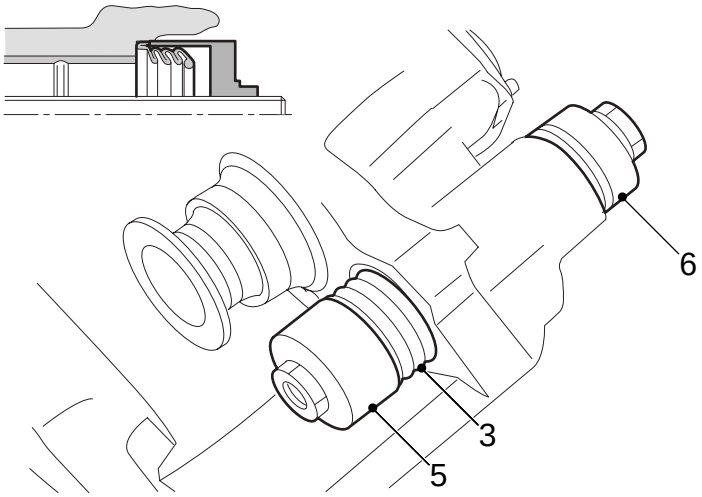
1. Clean the bronze bearing bush (4) in the brake calliper.
2. Check the bronze bearing bush for damage and dirt.

3. Assemble a press from the special tool set (DAF no. 1329495). To do this, use T7, T10, T8 and a washer.



R600761





R600724

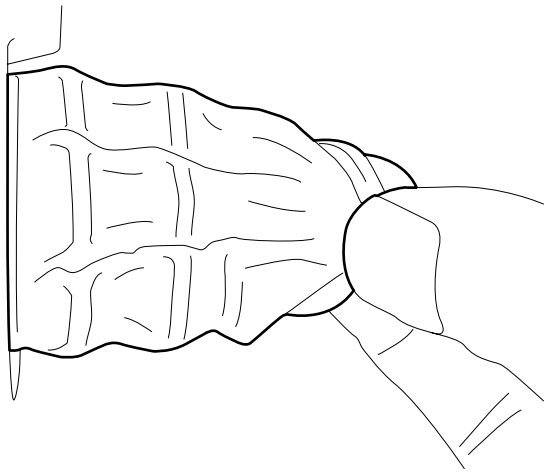
4. Place a new bellows (3) in the sleeve (5) of the assembled press.

5. Place the press and bellows in the bore of the brake calliper. Hand-tighten the press (6).

6. Tighten the press (6) to the specified torque. See "Technical data". Remove the press.

7. Check the bellows fastening by pulling it outwards by hand. Damage is not permitted.

8. Apply lubricating grease to the bronze bearing bush and guide bush. See "Technical data".



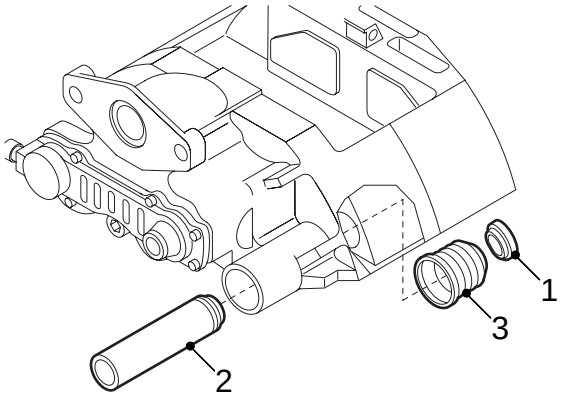
R600725

9. Install the guide bush (2).

10. Install the washer (1).

11. Check that the guide bush moves freely in the brake calliper.

12. Fit the brake calliper.



R600723

4. DISASSEMBLY AND ASSEMBLY

4.1 DISASSEMBLY AND ASSEMBLY, BRAKE CHAMBER

Removal, diaphragm

1. Turn the brakes back until the spring in the brake chamber is under tension.
2. Mark the position of the brake chamber halves in relation to one another.
3. Remove the clamping strap from the brake chamber.
4. Remove the rear half of the brake chamber and the diaphragm.

Installation, diaphragm

1. Fit the new diaphragm and brake chamber half. (Pay attention to the markings or the small drainage hole.)
2. Fit the clamping strap.
3. Adjust the brakes. See "Inspection and adjustment".
4. Check the complete brake chamber for air leaks.

Disassembling the brake chamber

1. Remove the yoke and the lock nut from the push rod.
2. Slide a sealing ring and a piece of pipe over the push rod.
3. Screw the lock nut onto the push rod until the spring in the brake chamber is slightly tensed.
4. Mark the position of the brake chamber halves in relation to one another.
5. Loosen the clamping strap and remove the brake chamber half, the push rod and the diaphragm.

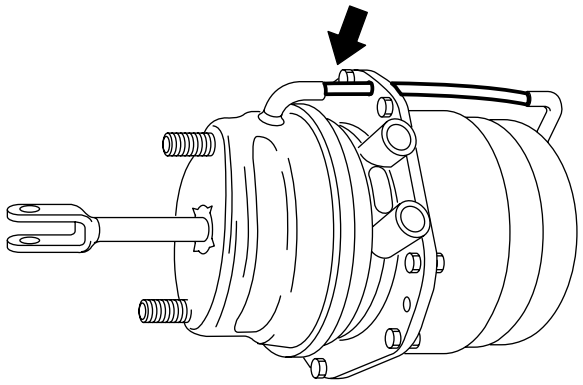
Assembly, brake chamber

1. Thoroughly clean all parts.
2. Check all parts for damage and replace them if necessary.
3. Replace the diaphragm in any case. Fit in the reverse order to removal.

4.2 DISASSEMBLY AND ASSEMBLY, WABCO SPRING BRAKE CYLINDER

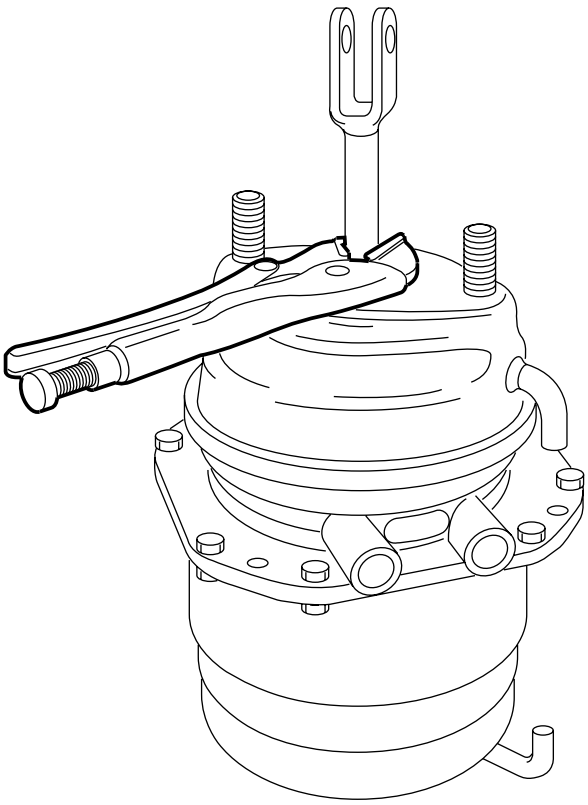
Disassembling the brake chamber

1. Clean the spring brake cylinder.
2. Remove the flexible bleed pipe with the internal sinter filter.



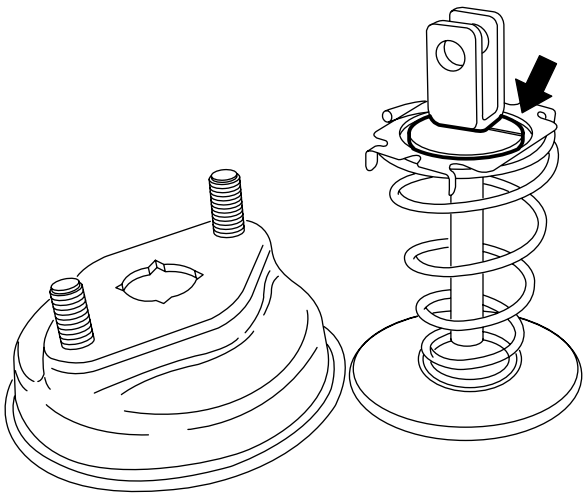
R600197

3. Place a wrench on the yoke rod at the assembly surface of the brake chamber.
4. Apply pressure to connection point (12) (min. 6.0 bar).
5. Remove the clamping strap.
6. Remove the front cover from the brake chamber.
7. Remove the diaphragm.
8. Remove the front cover from the yoke.



