Einleitung / Introduction

INTRODUCTION

This manual will be a source of reference on technical data, adjusting values and operating instructions for you, so that it will be easier for you to build up and enter your racing vehicle.

The technical information is only applicable to vehicles operated exclusively on closed racing circuits. Operation in public traffic is not permitted.

The manual has no influence on pertinent technical approval procedures for a motor vehicle racing event. Only the homologation sheet and enclosure J (in FIA Manual) are valid for questions concerning rules. Exceptions would be championships, which are carried out to one's own rules.

This manual is only available in German and English. The German wording is always binding exclusively in case of any misunderstandings from the translation.

I m p o r t a n t !

Photographs, descriptions and drawings serve exclusively the presentation of the text. We cannot accept any liability for completeness or conformity of the contents of this publication with the pertinent legislative regulations.

BMW MOTORSPORT GMBH
Preußenstr. 45
D–8000 Munich 40

M 3 GROUP A

GENERAL TECHNICAL DATA

VEHICLE DATA

Minimum weight	960 kg
Length	4355.0 mm
Width	1680.0 mm
Wheelbase	2565.5 mm
Track width - front	1412.0 mm
Track width - rear	1424.0 mm

BODY

Standard body of BMW M 3.

Steel rollover cage welded on passenger compartment cell.

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ENGINE S 14 – GROUP A

Bore	94 mm
Stroke	84 mm
Displacement	2332 cc
Compression ratio	12 : 1
Max. engine power	approx. 300 HP
Max. engine torque	270 Nm at 7000 rpm
Max. engine speed	8500 rpm
Crankshaft	Forged
Crankshaft bearings	Plain
Connecting rods	Forged steel
Connecting rod bearings	Plain bearing shells
Piston pin bearing in connecting rod	Press-fit brass bushing
Pistons	Forged light alloy
Piston rings	2 plain compression rings 1 double-bevelled oil control ring
Cylinder head	light alloy
Valve seat insert rings	Shrink-fit
Arrangement of valves per cylinder	2 intake valves/2 exhaust valves
Valve springs	2 coil springs for each valve
Valve timing	2 overhead camshafts
Cooling	Water
Clutch	Sintered metal

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ENGINE LUBRICATION

Oil cooling	Oil cooler in front end of vehicle
Oil pressure	4 to 6 bar
Oil pressure gauge with warning lamp	Lamp lights up at approx. 0.5 bar
Lubrication	Wet sump

FUEL SYSTEM

Fuel delivery	1 fuel pump
Fuel injection system	Motronic
Fuel tank	Safety rubber tank
Tank size	109.5 liters
Fuel pressure	5.0 bar

ELECTRICAL SYSTEM

Battery voltage	12 V
Battery capacity	26 Ah
Generator	Bosch
Firing order	1–3–4–2
Spark plugs	Bosch

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GEARBOX

Ratio	
1st gear	2.337
2nd gear	1.681
3rd gear	1.358
4th gear	1.150
5th gear	1.000
Reverse gear	2.660

FINAL DRIVE

Ratios	3.15 : 1 3.25 : 1 3.46 : 1 3.73 : 1 3.91 : 1 4.10 : 1 4.27 : 1 4.45 : 1 4.75 : 1 5.00 : 1 5.28 : 1
Limited slip differential	With 75 % locking ratio
Final drive cooling	With oil pump and oil cooler

BRAKES

Service (foot-operated) brakes	Hydraulic dual circuit brakes
Parking (hand-operated) brakes	Hydraulic in rear circuit
Brake discs	Inboard vented
Brake disc thickness - front	32.0 mm
Brake disc thickness - rear	20.7 mm
Brake disc diameter - front	332 mm
Brake disc diameter - rear	280 mm
Twin brake master cylinders	With balance arm
Brake force distribution	Front/rear (adjustable while driving)

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CHASSIS

Front Axle

Single-joint, spring strut axle

Reinforced aluminum spring struts with adjustable spring retainers to change height of vehicle

Wheels mounted with central locking nuts

Adjustable stabilizers

Rack-and-pinion steering

Rear Axle

Reinforced semi-trailing arms with joint mounts

Wheels mounted with central locking nuts

Adjustable spring struts to change height of vehicle

Adjustable stabilizers

WHEELS

Front Axle

Rim wells	1" x 16" outside well 8" x 16" inside well
Rim offset	24 mm
Collar height - spider	62 mm
Max. total width of wheels	10"

Rear Axle

Rim wells	1" x 16" outside well 8" x 16" inside well
Rim offset	24 mm
Collar height - spider	62 mm
Max. total width of wheels	10"

Tyres

Front and rear wheels	235/590 – 16"

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OPERATING MATERIALS

Engine oil	Castrol B 353
Gearbox oil	SAE 80
Final drive oil	SAE 90 hypoid gear lube
Wheel bearing grease	Klüber Nontub RB 3 (green)
Steering	Molykote Longterm 2

FUEL

Premium petrol	98 RON (premium)

CAPACITIES

Engine oil	5.0 liters
Gerabox oil	1.7 liters
Final drive oil	3.15 liters
Coolant	9.0 liters
Petrol	109.5 liters

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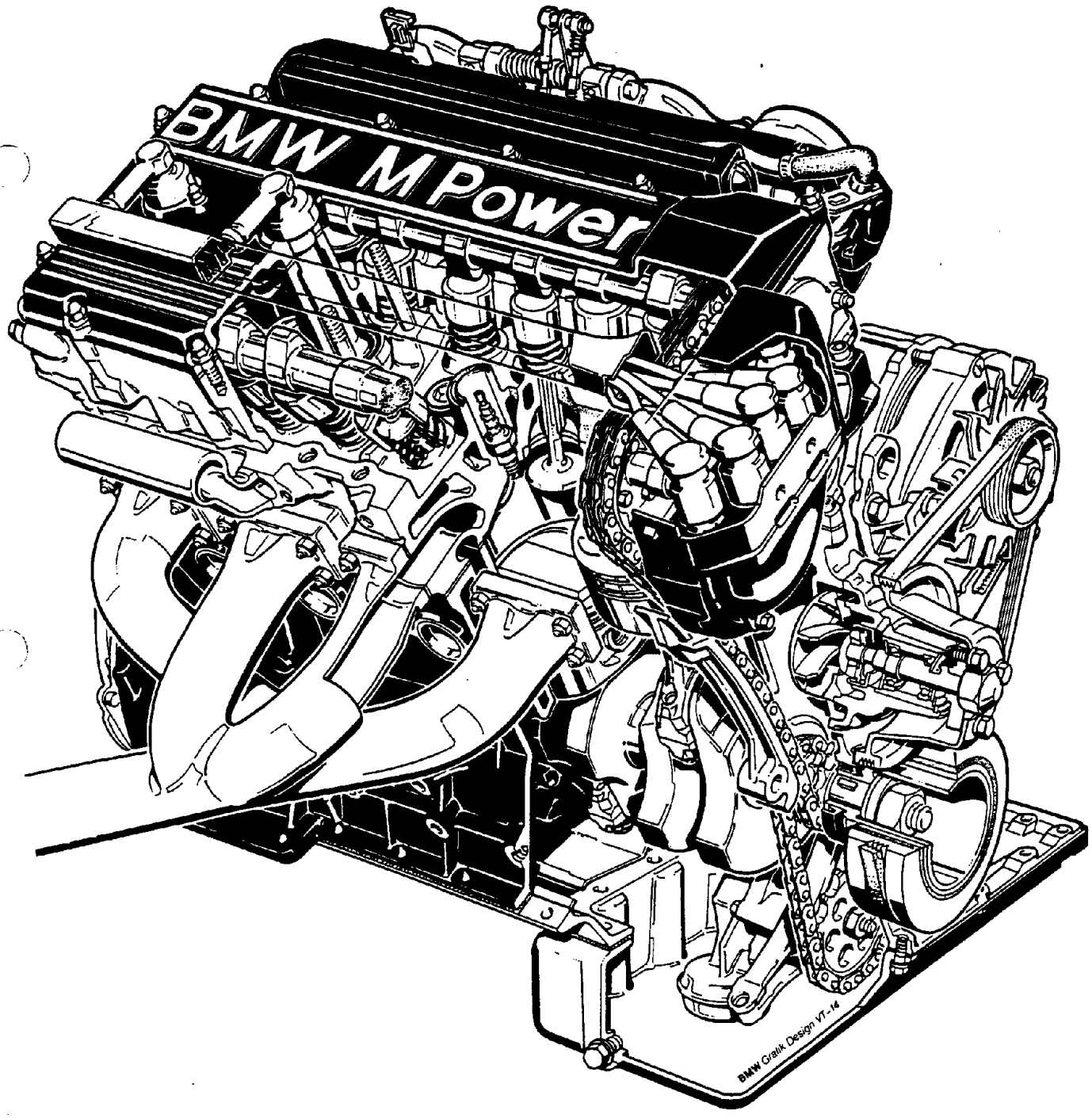
TIGHTENING TORQUE FOR M 3 – GROUP A

TIGHTENING TORQUE	Nm
2611 ... Guibo coupling to propeller shaft	115 – 130
3100 ... Front axle carrier to body	43 – 48
3111 ... Control arm to front axle carrier	77 – 95
3121 ... Front axle shaft (wheel bearings) Waxed collar nut	260 – 280
3221 ... Tie rod arm to spring strut	38 – 40
3321 ... Drive shafts	60 – 65
3331 ... Rear axle carrier to body	140 – 155
3341 ... Rear stub axle to drive flange	260 – 280
3411 ... Brake caliper to spring strut	110 – 123
3421 ... Brake caliper to arm	110 – 123
3610 ... Central locking nuts for wheels	700 – 800

ENGINE



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Technical Data **Page**

Enclosure: Running-in program for engine test stand

Source of Supply:

HWB
Robert Bosch Str. 7

D–8046 Garching

HA-wg / 01.01.87

LIST OF CONTENTS

11 00 . . . Engine in General

Bore	mm	94
Stroke	mm	84
Effective displacement	cc	2332
Compression ratio		12 : 1
Power to DIN 70020 at engine speed	kW / HP rpm	approx. 220 / approx. 300 8000
Max. engine speed	rpm	8500
Max. engine torque at engine speed	Nm rpm	approx. 270 7000
Compression pressure	bar	at least 15
Approved engine oil grades		Wintershall TFE Castrol B 353
Fuel grade		Leaded premium petrol
Octane		at least 98 RON

11 11 . . . Crankcase

1. Tightening Torque		Nm
Drain plug for coolant in crankcase	M 14	50 ± 2
Front/rear end covers to crankcase	M 6 M 8	9 ± 1 22 ± 2

2. Honing Crankcase (Test Sheet for Cylinder Sizes as Enclosure

2.1 Cylinder Sizes

Cylinder bore	mm	$93.81^{+0.01}$
Oversize 1	mm	$93.87^{+0.01}$
Oversize 2	mm	$93.93^{+0.01}$
Oversize 3	mm	$93.99^{+0.01}$

2.2 Honing Specifications

– Engine block with timing case cover (torque = 15 Nm) and plate with cylinder head gasket (torque = 85 Nm)

– Settings on honing machine:

Spindle speed	rpm	125
Spindle working stroke	rpm	49
Spindle stroke	rpm	145

2.2.1 Rough Honing – until cylinder bore D **minus** 0.030 mm

a) Pre-machined crankcase:
honing stone EHU 518 (C 30 J 64)

b) Removing carbon deposits on used crankcase:
honing stone with code C 30 J 85 (only for this purpose)

2.2.2 Form Honing – until cylinder bore D **minus** $0.010^{+0.005}$ mm

– Carry out form and size corrections according to honing pressure display (maximum value: 35 amperes) and BDC working stroke limit with a C 30 J 85 honing stone.

– Tolerance for out-of-true and conicity: 0.005 mm.

2.2.3 Finish Honing

– "Whet" hone with honing stone C 30 J 85.

Finish the honing procedures **without pressure** with an initial honing pressure of 20 to 22 amperes and a honing time of approx. 2 minutes **without feed.**

Important: After completion of honing, clean the crankcase – in particular all oil bores and the main oil bore. Plug the oil bore with a M 12 bolt afterwards.

2.2.4 Peak-to-Valley Surface Finish Values

	Nominal Values:
– Determined surface finish depth of max. peak-to-valley surface finish	R_Z = 1.0 to 3.0 µm
– Mean surface finish value	R_a = 0.06 to 0.1 µm
– Determined surface finish depth	R_{3Z} = 0.5 to 1.0 µm
– Carrying share in 0.5 µm cutting depth	TP = 70 to 90 %

11 12 . . . Cylinder Head

New cylinder head height	mm	96.00 ± 0.03
Combustion chamber volume with valves and spark plug	cc	43 ± 0.5

Tightening Torque		Nm
Cylinder head bolts (tightened crosswise from middle to outside)	M 12	
Step 1		50 ± 2
Step 2		80 ± 2 **Wait 15 minutes!**
Step 3		100 ± 2
Important: Wash and lubricate bolts and washers with engine oil prior to installation.		
Coolant pipe to cylinder head	M 6	11 ± 1
Rear water pipe plug	M 22 x 1.5	35 ± 2
Oil pressure bore plug	M 14 x 1.5	25 ± 2
Intake manifold to cylinder head	M 6	10 ± 1
Exhaust manifold to cylinder head	M 6	10 ± 1

11 12 . . . Valve Guides

Valve guide dia. – bore dia.		
Standard size	mm	12.00 x6 – 12.00 H7
Oversize 1	mm	12.20 x6 – 12.20 H7
Oversize 2	mm	12.40 x6 – 12.40 H7
Overall length	mm	43.5 ± 0.2
Valve guide inside dia. (installed)	mm	7.0 H7
Installing temperature		
Cylinder head	°C	+ 150
Valve guide		Chilled in liquid air or liquid nitrogen
Valve guide protrusion	mm	15 ± 0.3

(Test sheets for determination of radial play in valve guides as an enclosure.)

11 12 . . . Valve Seat Inserts

Valve seat insert dia. – bore dia. (distance "D")		
Intake		
Standard size	mm	40.15 g6 – 40.00 H7
0.2 mm oversize	mm	40.30 g6 – 40.15 H7
0.4 mm oversize	mm	40.45 g6 – 40.30 H7
Exhaust		
Standard size	mm	36.15 g6 – 36.00 H7
0.2 mm oversize	mm	36.45 g6 – 36.30 H7
0.4 mm oversize	mm	36.75 g6 – 36.60 H7
Valve seat insert height – bore depth (distance "H")		
Standard size	mm	$7.00_{-0.02}$ – 7.20 ± 0.01
0.2 mm oversize	mm	$7.15_{-0.02}$ – 7.35 ± 0.01
0.4 mm oversize	mm	$7.30_{-0.02}$ – 7.50 ± 0.01
Installing temperature		
Valve seat insert	°C	– 150
Cylinder head	°C	+ 150

11 12 . . . Valve Seats

Valve seat angle	degrees	45^{o}
Correction angles	degrees	35^{o} / 60^{o}
Valve seat width (distance "B")		
Intake	mm	$0.7 + 0.1$
Exhaust	mm	$0.9 + 0.1$
Valve seat diameter (distance "V")		
Intake	mm	$36.7 + 0.1$
Exhaust	mm	$31.6 + 0.1$
Valve protrusion to combustion chamber		
Intake	mm	$0.5 - 0.3$
Exhaust	mm	$0.5 - 0.3$

11 12 . . . Timing Case

Camshaft bearings		
Bore diameter	mm	$30 \begin{smallmatrix} + 0.020 \\ + 0.007 \end{smallmatrix}$
Bucket tappets		
Bore diameter	mm	$37.5 + 0.016$
Tappet play	mm	0.025 to 0.066

(Test sheet for determination of tappet play as an enclosure.)

Tightening Torque		Nm
Timing case to cylinder head	M 7	15 ± 1
	M 8	21 ± 1

11 21 . . . Crankshaft and Bearings
(Test Sheets for Main and Conrod Bearings in Enclosure)

Crankshaft bearing radial play		mm	0.040 to 0.080
Ground sizes of main bearing journal (double classification)			
Standard size	red	mm	$55.00 \begin{matrix} -0.010 \\ -0.020 \end{matrix}$
	blue	mm	$55.00 \begin{matrix} -0.020 \\ -0.029 \end{matrix}$
Undersize 1 (0.25 mm)	red	mm	$54.75 \begin{matrix} -0.010 \\ -0.020 \end{matrix}$
	blue	mm	$54.75 \begin{matrix} -0.020 \\ -0.029 \end{matrix}$
Undersize 2 (0.50 mm)	red	mm	$54.50 \begin{matrix} -0.010 \\ -0.020 \end{matrix}$
	blue	mm	$54.50 \begin{matrix} -0.020 \\ -0.029 \end{matrix}$
Undersize 3 (0.75 mm)	red	mm	$54.25 \begin{matrix} -0.010 \\ -0.020 \end{matrix}$
	blue	mm	$54.25 \begin{matrix} -0.020 \\ -0.029 \end{matrix}$
Ground sizes of crankshaft thrust bearing			
Standard size		mm	$30.0 \begin{matrix} +0.064 \\ +0.025 \end{matrix}$
Oversize 1		mm	$30.2 \begin{matrix} +0.064 \\ +0.025 \end{matrix}$
Oversize 2		mm	$30.4 \begin{matrix} +0.064 \\ +0.025 \end{matrix}$
Oversize 3		mm	$30.6 \begin{matrix} +0.064 \\ +0.025 \end{matrix}$
Crankshaft axial play		mm	0.080 to 0.180

Conrod bearing radial play	mm	0.03 to 0.07
Ground sizes of conrod bearing journals		
Standard size	mm	47.975 to 47.991
Undersize 1 (0.25 mm)	mm	47.725 to 47.741
Undersize 2 (0.50 mm)	mm	47.475 to 47.491
Undersize 3 (0.75 mm)	mm	47.225 to 47.241
Max. permissible imbalance of crankshaft (dynamic without flywheel)	gcm	1 to 1.5
Balancing speed	rpm	1100
Max. permissible runout on center main bearing journal (crankshaft running on outer bearing journals)	mm	0.1
Crankshaft throw	mm	84 ± 0.1
Max. permissible peak-to-valley surface finish of bearing journals	Rt (µm)	2

Tightening Torque	**Nm**
Main bearing caps to crankcase	65 ± 2.5
Important: Wash and lubricate bolts with engine oil prior to installation!	

11 22 . . . Flywheel

Minimum weight	g	8000
Max. axial runout measured on outside diameter	mm	0.1
Minimum flywheel thickness (distance "A")	mm	29.1 – 0.1

Tightening Torque	Nm
Flywheel to crankshaft **Important:** – Always replace the M 12 expansion head bolts. – Install bolts with Loctite 273.	105 ± 3

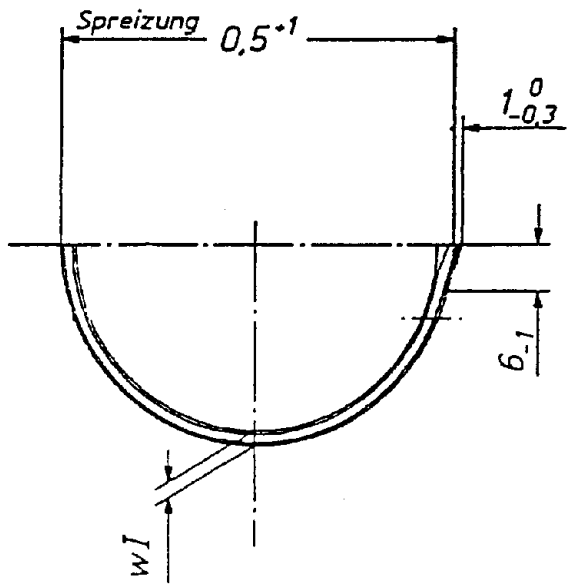
11 23 . . . Vibration Damper

Tightening Torque		Nm
Vibration damper hub to crankshaft	M 24	440 ± 10
Important: – Installed dry (no lubrication).		

11 24 . . . Connecting Rods and Bearings
(Test Sheets for Bearing Play and Conrod Weight in Enclosure)

Small conrod bore dia.	mm	22.020 to 22.024
Piston pin / conrod bore radial play	mm	0.020 to 0.029
Big conrod bore diameter	mm	52.010 to 52.020
Max. deviation in parallel of connecting rod bores with bearing shells at distance of 150 mm	mm	max. 0.04
Max. permissible displacement to one side	degrees	0^{o} 30'
Minimum weight of connecting rod with bearing shells	g	675
Max. permissible deviation in weight of connecting rods in one engine (without bearing shells)	g	± 2
Big end	g	± 1
Small end	g	± 1

Conrod Bearing Shell Table:



The bearing play is adjusted by selecting bearing shells with a different wall thickness "wl".

Part Number Code	Undersize Table	Step	Wall Thickness wl	Deviation in um for Color Codes Red	Yellow	Blue
1 310 515	0	Standard	1.986 mm			
1 310 517	2	0.25 mm	2.111 mm	+ 5	+ 10	+ 15
1 310 518	3	0.50 mm	2.236 mm	0	+ 5	+ 10
1 310 519	4	0.75 mm	2.361 mm			

Identification: on back of bearing, max. 8 mm away from joint, stamped
- company code B2 BMW N113 19.0
- manufacturing code, part number
- manufacturing month and year

Color code: on side surfaces

Installing specification: approved bearing shell matching
Connecting rod: yellow or blue
Conrod bearing cap: yellow or red

Nominal value for radial play of conrod bearings: see 11 21 . . ..

Tightening Specifications for M 11 Conrod Bolts (Bearing Shells Classified with Color Code)	
Step 1	15 ± 1 Nm
Step 2	30 ± 1 Nm
Step 3 (torque angle)	60 + 2°
Important: – Wash and lubricate bolts with oil prior to installation. – Always install new bolts.	

11 - 13 OIL NOZZLE L 18·3mm Dφ 6mm

11 25 . . . Pistons
(Test Sheets for Piston Sizes and Weight in Enclosure)

Identification on piston		"83/2"
Piston dia. (checkpoint "A")		
Standard size	mm	93.73
Oversize 1	mm	93.79
Oversize 2	mm	93.85
Oversize 3	mm	93.91
Piston running clearance	mm	0.08
Piston pin/bore radial play	mm	0.006 to 0.016
Piston pin axial play	mm	0.2 to 0.4
Max. difference in weight among all pistons	g	± 2
Tightening torque for piston pin installed with Loctite 648	Nm	20 ± 1

11 25 . . . Piston Rings
(Test Sheet for Piston Ring Clearance and Force in Enclosure)

Groove 1 (L-Ring)		
End clearance	mm	0.30 to 0.45
Side clearance	mm	0.1
Groove 2 (L-Ring)		
End clearance	mm	0.30 to 0.45
Side clearance	mm	0.07
Groove 3 (Double-bevelled Oil Control Ring with Spring)		
End clearance	mm	0.35 to 0.50
Side clearance	mm	0.04 to 0.05
Tangential force	N	at least 40

11 31 . . . Camshaft

Drive		Double-roller chain
Camshaft bearing dia.	mm	$30\ ^{-0.020}_{-0.033}$
Camshaft bearing play (test sheet in enclosure)		
Radial	mm	0.027 to 0.053
Axial	mm	0.1 to 0.15
Cam distance "N"		
Intake	mm	43.7570
Exhaust	mm	42.6005
Timing		
Spread - exhaust / intake	degrees	100^{o}

11 31 . . . Chain Tensioner
(rigid adjustment of chain tensioner with help of spacers)

Play on chain tensioner	mm	1.0 (equal to crankshaft play of 1.0 to 1.5^{o} on degree disc)
Chain tensioner piston dia.		
Step 1	mm	19.462 to 19.468
Step 2	mm	19.468 to 19.474
Chain tensioner cylinder dia.		
Step 1	mm	19.500 to 19.507
Step 2	mm	19.507 to 19.513

Tightening Torque		Nm
Bearing cap of camshaft	M 8	22 ± 1
Drive for distributor rotor to camshaft	M 8	23 ± 1
Sprocket to camshaft		10 ± 1
Plug for chain tensioner	M 22 x 1.5	40 ± 2
Cylinder for chain tensioner piston	M 26 x 1.5	50 ± 2

11 34 . . . Valves

Valve clearance (test sheet in enclosure) (coolant temperature max. 35° C)		
Intake and exhaust valves	mm	0.28 to 0.32
Min. edge thickness of valve head (distance "A")		
Intake	mm	0.30
Exhaust	mm	0.30
Head diameter (distance "T")		
Intake	mm	37 – 0.1
Exhaust	mm	32 – 0.1
Stem diameter (distance "S")	mm	6.975
Valve protrusion to combustion chamber		see 11 12 . . . Valve Seats
Minimum play between valve and piston (test sheet in enclosure)		
Intake	mm	1.5
Exhaust	mm	1.8
Minimum quench gap height	mm	1.2

11 34 . . . Valve Springs

The spring force of already used valve springs must be checked in accordance with the spring deflection.

	Spring Length mm	Spring Force N
Outer Spring (marked with paint stripe: green/green/white)	34.5 24.0	226 to 245 697 to 755
Inner Spring (marked with paint stripe: green/green/white)	29.5 19.0	94 to 102 307 to 333

(test sheet in enclosure)

Installed height of outer spring Intake and exhaust	mm	35 ± 0.3

11 34 . . . Spring Retainers

The installed spring length is adjusted by using shims on the lower spring retainer.

The lower spring retainer for intake valves is marked with a dot of paint (no paint mark on exhaust valve spring retainers).

11 40 . . . Oil Supply

Lubricating system		Pressure circulation with pressure control valve in filtered oil circuit
Oil grade		See special specifications
Oil volume for initial filling (dry engine)	ltr.	5.50
With (standard) oil cooler	ltr.	6.05
Oil change volume With/without oil filter	ltr.	4.90 / 4.60

Tightening Torque		Nm
Oil filter		30 ± 1
Oil drain plug (17 mm wrench)	M 12	35 ± 1
Oil pan to crankcase and timing case cover	M 6	10 ± 1

11 41 . . . Oil Pump

Design		Eaton rotor oil pump
Oil pressure at idle speed	bar	0.5 to 2.0
Oil pressure in speed range from 5000 to 8500 rpm	bar	4.0 to 6.0

Tightening Torque		Nm
Oil pump to crankcase	M 8	22 ± 2
Oil pump cover	M 6	9 ± 1
Sprocket to oil pump (nut installed with Loctite 648)	M 10 x 1	28 ± 2

11 51 . . . Water Pump

Tightening Torque		Nm
Water pump to crankcase	M 8	22 ± 2
	M 6	9 ± 1
Pulley to water pump	M 6	9 ± 1

ENGINE TEST STAND

2.0 / h – Running-in Program for M 3 - Group A - Engines
(without retightening cylinder head)

Test Point	Engine Speed (rpm)	Engine Torque (Nm)	Running Time (minutes)
1	2800	60	15
2	3000	70	15
3	3500	75	15
4	4000	80	15
5	4500	105	15
6	4800	95	15
7	5000	115	15
8	5500	125	15

Afterwards: 15 minute load cycle change, power output measured, engine idle speed adjusted, compression pressure tested.

Power Output Test (Speed Range 5000 to 8000 RPM)

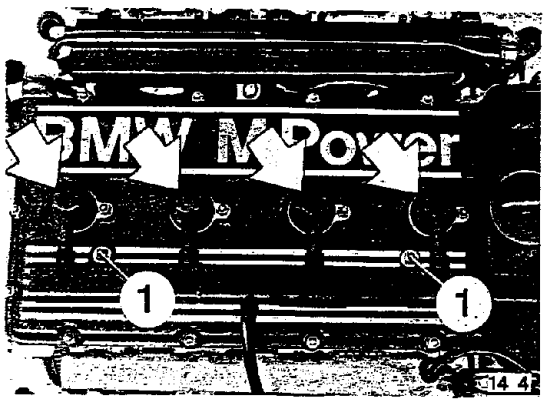
Test Point	Engine Speed (rpm)
9	5000
10	5500
11	6000
12	6250
13	6500
14	6750
15	7000
16	7250
17	7500
18	7750
19	8000
20	8250
21	8500

Limits

Max. oil temperature in sump	125° C
Max. coolant temperature	80° C
Max. coolant pressure	< 1.0 bar
Min. oil pressure	> 4.0 bar
Fuel pressure (nominal value)	5.0 bar
Min. compression pressure	15 bar

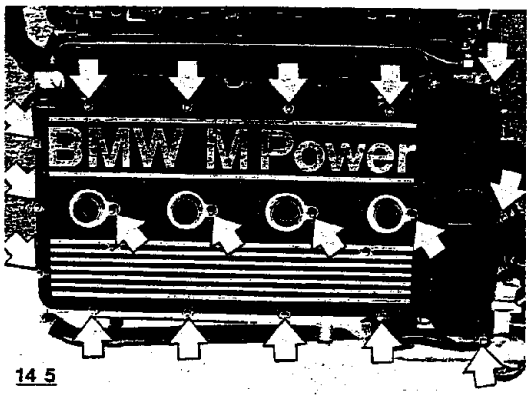
Engines Run Warm:

Engine Speed (rpm)	Engine Torque (Nm)	
2800	up to 60	up to approx. 40° C oil temperature
3000	60 – 80	up to approx. 50° C oil temperature
5000	80 – 120	up to approx. 80° C oil temperature
		Full load possible as from > 80° C oil temperature.



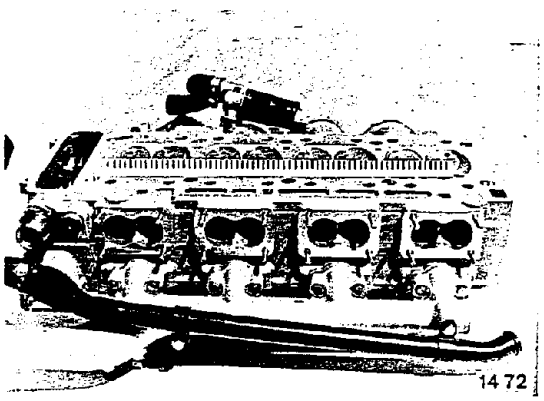
11 12 000 REMOVING CYLINDER HEAD COVER

Unscrew ignition lead tube (1) and pull out spark plug connectors.



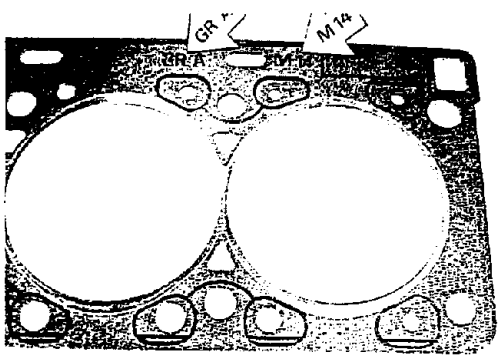
Unscrew cylinder head cover.

Installation:
Replace gaskets.



11 12 101 REPLACING CYLINDER HEAD GASKET

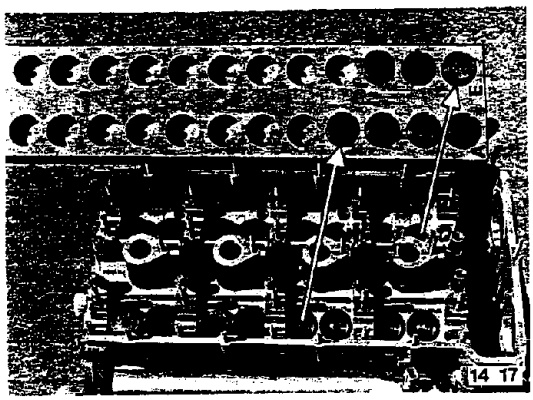
Remove cylinder head.
Clean sealing surfaces on cylinder head and crankcase thoroughly – use a sealant remover and hard wood scraper.
Check the levelness with a straight-edge (commercially available tool).



S14 11 01

Identification of Cylinder Head Gasket:

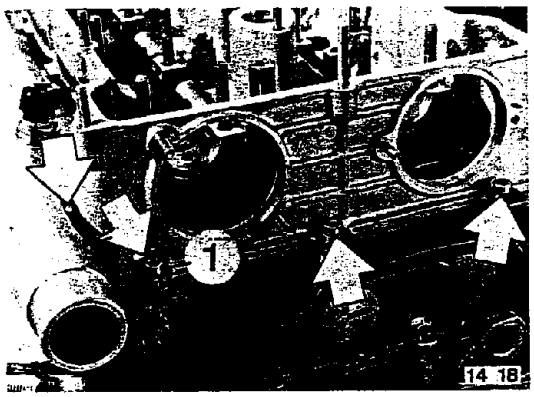
- Inscription "GR.A" between 3rd and 4th cylinders
- Inscription "M 14" at 4th cylinder



11 12 500 REMOVING AND INSTALLING CYLINDER HEAD
– Engine Removed –

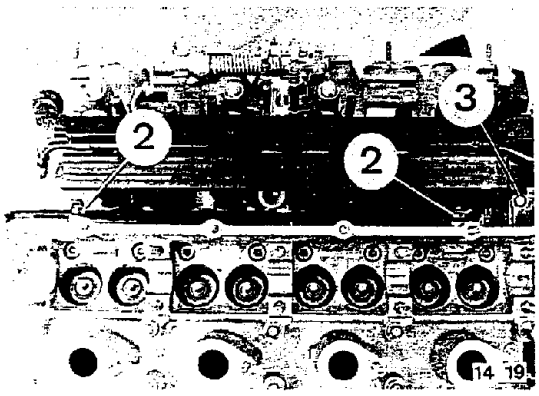
Remove camshaft – see 11 31 000.
Pull out tappets and place in tray, Special Tool 11 3 030.

Installation:
Don't mix up the tappets!

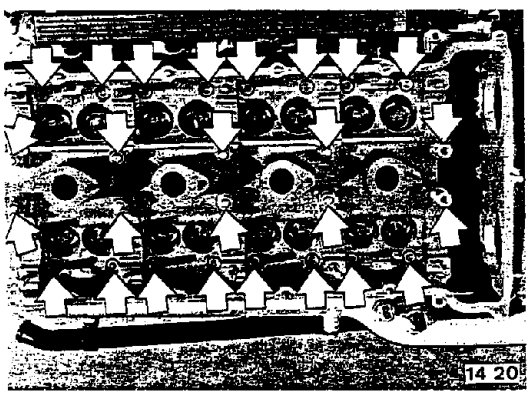


Unscrew bolts.

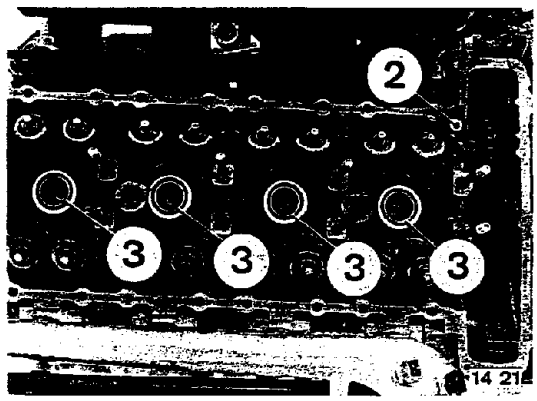
Installation:
The longer bolt (1) is required to hold the shaft for the upper tensioning rail.