R600194

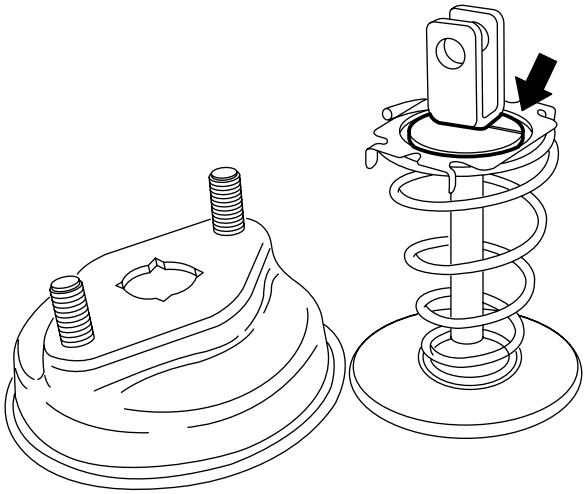
9. Remove the split ring between fork and spring retainer. The spring retainer and spring can now be removed.



R600195

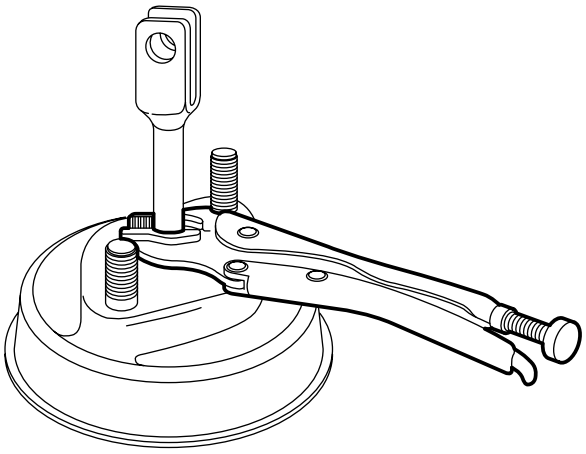
Assembly, brake chamber

1. Apply pressure to connection point (12) (min. 6.0 bar).
2. Install the diaphragm.
3. Place the spring and spring retainer on the yoke, and fit the split ring.



R600195

4. Place the front cover of the brake chamber on the yoke and press the cover downwards against the spring tension. Place a wrench on the yoke rod at the assembly surface of the brake chamber.
5. Place the complete front cover on the brake chamber and fit the clamping strap, tightening it to the specified torque. See "Technical data". Remove the wrench.
6. Fit the flexible bleed pipe with the sinter filter fitted at the brake chamber side. Ensure that the filter is correctly mounted in the flexible bleed pipe to prevent any dirt from entering the spring brake section.

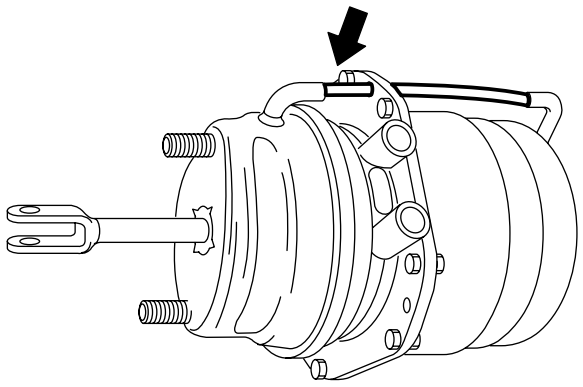


R600196

Disassembly, spring brake section

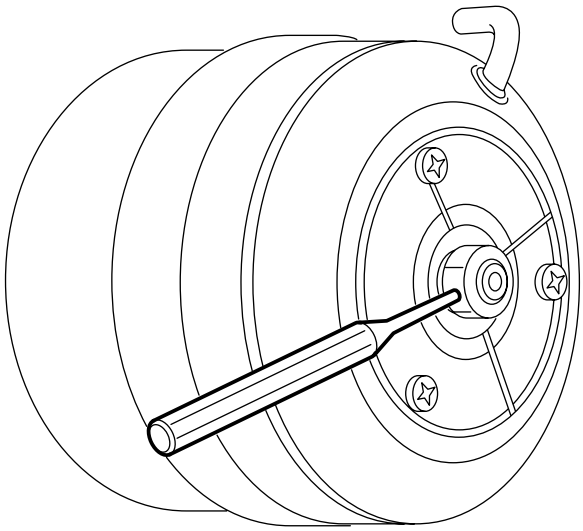
1. Remove the flexible bleed pipe with the internal sinter filter.

2. Apply marks to the two halves of the spring brake cylinder housing.



R600197

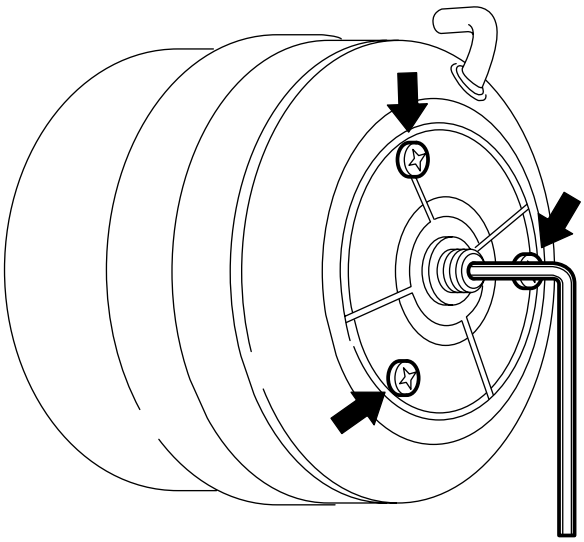
3. Remove the clamping pin from the release bolt and remove the nut, washer and O-ring from the release bolt.



R600198

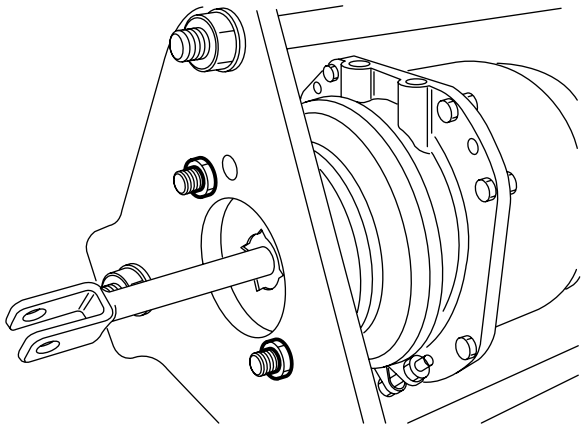
4. Using an Allen key, screw the release bolt into the spring brake cylinder until it falls freely into this cylinder.

5. Remove the three screws and the instruction plate on the rear of the spring brake cylinder.

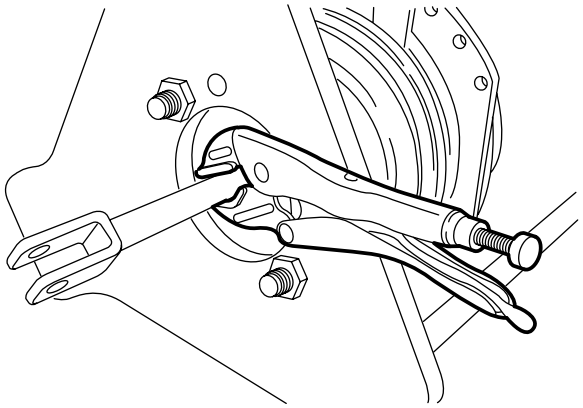


R600199

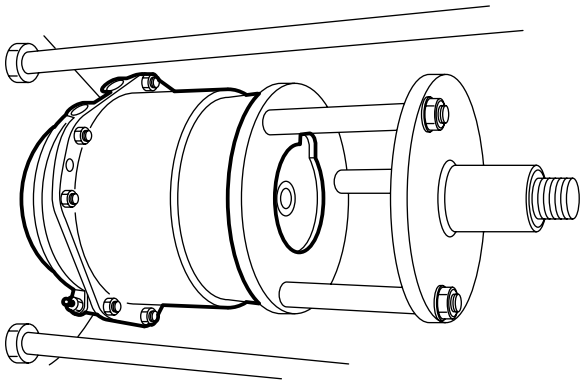
6. Place the complete spring brake cylinder in the special tool (DAF no. 0484840) and tighten the spring brake cylinder on the special tool using two nuts.


R600200

7. Apply pressure to connection point (11). The yoke can now be removed from the brake chamber. Place a wrench on the yoke rod at the assembly surface of the brake chamber. Now bleed the brake chamber.

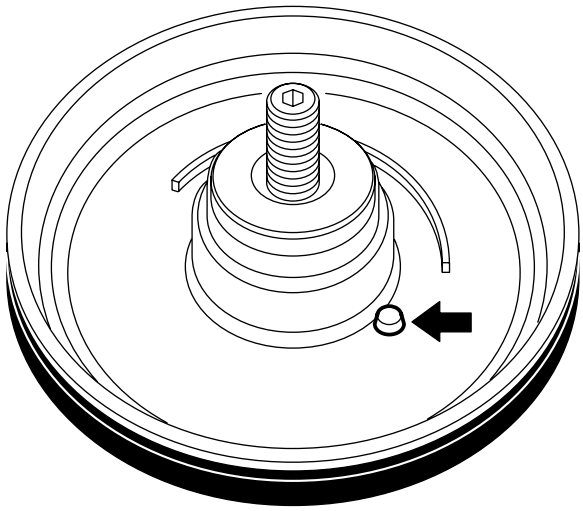

R600201

8. Place the special tool (DAF no. 0484845) on the spring brake cylinder; then turn the tool until it is under pressure.
9. Remove four of the eight attachment bolts at the circumference of the spring brake cylinder and fit four studs, each with two nuts, in their place. Studs, length approx. 210 mm, must be self-made.
10. Remove the four remaining attachment bolts.
11. Release the tool and thus the spring. Remove the various spring brake components from the special tool.

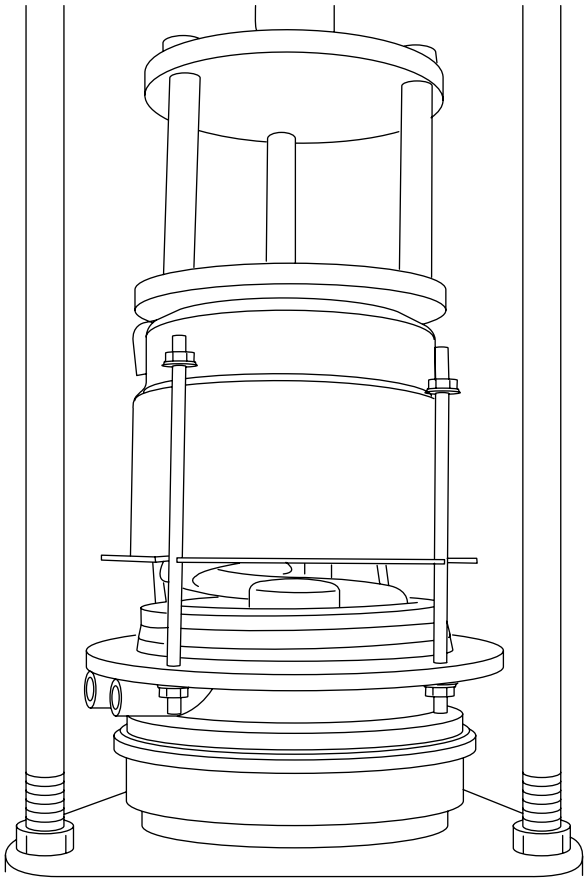

R600202

Assembling the spring brake section

1. Insert the top spring retainer in the spring brake cylinder.
2. Fit a new, greased sleeve on the lower spring retainer.
3. Fit a new O-ring and sealing ring in the intermediate housing of the spring brake cylinder.
4. Fit the bottom spring retainer, greased, in the intermediate housing.
5. Place the spring on the bottom spring retainer.
   The end of the spring should be placed against the cam in the spring retainer.
6. Place the spring brake cylinder and the auxiliary tool over the spring.
7. Fit four studs in the attachment holes. Pay attention to the marks.
8. Using the special tool, apply pressure to the spring, so that the two halves of the housing come into contact with one another. The studs also serve as guides.
9. Install four attachment bolts and tighten them to the specified torque. See "Technical data".
10. Remove the studs and tighten the remaining four attachment bolts to the specified torque.
11. Remove the wrench.
12. Remove the complete spring brake cylinder from the special tool.
13. Assemble the spring brake cylinder in such a way that the release bolt in the spring brake cylinder touches the top spring retainer. Screw the release bolt into the spring retainer.
14. Fit the O-ring and sealing ring on the release bolt. Fit the nut and clamping pin, and tighten the release bolt using the specified torque. See "Technical data".

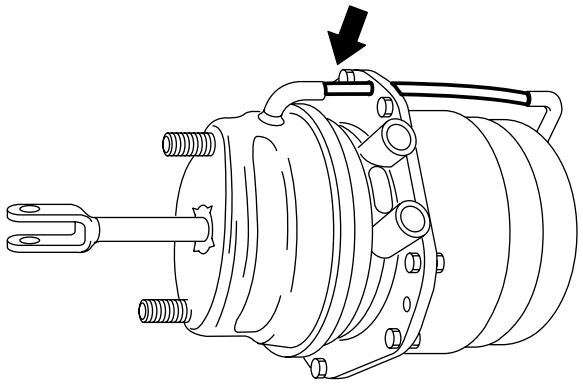


R600203



R600204

15. Fit the flexible bleed pipe with the sinter filter fitted at the brake chamber side. Ensure that the filter is correctly mounted in the flexible bleed pipe, to prevent any dirt from entering the spring brake section.