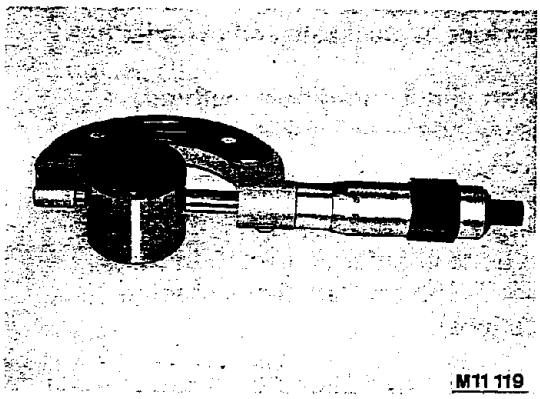
Unscrew pipe (2).
Unscrew bolt (3).



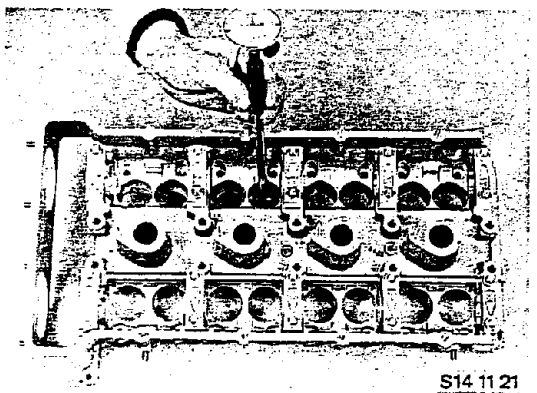
Unscrew the timing case.



Installation:
Timing case on cylinder head:
Replace O-rings (2) in oil bore.
Replace O-rings (3).
Coat sealing surfaces with CAF 1**.
Tighten bolts crosswise from the middle to the outside.
Tightening Torque:
M 7 = 15 ± 1 Nm
M 8 = 21 ± 1 Nm

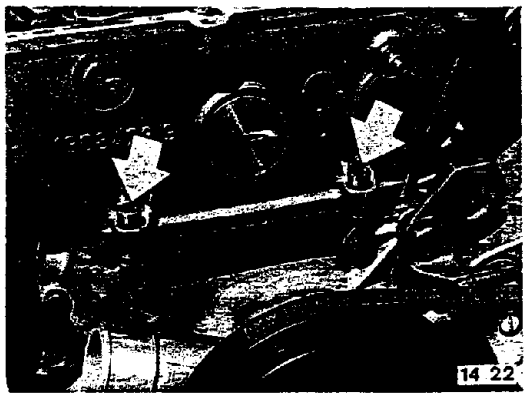


Measuring Tappet Clearance:
Measure the tappet diameter with a micrometer.

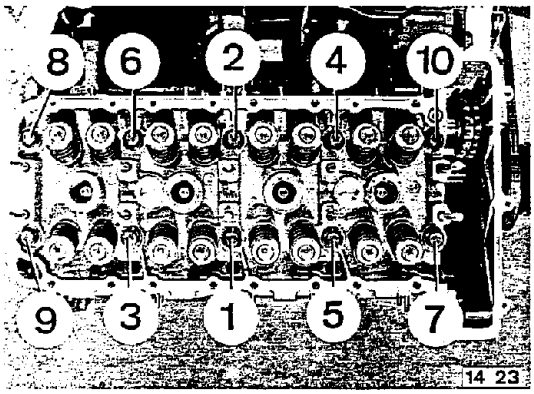


Set the internal calipers to zero on the micrometer with the measured tappet diameter.
Measure the tappet bore.
Compare the measured tappet clearance with the specified clearance (see Technical Data).

** Source of Supply: BMW Motorsport

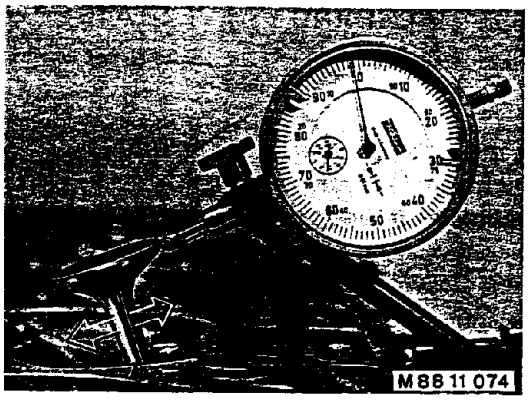


Unscrew bolts.



Unscrew cylinder head bolts in order of 10 to 1 and lift off the cylinder head.

Installation:
Clean cavities in crankcase and cylinder head bolts.
Lubricate cylinder head bolts with oil.
Replace cylinder head gasket – see 11 12 101.
Check arrangement of tensioning rails while mounting the cylinder head.
Tighten bolts in order of 1 to 10 in three steps (see Technical Data for tightening specifications).



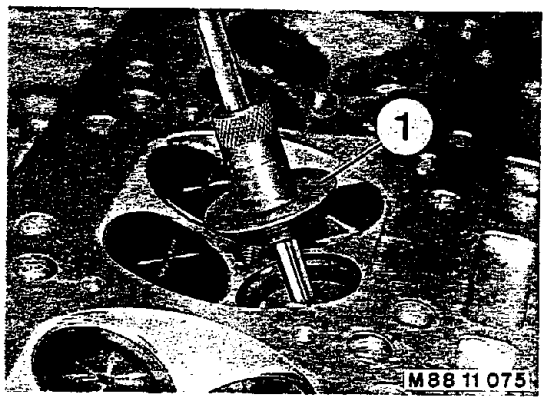
11 12 595 CHECKING VALVE GUIDE FOR WEAR

– Valve Removed –

To measure, install a new valve in such a manner that the end of the valve stem is flush with the valve guide.
Mount the dial gauge and measure the tilt clearance.
Max. permissible tilt clearance:

Intake valve	0.65 mm
Exhaust valve	0.80 mm

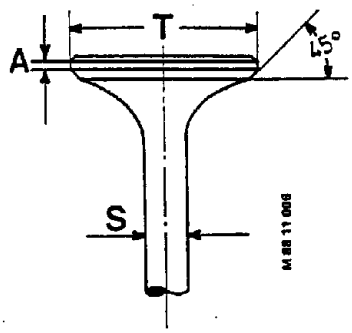
The valve guide must be renewed, if there is excessive play between the valve guide and valve stem.



11 12 600 REAMING OUT VALVE GUIDE

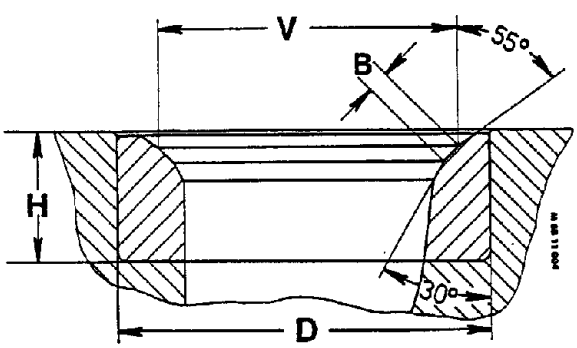
– Valve Removed –

The valve guide must be reamed out when there is insufficient play between the valve guide and valve stem (see Technical Data for radial play between valve stem and valve guide).

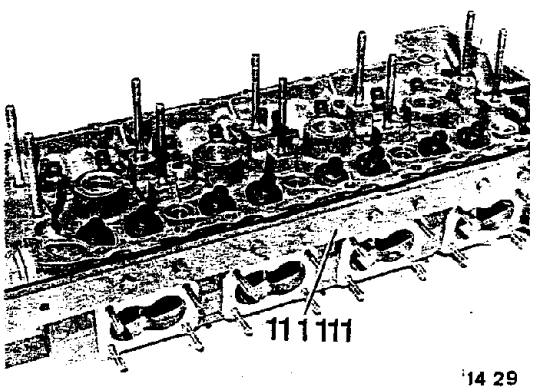


11 12 607 MACHINING VALVE SEATS AND VALVES
— Valves Removed —

A valve must be renewed, if minimum edge thickness "A" cannot be held (see Technical Data for dimensions A, S and T).



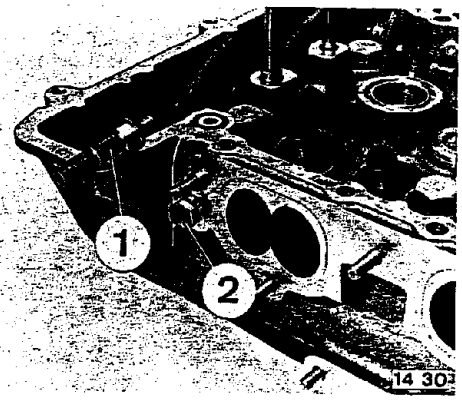
(See Technical Data for dimensions B, D, H and V.)



14 29

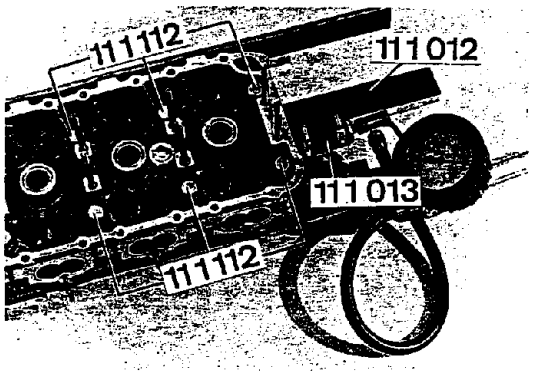
11 12 729 CHECKING CYLINDER HEAD FOR CRACKS IN WATER TEST
– Cyl. Head Disassembled –

Bolt on rails, Special Tool 11 1 111.



14 30

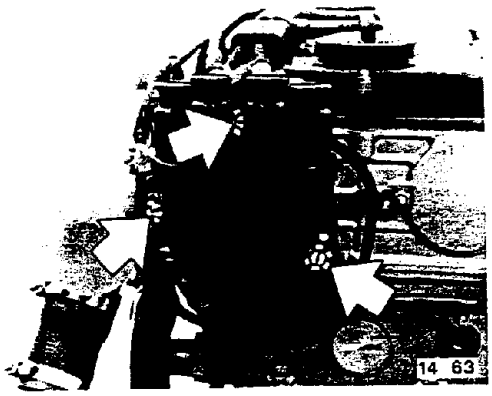
Unscrew connector (1).
Plug the opening with bolt (2) = copper bolt from M 30 exhaust manifold.



14 31

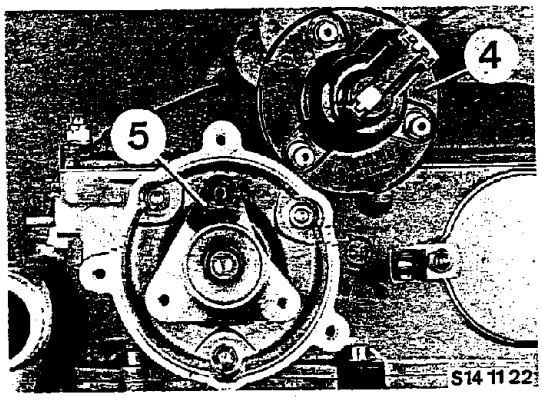
Bolt on rails, Special Tool 11 1 012, with bolts, Special Tool 11 1 112.
Mount the connector, Special Tool 11 1 113.
Fill cylinder head with compressed air (2 bar testing pressure) and check cylinder head for cracks in a water bath.

Note:
Relax the water bath with a liquid detergent if necessary.

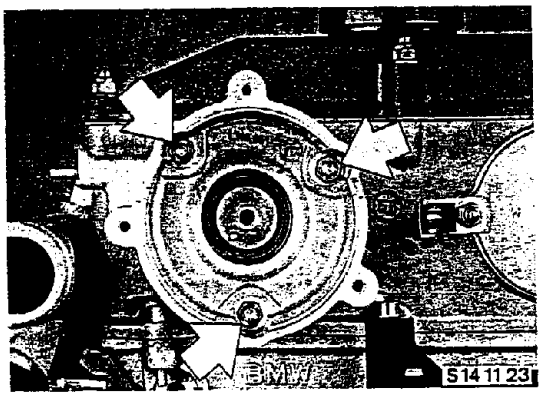


11 14 105 RENEWING RADIAL OIL SEAL IN DISTRIBUTOR HOUSING

Unscrew the ignition lead tube.
Remove the distributor cap.

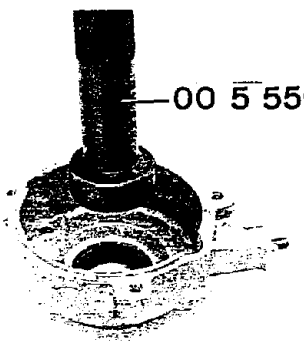


Unscrew distributor rotor (4).
Unscrew adapter (5).



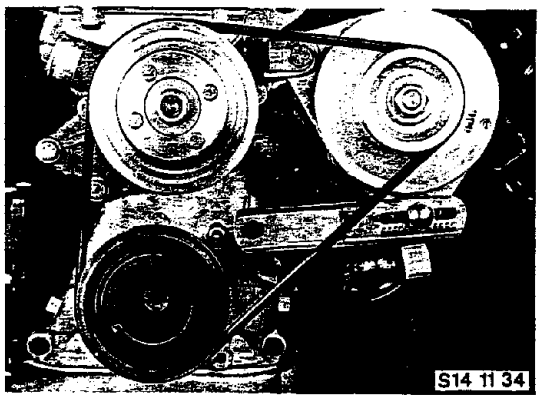
Unscrew distributor housing.

Installation:
Check the O-ring, renewing if necessary.



Lift out the radial oil seal.
Drive in a new radial oil seal flush with Special Tool 00 5 550.
Lubricate the sealing lip with oil.

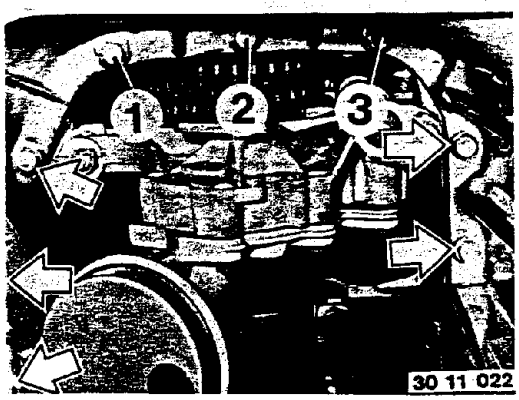
14 61



11 14 120 REMOVING AND INSTALLING/ SEALING LOWER TIMING CASE COVER

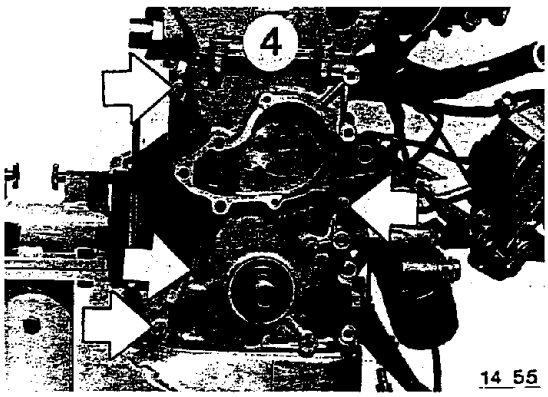
Disconnect the battery ground lead.
Remove the generator.

Installation:
Tighten the drive belt.



Unscrew bolts (1 ... 3).
Loosen the remaining oil pan bolts.

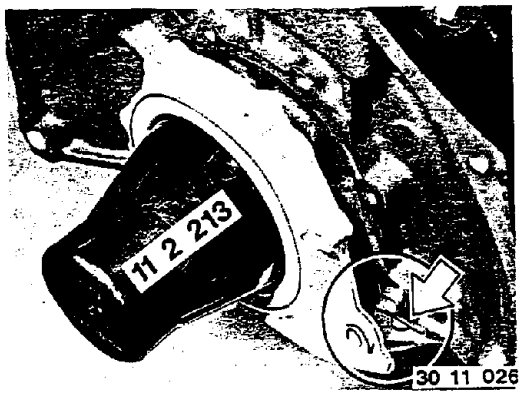
Installation:
Install bolts (1 ... 3) with Loctite.



Remove the water pump – see 11 51 000.
Remove the crankshaft pulley – see 11 21 120.
Remove the chain tensioner piston – see 11 31 090.
Unscrew bolts (4).
Unscrew remaining bolts on the timing case cover and take off the timing case cover.

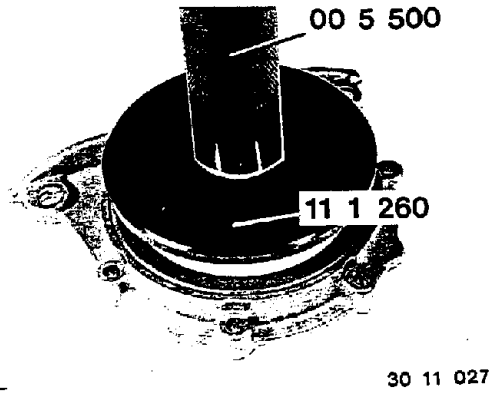
Installation:
Coat the sealing surface and gasket with Hylomar**.

** Source of Supply: HWB



11 14 605 RENEWING RADIAL OIL SEAL IN CLUTCH END COVER
– Transmission Removed –

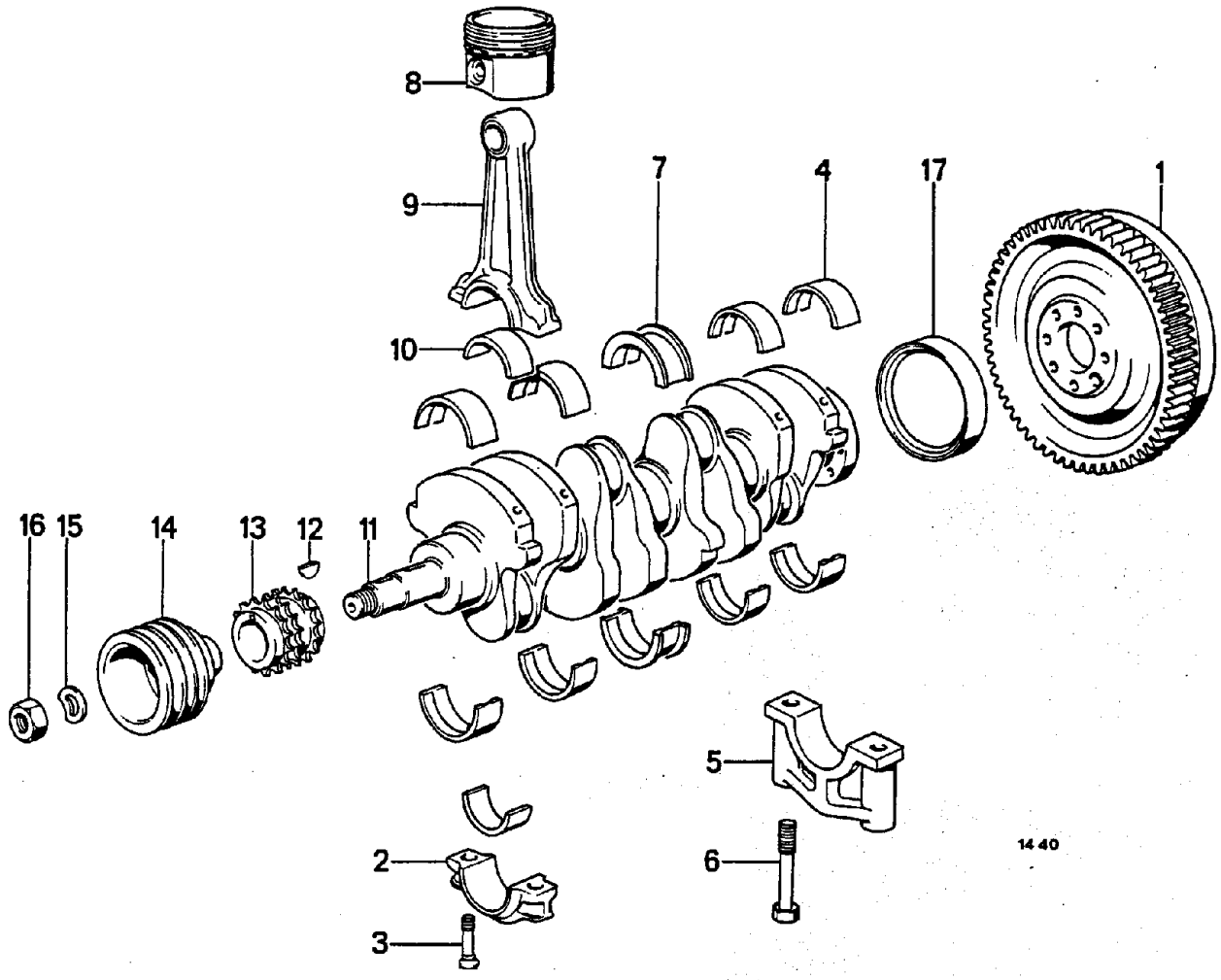
Remove the flywheel – see 11 22 000.
Drain the engine oil.
Loosen the oil pan.
Pry off the gasket carefully with a knife in the area of the end cover/oil pan joint.
Remove the end cover.
Press the radial oil seal out of the end cover.



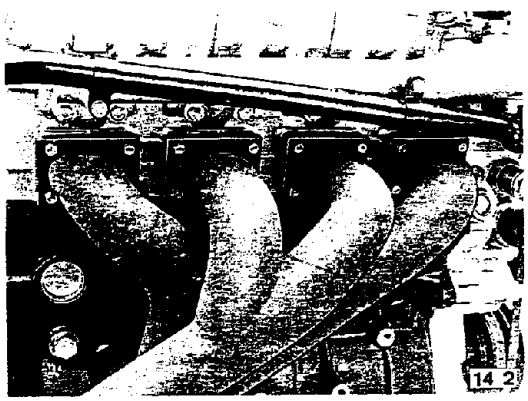
Installation:
Replace and coat the gasket with Hylomar**.
If the oil pan gasket was damaged, remove the oil pan – see 11 13 000.
Coat the end cover/oil pan joint with CAF 1**.
Use Special Tool 11 2 213 to avoid damaging the radial oil seal.
Drive in the radial oil seal with Special Tools 11 1 260 and 00 5 500.
The new radial oil seal must be pressed in flush.
Lubricate the sealing lip with oil.
Fill the engine with oil***.

** Source of Supply: HWB
*** See separate specifications

11 21 . . . Crankshaft Assembly Survey



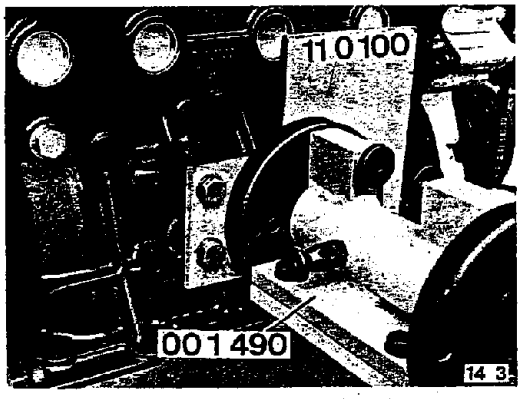
1 Flywheel
2 Conrod bearing cap
3 Conrod bolt
4 Main bearing shell
5 Main bearing cap
6 Main bearing bolt
7 Thrust bearing
8 Piston
9 Connecting rod
10 Conrod bearing shell
11 Crankshaft
12 Woodruff key
13 Sprocket set
14 Vibration damper
15 Washer
16 Nut
17 Radial oil seal



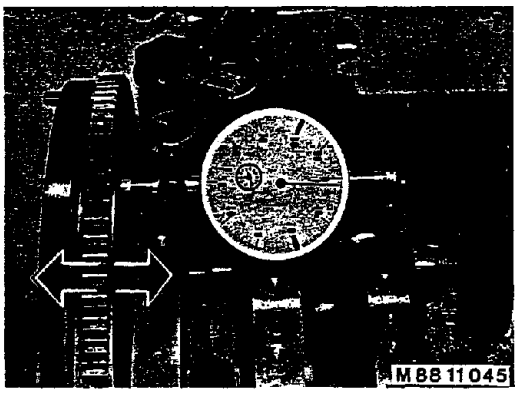
11 21 000 REMOVING AND INSTALLING CRANKSHAFT

Remove the engine – see 11 00 050.
Unscrew the exhaust manifold.

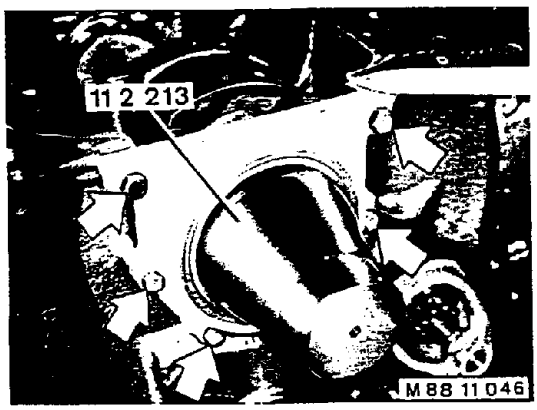
Installation:
Renew the gaskets.
See Technical Data for tightening torque of exhaust manifold on the cylinder head.

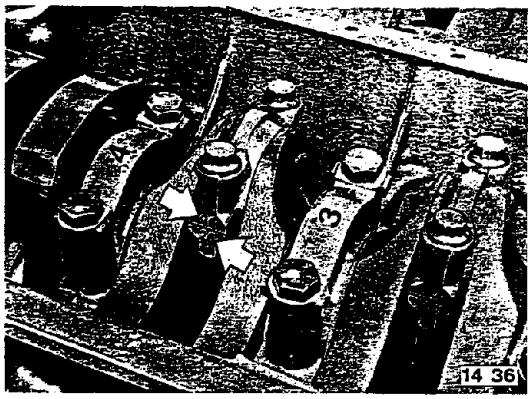


Unscrew the engine mounts.
Mount the crankcase on Special Tool 00 1 490 with help of Special Tool 11 0 100.



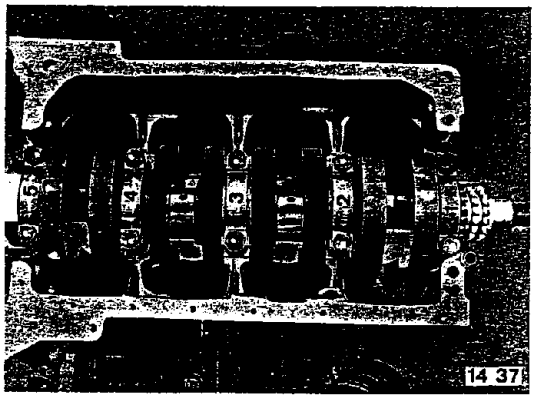
Unscrew the clutch.
Unscrew the cylinder head.
Remove the timing chain – see 11 31 051.
Remove the oil pump – see 11 41 000.
Measure the axial play (see Technical Data) prior to removing the crankshaft.
Check / renew the thrust bearing, if the maximum permissible play is exceeded.
Remove the flywheel – see 11 22 000.
Unscrew the end cover.





Unscrew the conrod bearing caps.

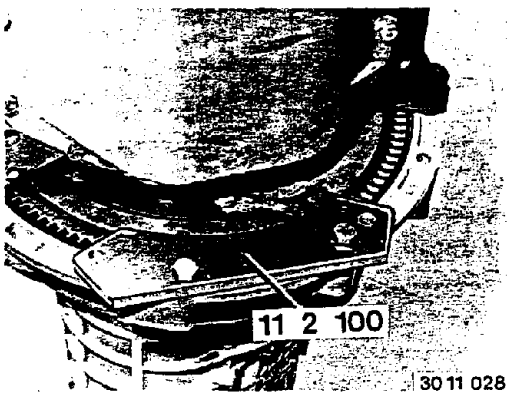
Installation:
Renew the conrod bearing shells and measure the conrod bearing play – see 11 24 571.
The pairing code (0 ... 99) must be the same on the connecting rod and conrod bearing cap.



Unscrew the crankshaft bearing caps and lift out the crankshaft.

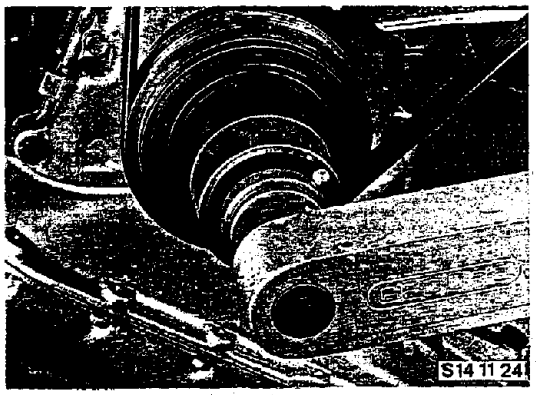
Installation:
Bearing cap no. 1 is on the sprocket end.
Install the bearing shells and check the bearing play – see 11 21 531.

Installation:
Measure the axial play with the crankshaft installed – loosen thrust bearing no. 3 again.
Center the thrust bearing by applying light knocks on the front and rear ends of the crankshaft with a plastic hammer.
Now tighten the thrust bearing cap bolts with the specified tightening torque.
Measure the axial play (see Technical Data).
If the crankcase had been renewed, clean all oil and water bores again thoroughly to eliminate any possible remainders of casting sand.



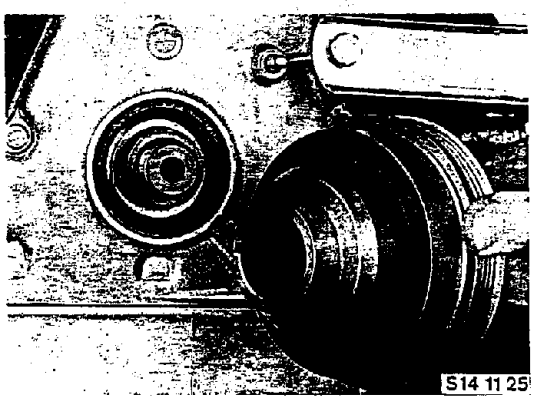
11 21 120 REMOVING AND INSTALLING PULLEY OF CRANKSHAFT

Hold the flywheel with Special Tool 11 2 100.



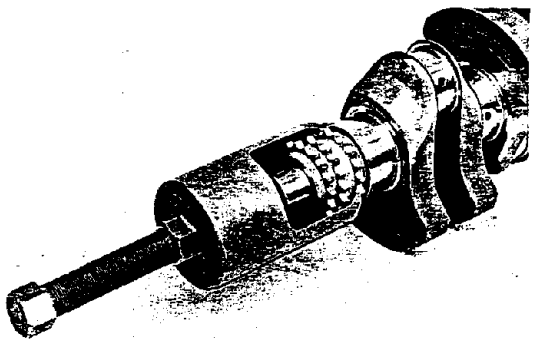
Unscrew nut on the pulley.
Pull off the pulley.

Installation:
Tightening torque*.



Installation:
Check for correct installed position of the woodruff key.

* See Technical Data



S14 11 32

11 21 501 REPLACING CRANKSHAFT
— Crankshaft Removed —

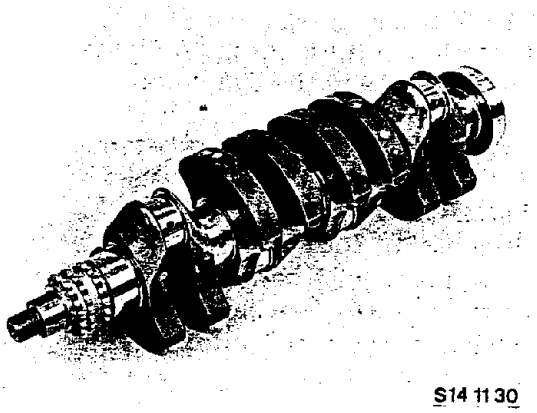
Lift out the woodruff key.
Pull off the sprocket with an extractor**.

Installation:
Heat the sprocket to max. 200° C for installation.

S14 11 31

Main Bearing Journal Tolerances:
double classification red/blue.

Measuring the bearing play is absolutely necessary — see 11 21 531.



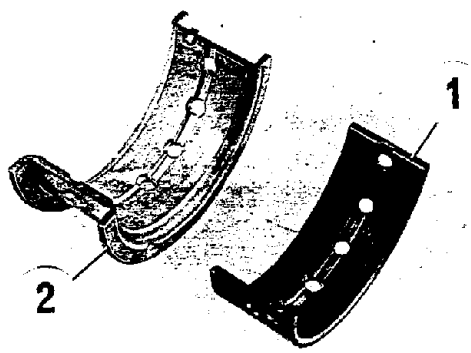
S14 11 30

The crankshaft is surface treated and therefore may only be reground in the factory.

Reground crankshafts are marked with stripes of paint.
Conrod Bearing Journal (A)
1 paint stripe size 1 *
2 paint stripes size 2 *

Main Bearing Journal (B)
1 paint stripe size 1 *
2 paint stripes size 2 *

* See Technical Data
** Source of Supply: HWB



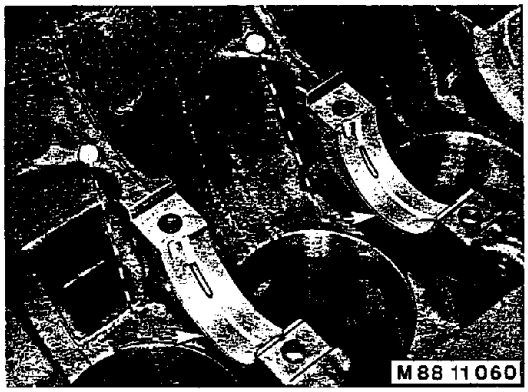
S14 11 02

11 21 531 RENEWING CRANKSHAFT MAIN BEARING SHELLS
– Engine Disassembled –

Double classification: red / blue.

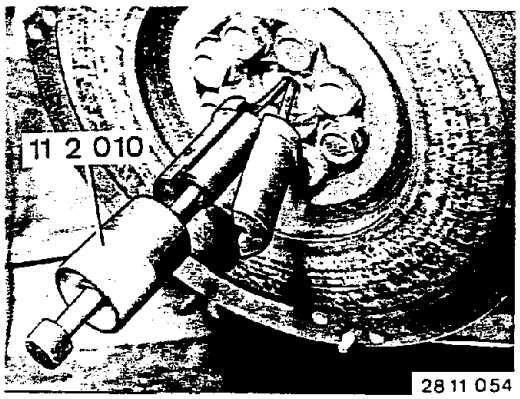
1 = Bearing shell 1–2–4–5
2 = Bearing shell 3 (thrust bearing)

Check ground size of main bearing journals!



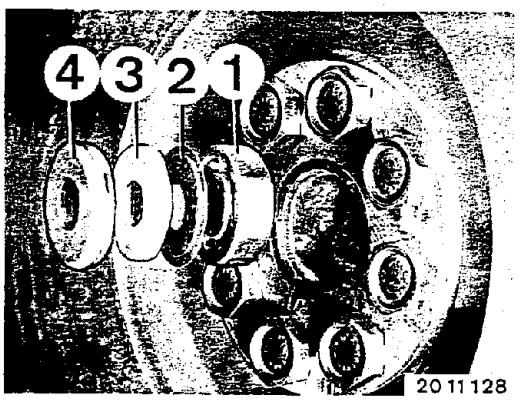
Bearing shells are installed in the crankcase according to the color code of the crankcase.

If the color code has been washed off of the crankcase, install both bearing shells to the crankshaft color code.
If the bearing shells supplied with an exchange crankshaft do not conform with the tolerance size (color code), they must be exchanged in Parts.
Install the crankshaft.
Place bearing shells in the bearing caps in accordance with the color code of the crankshaft.
Bolt down the bearing caps with bearing shells (but without the crankshaft) on the crankcase according to the tightening specifications.
Measure the bearing diameter and determine the radial play with the measured values of the crankshaft journals (see test sheet "main bearings").
The bearing play can be corrected by installing new bearing shells, bearing shells with a different machined size or a different color code (see Technical Data).

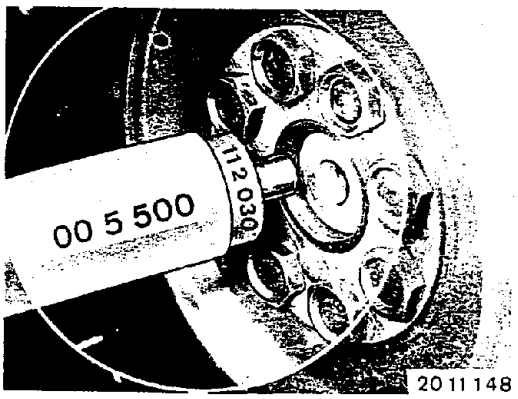


11 21 571 REPLACING PILOT BEARING IN CRANKSHAFT

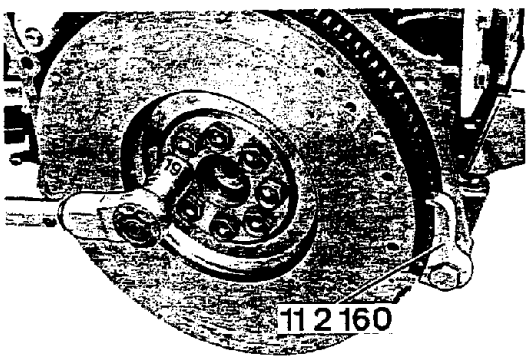
Remove the clutch.
Pull out the ball bearing with Special Tool 11 2 010.



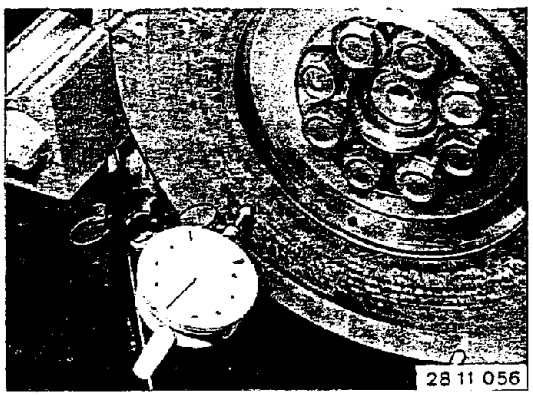
Installed Order:
Insert ball bearing (1), cover (2), felt ring (3) and capsule (4) with Loctite No. 273.
Cover (2) is inserted with the embossment facing out.



Lubricate the ball bearing with grease and drive it in with Special Tools 11 2 030 and 00 5 500.



14 32



11 22 000 REMOVING AND INSTALLING FLYWHEEL

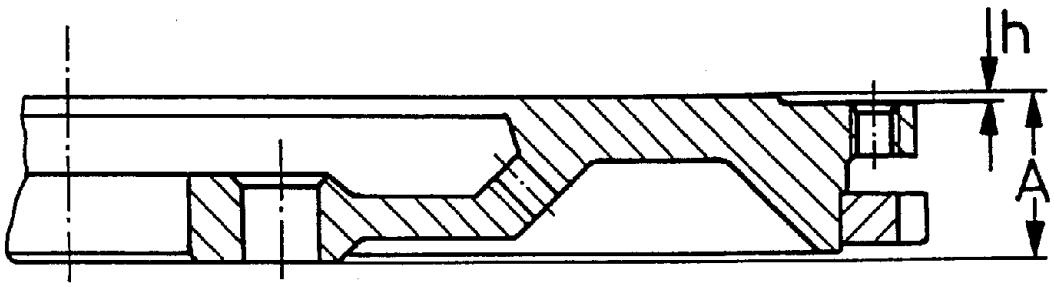
Remove the clutch.
Hold the flywheel with Special Tool 11 2 160.
Unscrew bolts and take off the flywheel.

Installation:
Clean the tapped bores.
Replace and install the expansion bolts with Loctite No. 273**.
Tightening torque: see Technical Data.

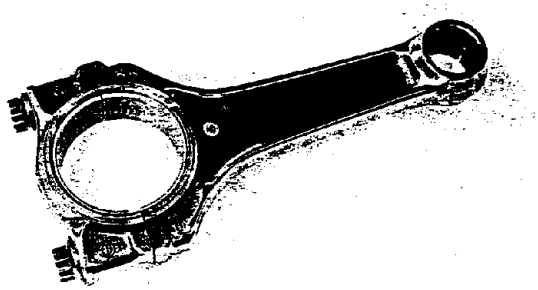
Check the flywheel for axial runout.
Max. permissible axial runout:
see Technical Data.

The friction surface may be machined to minimum distance A = 29.1 – 0.1 mm.
If machining the friction surfaces reduces distance "h" to zero, the flange surface must be machined.

M 88 11 072



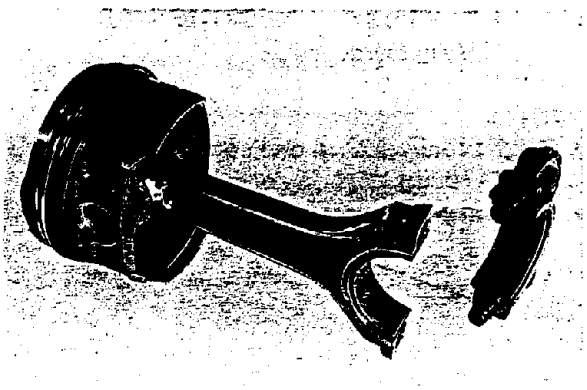
** Source of Supply: HWB



S14 11 03

11 24 521 RENEWING CONNECTING ROD
— Piston Removed —

Only install connecting rods within the permissible weight tolerances in one engine, see Technical Data (paint dots on connecting rods are of no importance).



S14 11 04

11 24 571 REPLACING CONNECTING ROD BEARING SHELLS
— Engine Disassembled —

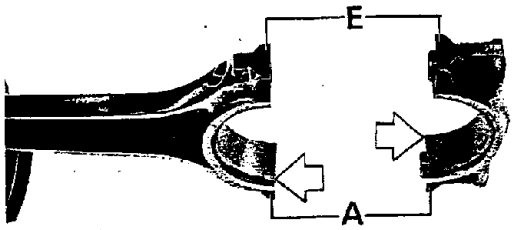
Place bearing shells in the connecting rods and bearing caps.

Check the machined size (conrod bearing diameter).
Bolt down connecting rod bearing caps with bearing shells (in removed state) in accordance with the tightening specifications.
Measure the bearing diameter and determine the radial play with the measured values of the crankshaft journals (see test sheet "conrod bearings").
The bearing play can be corrected by installing new bearing shells, bearing shells with a different machined size or different color code.
Use new conrod bearing cap bolts for final installation.
Tightening torque of conrod bearing cap bolts: see Technical Data.

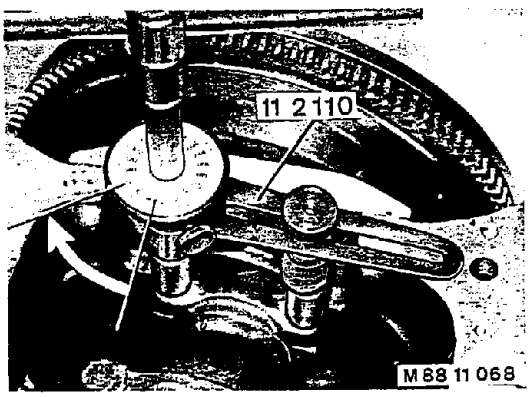
Installation:
Pairing codes and grooves of bearing shells must be on the exhaust side.

A = Exhaust

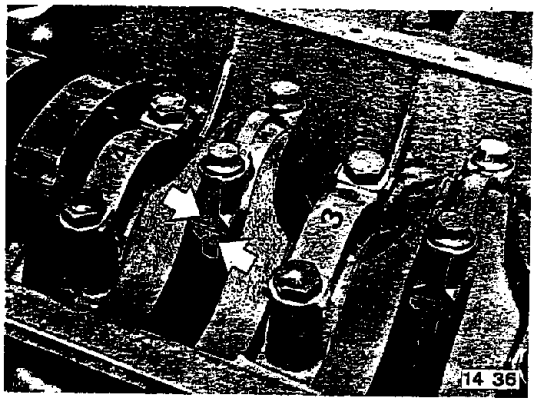
E = Intake



S14 11 05



Tightening connecting rod bearing cap bolts, see Technical Data.

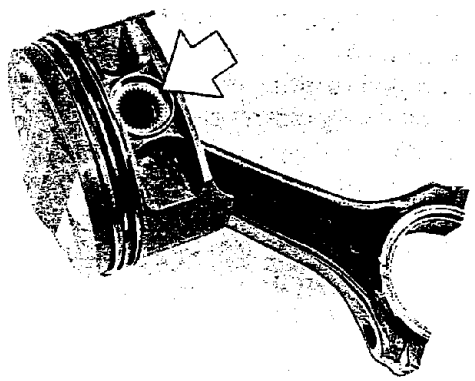


11 25 000 REMOVING AND INSTALLING PISTON

– Engine Removed –

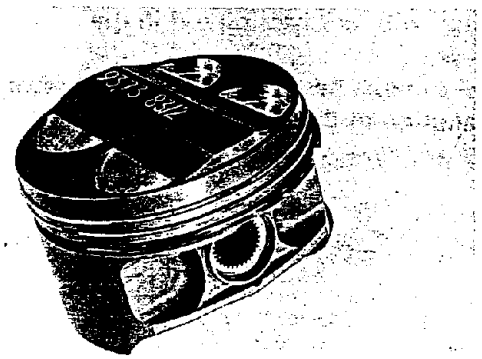
Take off the cylinder head.
Remove the oil pump – see 11 41 000.
Remove the conrod bearing cap and press out the piston with connecting rod upwards.

Installation:
Install the connecting rod – see 11 24 571.



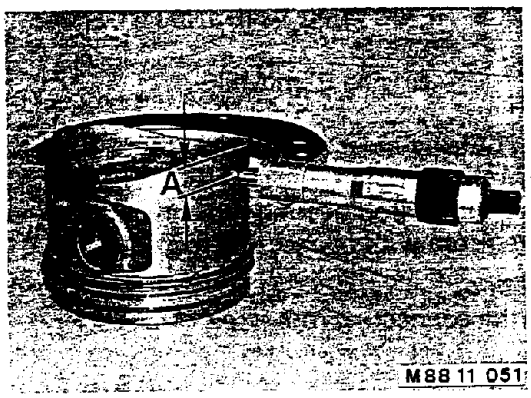
S14 11 06

Installation:
Screw in the piston pin retainer with Loctite No. 648 to the tightening specifications (see Technical Data) and lock by punching.
Important!
Check for correct play between the piston pin and piston or connecting rod bore (see test sheet and Technical Data).

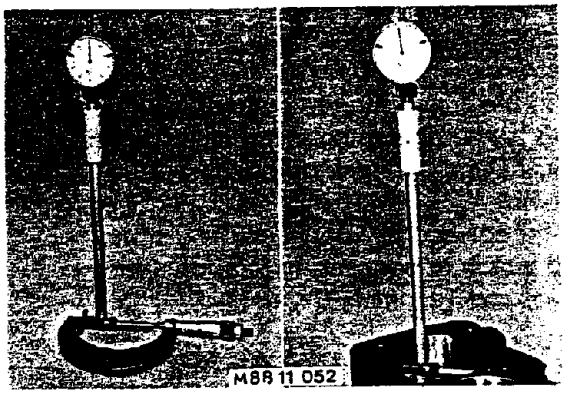


S14 11 07

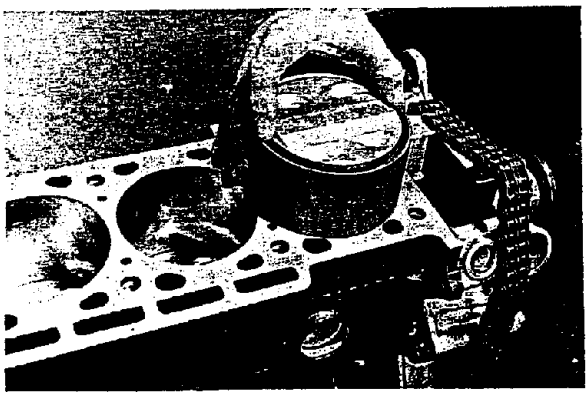
Only install pistons of the same make and same weight group (see Technical Data).
Identification: "83/2" or "83/3".



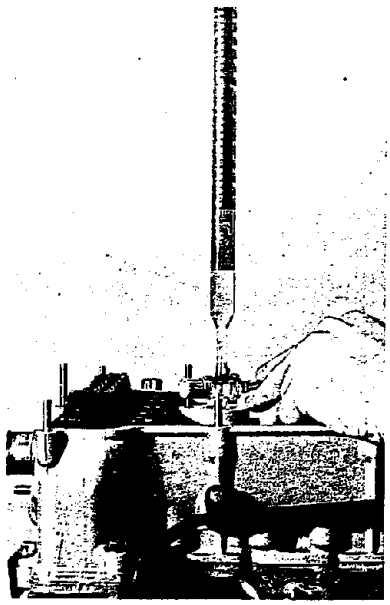
Measuring Piston Running Clearance:
Measure the piston diameter at checkpoint "A" with an external micrometer (see Technical Data and test sheet).



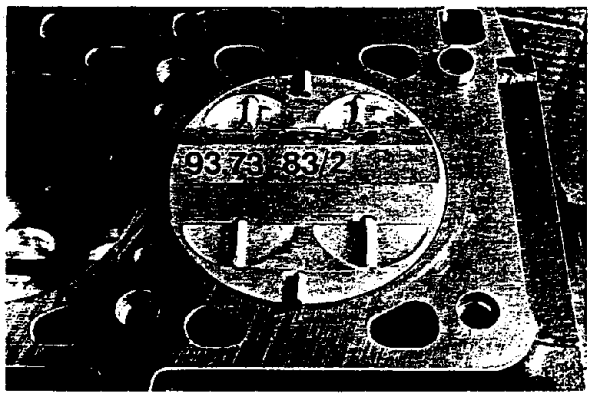
Set the internal calipers on the micrometer to zero with the measured piston diameter. Measure the cylinder bore at the bottom, middle and top with the internal micrometer in forward and rotating directions.
Specified piston running clearance:
see Technical Data.


S14 11 08

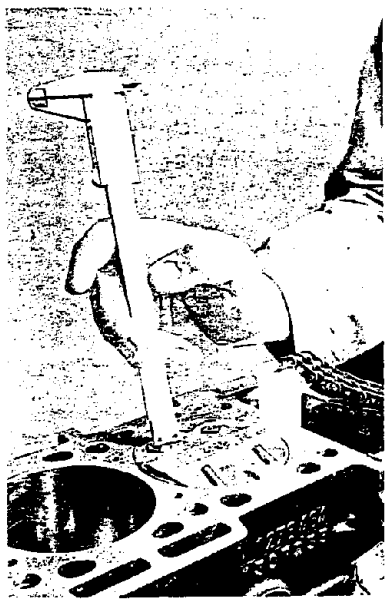
A pulling-in sleeve must be used to install the piston with connecting rod in the crankcase.
The piston must be lubricated with oil prior to installation in the crankcase.



S14 11 09



S14 11 10



S14 11 11

Measuring Volume of Combustion Chamber (Compression Ratio)

The engine must be vertical for volumetric measurements. The compression volume including the spark plug thread volume is measured. The measuring fluid is a mixture of oil and petrol.
To measure (piston in top dead centre position), pour in fluid until the level reaches the upper end of the spark plug threads. The thread volume (1.3 cc) must be substracted from the volume measured in liters for determination of the compression volume V_C. The compression ratio ε can be calculated with the following formula.

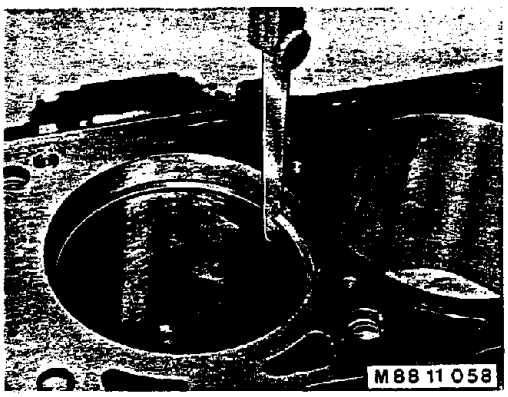
$$\varepsilon = \frac{V_H + V_C}{V_C}$$

(V_H = 2332 cc)

Machine the piston crown, if the compression ratio is too high.

Checking Valve Clearance:
Apply four plastiline strips in the valve pockets and two plastiline strips in the area of the quenching surfaces on the piston.
Rub in the plastiline with oil.
Install the complete cylinder head with cylinder head gasket and adjust the camshafts.
Crank the engine two complete revolutions.
Take off the cylinder head and measure the height of the plastiline strips with a sliding calipers.
Minimum distance between pistons and valves or minimum quench gap height: see Technical Data.

Machine the valve pockets, if necessary.
Only clamp pistons in a holding fixture approved for this purpose, after removal of the piston rings.

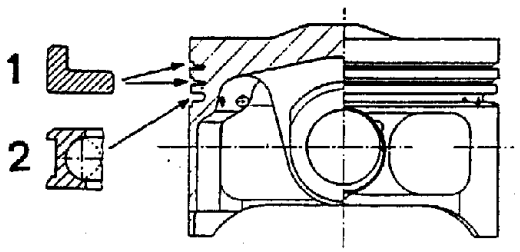


11 25 651 FITTING PISTON WITH PISTON RINGS

Measure the end clearance*, adjusting if necessary.

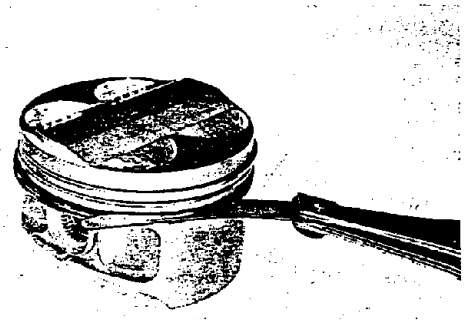
S14 11 12

Install the piston rings with a piston ring compressing pliers.



S 14 11 20

Installation:
Install the piston rings with "TOP" facing the piston crown.
1 = L-ring (plain compression ring)
2 = Double-bevelled oil control ring with hose lined spring

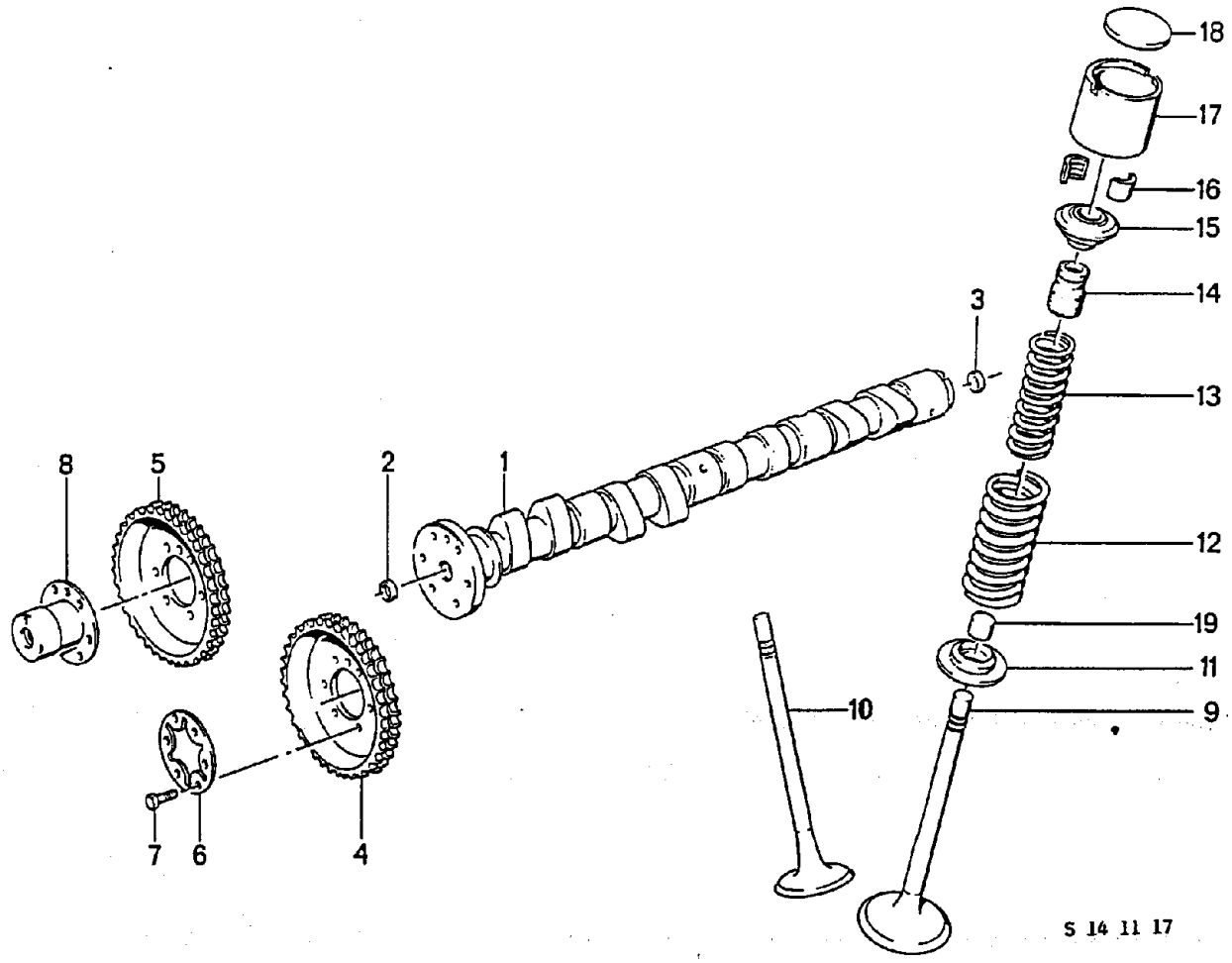


S14 11 13

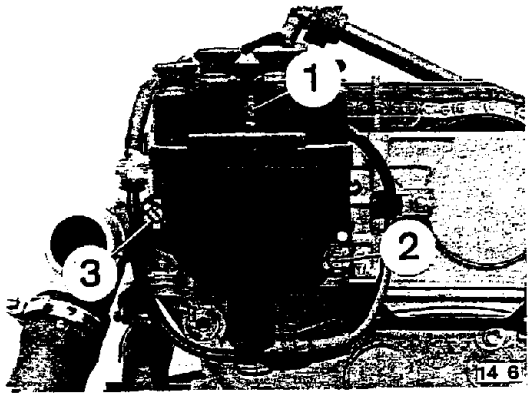
Measure the side clearance*.

* See Technical Data

11 31 . . . Valve Timing Survey

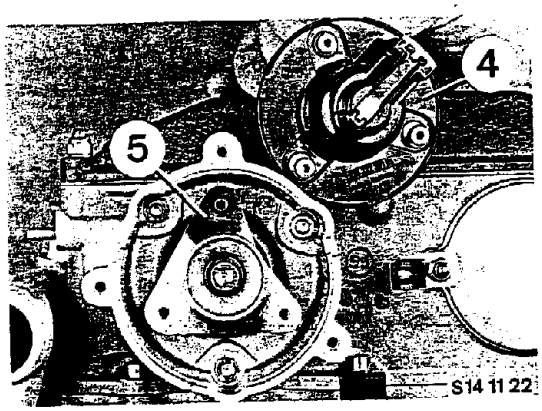


1 Camshaft
2 Plug for camshaft oil bore
3 Rear camshaft plug
4 Sprocket "E" - intake
5 Sprocket "A" - exhaust
6 Lockplate
7 Hexagon head bolt
8 Adapter for distributor rotor
9 Intake valve (37 mm dia.)
10 Exhaust valve (32 mm dia.)
11 Spring retainer, lower
12 Valve spring, outer
13 Valve spring, inner
14 Valve stem seal
15 Spring retainer, upper
16 Valve collet
17 Tappet
18 Shims from 3.00 to 4.25 mm in steps of 0.05 mm
19 Valve caps for axial compensation; only for intake valves!



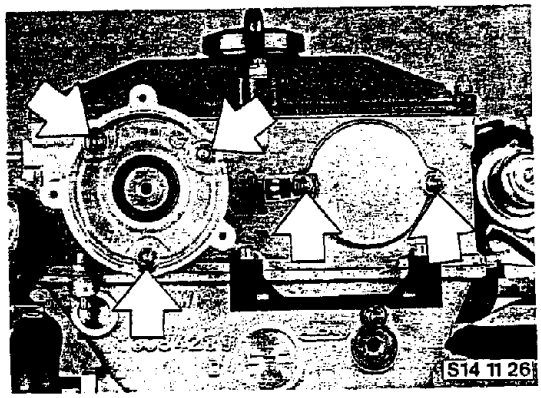
11 31 000 REMOVING AND INSTALLING CAMSHAFT

Removing Camshafts:
Remove the cylinder head cover – see 11 12 000.
Unscrew bolts (1 ... 3) and take off the distributor cap.



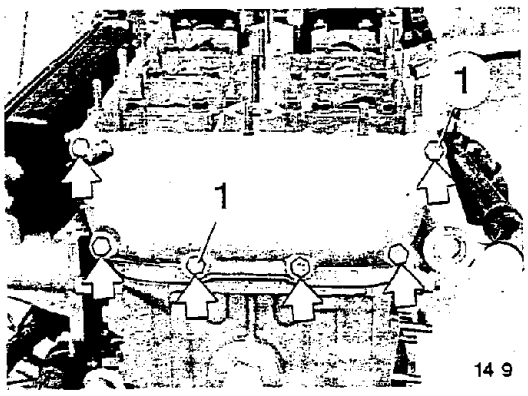
Unscrew distributor rotor (4).
Unscrew adapter (5).

Installation:
Tightening torque: 23 ± 1 Nm.



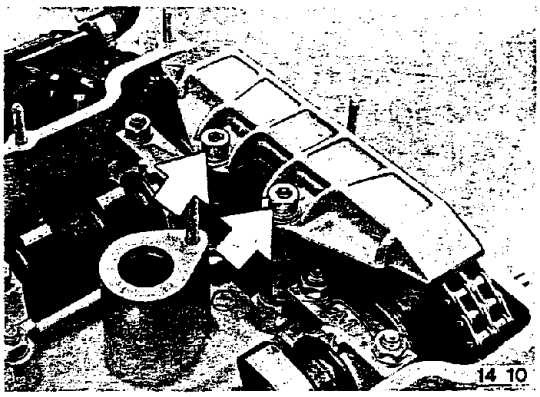
Remove the distributor housing and plug.

Installation:
Check the O-rings, replacing if necessary.

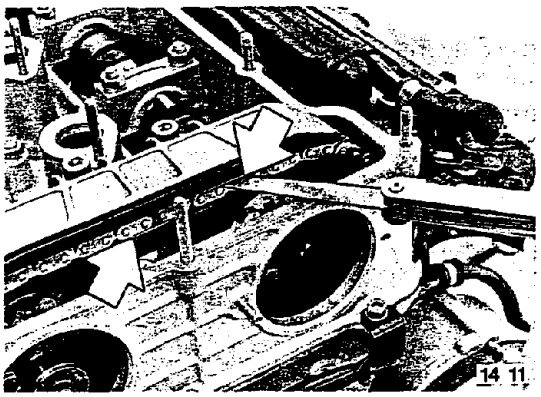


Unscrew the end cover.

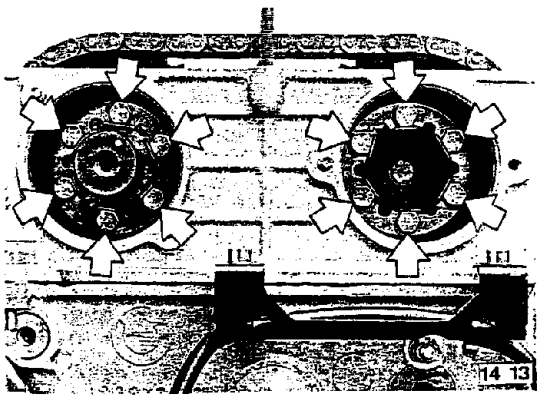
Installation:
Replace the gasket.
Use longer bolts in the bores fitted with a dowel sleeve (1).



Unscrew the sliding rails.

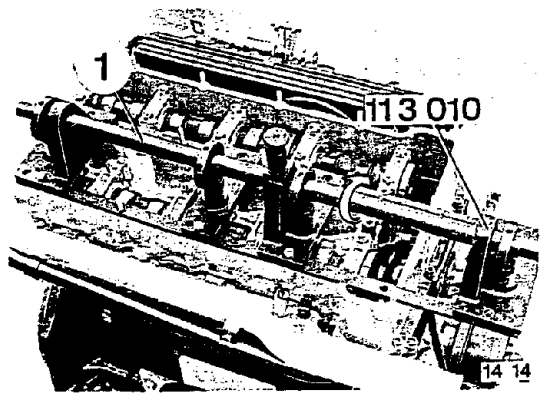


Installation:
Center the sliding rails with a feeler gauge blade.

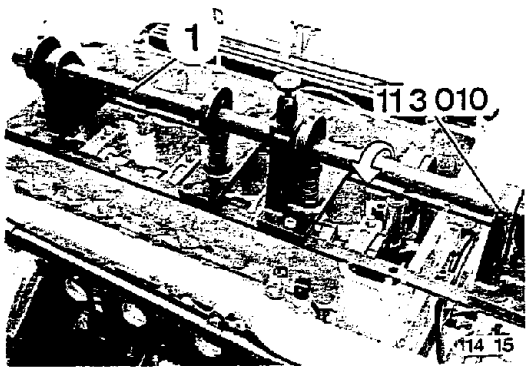


Remove the chain tensioner – see 11 31 090.
Open the lockplates and unscrew the sprockets.

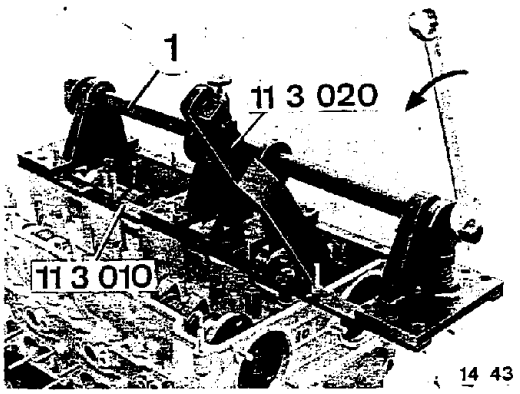
Installation:
Tightening torque = 10 ± 1 Nm.



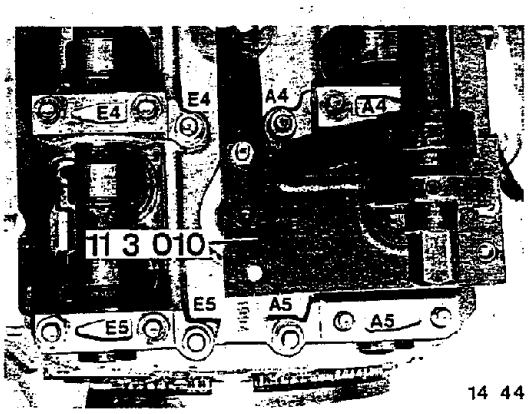
Mount Special Tool 11 3 010 on the timing case.
Turn shaft (1) up to the lock – the camshaft will be held down for removal of the bearing caps.
Unscrew the camshaft bearing caps.



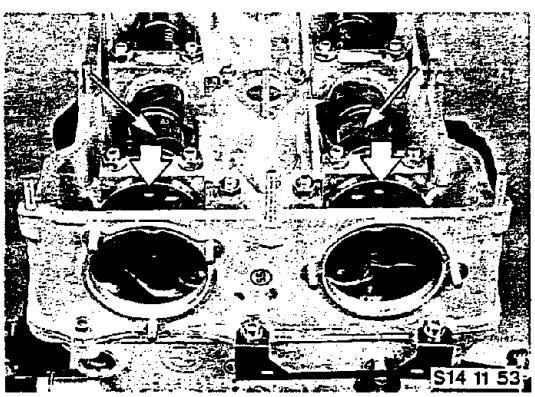
Unlock the lock and take tension off of the camshaft.
Remove Special Tool 11 3 010.
Remove the camshafts.



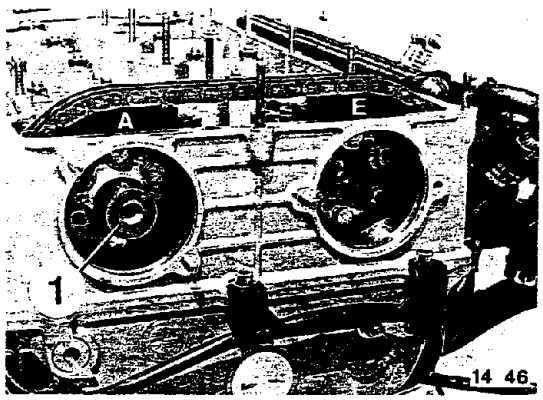
Installing Camshafts:
Insert the camshaft and bearing caps.
Bolt Special Tool 11 3 010 on the timing case.
Hold the camshaft in TDC position* with Special Tool 11 3 020 and turn shaft (1) up to the lock.



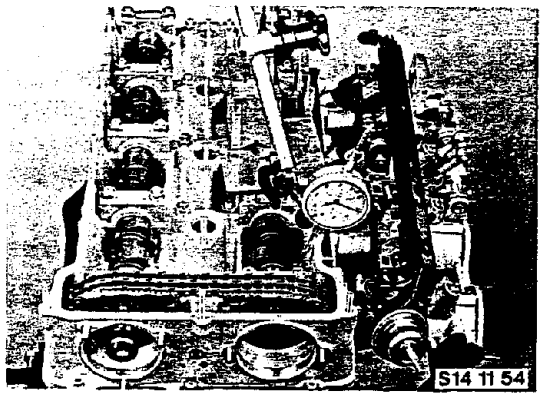
Bolt camshaft bearing caps according to the lettering on the timing case.
Tightening torque: see Technical Data.



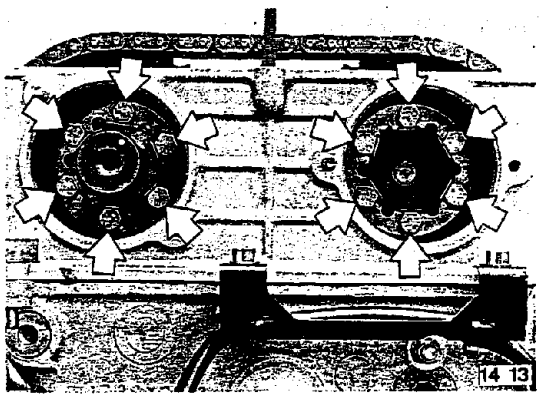
* Checking TDC Position of Camshafts:
- Crankshaft in TDC.
- The intake cams and exhaust cams of cylinder no. 1 face in approx. 45°, whereby one each tapped bore for the sprockets are precisely at the top dead center point.



Tighten the timing chain against the turning direction of the engine and first place it on the intake end sprocket "E".
Install the lockplate and mount the sprocket.
Tightening torque = 10 ± 1 Nm.