R600197

CONTENTS

1. GENERAL

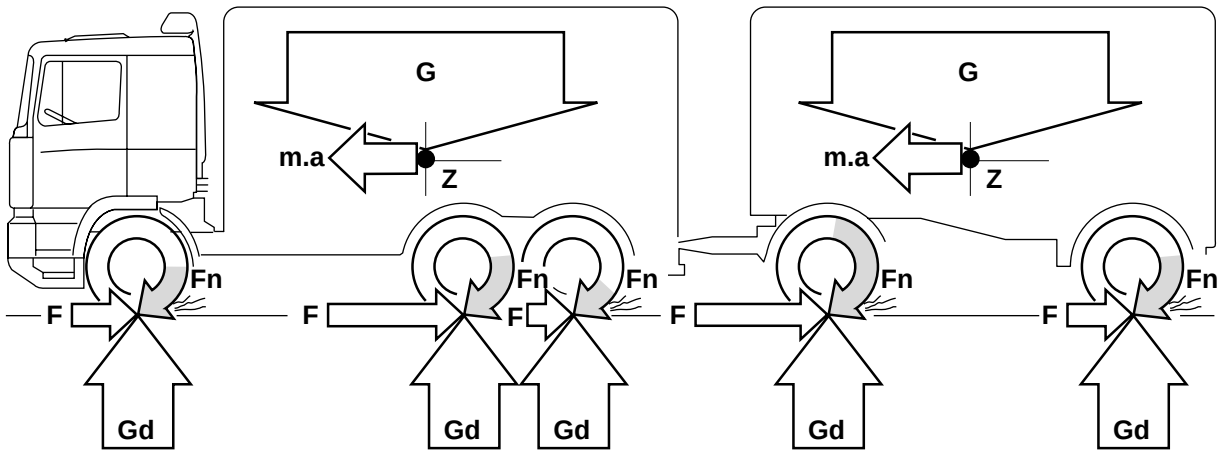
1.1 INTRODUCTION

How is a good braking performance of a vehicle combination (truck and trailer vehicle) achieved, both for new vehicle combinations and following brake reconditioning, while still guaranteeing interchangeability?
The vehicles should meet the legal requirements and all settings should be in accordance with the directives. However, adhering to the directives does not necessarily mean that there will be no brake problems.

Note:
Trucks and trailer vehicles may be fitted with an EBS brake system or a non-EBS brake system (conventional brake system).

The adjustability of an EBS brake system is limited, since brake equalisation is managed as a control function by the EBS control system.

1.2 WHAT IS A VEHICLE COMBINATION WITH A GOOD BRAKING PERFORMANCE?



R600023

G weight

m = mass

α = deceleration (m x a is the force chang ing the axle load)

Dynamic axle load: during braking, changes the load on each axle.

F = braking force (Fmax = Gd x m)

Gd = dynamic axle load

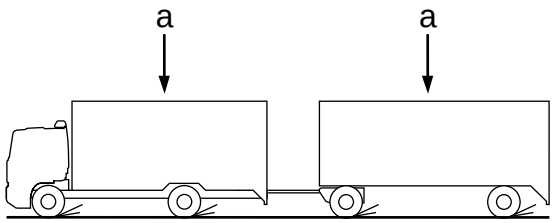
m = the friction coefficient between tyre and road

Fn = braking force of the wheel brake

A vehicle combination of which, in laden condition and with a 1 to 3 bar pressure at the service coupling head, the braking deceleration of the tractive unit is the same or virtually the same as that of the drawn vehicle.

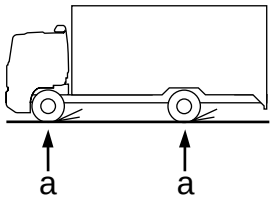
When problems occur which are related to the brake system, such as excessive brake-lining wear, brake vibrations or the vehicle pulling to one side during braking, the cause should primarily be sought in an unbalanced distribution of braking forces.

- for vehicle combinations:
- between prime mover and trailer vehicle.



R600024

- for rigid vehicles:
- between the different axles.
- if the vehicle has disc brakes and drum brakes



R600025

Conditions for a practical distribution of braking forces

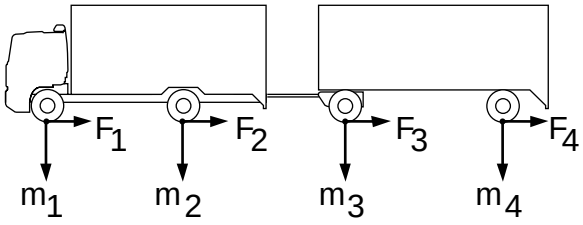
- Both the prime mover and the trailer vehicle should have a sufficiently effective brake system without mechanical defects or failures in the air system.

With vehicle combinations the braking performance level of the trailer vehicle without EBS may be noticeably lower than that of the truck. This means that the prime mover has to provide a disproportionately large part of the deceleration required for the total vehicle combination. As the brakes of the trailer vehicle will consequently be subjected to low loads only, their condition will deteriorate (risk of glazing), which will lead to even higher overloading of the prime mover brakes. Therefore, it is important that the adjustment is correct, as dangerous situations can arise where the trailer is jostling the prime mover.

Possible causes of poor braking performance of a trailer vehicle

- Unduly large brake-chamber stroke.
- Incorrect position of the brake levers (drum brakes).
- Damaged diaphragms in the brake chambers.
- Greasy, glazed or fully worn linings.
- The mechanical part of the wheel brake does not operate smoothly.
- A leak in the brake system.
- A blockage in the brake pipe system.
- Not all the valves are in good working order.
- Incorrect setting of the load sensing valve (conventional brake system).

The starting point is that the braking forces between the axles of the vehicle combination should be distributed in proportion to the axle loads. This will also distribute the temperature correctly over the axles.
Whether this will give the correct distribution between prime mover and trailer vehicle depends not only on the quality of the two brake systems, but also on a correct balancing of the braking pressures. With non-EBS tractors and trucks, the latter can be achieved by adjusting the brake pressure advance between tractor and trailer in such a way that at the most frequently used brake pressures, i.e. 2 - 3 bar on the service line, the braking performance of the tractive unit is the same as that of the trailer vehicle.
This can entail a change in the brake pressure advance set by the factory.



$$F_1 : F_2 : F_3 : F_4 = m_1 : m_2 : m_3 : m_4$$

R600026

1.3 BRAKE EQUALISATION BY MEANS OF BRAKE DYNAMOMETER

1. Make sure the vehicle combination is in **laden condition**. A laden combination makes for a more reliable and accurate measurement. Furthermore, the maximum braking performance will be achieved when the vehicle combination is in laden condition.

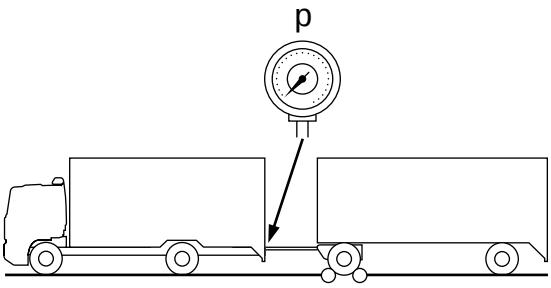
2. The braking forces must be measured on a system with warm brakes. (Normal operating temperature for drum brakes ≤90°C for disk brakes ≤150°C.)