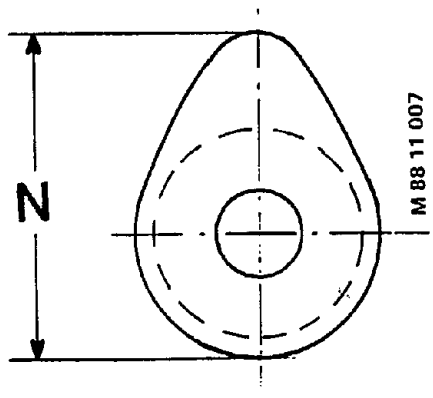


Installation:
Install the exhaust end sprocket "A".
Insert adapter (1).
Install the lockplate and mount the sprocket.
Tightening torque = 10 ± 1 Nm.
Install the chain tensioner — see 11 31 090.
Crank the engine once in turning direction and adjust the valve clearance — see 11 34 004.
Adjust the timing (spread):
see Technical Data (dial gauge on edge of bucket tappet).



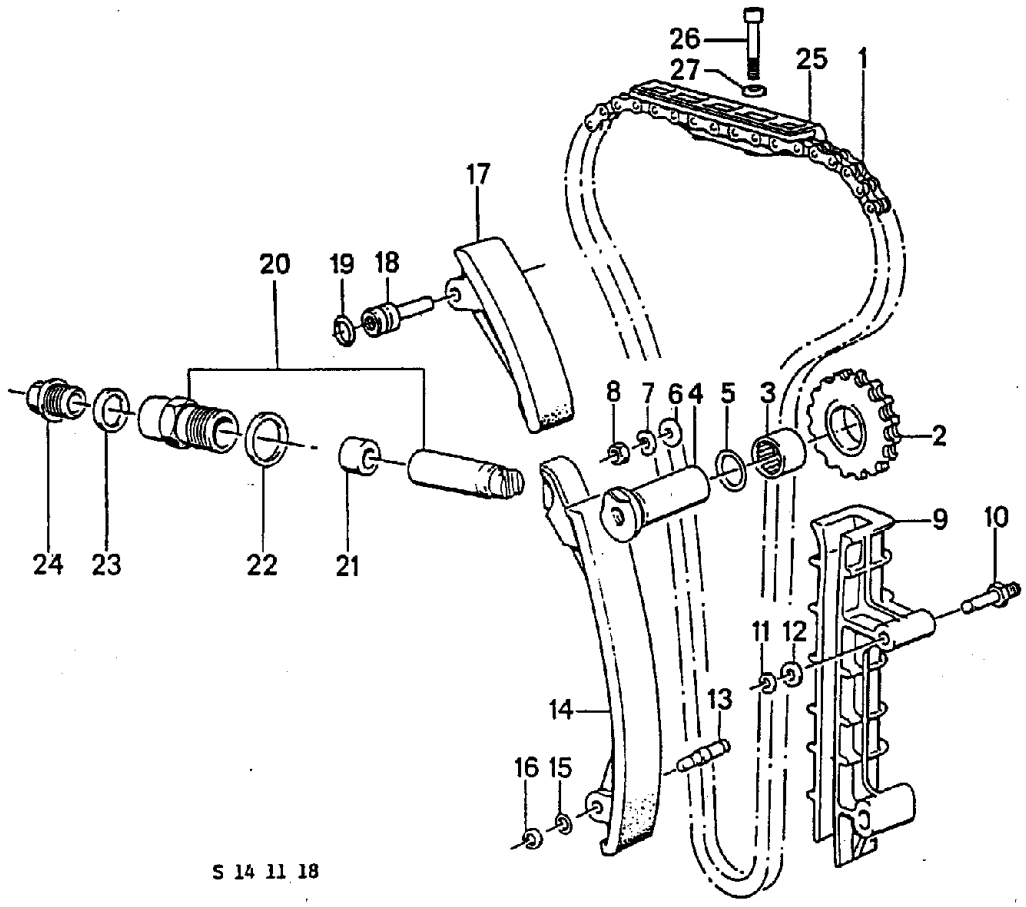
Lock the sprocket mounting bolts with a lockplate.

Mount the upper guide rail.

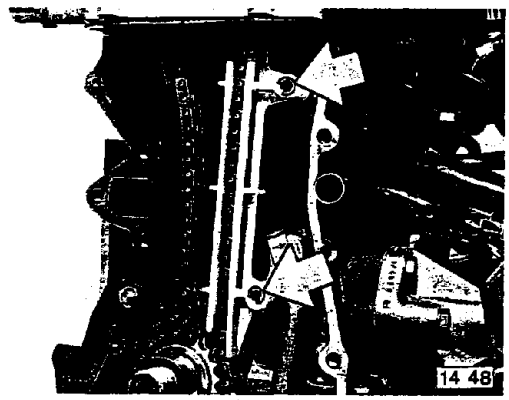


Cam distance "N" (see Technical Data).

11 31 . . . Timing Chain Survey

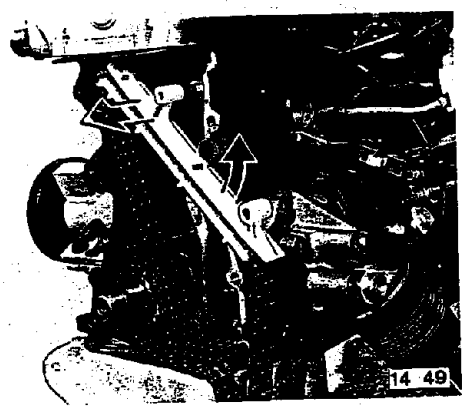


1 Timing chain (double-row)
2 Sprocket (guide wheel)
3 Needle sleeve
4 Shaft
5 O-ring
6 Washer
7 Spring washer
8 Hexagon nut
9 Sliding rail
10 Bearing shaft
11 Lock washer
12 Washer
13 Bearing shaft
14 Tensioning rail, lower (head removed)
15 Lock washer
16 Circlip
17 Tensioning rail, upper (timing chain removed)
18 Bearing shaft
19 O-ring
20 Chain tensioner piston and cylinder (matched)
21 Spacer (in steps of 1 mm)
22 Seal
23 Seal
24 Plug
25 Sliding rail
26 Bolt
27 Washer

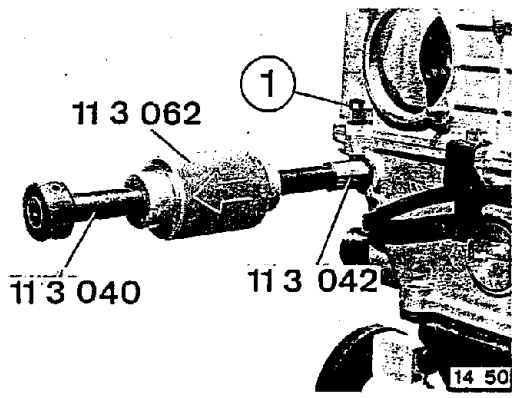


11 31 051 RENEWING TIMING CHAIN

Remove the lower timing case cover.
Unscrew sprockets on the camshafts – see 11 31 000.
Take off lock washers.



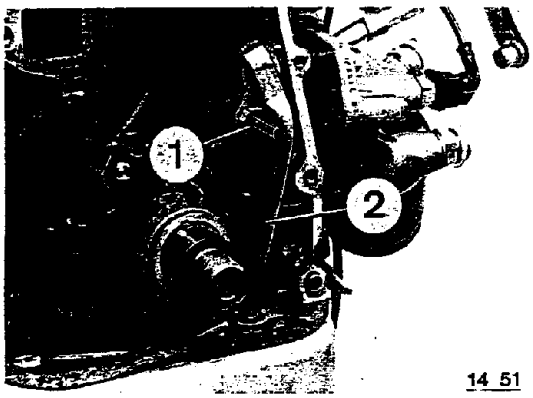
Pull the sliding rail forward and swing it aside.
Remove the timing chain.



11 31 . . . REMOVING AND INSTALLING UPPER TENSIONING RAIL

Remove the timing chain – see 11 31 051.
Unscrew bolt (1) partially.
Screw on Special Tool 11 3 040 with adapter 11 3 042 and impact sleeve 11 3 062.
Knock out the shaft.

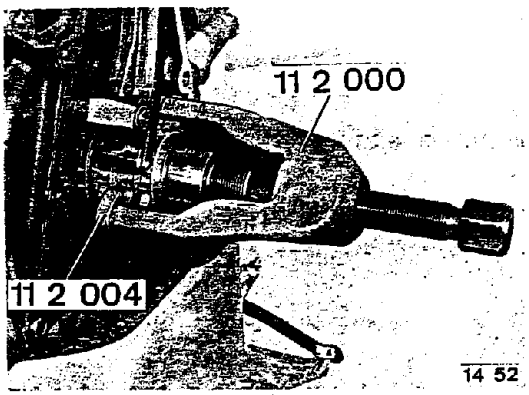
Installation:
Check the O-ring, replacing if necessary.
Check the arrangement of tensioning rails!



11 31 061 RENEWING SPROCKET SET
— Timing Chain Removed —

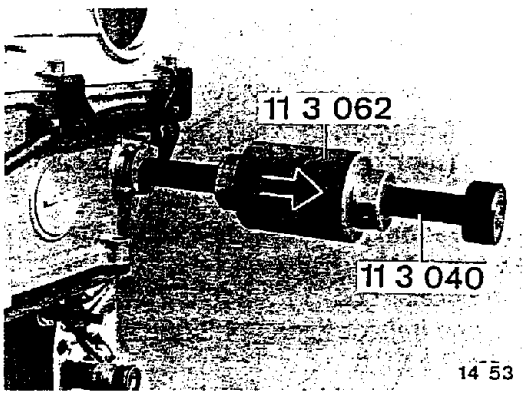
Remove the oil pump drive chain — see 11 41 151.
Unscrew bearing shaft (1) and take off oil pipe (2).

Installation:
Check the O-rings, replacing if necessary.

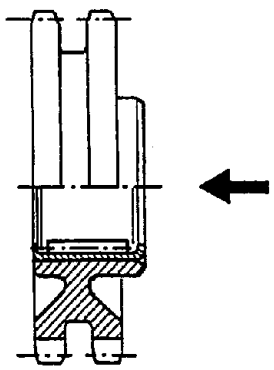


Pull off the sprocket with Special Tools 11 2 000 and 11 2 004.

Installation:
Heat the sprocket to max. 200° C for installation.
Tighten the oil pump drive chain — see 11 41 000.

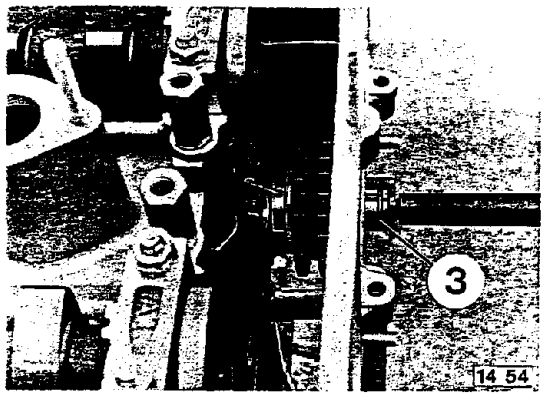


Mount Special Tools 11 3 040 and 11 3 062 on the shaft of the sprocket guide wheel.
Knock out the shaft.



Installation:
Check the needle sleeve in the sprocket, replacing if necessary.
Press in the needle sleeve in forward direction.

14 1

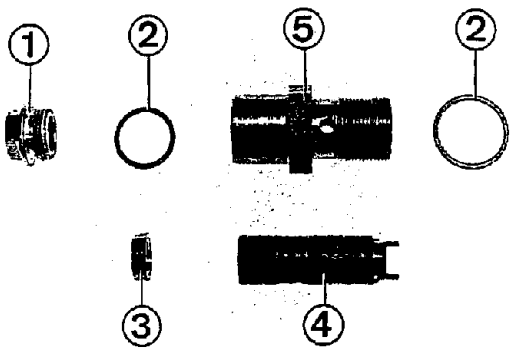


Installation:
Replace O-ring (3).
Drive in the shaft — with bore facing up — partially.
Slide on the sprocket guide wheel.
Drive in the shaft against the stop.

11 31 090 REMOVING AND INSTALLING CHAIN TENSIONER PISTON

Unscrew plug (1).
Remove spacer (3) and piston (4).

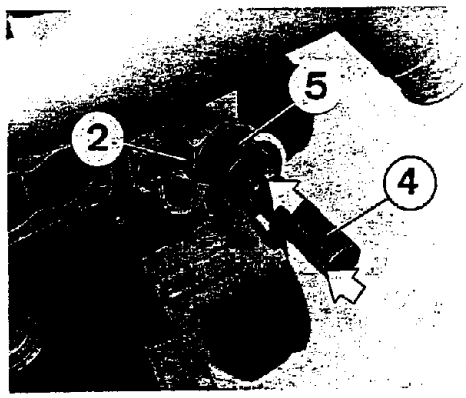
Installation:
Replace seal (2).



S14 11 14

Chain Tensioner Components:
(1) Plug
(2) Seal
(3) Spacer (in steps of 1 mm)
(4) Piston
(5) Cylinder

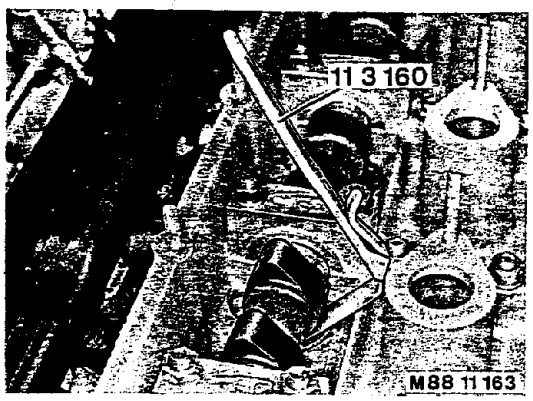
Installation:
Tightening torque for plug (1) and cylinder (5): see Technical Data.



14 78

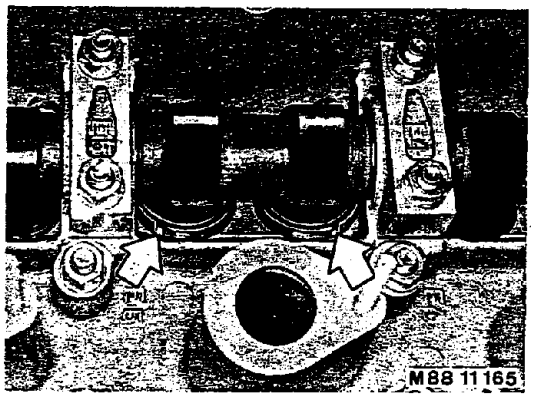
Piston (4) and cylinder (5) are matched* – identification code 1 or 2.
Only install parts with the same pairing number.
Install cylinder with groove facing back (as seen in forward direction) and piston with the groove facing up.
Guide the piston opening into the tensioning rail.

* See Technical Data

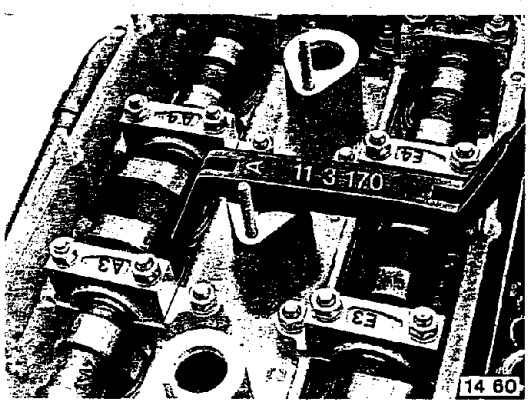


11 34 004 ADJUSTING VALVE CLEARANCE

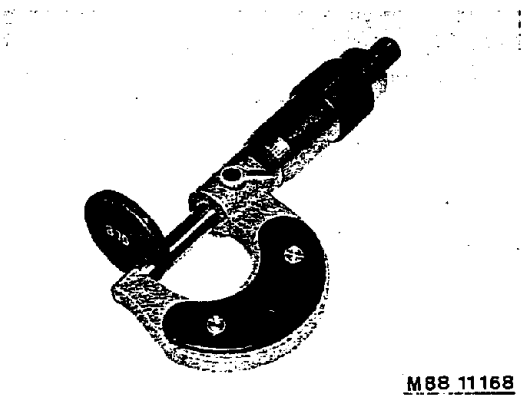
Remove the cylinder head cover – see 11 12 000.
Measure the valve clearance at the cams facing up.
Compare the measured valve clearance with the specified valve clearance (see Technical Data).



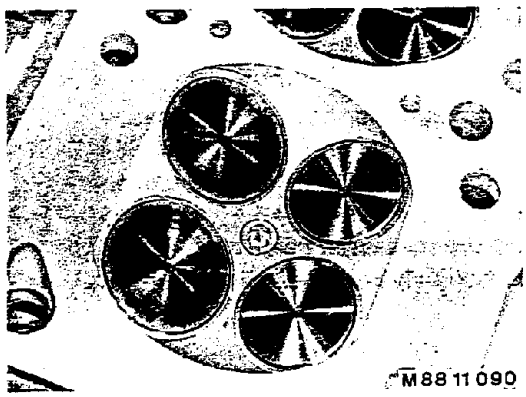
If the measured valve clearance is not within specified valve clearance tolerances:
Turn the opening of the tappet as shown in the picture.



Guide in Special Tool 11 3 170 according to camshaft "A" or "E" and press down on the tappets.
Take out the valve adjusting disc with magnet.



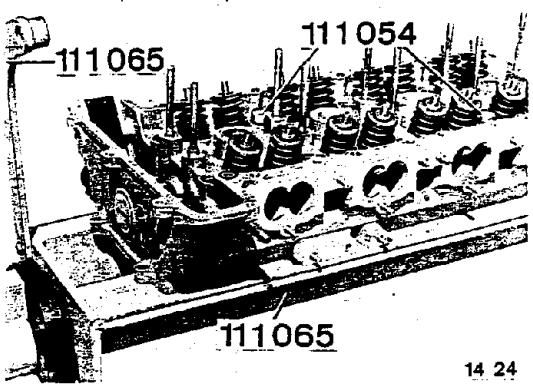
Measure the removed valve adjusting disc.
Install an adjusting disc of correct thickness with the lettering facing down.



11 34 509 CHECKING VALVES FOR LEAKS

– Cylinder Head Removed –

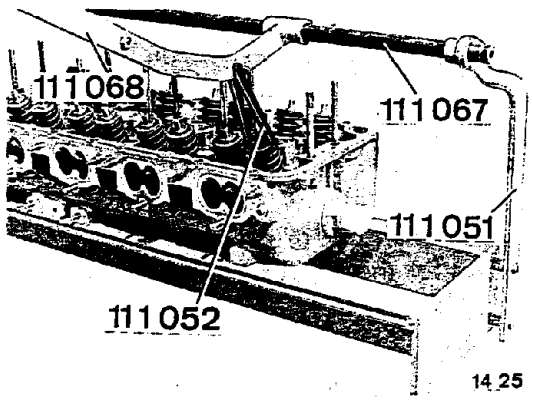
Pour petrol into the intake and exhaust ports.
The valves and valve seats must be inspected, if the petrol runs past the valve heads.
The valves can also be checked for leaks with a vacuum tester.
Remove the valves – see 11 34 550.
Machine valve seats – see 11 12 607.



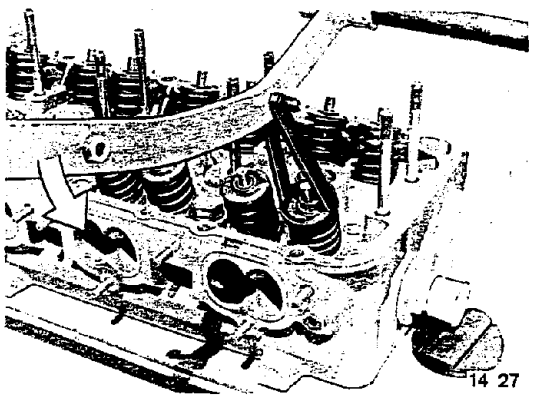
11 34 550 REMOVING AND INSTALLING VALVES

— Cylinder Head Removed —

Mount the cylinder head on Special Tool 11 1 065 with bolts 11 1 054.
Bolt on Special Tool 11 1 065.

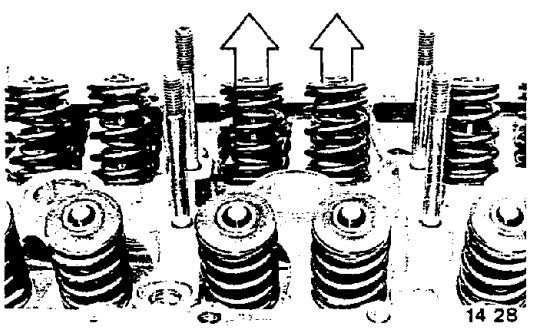


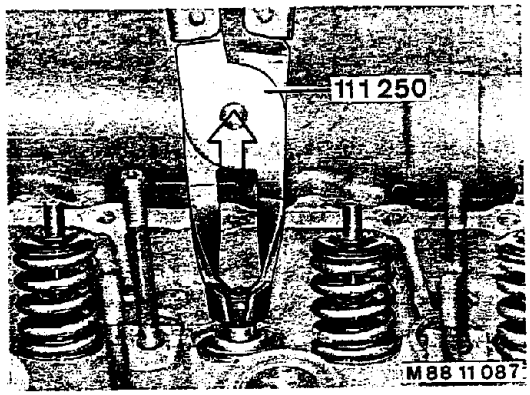
Bolt on Special Tool 11 1 051.
Mount Special Tools 11 1 068, 11 1 052 and 11 1 067.



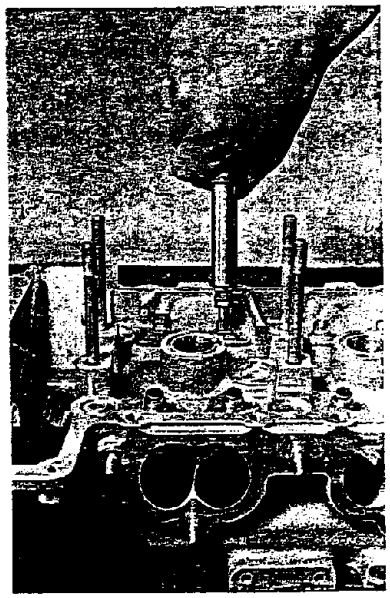
Compress the valve springs and take out the valve collets.

Remove the valve springs.
Pull out the valve.



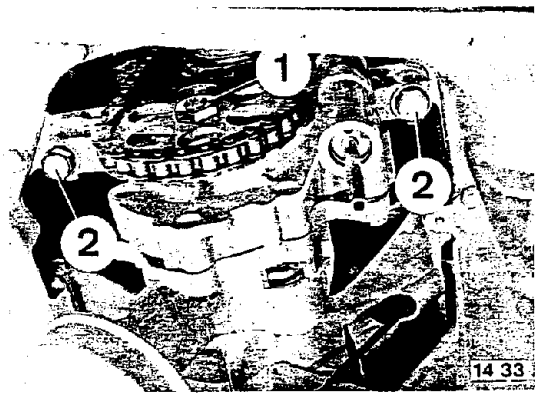


Pull off the valve stem seal with Special Tool 11 1 250.
Check the valve guide for wear — see 11 12 595.


514 11 15

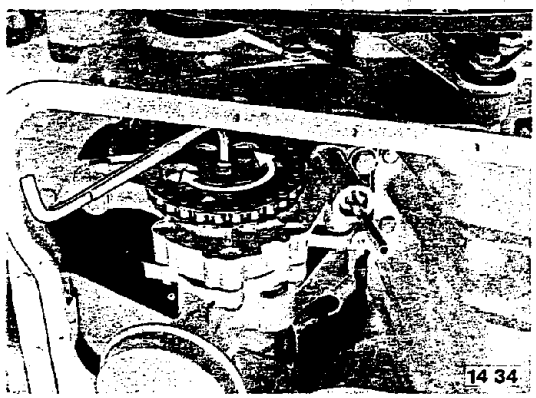
Install valve.
Insert lower spring retainer for intake or exhaust end.
Lubricate the valve stem seal with oil, mount and press it on by hand with the special tool.

Important!
The installed length of springs is adjusted with washers for the lower spring retainer.

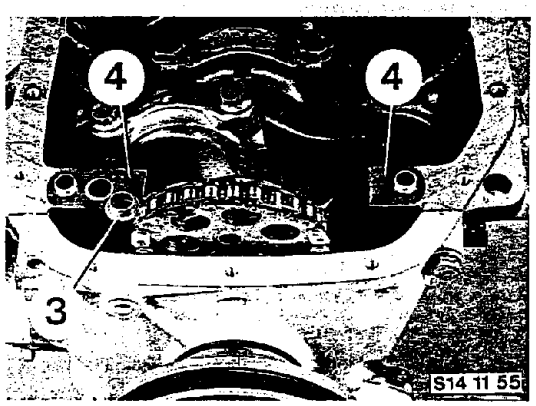


11 41 000 REMOVING AND INSTALLING OIL PUMP

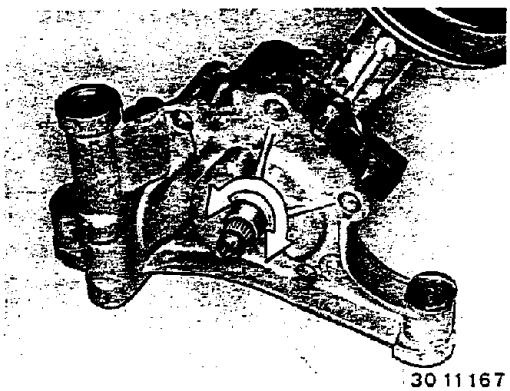
Unscrew the lower oil pan section.
Unscrew nut (1) and take off the sprocket.
Unscrew bolts (2).



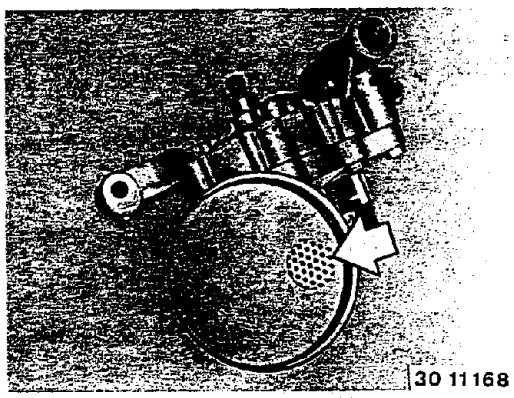
Installation:
Push on the sprocket with mounted oil pump.
Tightening torque of nut = 28 ± 2 Nm.



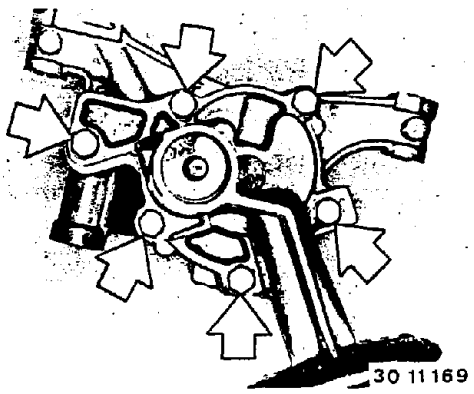
Installation:
Check the installed position of O-ring (3) between the housing and pressure pipe.
Adjust the chain tightness with shims (4) in such a manner, that the chain will give by about 5 mm under light thumb pressure (check this at different points).
Check position of the oil bore in the shims.


30 11 167

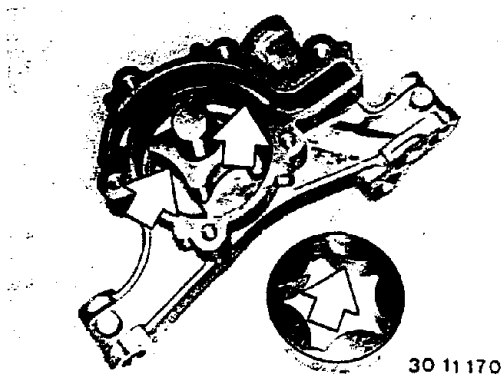
Testing and Servicing:
Check whether the oil pump moves easily by turning on the drive shaft.


30 11 168

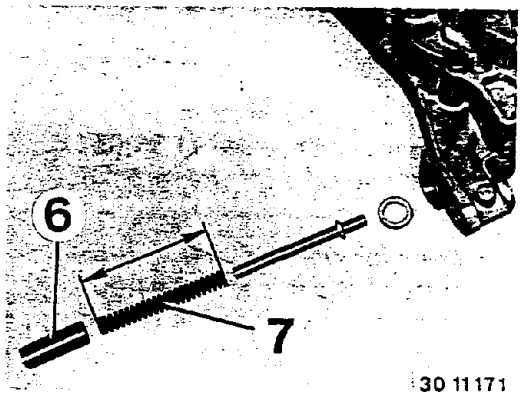
Clean the oil filter screen.


30 11 169

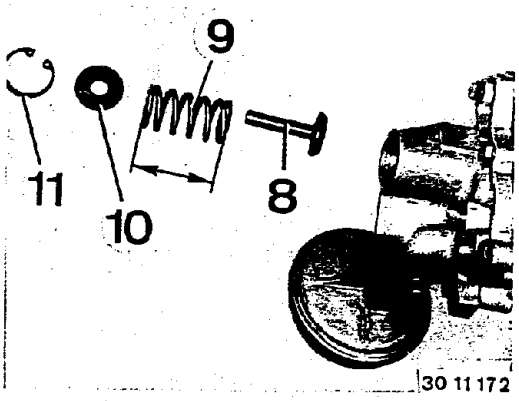
Disassemble the oil pump.


30 11 170

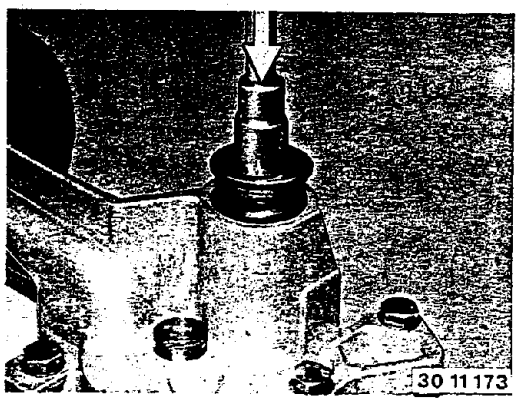
Check the oil pump for wear.
Check the housing for scoring and the rotors for wear.



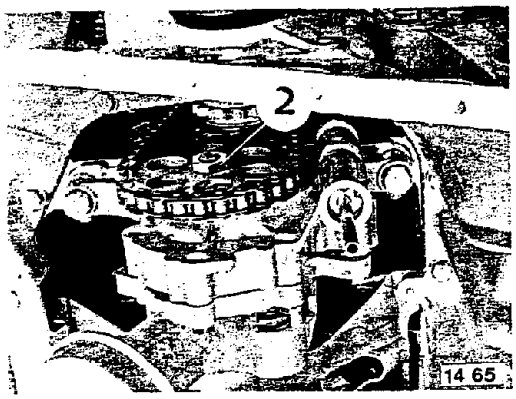
A pressure safety valve is located in the main bore and regulates the engine oil pressure.
Check whether piston (6) moves easily.
Check the length of spring (7) = 68 mm.



The 8 bar pressure safety valve regulates the oil pressure in front of the oil filter and prevents oil filter leakage.
Check the sealing of valve seat (8).
Check the length of spring (9) = 44 ± 0.4 mm.



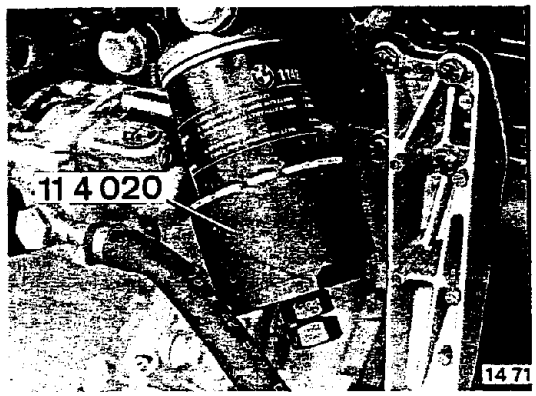
Installation:
Push in spring (9) and washer (10), and mount circlip (11).



11 41 151 RENEWING OIL PUMP DRIVE CHAIN

Unscrew the lower oil pan section.
Remove the timing chain – see 11 31 051.
Unscrew nut (2) and take off the sprocket.

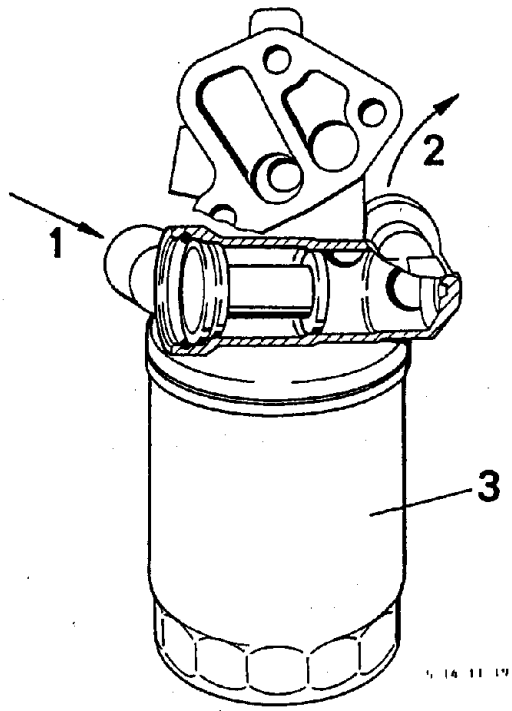
Installation:
Check sprockets for wear.
Adjust tightness of chain – see 11 41 000.
Chains with a green color code are tighter than chain with a red color code.



11 42 021 RENEWING FULL FLOW OIL FILTER

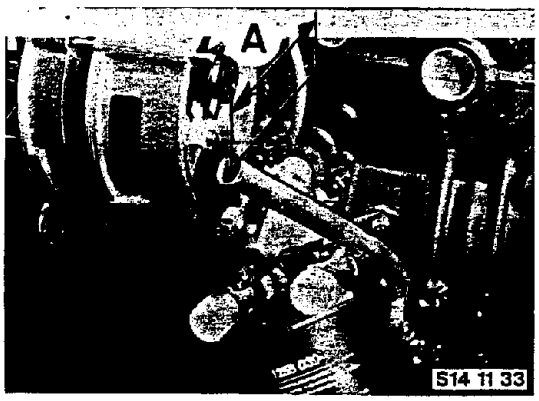
Unscrew the filter with Special Tool 11 4 020.

Installation:
Lubricate the gasket with a light coat of oil. Screw on the oil filter by hand until the gasket bears – tighten with specified torque afterwards (see Technical Data).
Pour in oil and check the oil level.
Then start the engine and check for leaks.



1 From oil cooler
2 To oil cooler
3 Oil filter

The oil circuit always includes the oil cooler regardless of the oil temperature (fixed piston instead of an expansion element).



11 43 101 REPLACING GUIDE TUBE FOR OIL DIPSTICK

Insert the guide tube with Loctite No. 648 and drive it in against the stop.

Distance A between mouth of the oil pipe and crankcase = 190 to 195 mm.

ENGINE ELECTRICAL EQUIPMENT

Enclosure

Engine electrical equipment wiring diagram

12.1 INSTRUCTIONS FOR WORKING ON ENGINE ELECTRICAL AND IGNITION SYSTEMS

- Disconnect the battery or interrupt the power supply for the DME control unit and ignition coil for any type of work on the electrical system as well as charging the battery or welding. Danger – dangerous high voltage in the engine and car electrical systems (for example, on the tachometer).

- The engine may not be started after removing the distributor cap or disconnecting the lead on terminal 4 of the ignition coil.

- The battery and leads on the generator and starter must not be disconnected while the engine is running.

- Only use specified, original BMW parts.

- A suppressed condenser or testing lamp must not be connected on terminal 1 of the ignition coil.

- The lead of terminal 1 on the ignition coil must not be connected with earth or B + (battery positive).

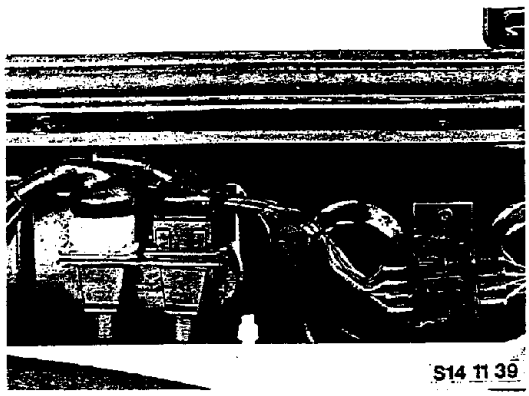
- The master relay for the DME control unit must be removed when checking the compression pressure.

12.2 · TEST POSITIONS FOR TROUBLESHOOTING DIGITAL MOTOR ELECTRONICS (DME)

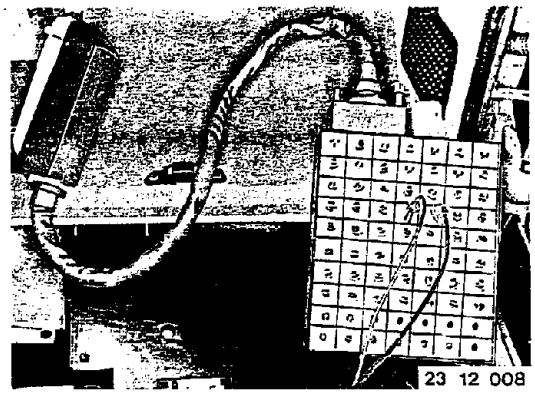
Application:
This survey will be a help in troubleshooting and therefore finding sources of fault faster.

The points have been compiled on the basis of being most probable, so that it could be possible to have to carry out other tests in addition.

12.2.1 CHECKING SPEED AND REFERENCE MARK SENDERS



Check leads for tight fit and damage.
Check connections and arrangement of plugs.
Fig. S 14 11 39: reference mark sender plug on the left / gray plug on the right.
Speed sender plug connector, black.



Check leads to the DME control unit.
Check routing and terminal designations – see engine electrical system wiring diagram.
Pull off plug on the control unit and connect the (35-pin) universal adapter**.
Measure the resistance and insulation (M 06) of the leads on the specified pins.

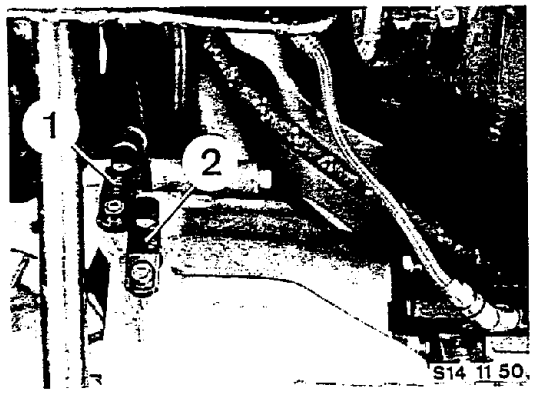
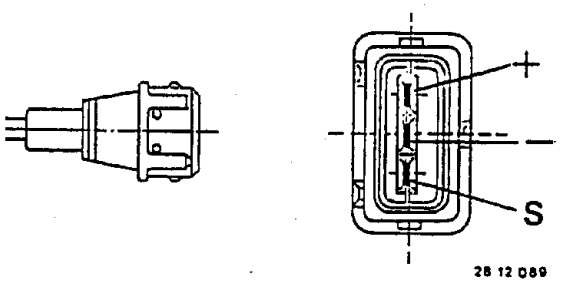
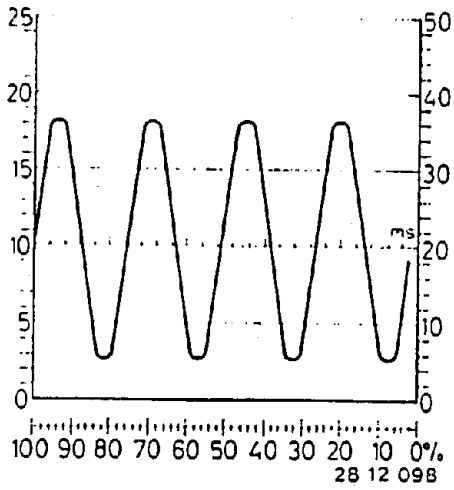


Fig. S 14 11 50:
Bottom View of Vehicle
(1) Speed sender
(2) Reference mark sender

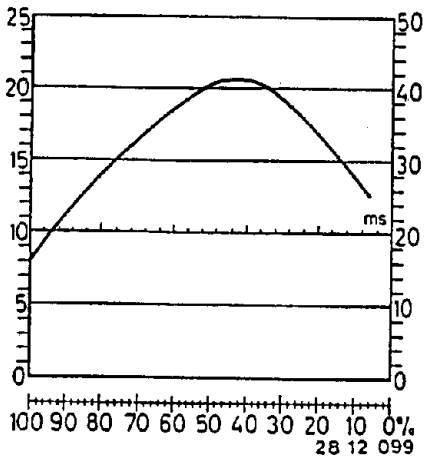
** Source of Supply: HWB



Disconnect the plug.
Measure the resistance* of the sender winding (M 06) on + and – of the plug.
Check the insulation* on + / S and – / S of the plug.



Connect an oscilloscope on the + and – connections of the speed sensor.
Crank the engine with the starter motor.
The displayed signal should appear on the screen.

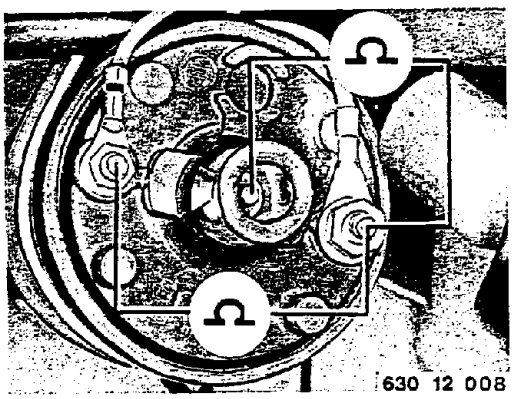


Test the reference mark sender in the same manner.
If the oscillograph shows deviations, remove the sender and check it for dirt (grease, burrs or dust), cleaning if necessary.
Check the reference mark.

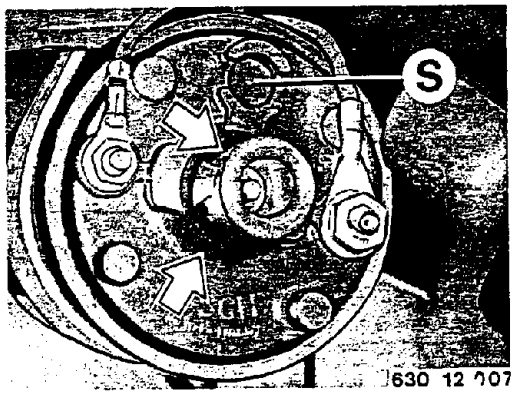
* See Technical Data

12.2.2 CHECKING IGNITION COIL

Check the code number* of the ignition coil. Check whether the ignition coil is damaged, plug (S) is missing and lead connections have good contact.



Multimeter Test (M 06):
Measure the resistance* of primary winding (term. 1/15) and secondary winding (term. 15/4).

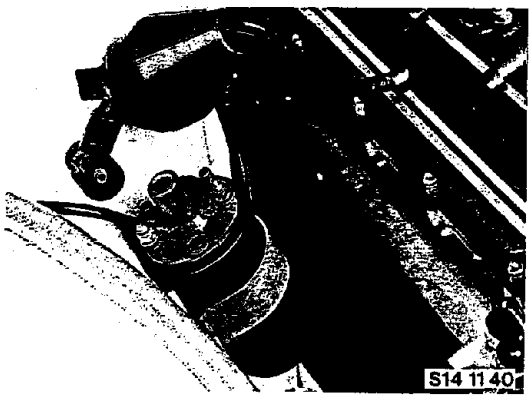


Check the connection plate for hairline cracks and traces of burning.
Check plug (S) for tight fit and, if pressed out, renew the ignition coil.

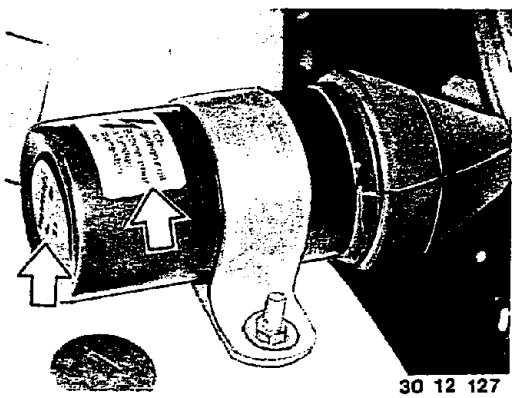
* See Technical Data

RENEWING IGNITION COIL

Caution!
Only work on the ignition system after turning off the ignition – dangerous high voltage.
See 12.1 for instructions for working on ignition systems.



Pull off the protective cap and ignition lead (term. 4).
Disconnect connections (term. 1 and term. 15).
Loosen the holder and take off the ignition coil.



Installation:
Make sure that the new ignition coil has the correct code number*.

* See Technical Data

12.2.3 CHECKING SPARK PLUGS

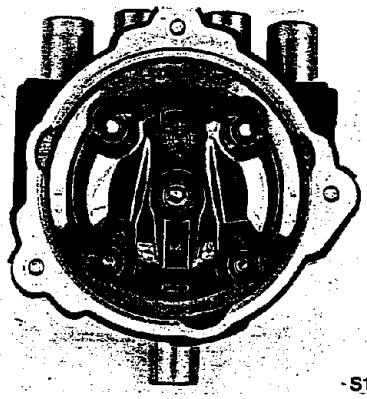
Check the spark plugs for tight fit (leakage).
Check the insulation for traces of surface leakage current.

Approved spark plug type:
Bosch B 241035924

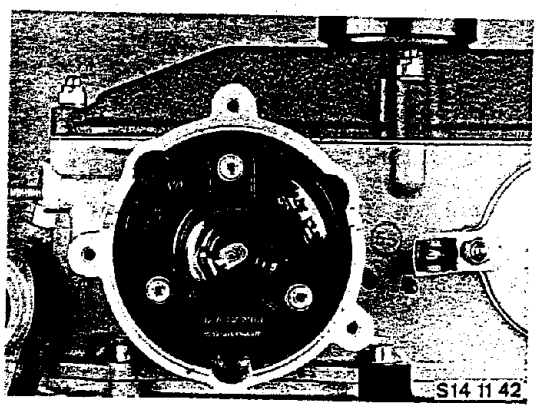
Tightening torque: 20 ± 2 Nm

12.2.4 CHECKING HIGH-TENSION DISTRIBUTOR

Check the distributor cap and rotor for tight fit, damage as well as traces of burning and hairline cracks.
Check the lead connections for good contact and tight fit.


S14 11 41

Check the resistance (M 06) from the distributor tower to a corresponding contact in the distributor cap.
The resistance should be approximately 0 ohm.

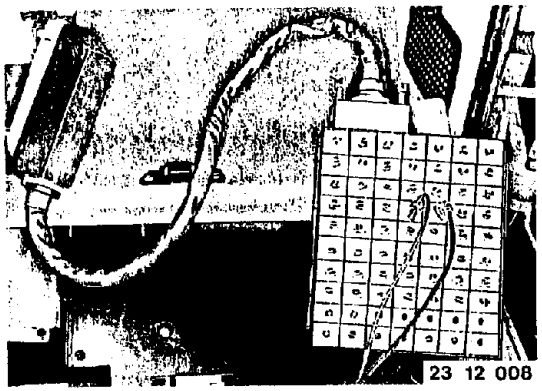

S14 11 42

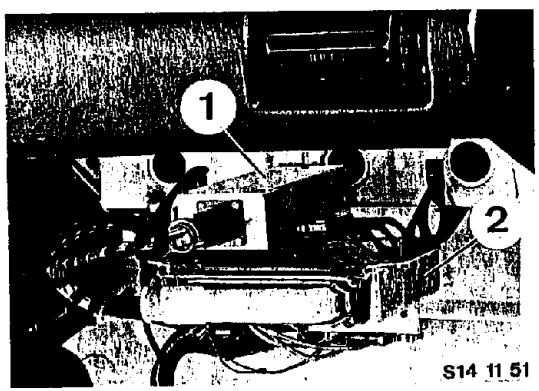
Check the resistance* (M 06) of the distributor rotor.

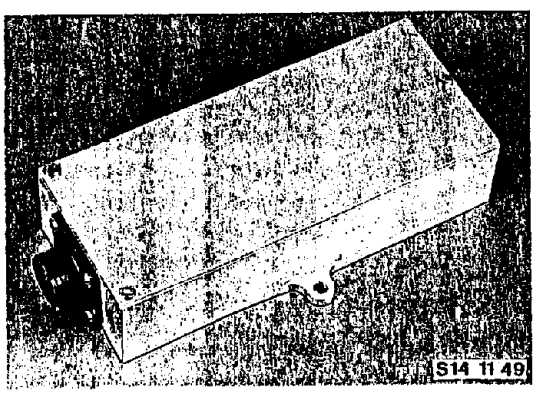
12.2.5 CHECKING IGNITION LEAD CONNECTORS AND LEADS

Check spark plug and suppressed connectors for damage, tight fit and good contact.
Bend ignition leads in a tight radius and check for cracks.
Check the resistance* (M 06) of ignition lead connectors and ignition leads.

* See Technical Data







12.2.6 CHECKING DME CONTROL UNIT AND POWER SUPPLY

Check code number* of DME control unit. → Check activation of DME control unit relay.

↓

Check power supply**:
Pull off plug on control unit and connect on the 35-pin universal adapter*.
Turn on ignition and check voltage on pins**, e.g. conn. 17 (–) and 35 (+).

↓

Re-connect control unit and start engine. → Pull off plug on DME control unit. Connect 35-pin universal adapter* and perform periphery test.

↓

Not okay!

↓

Renew DME control unit (2 in Fig. S 14 11 51).
Renew auxiliary control unit (1 in Fig. S 14 11 51, Fig. S 14 11 49).

* Source of Supply: HWB
* See Technical Data
** See engine electrical system wiring diagram

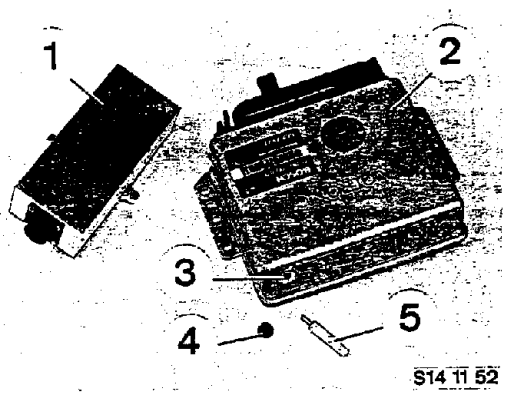
P.S. The relay for the DME control unit is located next to the DME control unit on the left-hand side.

12.2.7 CHECKING FUEL SUPPLY

Check fuel feed to the electric fuel pump.
Check the electric fuel pump, fuel pipes, pressure regulator and fuel pressure (see Troubleshooting Fuel Injection System in Group 13).

12.2.8 CHECKING INTAKE SYSTEM

Check the intake manifold for tight fit and damage.
Check connections for tight fit and leakage.



12.3 POSSIBLE ADJUSTMENTS ON DME CONTROL UNIT

The control data stored in the memory of a DME control unit can be adjusted from the outside via a printed circuit board switch (8 positions).
This requires removing rubber plug (4) on the back of DME control unit (2). Turn the printed circuit switch counterclockwise against the left stop with help of a small screwdriver (5); then adjust to the desired position by turning clockwise and counting the number of engaged positions.

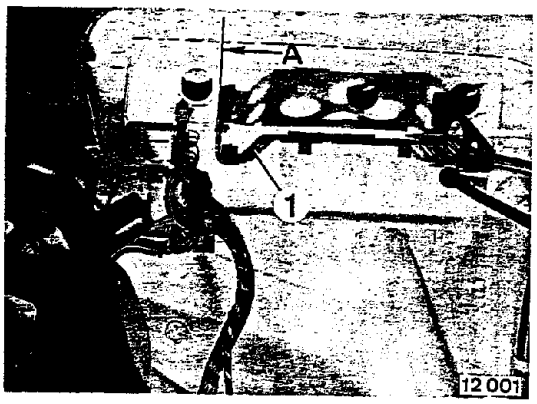
Avgas →

Pos.	KF	ZW
0 (left stop)	0 %	
1	+ 1.8 %	
2	+ 3.5 %	
3	− 1.8 %	
4	0 %	− 3.1°
5	+ 1.8 %	− 3.1°
6	+ 3.5 %	− 3.1°
7 (right stop)	− 1.8 %	− 3.1°

Pos. = Printed circuit board switch position

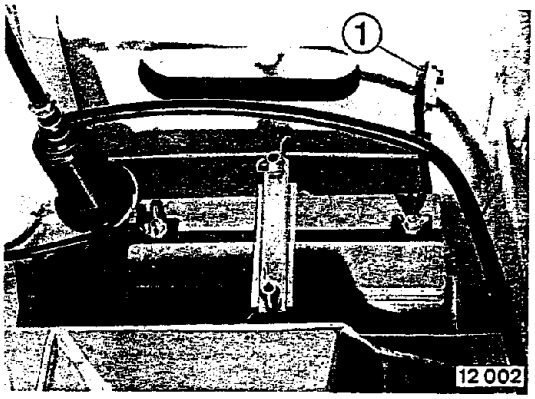
KF = Over-all mixture change in curve family (+ = richer; − = leaner)

ZW = Over-all ignition timing change in curve family (negative value = ignition retarded)



12.4 CONTROL UNIT INSTALLATION / BATTERY CONNECTIONS

The holder for control units (1) is mounted on the firewall with four M 4 rivet nuts, four M 4 oval head screws and four washers. This requires drilling four 7.9 mm dia. holes after positioning (A) the holder.



The battery negative (earth) cable is mounted on the tail panel with a M 8 hexagon head bolt (1) and lock washer.

12.5 TROUBLESHOOTING GENERATOR

Testing Requirements: – Correct connections on battery, starter and generator
– Good earth connection between engine and body
– Tightened drive belts

Charge control lamp NOT on with ignition turned on

Pull off plug D+/61 and connect with earth (term. 31).

Charge control lamp on.

Remove voltage regulator. Check carbon brushes, renewing if necessary. Check slip rings for wear or oxidation.

Charge control lamp not on.

Check connections and leads (see wiring diagram) for charge control lamp or renew light bulb.

Charge control lamp ON with ignition turned off

Renew generator.

Charge control lamp GLOWS or LIGHTS UP with engine running

Renew generator.

Battery CHARGED INSUFFICIENTLY/ Charge control lamp goes out while engine is running

Check battery, renewing if necessary. Check power consumption with electric consumers switched off.

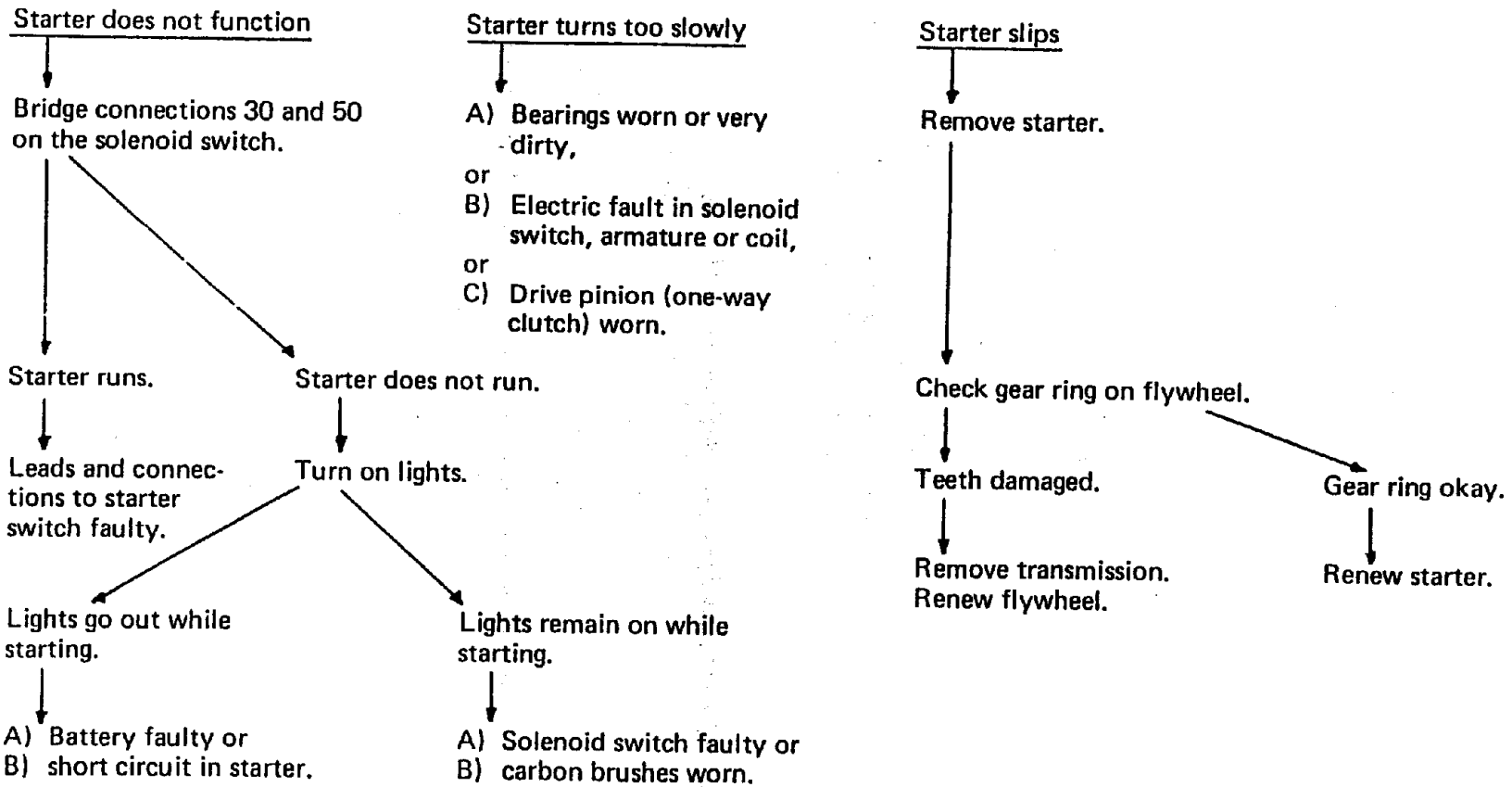
Charging current too low with electric consumers switched on.

Check tightness of drive belt.

Renew generator.

12.6 TROUBLESHOOTING STARTER

Testing Requirements: – Correct connections on battery and starter
– Good earth connection between engine and body
– Charged battery



12.7 TECHNICAL DATA

1. Reference Mark Sender, Speed Sender

BMW No. 1 274 644
Bosch No. 0 261 210 002
Resistance: 1020 ohms ± 10 %
Insulating resistance: greater than 100 k-ohms

2. Ignition Coil

BMW No. 1 286 087
Bosch No. 0 221 118 335
Primary resistance: 500 ohms (term. 15/term. 1)
Secondary resistance: 6 k-ohms (term. 4/term. 1)

3. High Tension Distributor

BMW No. 1 309 798
Bosch No. 1 234 332 391 R1
Resistance: 1000 ohms $^{+\ 30\ \%}_{-\ 10\ \%}$

4. Ignition Tackle

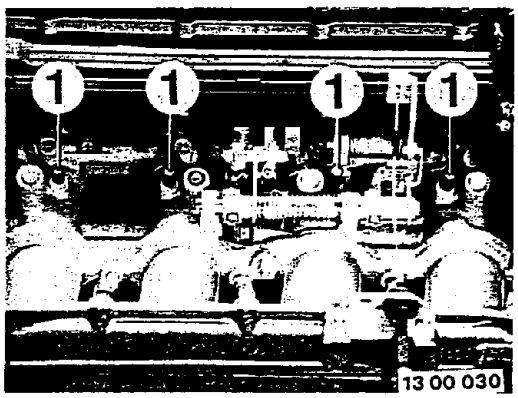
BMW No. 1 310 008
Resistance of angled plugs on cap: 1 k-ohm ± 20 %
Resistance of spark plug connector: 5 k-ohm ± 20 %

5. DME Control Unit

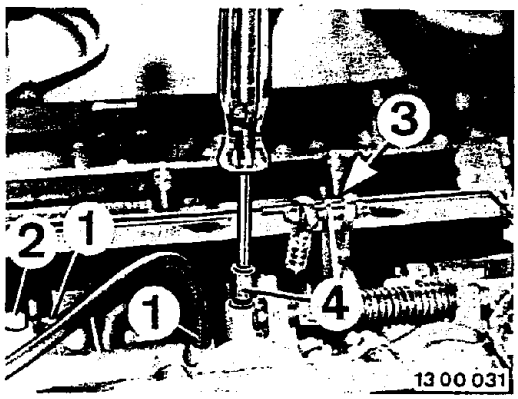
BMW No. 1 311 321
Bosch No. 0 261 200 071

FUEL SYSTEM

13 00 054 ADJUSTING ENGINE IDLE SPEED

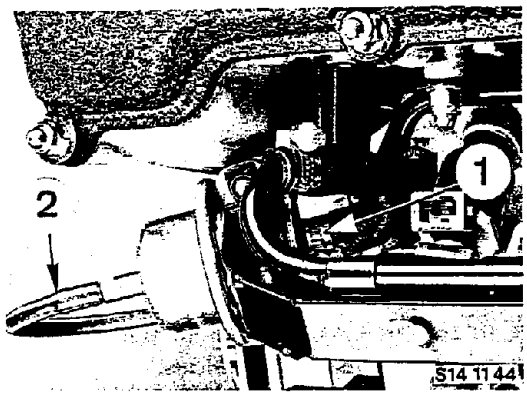


Synchronization:
Requirement – push rod adjusted correctly (see Removing and Installing Throttle Valve Necks in 13 54 030).
Pull off caps (1).
Measure intake pipe vacuum on all four throttle valve necks and note values.
Leave caps (1) on throttle valve necks not being measured.
Altitude correction box connected.



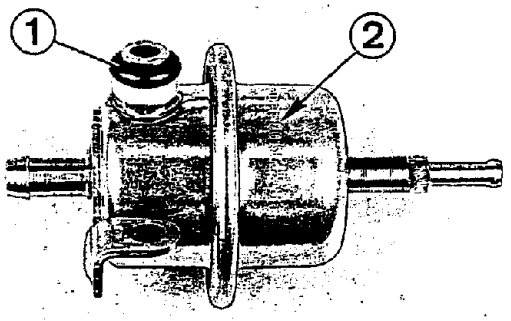
Adjust each throttle valve neck to the same intake pipe vacuum value at nominal idle speed* (screw 3) with screw (4) (7 mm wrench).
Max. vacuum difference: ± 5 mbar.
Install new anti-tamper locks (5) after finishing adjustments.
Then recheck the engine idle speed*, correcting if necessary.

* See Technical Data



13 51 200 REMOVING AND INSTALLING FUEL PRESSURE REGULATOR

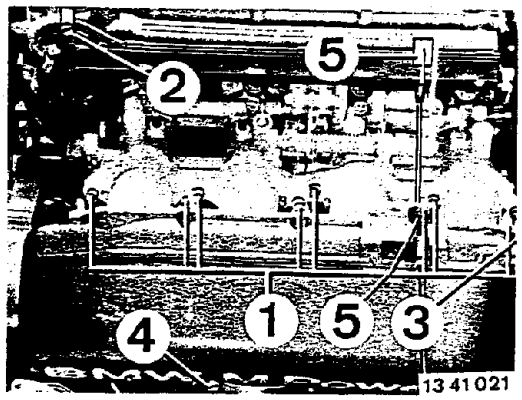
Disconnect fuel hose (1).
Unscrew bolts.
Pull fuel pressure regulator out of the injection pipe.
Pull off vacuum hose (2).



Installation:
Check seal (1), renewing if necessary.
Check code number (2)*.

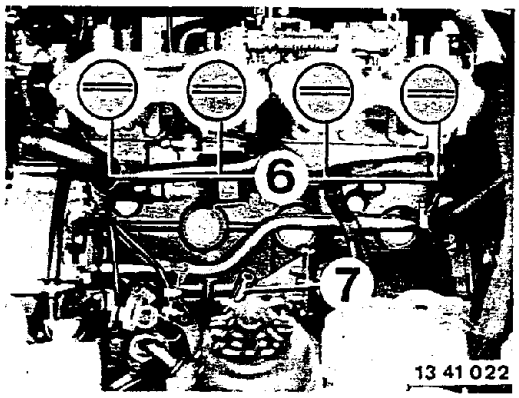
Checking:
Install a pressure tester with connecting pipe and T-adapter in the feed pipe.
Turn on the fuel pump.
Check the fuel pressure*.

* See Technical Data

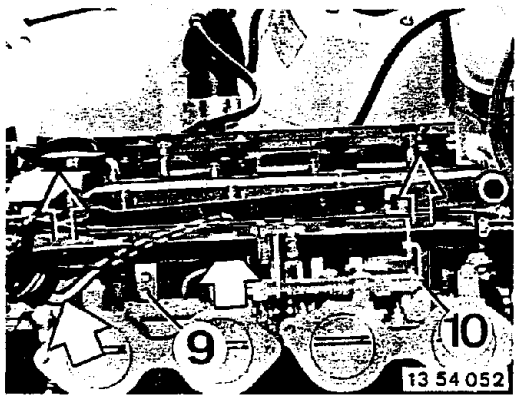


13 54 030 REMOVING AND INSTALLING THROTTLE VALVE NECKS

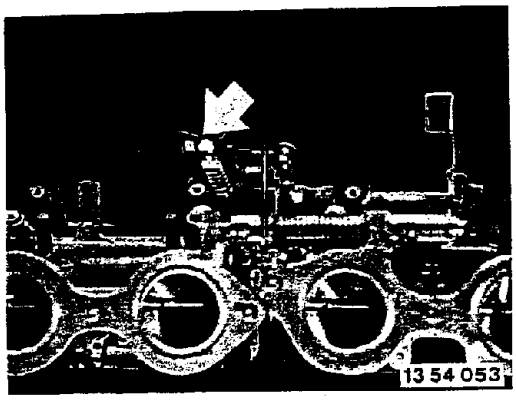
Unscrew capped nuts (1) on all four throttle valve necks.
Unscrew mounting nuts.
Loosen hose clamps (2 ... 4).
Disconnect throttle cable (5).
Remove the intake manifold.



Installation:
Check O-rings (6), renewing if necessary.

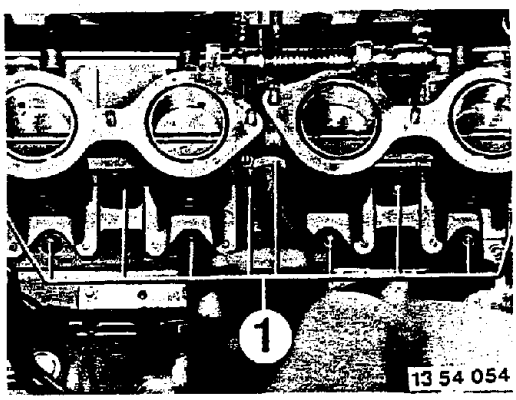


Pull off plug on the throttle valve potentiometer.
Pull off plugs on the fuel injectors.
Pull off vacuum hose for the fuel pressure regulator.
Unscrew bolts (9 and 10).
Lift off the injection pipe with fuel injectors.

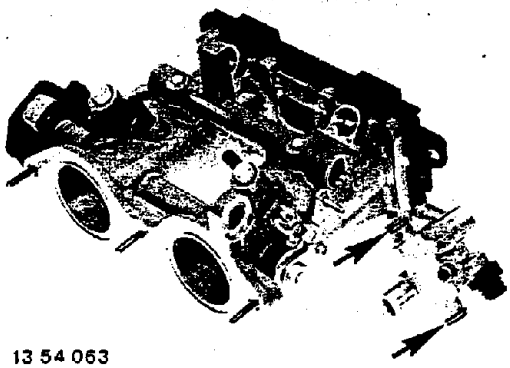


Unscrew nut on the joint.

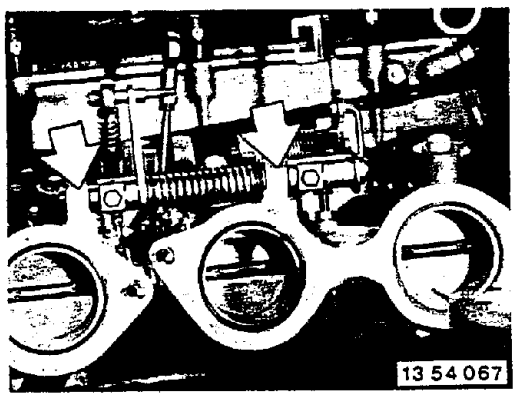
Installation:
Replace the self-locking nut.



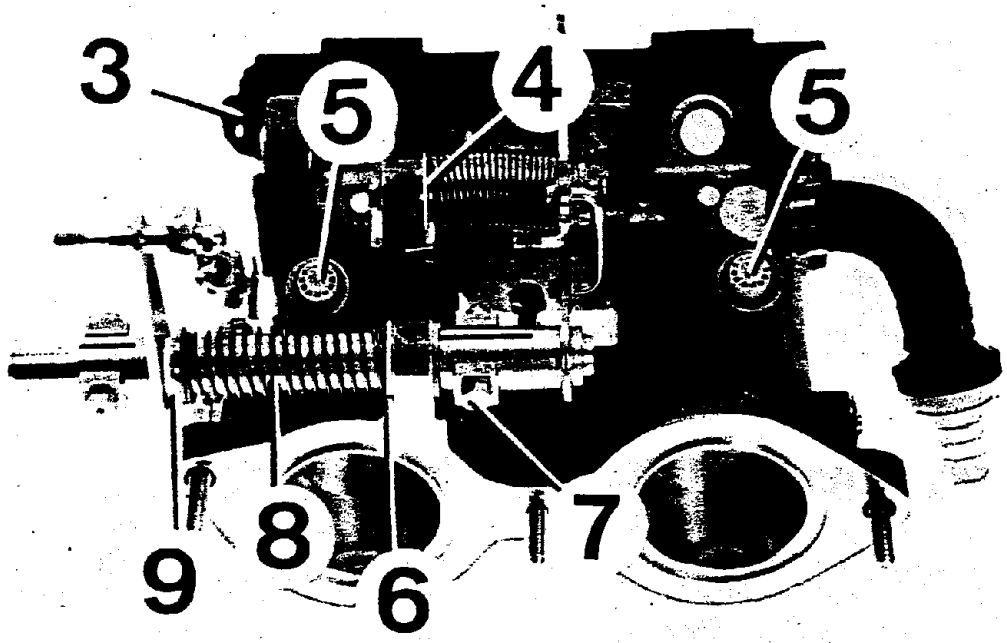
Unscrew Torx nuts (1) on all throttle valve necks.
Take off throttle neck assembly.