3. The brake linings must have been bedded in. Only then can a reliable verdict on the braking forces be obtained.

4. Write down the braking forces of the various axles on the "brake equalisation form for brake dynamometer" at the following braking pressures, measured at the service coupling head:
   p = 0.5 - 1.0 - 1.5 - 2.0 - 3.0 - 4.0 - 5.0 bar

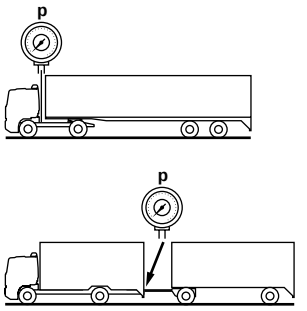
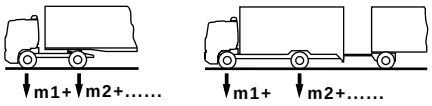
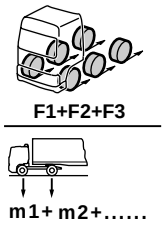
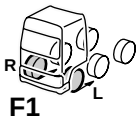
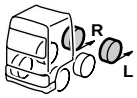
5. Using the data on the "brake equalisation form for brake dynamometer", calculate the braking deceleration percentages.

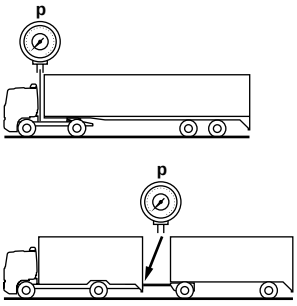
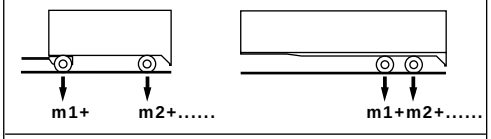
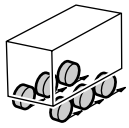
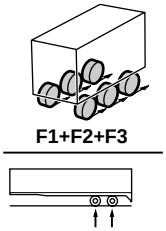
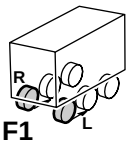
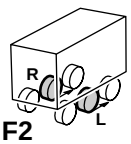
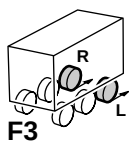
6. Plot the calculated values in the "brake equalisation form for brake dynamometer" in the appropriate EC band graph and evaluate the measured brake equalisation.



R600028

1.4 BRAKE EQUALISATION FORM FOR BRAKE DYNAMOMETER

	 m1+ m2+..... m1+ m2+.....						 F1+F2+F3	 F1+F2+F3 X 100 % m1+ m2+.....
	 F1		 F2		 F3			
	L	R	L	R	L	R		
0.5								%
1.0								%
1.5								%
2.0								%
3.0								%
4.0								%
5.0								%

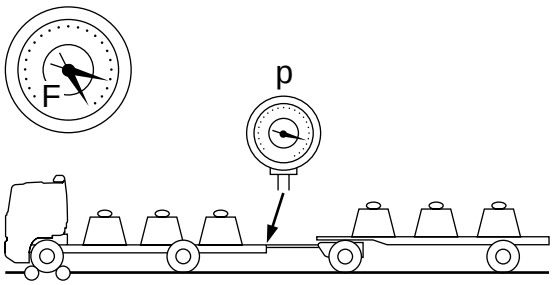
	 m1+ m2+..... m1+m2+.....						 F1+F2+F3	 F1+F2+F3 X 100 % m1+m2+.....
	 F1		 F2		 F3			
	L	R	L	R	L	R		
0.5								%
1.0								%
1.5								%
2.0								%
3.0								%
4.0								%
5.0								%

R600119

Filling in brake equalisation form for brake dynamometer

Note:
1 kg = 10 newtons (N)

1. Determine the weight of the **laden** prime mover and/or trailer vehicle (coupled), and enter these values in the table (in kg or newtons).
2. Make a short test run to warm up the brakes.
3. Position the vehicle, starting with the front axle, on a brake dynamometer.
4. Connect a pressure gauge to the yellow coupling head.
5. Depress the brake pedal until the pressure gauge reading is 0.5 bar.
   Always build **up** pressure, i.e. from low to high pressure, and never from high pressure to low pressure, and always begin every measurement with 0 bar.
6. Read the braking forces and write them down in the appropriate column (in kg or newtons).
7. Now repeat this procedure at pressures of 1.0 - 1.5 - 2.0 - 3.0 - 4.0 and 5.0 bar.
8. Also perform these measurements on all other vehicle axles.
9. Count all braking forces that belong to a certain braking pressure and note these in the "Total braking force" column.
10. Divide the braking forces (in kg or newtons) just entered at point 9 by the weight of the vehicle (in kg or newtons), multiply the result by 100 (%) and enter the values thus obtained in the next column.
    braking deceleration as % of the weight
11. Plot the values obtained in point 10 in the relevant EC tyre graph.

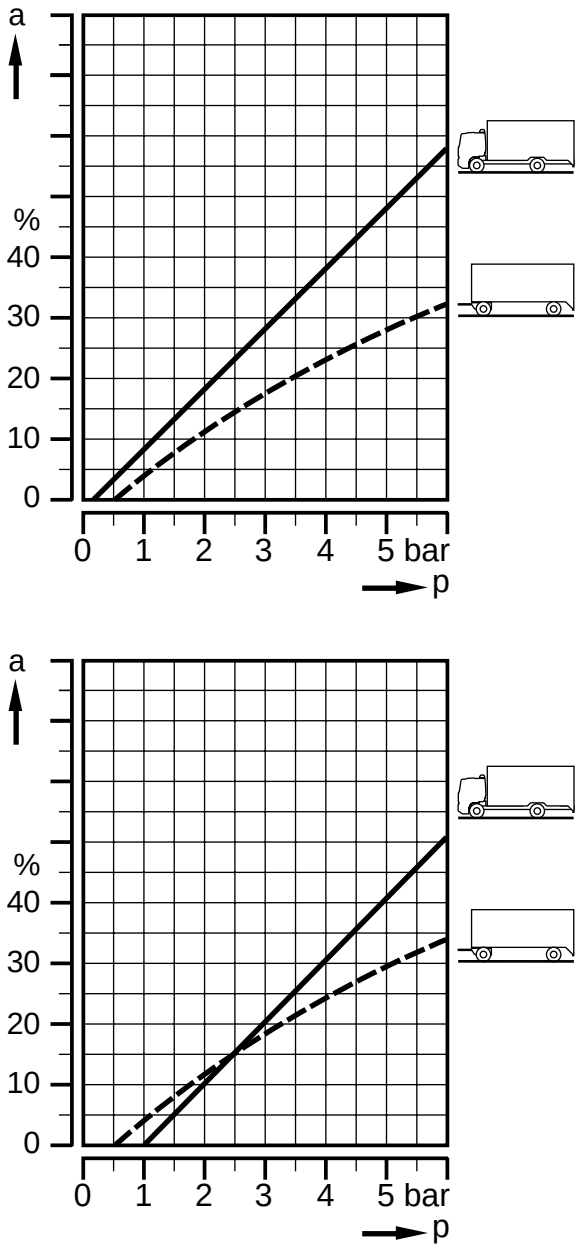


R600029

Example of a diagram for a prime mover and trailer vehicle with poor brake balance.