13 54 063

Separate the throttle valve necks.
Check O-ring of connecting pipe, renewing if necessary.



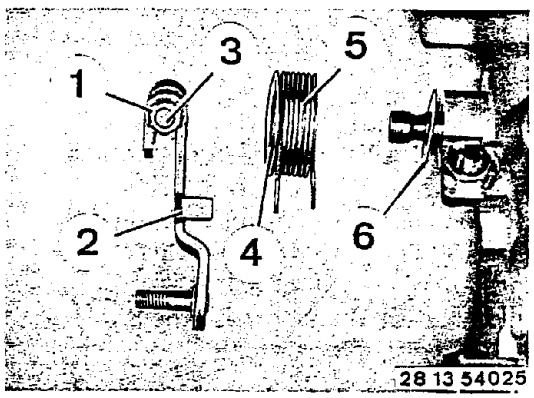
Note:
The shaft runs in needle bearings.
Protect the bearings against dirt.
Don't damage the shaft.



13 54 055

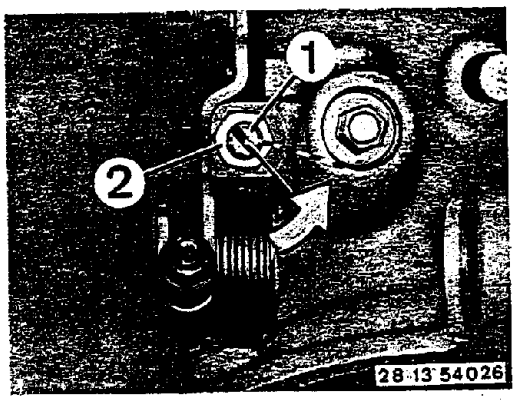
Throttle Valve Neck – Cylinders 3 and 4:
Replace gasket (3).
Lift out circlip (4).
Unscrew throttle screws.
Check O-rings (5), replacing if necessary.
Take off bearing lever (7), sleeves (6), spring (8) and washer (9).

Installation:
Screw in the throttle screws carefully to fit tight and then loosen them by one and one half turns.
Tension spring (8) with about one half turn.

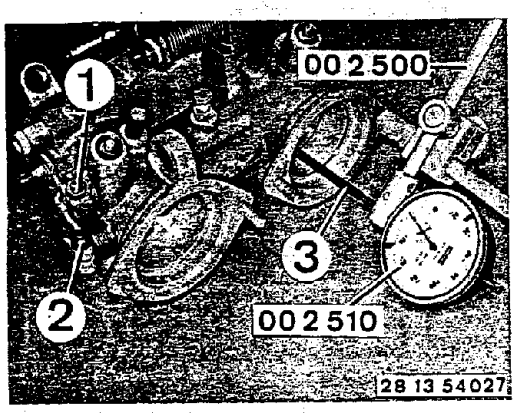


Note:
A basic adjustment of the throttle valve necks is only necessary after renewing parts, in case of a loose clamping screw or incorrect adjustment.
Unscrew nut (1).
Take off throttle lever (2) with screw (3).
Take off sleeve (4) with spring (5).
Note washer (6).

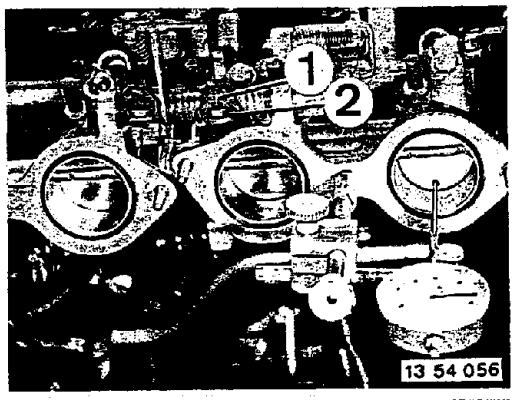
Installation:
Tension spring (5) with about one half turn.
Adjusting Conditions:
Component temperature = approx. 20° C.



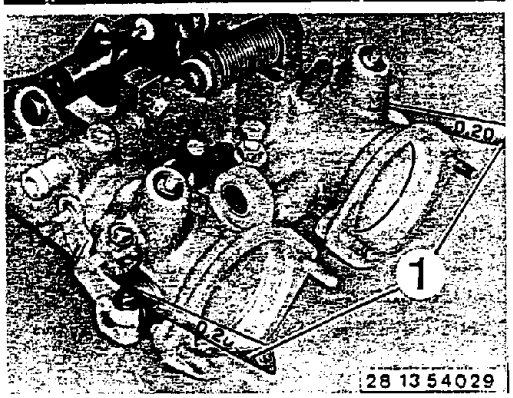
Loosen nut (2).
Turn idle stop screw (1) in direction of arrow by about 1/10th of a turn.
Tighten nut (2) again.



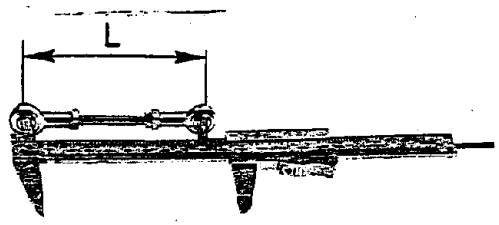
Close the throttle valves.
Press the throttle lever against idle stop screw (1) and tighten nut (2).
Mount dial gauge 00 2 510 (with extension 3) and holder 00 2 500 on the throttle valve neck.
Pre-load the dial gauge tip on the throttle valve at the lowest possible point.



Loosen nut (2).
Adjust the throttle valve lower edge to 0.1 + 0.05 mm with idle stop screw (1) by turning it about 1/10th of a turn.
Lock the idle stop screw (1) with nut and paint.

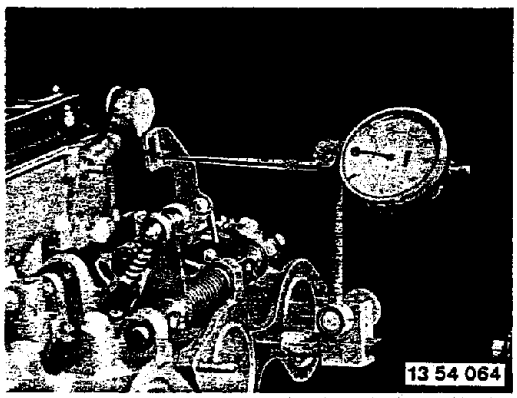


Checking Axial Gap:
A 0.2 mm thick feeler gauge blade (1) must fit easily between the circlip or throttle lever and housing simultaneously on the left and right sides with the throttle valve closed and a room temperature of about 20° C.
Check whether the throttle valve moves easily at operating temperature.

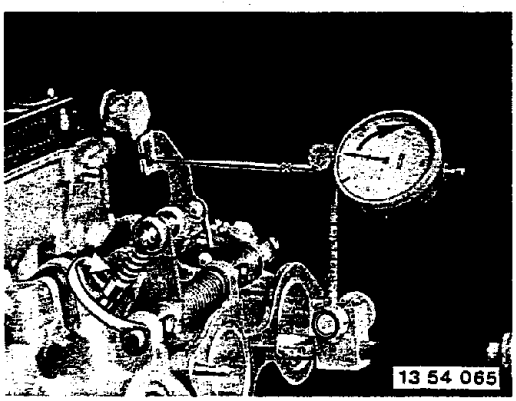


13 54 057

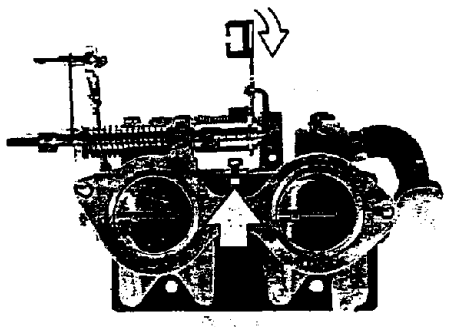
Basic Adjustment of Throttle Valve Linkage:
Adjust the push rod of 3rd and 4th cylinder throttle valve necks to length L = 92.0 ± 0.4 mm.
Also adjust the push rod of 1st and 2nd cylinder throttle valve necks to length L = 92.0 ± 0.4 mm.



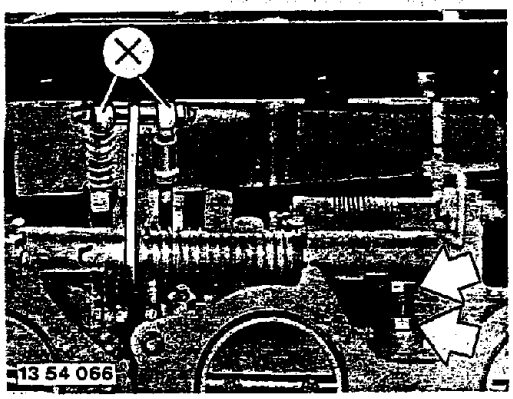
Mount the dial gauge with holder.
Have the dial gauge bear with pre-load on the operating lever for 3rd and 4th cylinders.



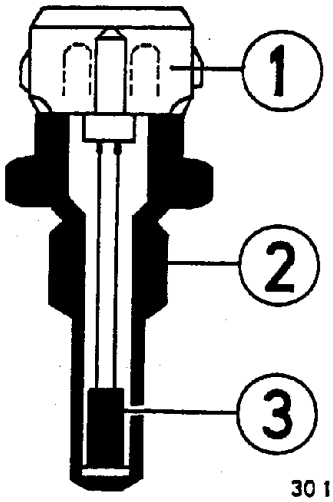
Shorten the push rod for 1st and 2nd cylinders enough, until the dial gauge needle begins to move.
Both throttle levers must bear on the idle stop simultaneously.



Full Load Stop Adjustment:
Open the throttle valves until the valves are parallel to the direction of flow.
Turn the full load stop screw until it presses against the stop on the operating lever.

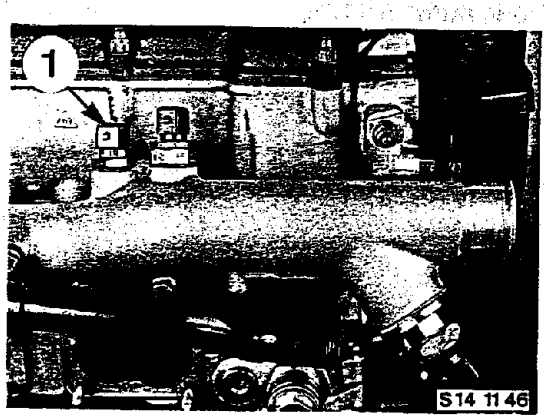


Important!
Be careful not to maladjust the push rods during this adjustment.
Adjust the stop screw in such a manner, that any slight deviation would be distributed uniformly to both necks.



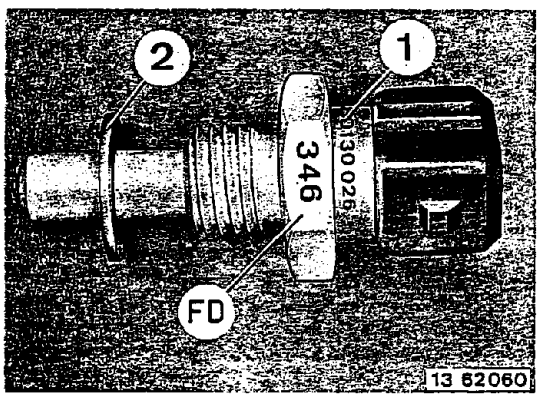
13 62 531 REMOVING AND INSTALLING/ CHECKING TEMPERATURE SENSOR FOR COOLANT

The temperature sensor measures the engine temperature and sends this information to the control unit in the form of a resistance value. The resistance value drops with rising temperature (NTC).
1 = Plug connection
2 = Housing
3 = NTC resistor



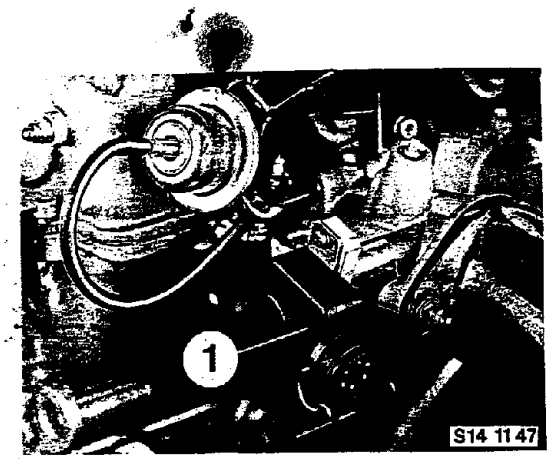
Removing and Installing:
Pull off the plug on temperature sensor (1).
Unscrew the temperature sensor.

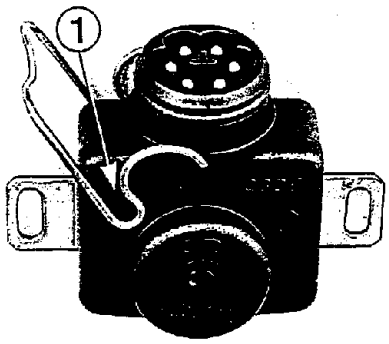
Installation:
Tightening torque*.



Installation:
Check code number (1)*.
Renew seal (2).
FD = Manufacturing date
Fill and bleed the cooling system (Group 17).

* See Technical Data





S14 11 48

13 63 544 ADJUSTING THROTTLE VALVE POTENTIOMETER

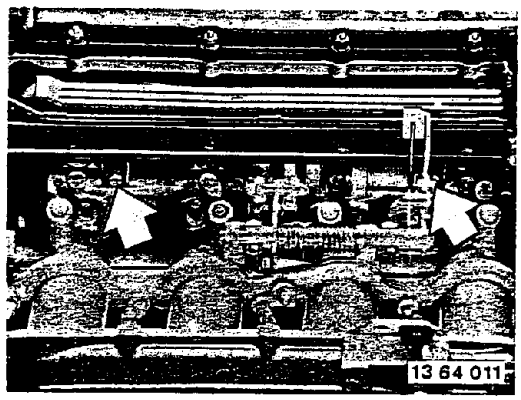
Requirement:
Throttle valve adjustments are correct.

Adjusting:
Pull off plug on the throttle valve potentiometer.
Connect an adapter lead* inbetween and measure the voltage with a digital voltmeter.
The voltage must be 0.640 ± 0.005 V with the throttle valve closed and the ignition turned on.
Correct by loosening the screws and turning the throttle valve potentiometer.

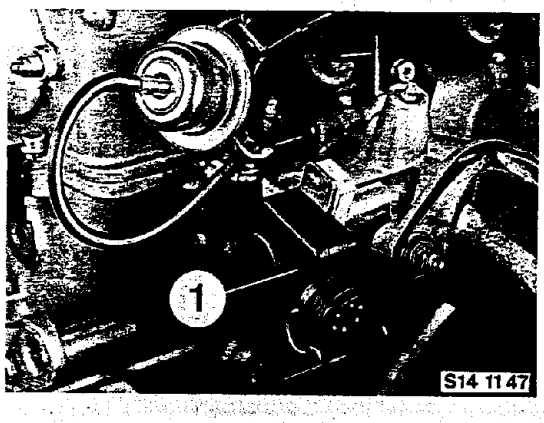
Installation:
Check code number (1)*.

* See Technical Data

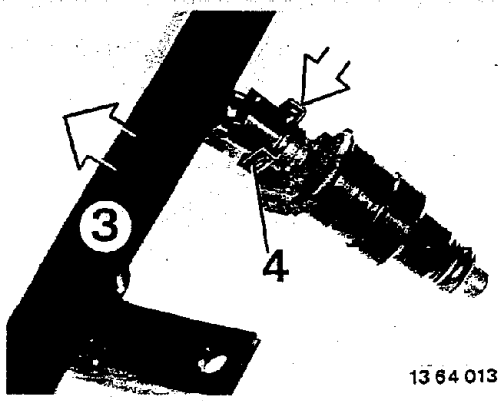
13 64 501 REMOVING AND INSTALLING ONE FUEL INJECTOR



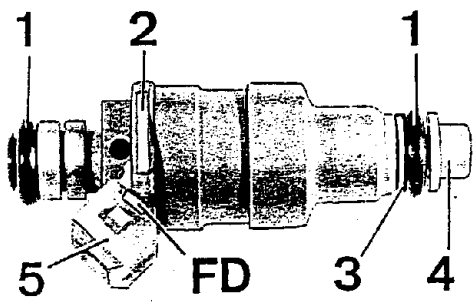
Unscrew bolts on the injection pipe.



Pull off plugs on the fuel injectors.



Push up injection pipe (3) until the fuel injectors are lifted out of the guides for the throttle valve necks.
Lift out retainer (4) and take off the fuel injector.



Installation:
Check O-rings (1), renewing if necessary.
Check code number (2)*.
FD = Manufacturing date.
Check position of plastic washer (3) and color* of plug receptacle (5).
Only coat O-rings with vaseline or SAE 90 gear lube for installation.

* See Technical Data

TECHNICAL DATA

1. **Fuel Pressure Regulator**

   BMW No. 13.53–1 310 490
   Bosch No. B 280 500 531

2. **Throttle Valve Potentiometer**

   BMW No. 13.54–1 311 320.9
   Bosch No. 0280 120 402

3. **Adapter Lead for Throttle Valve Potentiometer Test**

   BMW No. 1 311 330.3

4. **Coolant Temperature Sensor**

   BMW No. 0711–9 963 130.9

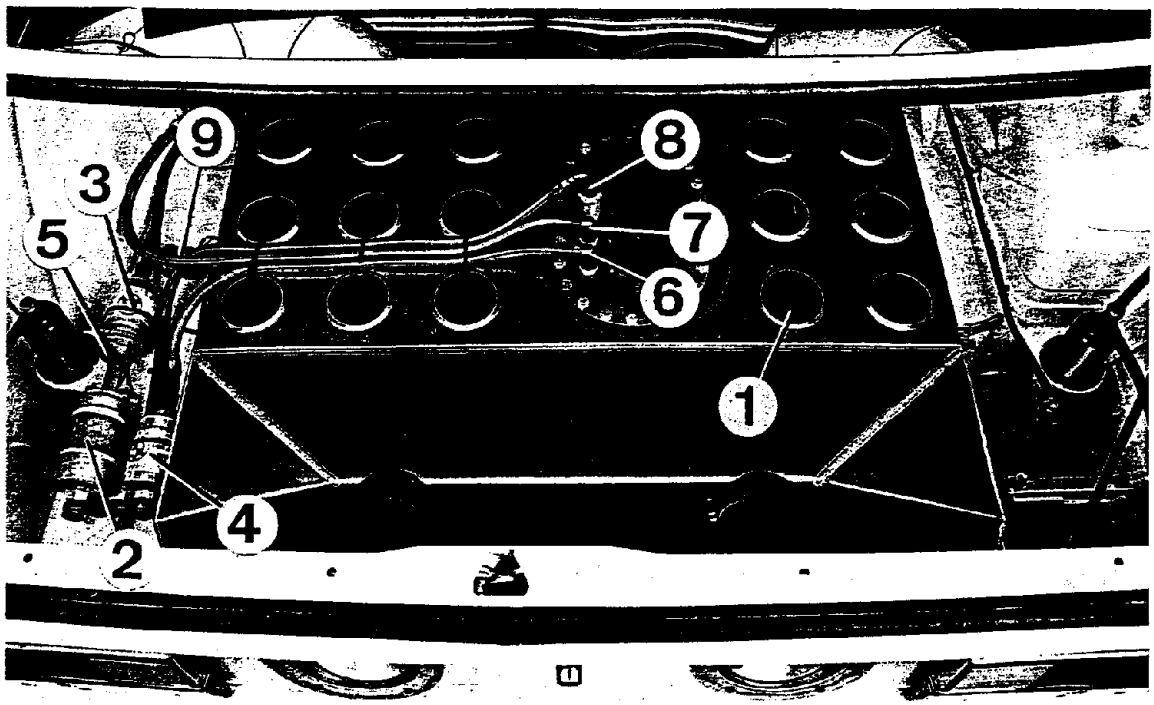
5. **Fuel Injectors**

   Colour of plug receptacle: turquoise
   BMW No. 13.64–1 311 403
   Bosch No. 0280 150 355

6. **Engine Idle Speed at Operating Temperature**

   1500 ± 100 rpm

FUEL SYSTEM



16 001

1 Fuel tank

2 Fuel pump

3 Filter – pressure line

4 Filter – intake line

5 Fuel tank draining connection

6 Intake line

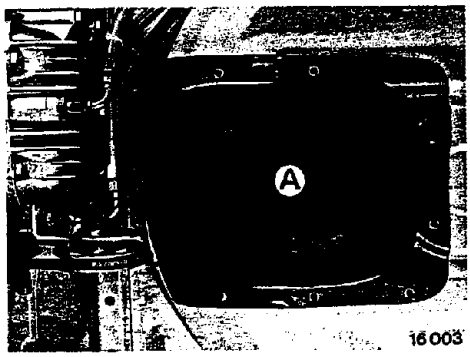
7 Return line

8 Vent

9 Fuel pressure sender

A = Intake line
B = Return line

IMPACT GUARD–SCAVENGER



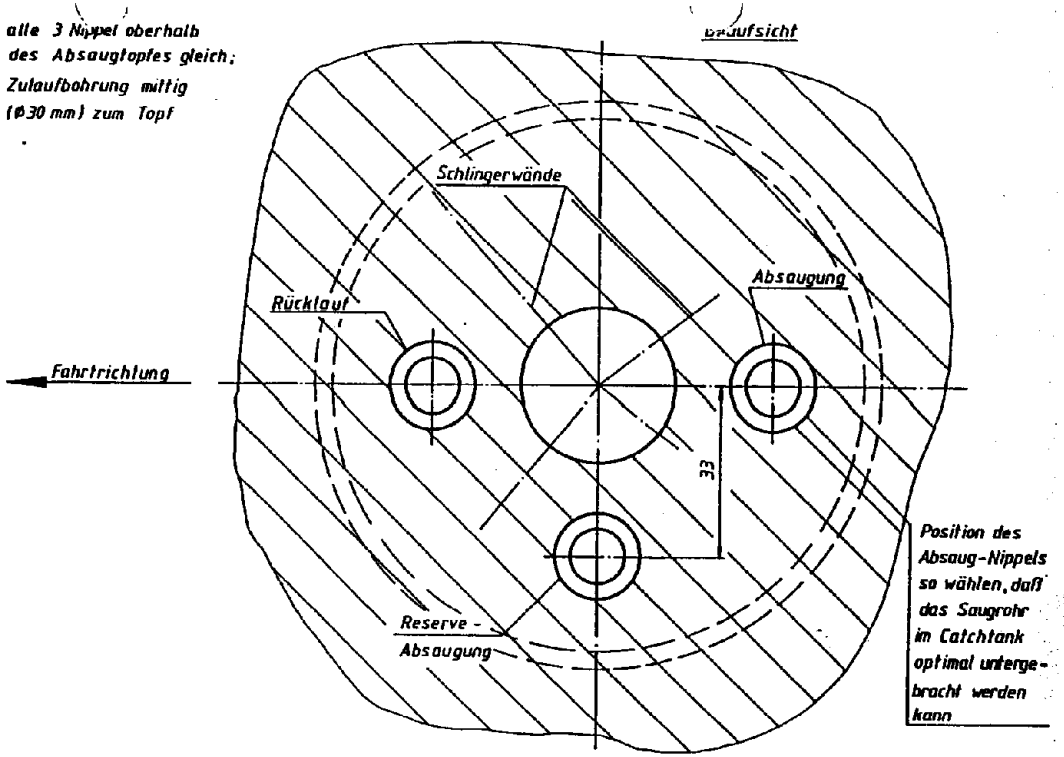
Important!
The holes for the impact guard must be drilled and the bolts held in position by spot welding prior to installation of the fuel tank assembly.

Important!
After installation of the fuel tank assembly in the car it will be necessary to flush out the fuel lines before connecting the lines on the injection plate (pump approximately 5 litres of petrol into a tank).
The fuel filter of the intake line must be renewed after the first training.

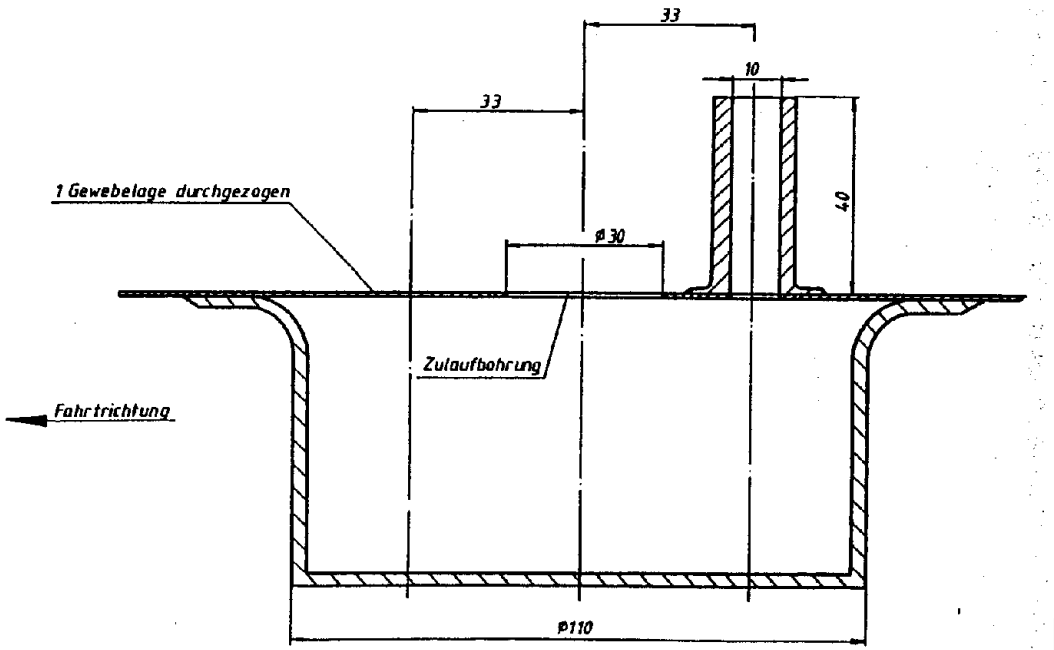
Fundamentally the fuel filters must always be renewed after each race.

The fuel tank should be filled with the specified amount of liters (109.5 litres) prior to each racing event.

alle 3 Nippel oberhalb des Absaugtopfes gleich; Zulaufbohrung mittig (Ø30 mm) zum Topf

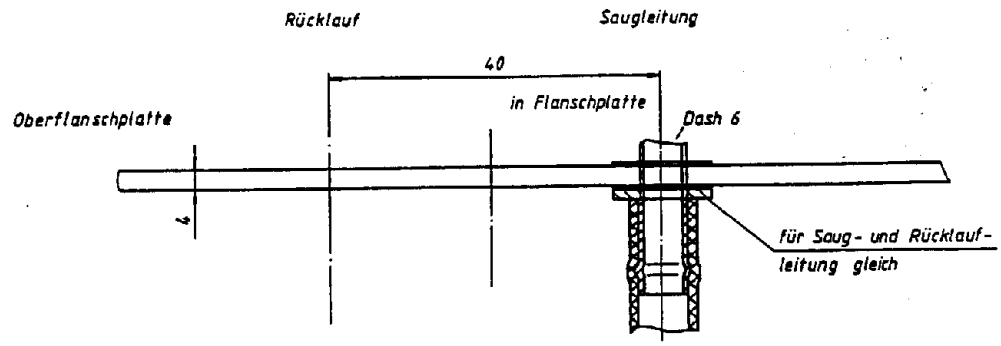


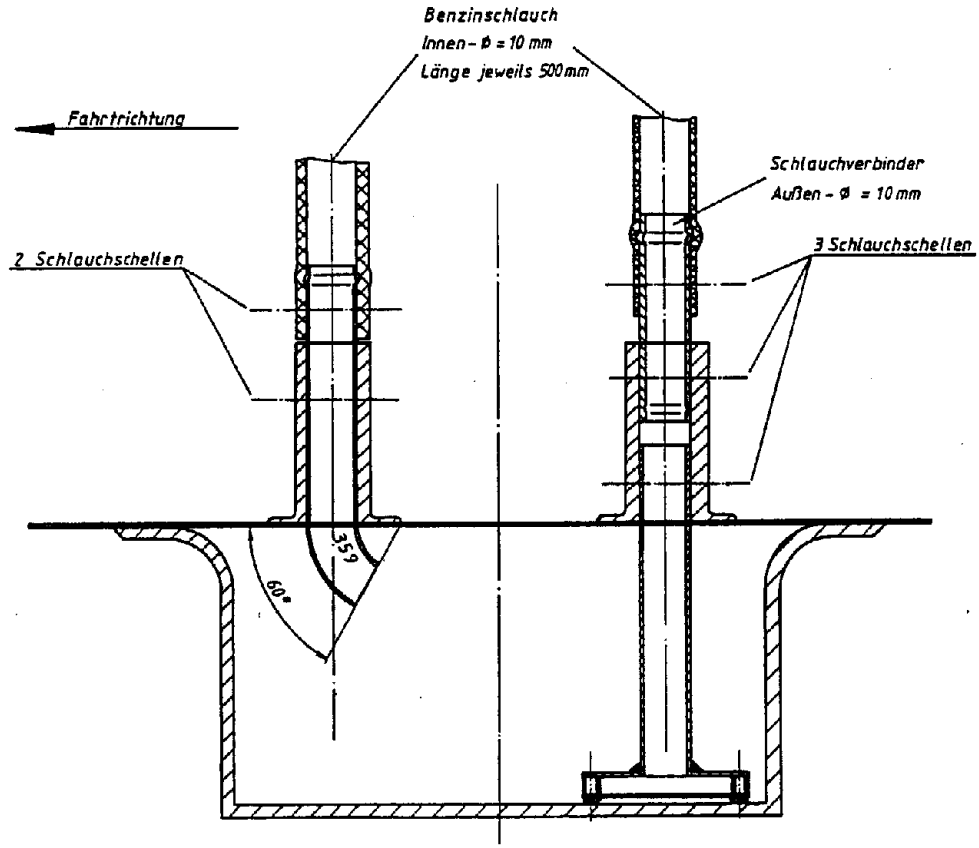
Position des Absaug-Nippels so wählen, daß das Saugrohr im Catchtank optimal untergebracht werden kann



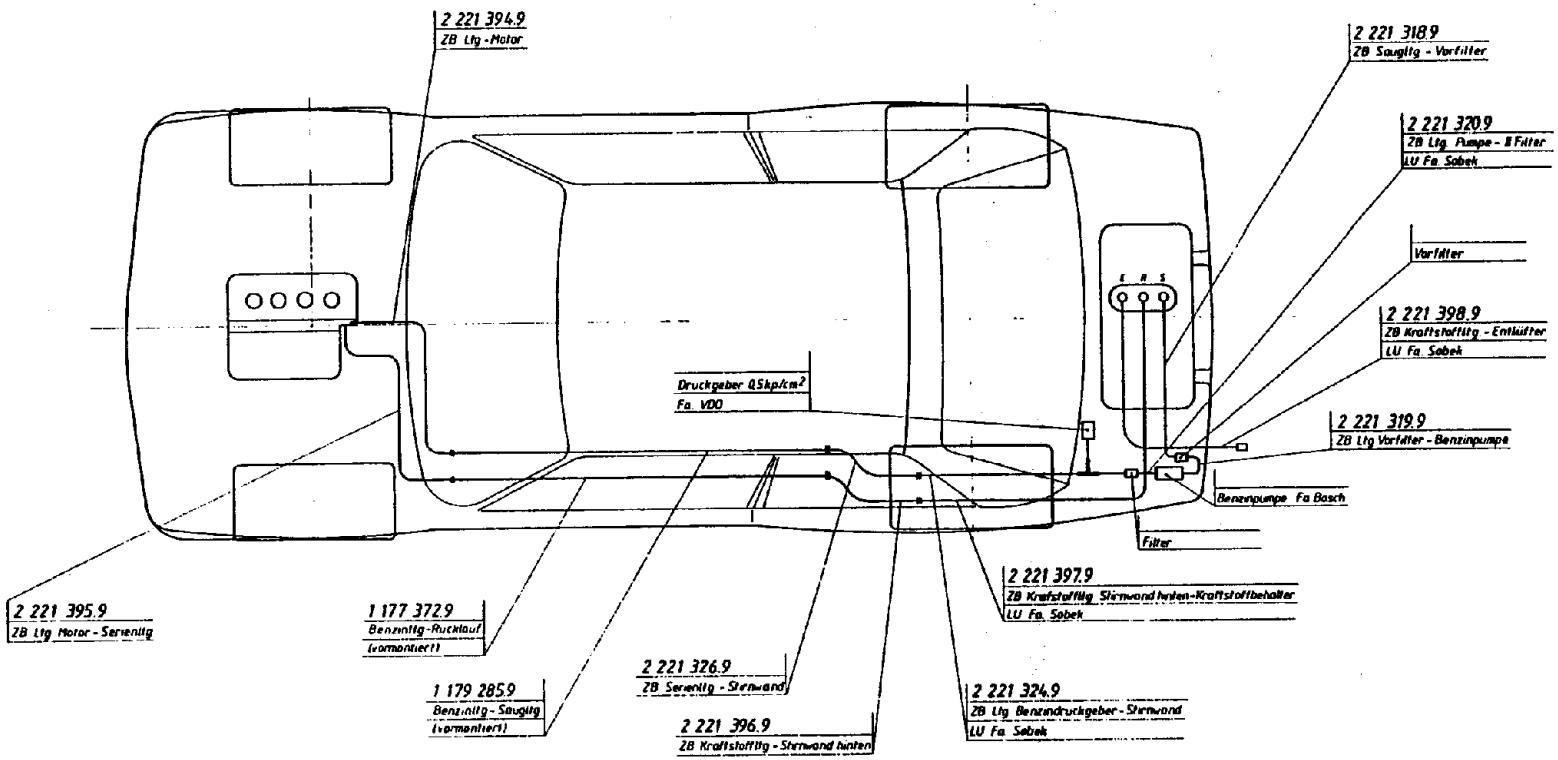
16-3

Benennung: Absaugtopf f. Renntank anvulkanisiert	Zeichnungs-Nr. / Drawing-No. 2 221 424	Format Size 3





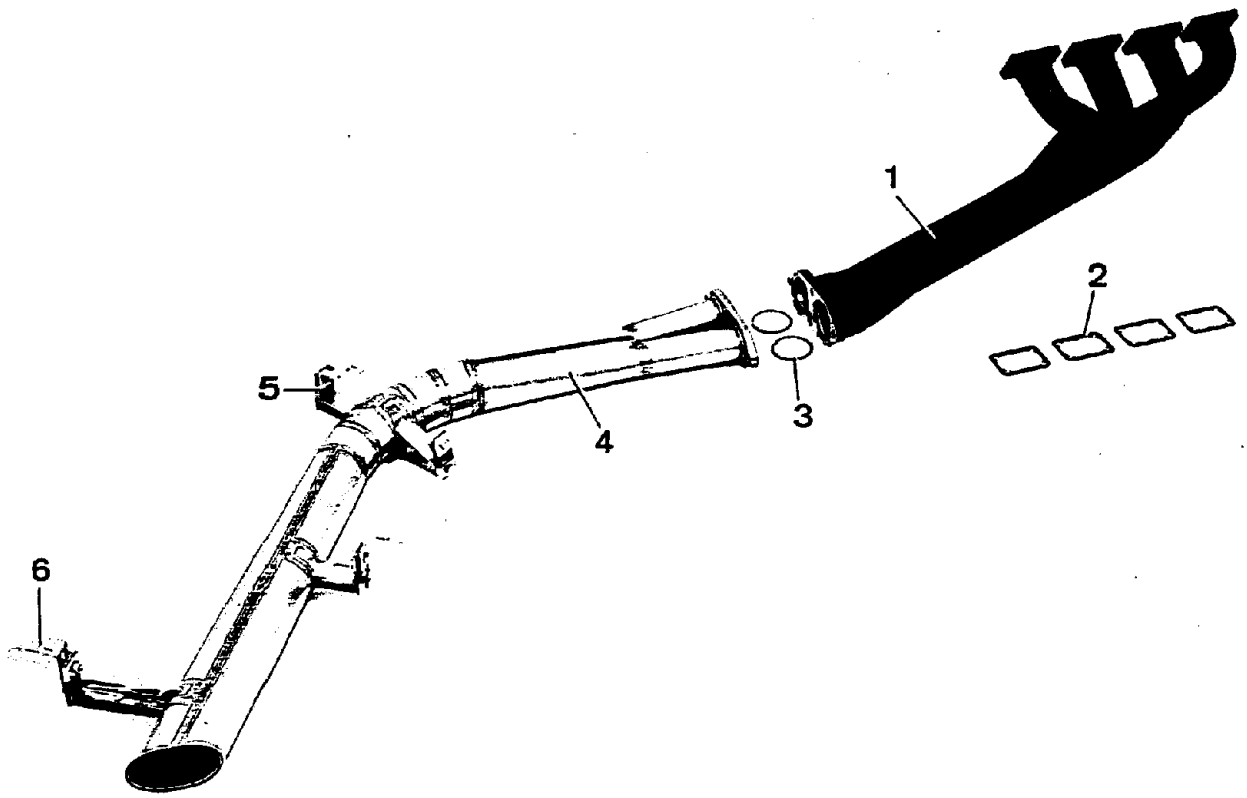
Benennung: ZB Tankabsaugung und Rücklauf	Zeichnungs-Nr. / Drawing-No. 2 221 425	Format Size 3



16-5

AO Kraftstoffsystem	2 221 434	1/1

EXHAUST ASSEMBLY



18 001

1 Exhaust manifold

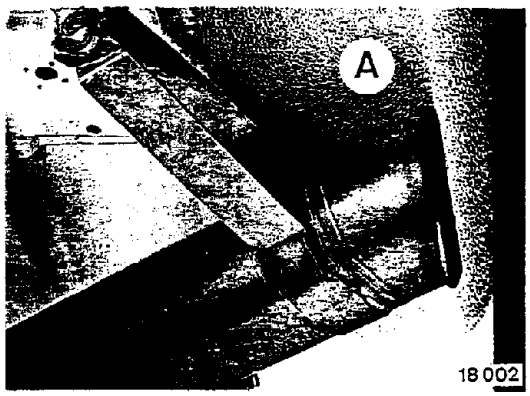
2 Gasket

3 Gasket

4 Exhaust tailpipe

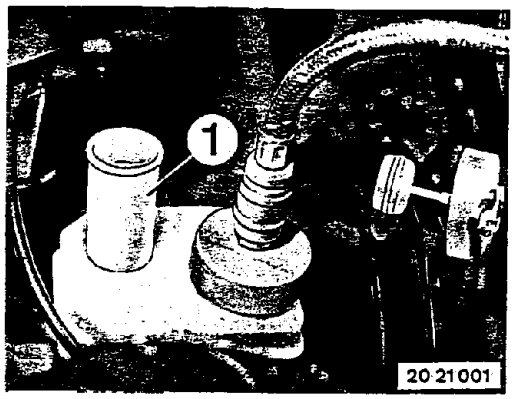
5 Rubber mount

6 Bracket



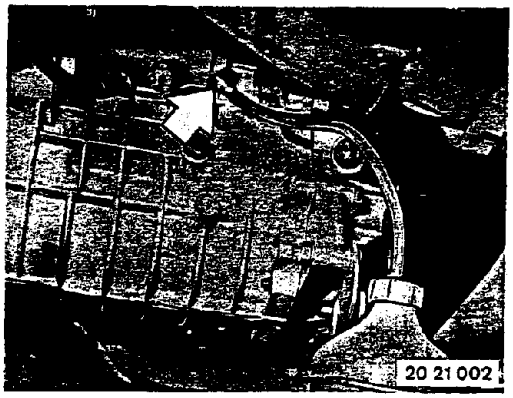
Important!
In the area of the exit of the exhaust pipe a flame-proof protection has to be fitted to the right skills.

CLUTCH

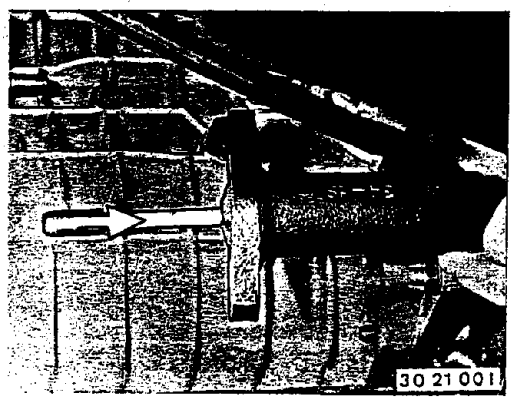


21 00 006 BLEEDING CLUTCH HYDRAULIC SYSTEM

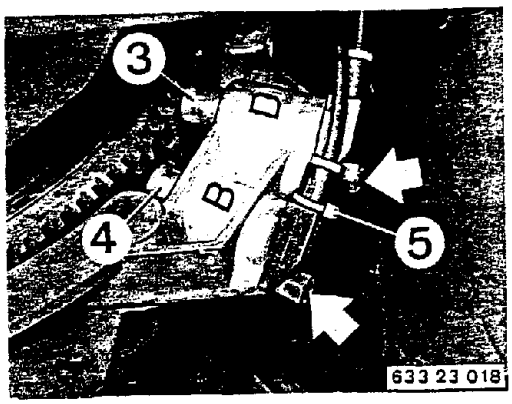
Unscrew cap on the brake fluid reservoir.
Connect the bleeder.



Loosen bleeder screw on the clutch slave cylinder until the escaping brake fluid is without air bubbles.
Operate the clutch pedal several times during this step.



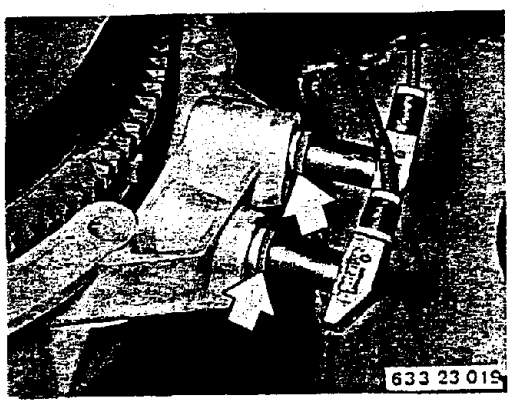
If there is still air in the hydraulic system after bleeding several times, the slave cylinder must be taken off of the gearbox.
Push the push rod into the slave cylinder against the stop and let it come back slowly.
This will force back any residual air into the brake fluid reservoir and provide maximum clutch release travel.
Never operate the clutch pedal as long as the slave cylinder is removed.



21 11 000 REMOVING AND INSTALLING CLUTCH HOUSING

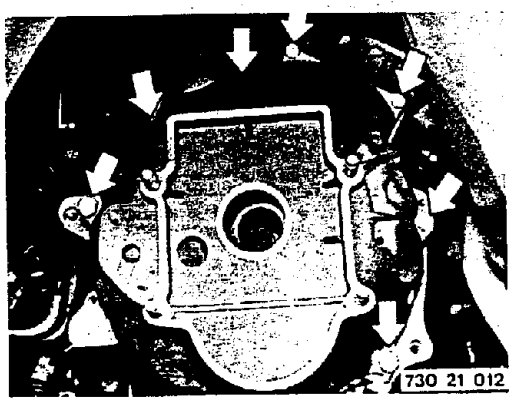
Remove the gearbox.
Remove the DME senders.

Important! – Installation:
Check the installed position and don't mix up plug connections.
Install speed sender (3) in bore (D) and reference mark sender (4) with ring (5) in bore (B).
The engine cannot be started if mixed up.



Installation:
Check the O-rings.
Install senders with Molykote Longterm 2.

Important!
Keep grease and dirt off of the face of DME senders.

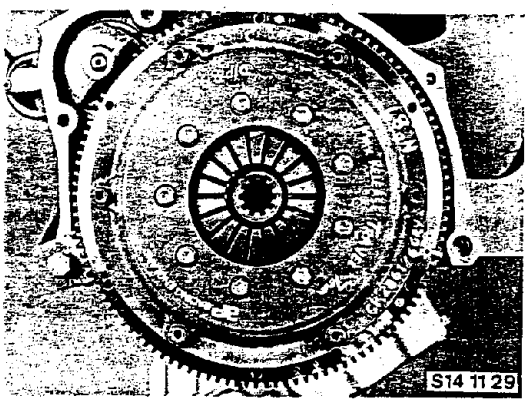


Unscrew the clutch housing.
Unscrew Torx bolts with a Torx socket**.

Important! – Installation:
Washers must be used on the version with Torx bolts to avoid increasing the breaking-loose torque.
Tightening torque*.

* Bezugsnachweis HWB

* See Technical Data
** Source of Supply: HWB

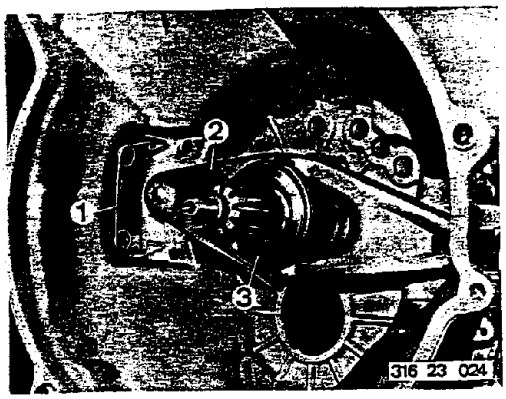


21 21 000 REMOVING AND INSTALLING CLUTCH

Remove the gearbox.
Check tips of diaphragm spring for lateral runout deviation.
Hold the flywheel with a holding tool.
Loosen the mounting bolts one to one and one half turns separately, until tension is removed from the clutch assembly.
Take off the mounting bolts, clutch disc and drive plate.
Check the drive plate for wear and cracks.

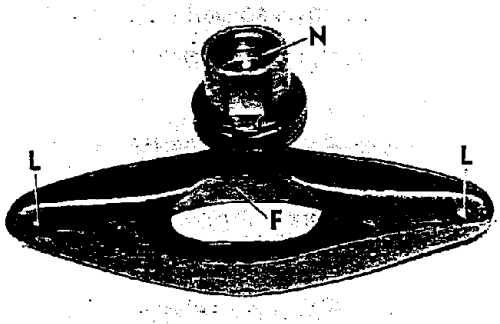
Installation:
Note gearbox end mark on the drive plate.

Check whether the grooved ball bearing in the crankshaft moves easily, renewing if necessary.
Inspect the flywheel for scoring.
Center the drive plate in the flywheel with a centering mandrel.
Tighten the mounting bolts one after the other uniformly to the specified tightening torque.
Lubricate the splines of the gearbox drive shaft lightly with Molykote Longterm 2.



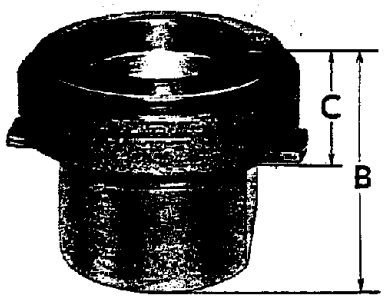
21 51 000 REMOVING AND INSTALLING OR RENEWING CLUTCH RELEASE

Remove the gearbox.
Remove spring (1) and release lever (2) with release (3).



316 23 025

Installation:
Lubricate the internal bore lightly with Klüber Microlube GL 261.
Apply a light coat of Klüber Microlube GL 261 on guide (F) and bearing (L) surfaces.
Non-conformance could cause the bearing to seize on the guide sleeve.

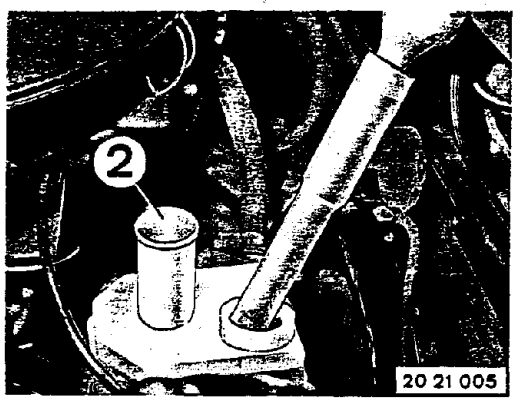


316 21 017

Check specified height B and C of the release bearing.

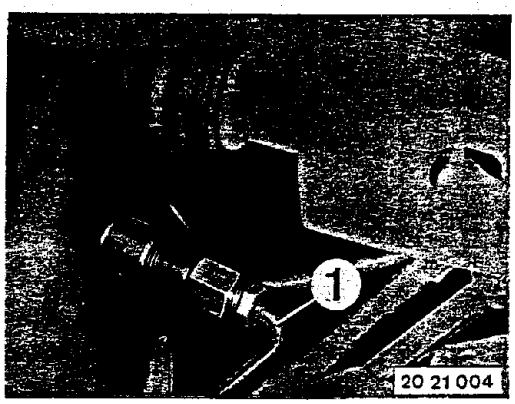
B = 55 mm

C = 33 mm



21 52 010 REMOVING AND INSTALLING CLUTCH SLAVE CYLINDER

Unscrew cap on the brake fluid reservoir.
Draw off brake fluid through the bleeder screw bore.



Unscrew slave cylinder on the gearbox.
Take off the slave cylinder.
Disconnect pipe (1).

Installation:
The bleeder screw faces down.
Install the front push rod with Klüber Microlube GL 261.
Bleed the clutch hydraulic system — see 21 00 006.

TROUBLESHOOTING CLUTCH

Fault	Cause	Correction
Clutch slips	a) Clutch contact pressure insufficient b) Liners worn excessively c) Oil on liners – gearbox or crankshaft seal d) Clutch was overheated	a) Renew clutch – see 21 21 000 b) Renew clutch – see 21 21 000 c) Renew seal and clutch d) Renew clutch – see 21 21 000
Clutch grabs	a) Oil on liners b) Release pressing onesidedly c) Pressure plate pressing crooked d) Crankshaft not aligned with gearbox drive shaft	a) Renew clutch – see 21 21 000 b) Check release lever c) Replace clutch – see 21 21 000 d) Inspect centering surfaces on engine and gearbox
Clutch does not declutch	a) Air in clutch hydraulic system b) Release travel on slave cylinder too small c) Drive plate wrenched excessively or linings broken d) Drive plate seized on gearbox drive shaft e) Pilot bearing in crankshaft for gearbox drive shaft	a) Bleed clutch hydraulic system – see 21 00 006 b) Adjust release travel on slave cylinder (12 to 14 mm) c) Renew clutch – see 21 21 000 d) Service drive plate on gearbox drive shaft, renewing faulty parts if necessary e) Replace pilot bearing in crankshaft – see 11 21 571
Clutch noise	a) Excessive imbalance of clutch disc and drive plate b) Clutch release c) Pilot bearing in crankshaft for gearbox drive shaft	a) Replace clutch – see 21 21 000 b) Replace clutch release – see 21 51 001 c) Replace pilot bearing in crankshaft – see 11 21 571

LUG DRIVE CLUTCH 8½"-215mm
CP2861

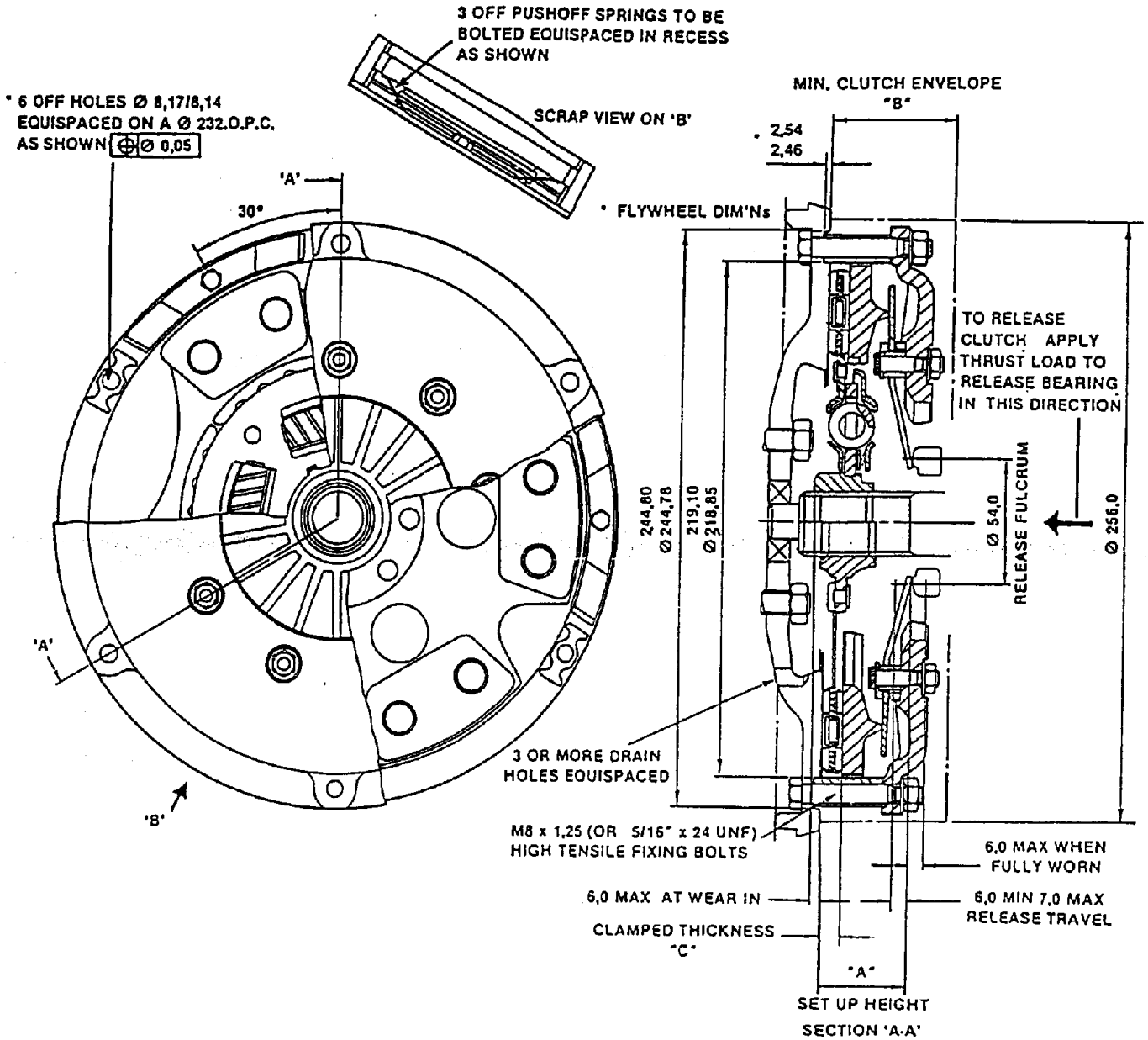


CHART SHOWING SET UP HEIGHT, CLAMP THICKNESS AND MIN. CLUTCH ENVELOPE

PART NUMBER	SET UP HEIGHT "A"	MIN. CLUTCH ENVELOPE "B"	CLAMP THICKNESS "C"
CP2861-6.GRY	35 MIN / 39 MAX	53,0	8,90

NOTE:- CLEARANCE BETWEEN CLUTCH ENVELOPE AND CLUTCH HOUSING TO BE 2,5 MIN.

Publication Ref. 1/J/1 1986

FIVE SPEED RACING SPORT GEARBOX

Gear Ratios

Homologated for BMW M 3 Group A:

1st gear	2.337
2nd gear	1.681
3rd gear	1.358
4th gear	1.150
5th gear	1.000
Reverse gear	2.660

Oil Grade

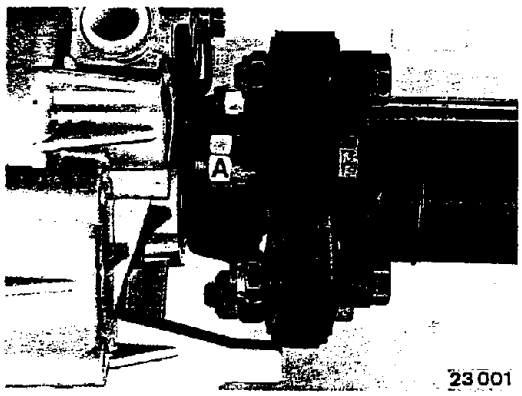
SAE 80

Oil Capacity

1.5 ltr. after test stand run
1.7 ltr. without test stand run

Gearbox Bleeding

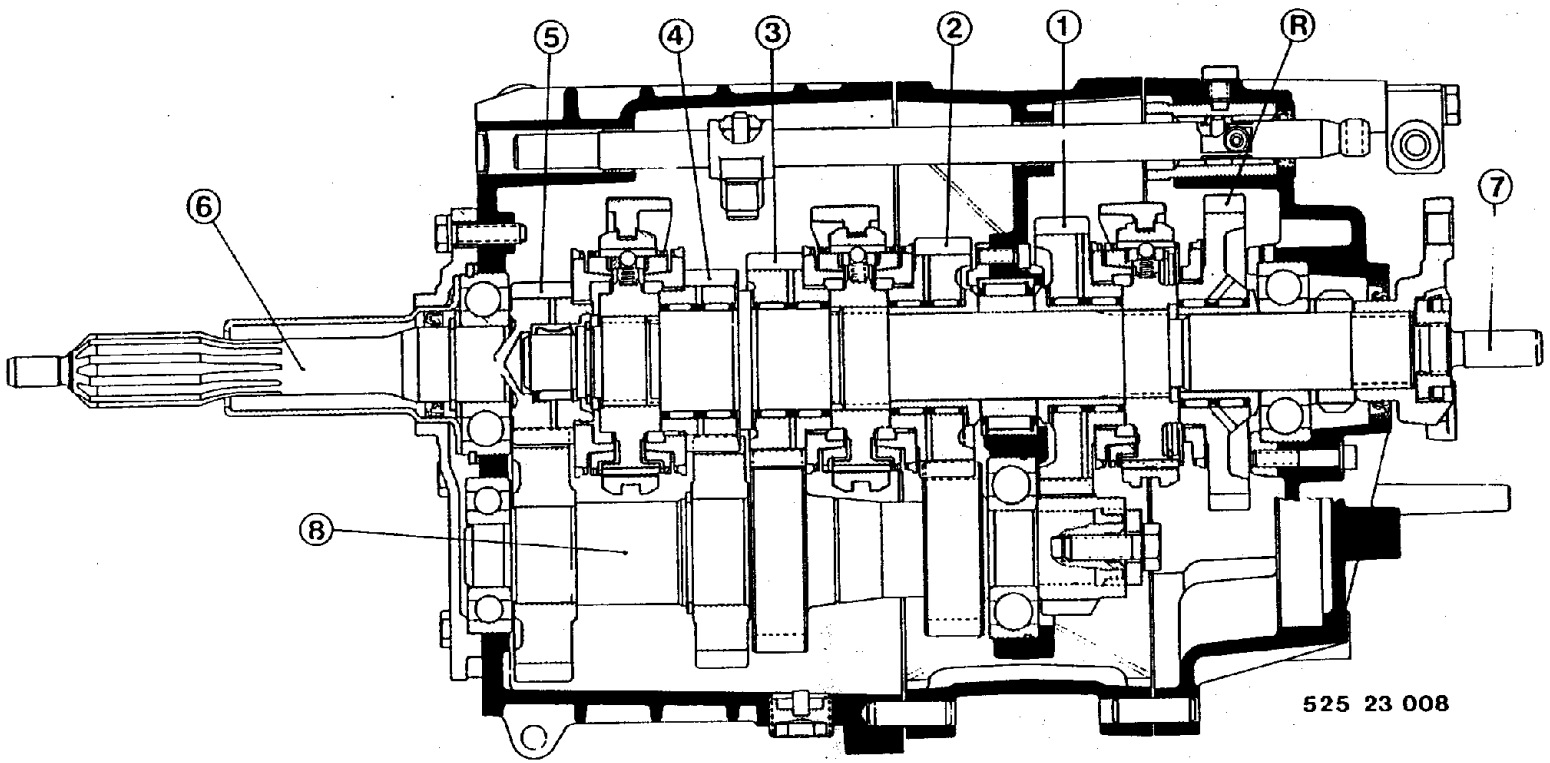
The gearbox is to be bled during racing operations via a hose and container to catch the oil.



GUIBO COUPLING

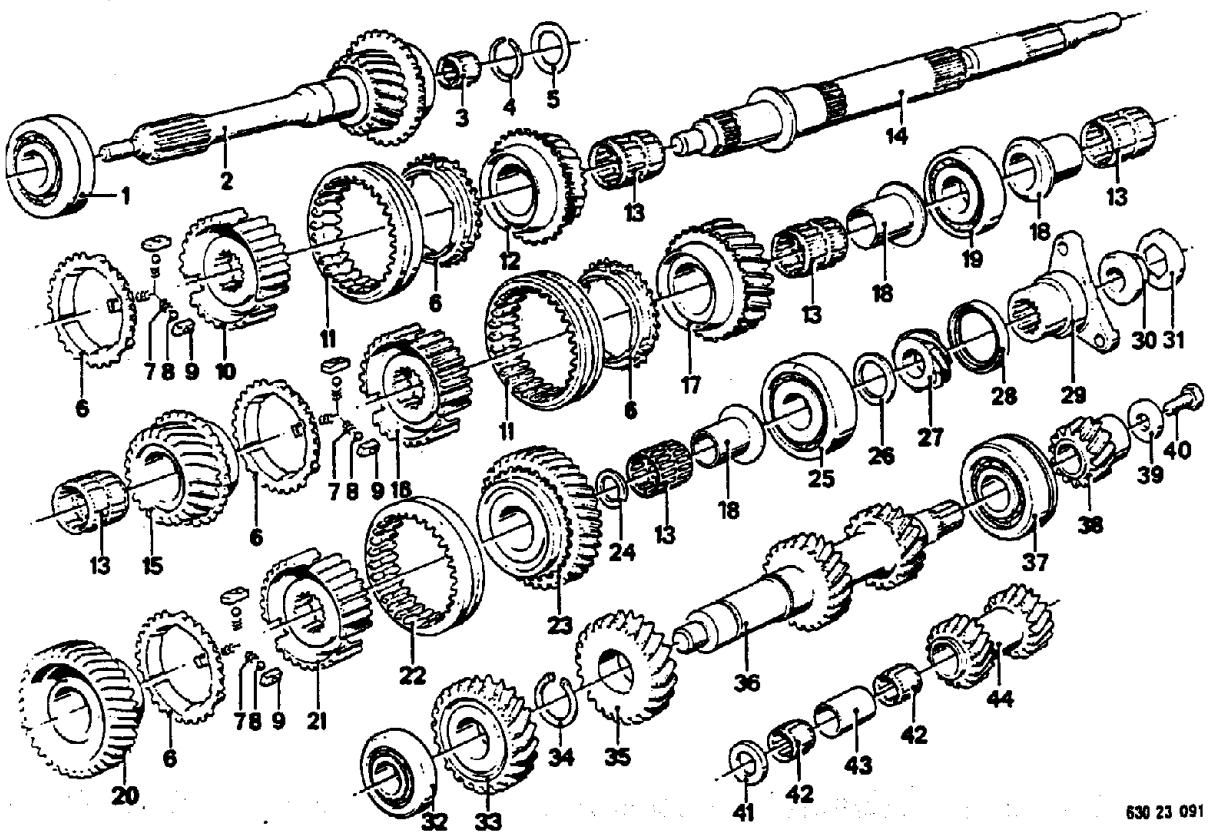
Important!
Only tighten the nuts (never the bolts) to avoid tension in the Guibo coupling!

See Technical Data for correct tightening torque.



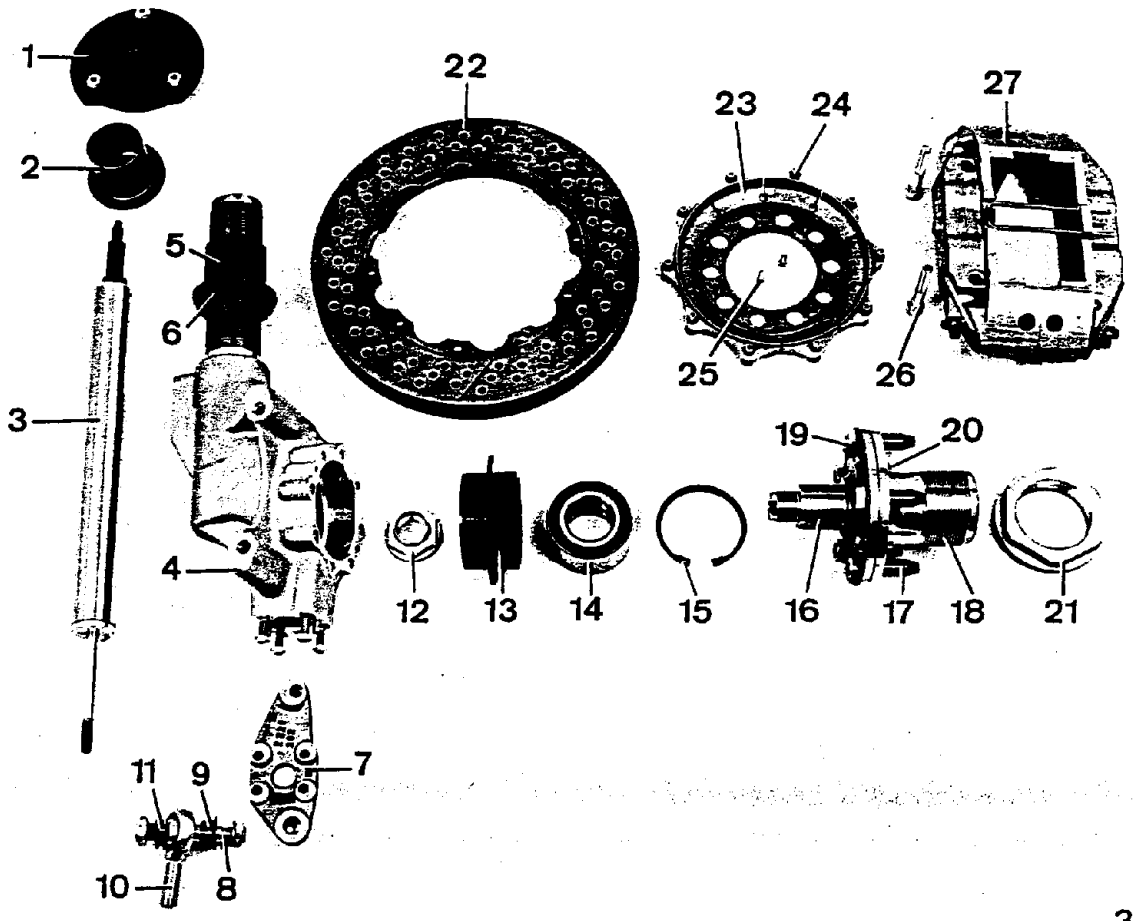
SECTION DRAWING OF 265/SPORT GEARBOX

1 First gear wheel
2 Second gear wheel
3 Third gear wheel
4 Fourth gear wheel
5 Fifth gear wheel
R Reverse gear wheel
6 Input shaft
7 Output shaft
8 Countershaft



1 Ball bearing
2 Input shaft with 5th gear wheel
3 Needle bearing
4 Circlip
5 Spacer
6 Synchromesh ring
7 Spring
8 Ball
9 Pressure piece
10 Guide sleeve
11 Operating sleeve
12 Fourth gear wheel
13 Needle bearing
14 Output shaft
15 Third gear wheel
16 Guide sleeve
17 Second gear wheel
18 Bearing sleeve
19 Ball bearing
20 First gear wheel
21 Guide shaft
22 Operating sleeve
23 Reverse gear wheel
24 Spacer
25 Ball bearing
26 Spacer
27 Speedometer gear/spacer
28 Radial oil seal
29 Output flange
30 Collar nut
31 Lockplate
32 Ball bearing
33 Fifth gear wheel
34 Circlip
35 Fourth gear wheel
36 Countershaft
37 Ball bearing
38 First gear wheel
39 Washer
40 Bolt
41 Thrust washer
42 Needle bearing
43 Sleeve
44 Double gear wheel

FRONT AXLE



31 001

Spring Strut Assembly

1 Supporting mount
2 Upper spring retainer
3 Shock absorber
4 Wheel carrier
5 Lower spring retainer
6 Locknut
7 Steering arm
8 Control arm pin
9 Spacer
10 Joint rod head M 16 x 1.5 mm
11 Spacer
12 Collar nut
13 Wheel bearing sleeve
14 Wheel bearing
15 Circlip 80 x 2.5 mm
16 Front axle shaft
17 Drive pin
18 Central locking shaft
19 Universal stop nut M 12 x 1.5 mm
20 Fillister head bolt M 10 x 25 mm
21 Wheel nut
22 Brake disc
23 Brake disc shell
24 Fillister head screw M 5 x 16 mm
25 Fillister head screw M 5 x 10 mm
26 Fillister head screw M 12 x 1.5 x 80 mm
27 Brake caliper

Stabilizer Selection Table

Stabilizer	19 mm dia.
Stabilizer	21 mm dia.
Stabilizer	23 mm dia.
Stabilizer	25 mm dia.

Coil Spring Selection Table

Coil spring	140 N/mm
Coil spring	150 N/mm
Coil spring	160 N/mm
Coil spring	170 N/mm
Coil spring	180 N/mm
Coil spring	200 N/mm

Shock Absorber Selection Table

	Rebound/Compression
Shock absorber cartridge	300 / 200 kg
Shock absorber cartridge	300 / 300 kg
Shock absorber cartridge	250 / 250 kg

Track Rod Spacer Selection Table

Spacer	h = 4 mm
Spacer	h = 6 mm
Spacer	h = 8 mm
Spacer	h = 10 mm
Spacer	h = 12 mm

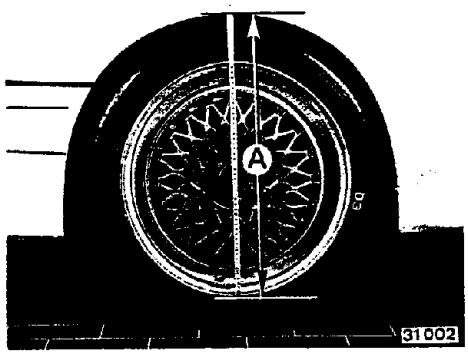
BASIC ADJUSTMENT VALUES (Wheel Geometry)

Vehicle height	510 mm
Coil springs	170 N/mm
Shock absorbers	250/250 kg
Stabilizer	23 mm dia.
Total toe	+ 2 mm
Camber	-2^{o}
Caster	approx. 10^{o}
Toe change while compressing suspension	0 mm with 30 mm compression

WHEEL BEARINGS

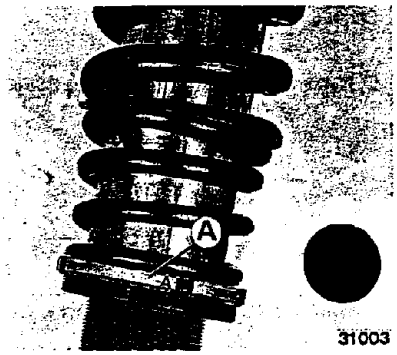
Our investigations have shown that the wheel bearings must be renewed after an operating time of max. 25 hours.
The new wheel bearings must be washed out and then filled with Klüber Nontrob RB3 (green) wheel bearing grease.