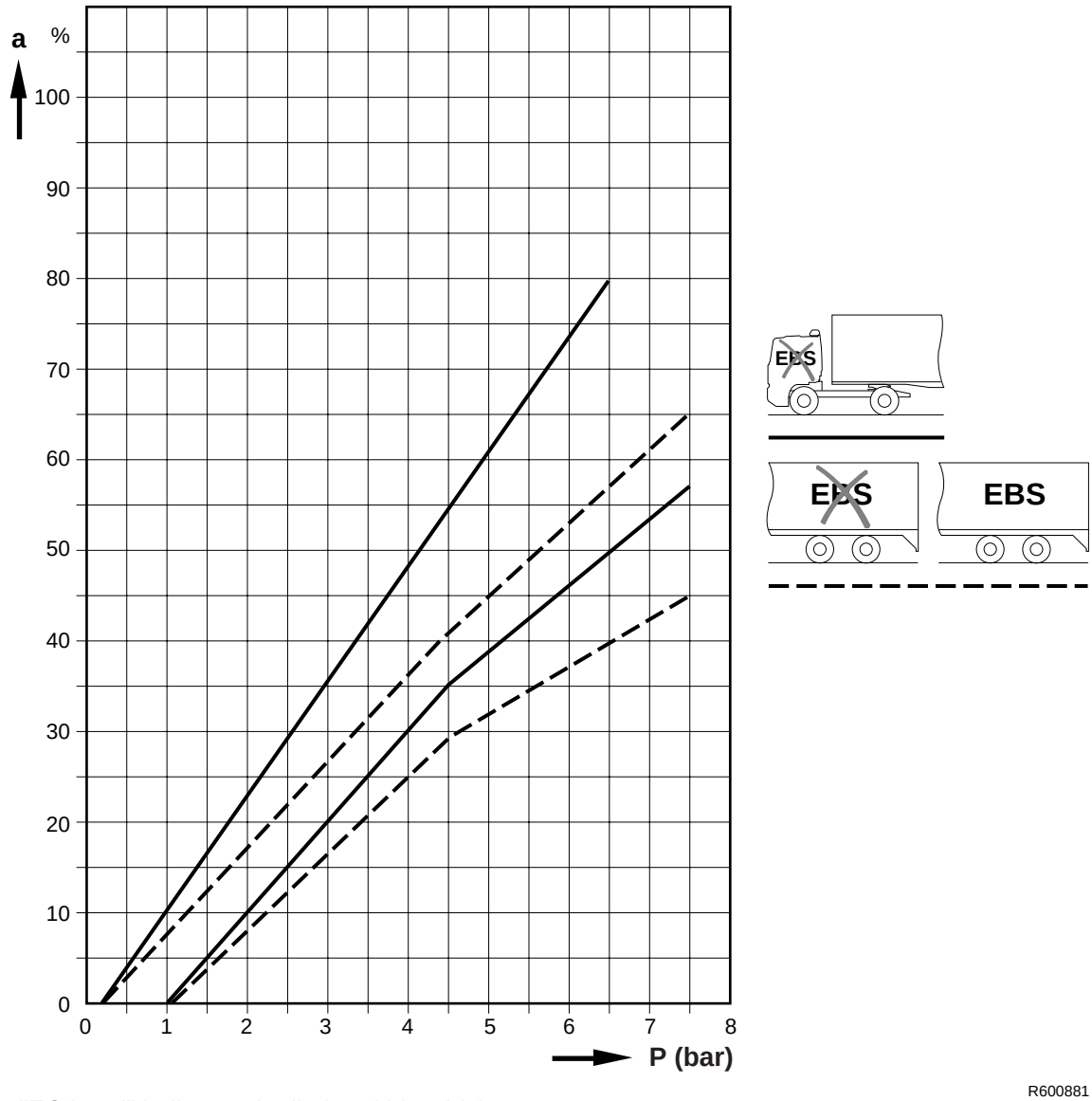
Example of a diagram for a prime mover and trailer vehicle with correct brake balance.

The combination is correctly balanced if the braking performance at 2 - 3 bar for the truck and the trailer vehicle are in a comparable position in the appropriate EC band, i.e. both in the upper part, both in the lower part or both in the middle part.



R600022

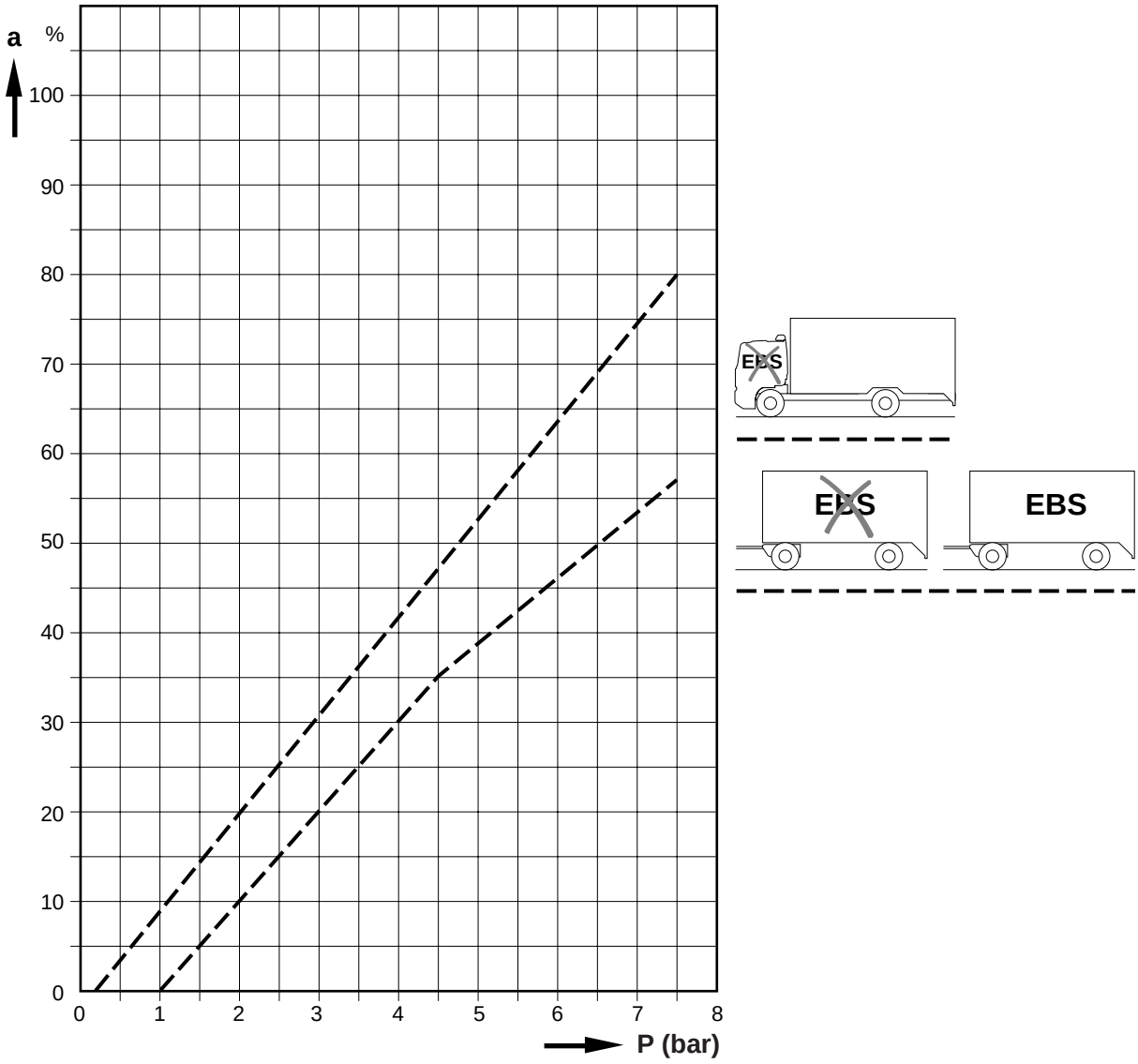
1.5 EC BAND FOR A LADEN TRACTOR/SEMI-TRAILER COMBINATION



The "EC band" indicates the limits within which the deceleration value must lie.

The "EC band" applies to:
- tractor with conventional brake system
- semi-trailer with conventional or EBS brake system

1.6 EC BAND FOR A LADEN TRUCK/TRAILER COMBINATION



The "EC band" indicates the limits within which the deceleration value must lie.

The "EC band" applies to:
- truck with conventional brake system.
- trailer with conventional or EBS brake system.

Note:
The following applies to mid-axle trailers fitted with air brakes:
The permissible ratio between the deceleration and the pressure at the yellow coupling head of a laden mid-axle trailer with air brakes should be within the two areas derived from the EC band for a laden truck/trailer combination, for which the vertical scale has been multiplied by 0.95.

2. INSPECTION AND ADJUSTMENT

2.1 CHECKING BRAKING PERFORMANCE ON EBS TRUCK

It is not easy to perform a realistic braking deceleration test or braking deceleration calculation on a vehicle that is not fully laden and is fitted with an EBS system on a test bench.

The reason for this is that the EBS system has its own control principle which calculates the optimum brake pressure to the front and rear axles in relation to the dynamic axle loads.

Note:
The test bench function and deceleration measurement can be carried out on a vehicle with the EBS system in fully laden state, if desired.

It is however possible to inspect the brake performance of the vehicle by means of braking force measurements, though only the static condition of the brake system can be assessed.

Inspection, brake performance

1. The brake performance of the vehicle can be inspected by placing the fully laden vehicle on a test bench and then activating the test bench function of the EBS system.

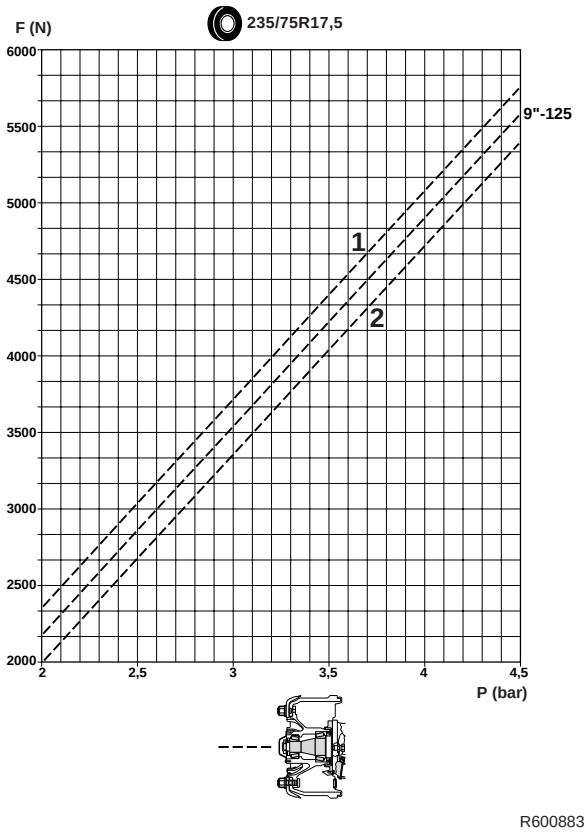
2. The braking forces must be measured on a brake system with warm brakes (temperature under normal operating conditions).

3. The braking forces cannot be evaluated until the brake lining has bedded in.

4. The braking forces must be measured in relation to the pressure in the brake cylinder.

5. Based on the relevant graph (see "Technical data"), determine whether the braking performance is correct. An example is used to explain how the measured braking performance should be evaluated.

The braking forces are increased, from 2 bar, in increments of 0.5 bar, until the rolling bench turns off. This yields several points that are plotted out in the graph; when the dots are connected, a line such as line (1) results.
If this line (1) is equal to or above the reference line, the measured braking performance is correct. If the line is below the reference line, such as example line (2), the measured braking performance is not correct and the mechanical condition of the basic braking system must be inspected.



Activating test bench function on EBS truck
In the test bench function, the EBS control function is switched off and a switchover is made to a test function with accompanying curve.

In this test function, it is possible to inspect the brake performance.

Test function curve
- The output pressures to the front axle and rear axle are those as with a fully laden vehicle.
- The pressure ratio control between front and rear axles is not active (pressure ratio 1:1).
- The command pressure to the drawn vehicle has a reading in the middle of the EC brake band.
- The brake functions such as deceleration control, wheel slip control etc. are switched off.

Condition for being able to activate the test function
At least one of the axles must have a wheel speed lower than 2 km/h. On all other axles, the wheel speed must be lower than 12 km/h.

Note:
This means that both on a vehicle which has not been on the test bench (stationary vehicle) and on a vehicle that has been on the test bench, the test function can be activated.

Activation of the test function

1. Switch the vehicle ignition off.

2. Apply the brake pedal. The test function will now be activated if the condition has been met.

   Note:
   - If during application of the brake pedal the contact is turned on, the test function will remain active even if the brake pedal is then released.
   - The test function will be automatically switched off if the condition is no longer met or if, when the contact is on, the contact is switched off when the brake pedal is not being applied.

2.2 INSPECTING AND ADJUSTING BRAKE EQUALISATION OF NON-EBS TRUCK WITH NON-EBS TRAILER VEHICLE

Inspecting brake equalisation of non-EBS truck with non-EBS trailer vehicle

1. Take a test drive and evaluate the braking behaviour.

2. In the case of disc brakes, inspect the mechanical condition of the brake calliper, brake disc and brake pads. In the case of drum brakes, inspect the mechanical condition of the brake drums and brake linings. Their condition may provide clues to the settings that need to be made.

3. Perform a brake equalisation test using a brake dynamometer and fill in the "Brake equalisation form for brake dynamometer". See "General".

4. Evaluate the brake equalisation of the combination using the "EC band graph". The combination is correctly balanced if the braking performance at 2 - 3 bar for the truck and the trailer vehicle are in a comparable position in the appropriate EC band, i.e. both in the upper part, both in the lower part or both in the middle part.

   Note:
   On a tractor/drawn vehicle combination the values for the drawn vehicle may be slightly lower than those for the prime mover.
   The deceleration values for the truck and the drawn vehicle of a truck/trailer combination should be the same. The reason for this lies in the dynamic axle load displacement, which on semi-trailers causes a transfer of weight to the tractive unit, whereas on trailers it does not cause a transfer of weight to the tractive unit.

5. Due to the adjustment of the brake pressure advance on the truck and/or trailer vehicle the deceleration lines in the "EC band graph" can be affected.

   Note:
   For optimum interchangeability of vehicles, the correct choice between these two alternatives must be made.

6. If the mechanical condition of the wheel brakes, the results of the test drive and the data obtained from the brake equalisation test using the brake dynamometer give cause for doing so, the brake pressure advance of the trailer vehicle control valve can be adjusted.

Adjusting brake equalisation of non-EBS truck with non-EBS trailer vehicle

1. When the brake pressure advance in the trailer vehicle control valve on the truck is increased or decreased, the position of the curve for the trailer vehicle (B) in the graph will not be affected. This is because the reference pressures are measured at the yellow coupling head (= service line).
   For the same reason, however, the curve for the truck (A) will shift to the right or the left (will appear to be lower or higher respectively).
   So the horizontal axis indicates how much the brake pressure advance has to be changed. Reducing the brake pressure advance results in increased deceleration of the truck. Increasing the brake pressure advance results in decreased deceleration of the truck.

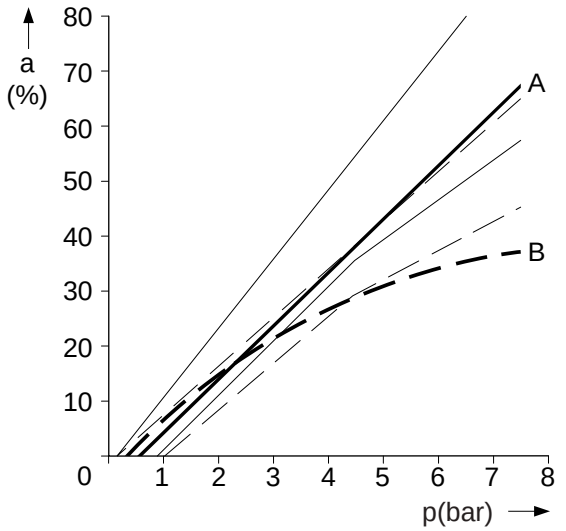
   Note:
   Increasing the brake pressure advance on the trailer vehicle reaction valve on the trailer vehicle results in increased deceleration of the trailer vehicle.

   Bear in mind that an increase in the brake pressure advance does not necessarily improve the braking performance of the trailer vehicle. It only means that the brake pressure balance between prime mover and trailer vehicle is changed. Moreover, in the event of an emergency stop the poorer braking performance of the trailer vehicle will again be noticeable, as the brake pressure advance is eliminated when the maximum brake pressure is used.

2. So the horizontal axis indicates how much the brake pressure advance has to be changed.

3. Take a test run, perform a brake equalisation test using a brake dynamometer and fill in the "Brake equalisation form for brake dynamometer". See "General". If desired or required, the setting of the trailer vehicle control valve can be adjusted again.

4. If the desired brake equalisation cannot be achieved, the cause must be sought and remedied by means of the diagnostics table. See "Diagnostics".



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2.3 INSPECTING AND ADJUSTING BRAKE EQUALISATION OF NON-EBS TRUCK WITH EBS TRAILER VEHICLE

Inspecting brake equalisation of non-EBS truck with EBS trailer vehicle

1. Take a test drive and evaluate the braking behaviour.

2. In the case of disc brakes, inspect the mechanical condition of the brake calliper, brake disc and brake pads. In the case of drum brakes, inspect the mechanical condition of the brake drums and brake linings. Their condition may provide clues to the settings that need to be made.

3. Perform a brake equalisation test using a brake dynamometer and fill in the "Brake equalisation form for brake dynamometer". See "General".

   Note:
   The EBS trailer vehicle must be correctly connected and the test function of the EBS system must be activated.

4. Evaluate the brake equalisation of the combination using the "EC band graph". The combination is correctly balanced if the braking performance at 2 - 3 bar for the truck and the trailer vehicle are in a comparable position in the appropriate EC band, i.e. both in the upper part, both in the lower part or both in the middle part.

   Note:
   On a tractor/semi-trailer combination the values for the drawn vehicle may be slightly lower than those for the tractor. The deceleration values for the truck and the drawn vehicle of a truck/trailer combination should be the same. The reason for this lies in the dynamic axle load displacement, which on semi-trailers causes a transfer of weight to the tractive unit, whereas on trailers it does not cause a transfer of weight to the tractive unit.

5. Due to the adjustment of the brake pressure advance on the truck, the deceleration line in the "EC band graph" can be affected.

6. If the mechanical condition of the wheel brakes, the results of the test drive and the data obtained from the brake equalisation test using the brake dynamometer give cause for doing so, the brake pressure advance of the trailer vehicle control valve can be adjusted.

Inspecting brake equalisation of non-EBS truck with EBS trailer vehicle

1. When the brake pressure advance in the trailer vehicle control valve on the truck is increased or decreased, the position of the curve for the trailer vehicle (B) in the graph will not be affected. This is because the reference pressures are measured at the yellow coupling head (= service line).
   For the same reason, however, the curve for the truck (A) will shift to the right or the left (will appear to be lower or higher respectively).
   So the horizontal axis indicates how much the brake pressure advance has to be changed. Reducing the brake pressure advance results in increased deceleration of the truck. Increasing the brake pressure advance results in decreased deceleration of the truck.

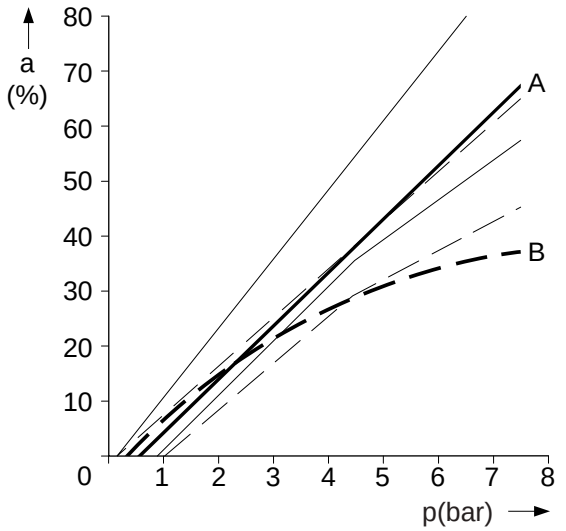
   Note:
   Due to the operation of EBS on the trailer vehicle it is not possible to set the brake pressure advance on the trailer vehicle.
   The brake pressure advance is automatically adjusted electronically by the EBS.

   Bear in mind that an increase in the brake pressure advance does not necessarily improve the braking performance of the trailer vehicle. It only means that the brake pressure balance between prime mover and trailer vehicle is changed. Moreover, in the event of an emergency stop the poorer braking performance of the trailer vehicle will again be noticeable, as the brake pressure advance is eliminated when the maximum brake pressure is used.

2. So the horizontal axis indicates how much the brake pressure advance has to be changed.

3. Take a test run, perform a brake equalisation test using a brake dynamometer and fill in the "Brake equalisation form for brake dynamometer". See "General". If desired or required, the setting of the trailer vehicle control valve can be adjusted again.

4. If the desired brake equalisation cannot be achieved, the cause must be sought and remedied by means of the diagnostics table. See "Diagnostics".



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2.4 INSPECTING AND ADJUSTING BRAKE EQUALISATION OF EBS TRUCK WITH NON-EBS TRAILER VEHICLE

Inspecting brake equalisation of EBS truck with non-EBS trailer vehicle

1. Take a test drive and evaluate the braking behaviour.

2. Check the mechanical condition of the braking system of the EBS truck with the help of the brake performance measurement, using a rolling testing device.

3. Connect a pressure gauge to the yellow coupling head of the trailer. Activate the testing function of the EBS truck and gradually depress the brake pedal. Now you must gradually increase the pressure on the yellow coupling head and eventually exert a pressure value in excess of 8 bar.

4. Evaluate the brake performance of the non-EBS trailer with the "EC band graph". The measured deceleration must be within the EC band graph.

5. By adjusting the advance pressure in the trailer reaction valve of the non-EBS trailer, the deceleration line in the EC band graph can be influenced. Changing the advance pressure is only allowable if the mechanical condition of the brake system of the trailer allows for this.

Inspecting brake equalisation of EBS truck with non-EBS trailer vehicle

1. If the advance pressure of the trailer reaction valve is increased or decreased, this will also result in an increase or decrease of the measured deceleration of the trailer vehicle.

Bear in mind that an increase in the brake pressure advance does not necessarily improve the braking performance of the trailer vehicle. It only means that the brake pressure balance between prime mover and trailer vehicle is changed. Moreover, in the event of an emergency stop the poorer braking performance of the trailer vehicle will again be noticeable, as the brake pressure advance is eliminated when the maximum brake pressure is used.

Note:
The EBS system on the truck has a system that automatically adjusts the brake pressures. It is not possible to adjust it. If the EBS system has not stored an error code and the brakes of the truck are in proper condition, the cause of the brake troubles must be sought in the condition and sizing of the brakes of the trailer vehicle. If an improvement of comfort (pulling or pushing) is desired for low brake decelerations, this is possible by changing the pressure pulse control of the trailer vehicle.