Important!
Use a new collar nut when installing a new wheel bearing on the front axle.
Install the new collar nut with Loctite No. 270 and lock it by punching (tightening torque = 280 Nm).



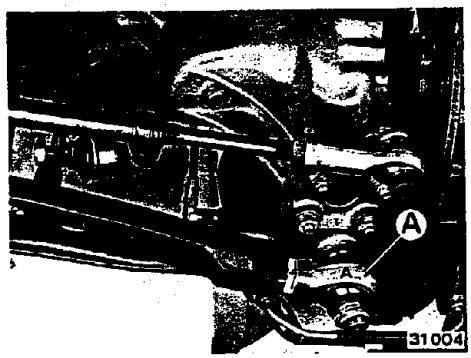
VEHICLE HEIGHT CHECKPOINT

The vehicle height is measured between the wheel rim flange and wheel opening (checkpoint A).
Height = 510 mm.



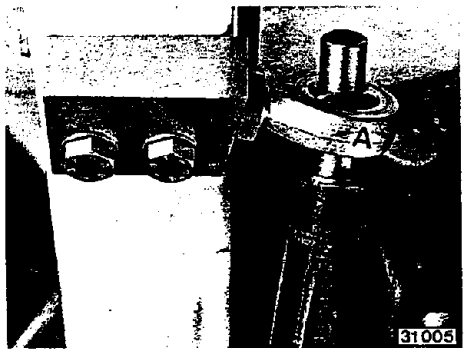
ADJUSTING VEHICLE HEIGHT

The vehicle height can be adjusted by turning the spring retainer (point A).



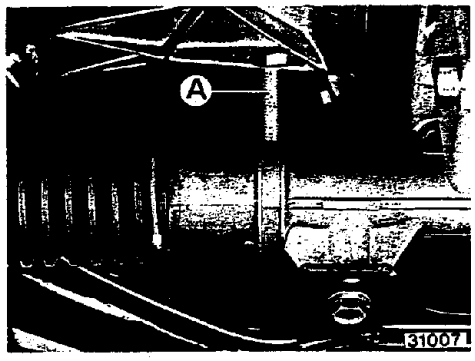
ADJUSTING CAMBER

The supporting mount is used for basic adjustment of the camber.
Fine adjustments are made with the guide joint (point A).
Turned counterclockwise = more camber.
Turned clockwise = less camber.



ADJUSTING CASTER

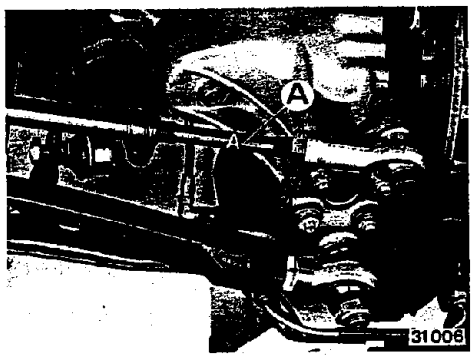
The caster can be adjusted on the universal joint (point A).
Turned counterclockwise = less caster.
Turned clockwise = more caster.



LOCKING THE STEERING

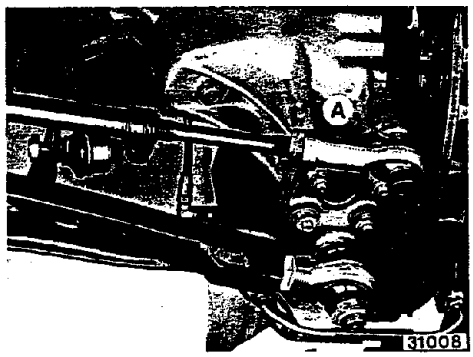
The steering must be locked in straight ahead position prior to checking or adjusting the wheel alignment of the vehicle (point A).

Important!
Remove the centering bolt after checking and adjusting the wheel alignment.



ADJUSTING TOE

The toe can be adjusted on the tie rod (point A).

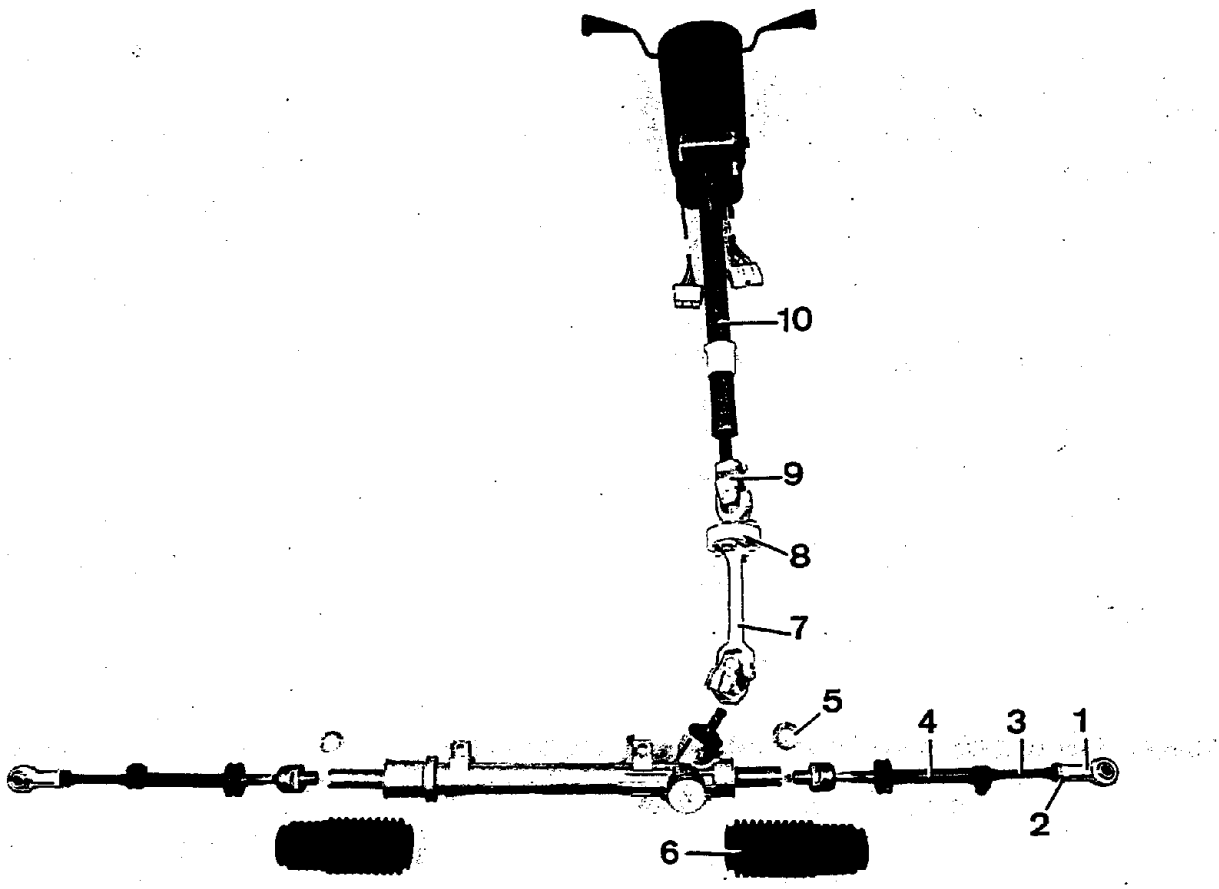


TOE CHANGE

A spacer with thickness H = 6 mm is installed for the basic adjustment (point A).
The toe must not change when the suspension is compressed by 30 mm.

Important!
If a change in toe is measured, it must be corrected by using different spacers (H = 4, 6, 8, 10, 12 mm).

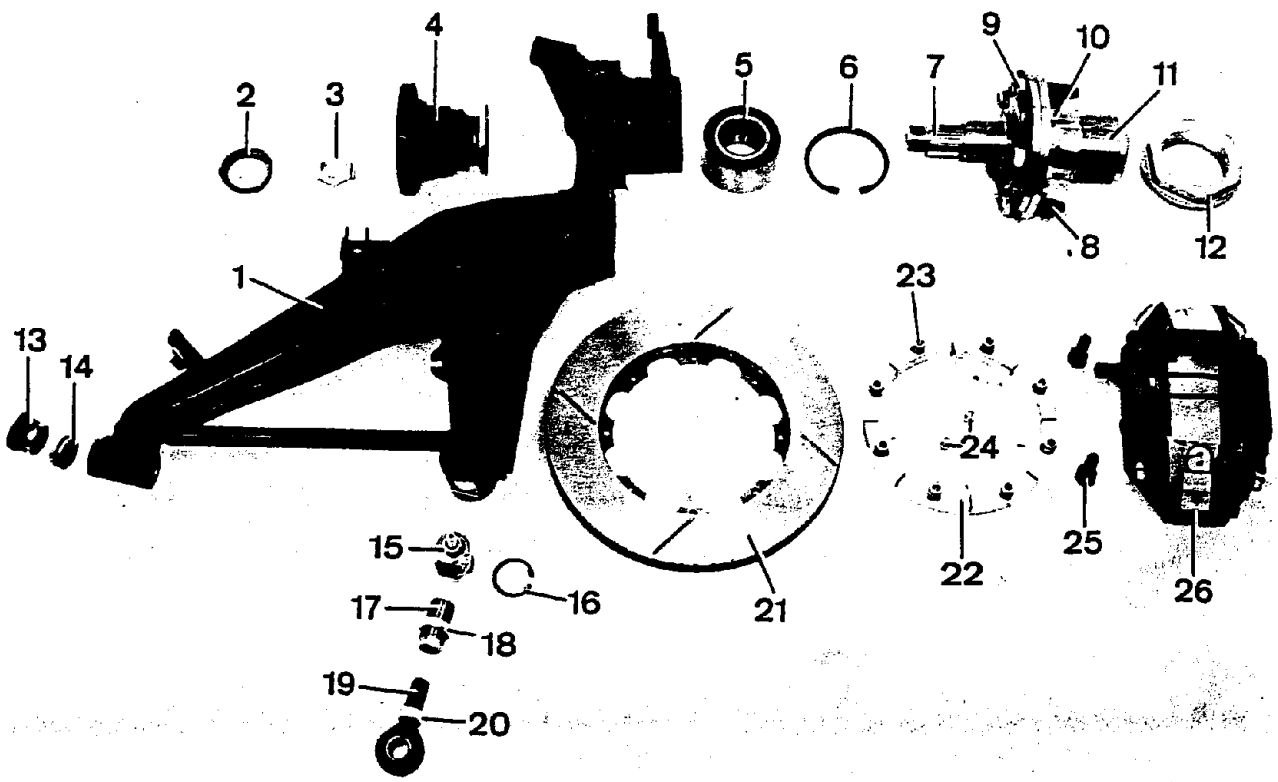
STEERING



32 001

1 Joint rod head M 14 x 1.5 mm
2 Universal stopnut M 14 x 1.5 mm
3 Tie rod intermediate rod
4 Tie rod
5 Lockplate
6 Dust cover
7 Lower steering spindle
8 Coupling
9 Upper universal joint
10 Steering spindle with outer tube

REAR AXLE



33 001

Semi-trailing Arm Assembly

1 Semi-trailing arm
2 Lockplate
3 Collar nut
4 Drive flange
5 Wheel bearing
6 Circlip 80 x 2.5 mm
7 Stub axle
8 Drive pin
9 Universal stopnut M 12 x 1.5 mm
10 Fillister head bolt M 10 x 25
11 Central locking shaft
12 Wheel nut
13 Threaded sleeve
14 Joint mount
15 Threaded sleeve
16 Circlip 36 x 1.5 mm
17 Adjusting sleeve
18 Locknut
19 Joint rod head M 16 x 1.5 mm left
20 Locknut M 16 x 1.5 mm left
21 Brake disc
22 Brake disc shell
23 Fillister head bolt M 8 x 16
24 Fillister head screw M 5 x 12
25 Bolt M 12 x 1.5 x 32 mm
26 Brake caliper

BASIC ADJUSTMENT VALUES (Wheel Geometry)

Vehicle height	495 mm
Coil springs	120 N/mm
Shock absorbers	200/200 kg
Stabilizer	20 mm dia.
Toe per wheel	+ 2 mm
Camber	-2^{o}

WHEEL BEARINGS

Our investigations have shown that the wheel bearings must be renewed after an operating time of max. 25 hours.
The new wheel bearings must be washed out and then filled with Klüber Nontrob RB 3 (green) wheel bearing grease.

Important!
Use a new collar nut (waxed) and a new lockplate when installing a new wheel bearing on the rear axle.
Install the new collar nut with a tightening torque of 280 Nm and lock the lockplate by punching.

Stabilizer Selection Table

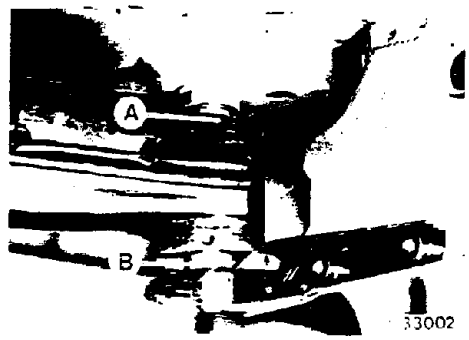
Stabilizer	14 mm dia.
Stabilizer	16 mm dia.
Stabilizer	18 mm dia.
Stabilizer	20 mm dia.
Stabilizer	22 mm dia.

Coil Spring Selection Table

Coil spring	90 N/mm
Coil spring	100 N/mm
Coil spring	110 N/mm
Coil spring	120 N/mm
Coil spring	130 N/mm
Coil spring	140 N/mm
Coil spring	150 N/mm

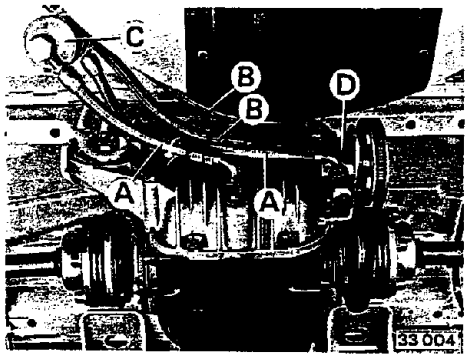
Shock Absorber Selection Table

	Rebound/Compression
Shock absorber	200 / 200 kg
Shock absorber	250 / 150 kg
Shock absorber	250 / 250 kg



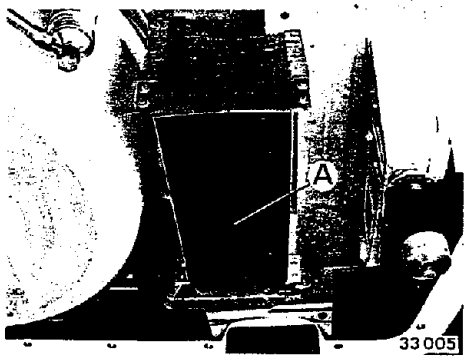
REAR AXLE CARRIER INSTALLATION

The rear axle carrier is installed with sleeves.
H = 13 mm / point A
H = 13 mm / point B

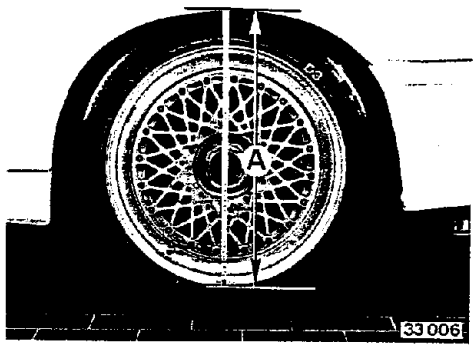


FINAL DRIVE COOLING

A = Suction pipe
B = Return pipe
C = Oil filter
D = Oil pump



POSITION OF FINAL DRIVE COOLER

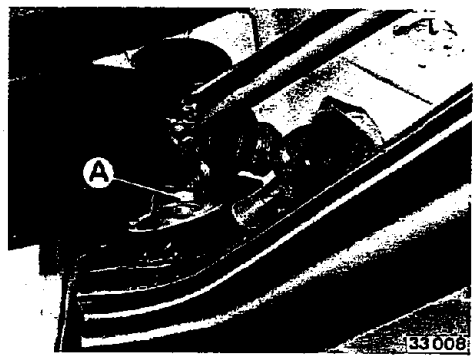


VEHICLE HEIGHT CHECKPOINT

The vehicle height is measured between the wheel rim flange and wheel opening (checkpoint A).
Height = 495 mm.

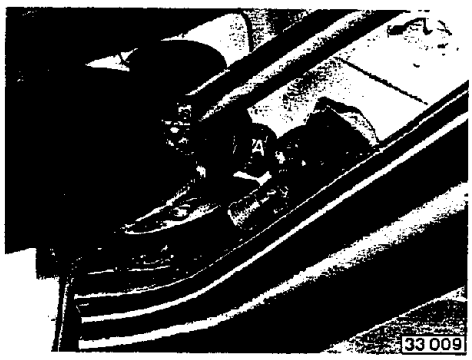
ADJUSTING VEHICLE HEIGHT

The vehicle height can be adjusted by turning the spring retainer (point A).



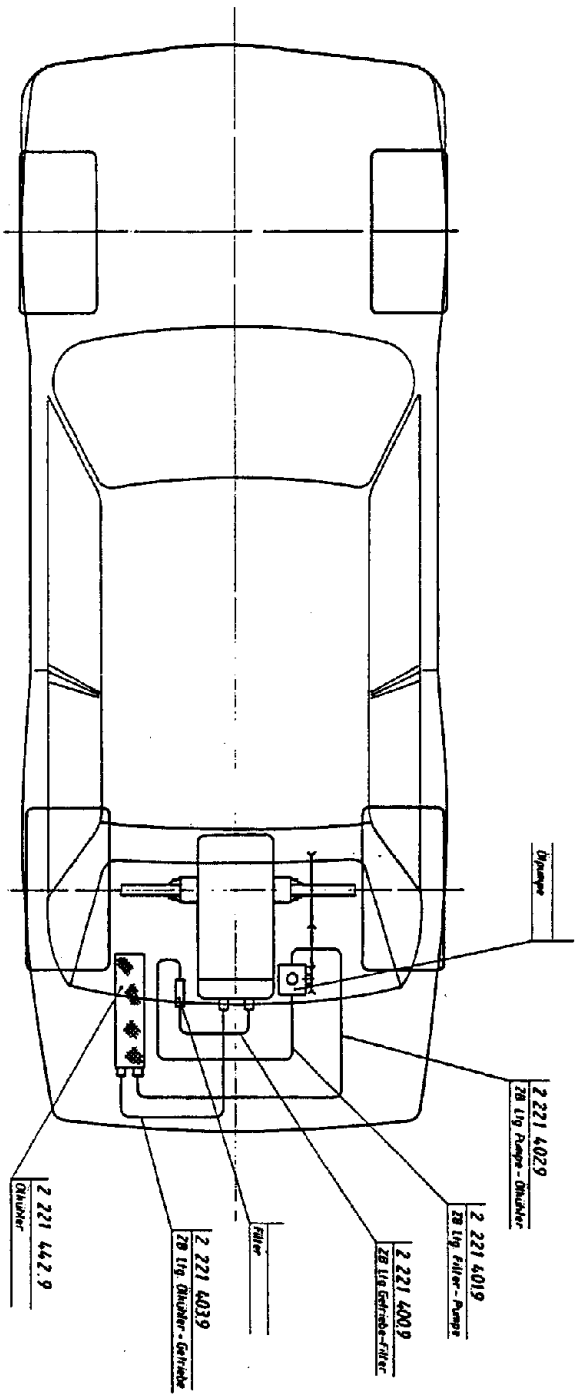
ADJUSTING CAMBER

The camber cān be adjusted on the adjusting spindle (point A).



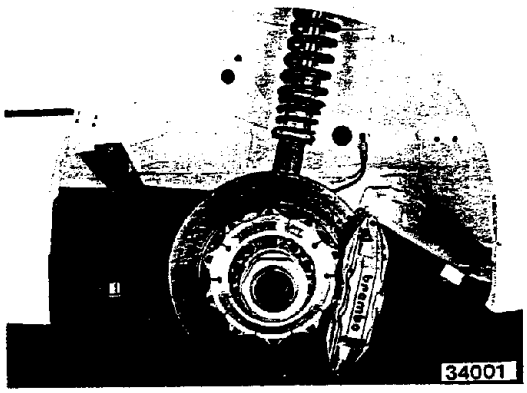
ADJUSTING TOE

The threaded sleeve (point A) is used to adjust the toe.



A0 Hinterachsgetriebe-Ölsystem	2 221 435	1

BRAKE SYSTEM

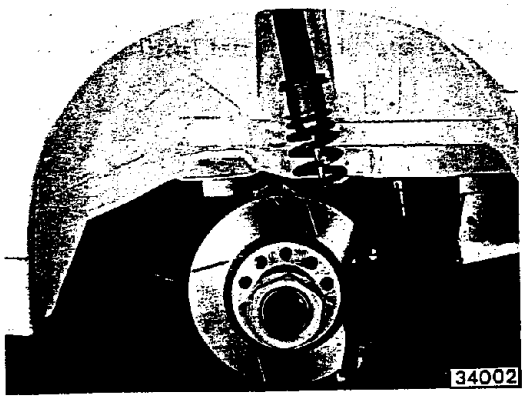


FRONT AXLE

Brake disc (Brembo) drilled
332 mm diameter

Brake caliper (Brembo)

Piston diameter
2 x 38 mm
2 x 42 mm



REAR AXLE

Brake disc (AP) not drilled
280 mm diameter

Brake caliper (AP)

Piston diameter
4 x 36 mm

Brake Master Cylinders

Front axle 0.625" (installed on right-hand side as seen looking forward in car)
Rear axle 0.750" (installed on left-hand side as seen looking forward in car)

Brake Fluid

Use the standard brake fluid from BMW (BASF Hydraulan DOT 4 Type 75974).
BMW Order No. 07 53 1119 334

BLEEDING BRAKES

Basically it is only permitted to work with two bleeding bottles, whereby bleeding must be performed simultaneously on one front wheel and one rear wheel on the same side of the vehicle.

Bleeding must always be carried out to the specified order of steps.

1. Fill the brake fluid tank.

2. Loosen the bleeder screws on the front and rear wheels on the right-hand side as seen looking forward in the vehicle by one full turn.

3. Pump the brake fluid through the system by operating the brake pedal until the escaping brake fluid is without air bubbles.

4. Tighten the bleeder screws with the brake pedal depressed.

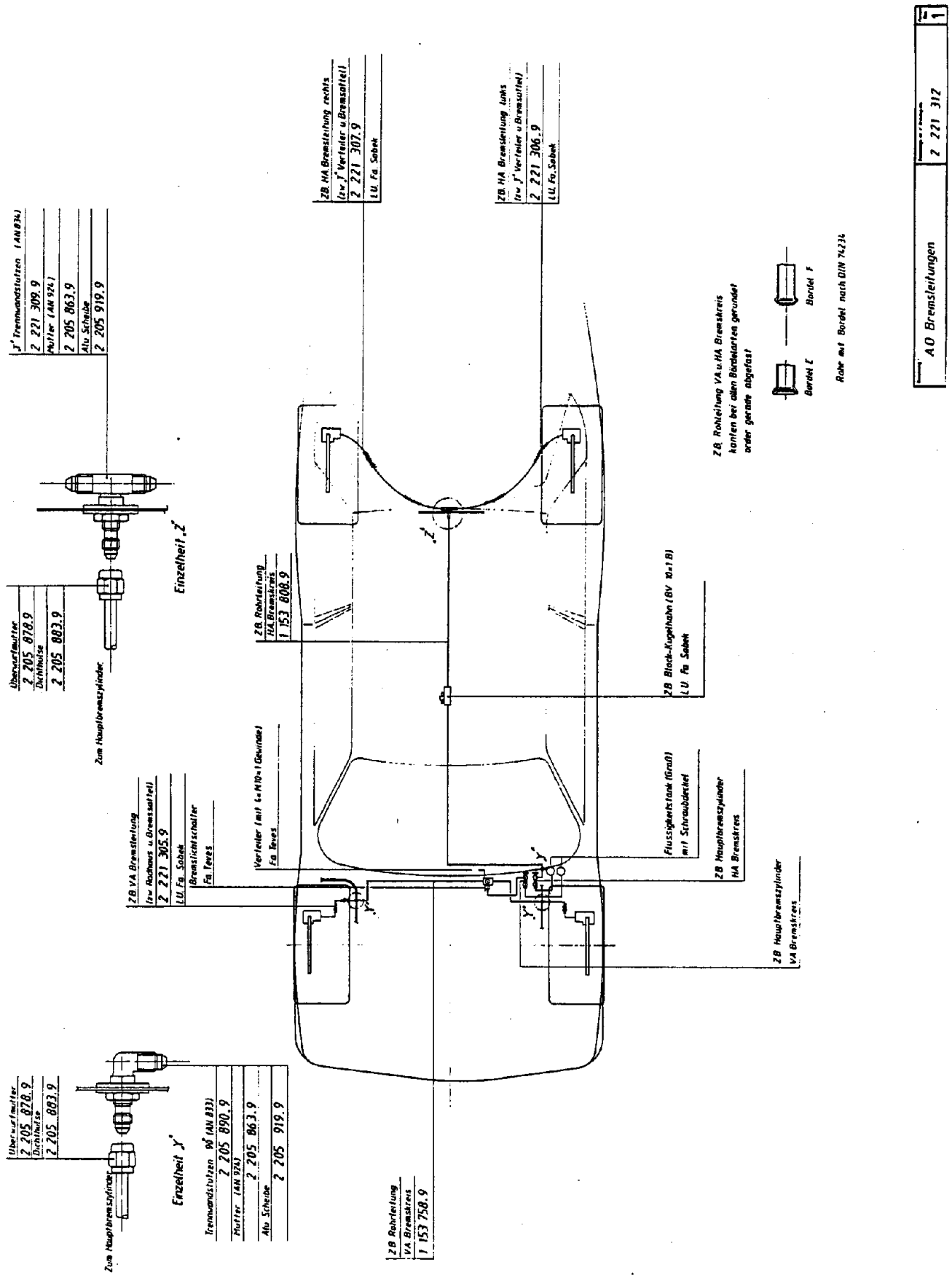
   Important!
   The bleeder screws have aluminum threads – *be careful while tightening!*

5. Repeat the same procedures on the left-hand side of the vehicle.

   Important!
   Always hold the parking brake valve in "open" position!

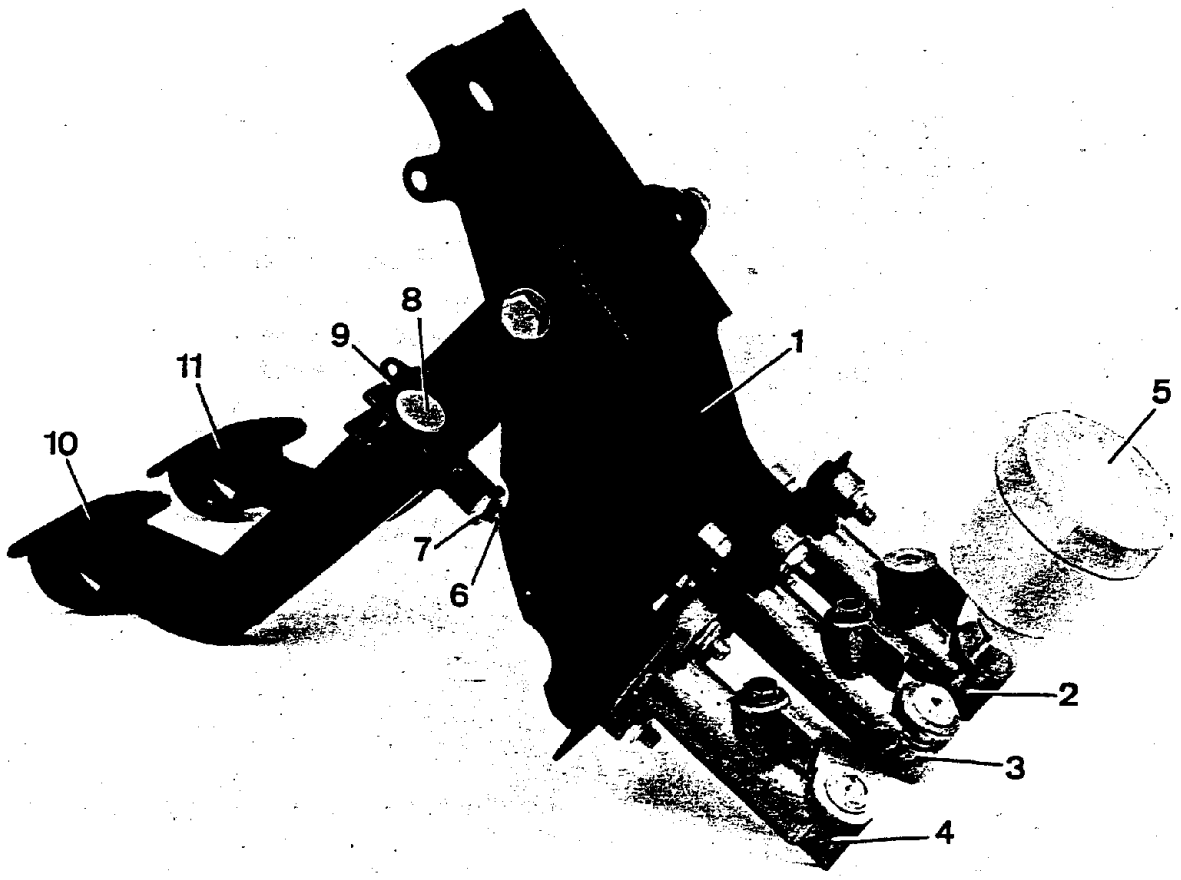
RUNNING-IN BRAKES

New brake linings and brake discs must be run in thoroughly and carefully. Apply the brakes the first few times with as little pressure as possible. The brakes should be applied up to the "fading" point after two or three rounds, then let the brakes cool off for one complete round and finally apply the brakes as often as necessary until the optimal braking power is reached.


1" Trennwandstutzen (AN 924)
2 221 309.9
Mutter (AN 924)
2 205 863.9
Alu Scheibe
2 205 919.9
Überwurfmutter
2 205 878.9
Dichthülse
2 205 883.9
Zum Hauptbremszylinder
Einzelheit „Z"
ZB HA Bremsleitung rechts
(zw. 1" Verteiler u. Bremssattel)
2 221 307.9
LU Fa. Sobek
ZB HA Bremsleitung links
(zw. 1" Verteiler u. Bremssattel)
2 221 306.9
LU Fa. Sobek
ZB Rohrleitung
HA Bremskreis
1 153 808.9
ZB VA Bremsleitung
(zw. Aufbau u. Bremssattel)
2 221 305.9
LU Fa. Sobek
Bremslichtschalter
Fa. Teves
Verteiler (mit 6x M10x1 Gewinde)
Fa. Teves
ZB Block-Kugelhahn (BV 10x1 B)
LU Fa. Sobek
Flüssigkeitstank (Grau)
mit Schraubdeckel
ZB Hauptbremszylinder
HA Bremskreis
ZB Hauptbremszylinder
VA Bremskreis
ZB Rohrleitung
VA Bremskreis
1 153 758.9
Einzelheit „Y"
Trennwandstutzen 90° (AN 83)
2 205 890.9
Mutter (AN 924)
2 205 863.9
Alu Scheibe
2 205 919.9
Überwurfmutter
2 205 878.9
Dichthülse
2 205 883.9
Zum Hauptbremszylinder
ZB Rohrleitung VA u. HA Bremskreis
konfen bei allen Bördelarten gerundet
oder gerade abgefast
Bördel E
Bördel F
Rohr mit Bördel nach DIN 74234
AO Bremsleitungen
2 221 312
1

Fußbetätigung / Pedal assembly

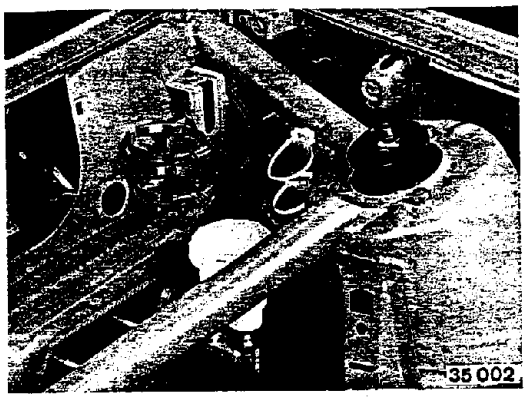
PEDALS



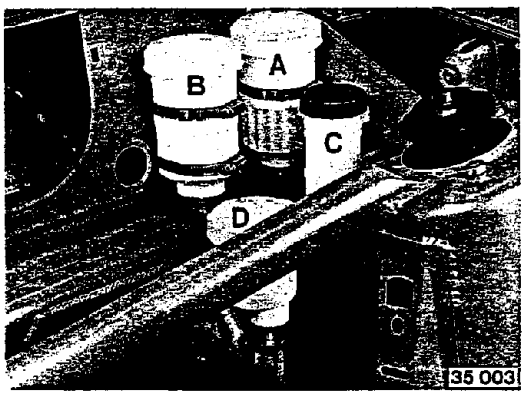
35 001

Pedal Base Assembly

1 Pedal base
2 Clutch master cylinder 0.700"
3 Brake master cylinder 0.750" – rear axle
4 Brake master cylinder 0.625" – front axle
5 Hydraulic fluid reservoir – clutch
6 Push rod
7 Locknut
8 Adjusting nut
9 Swivel
10 Brake pedal
11 Clutch pedal

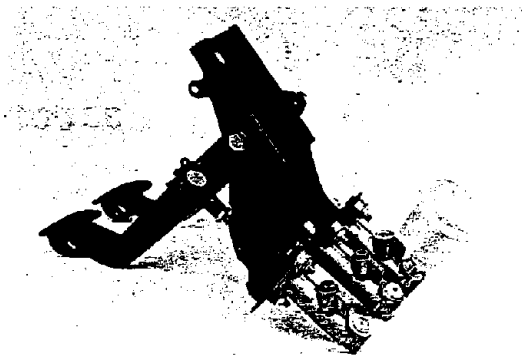


Position of holder for hydraulic fluid reservoir



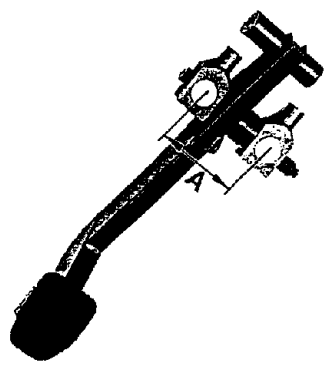
Hydraulic Fluid Reservoir Layout:

A = Brakes – rear axle
B = Brakes – front axle
C = Gearbox bleeding
D = Clutch



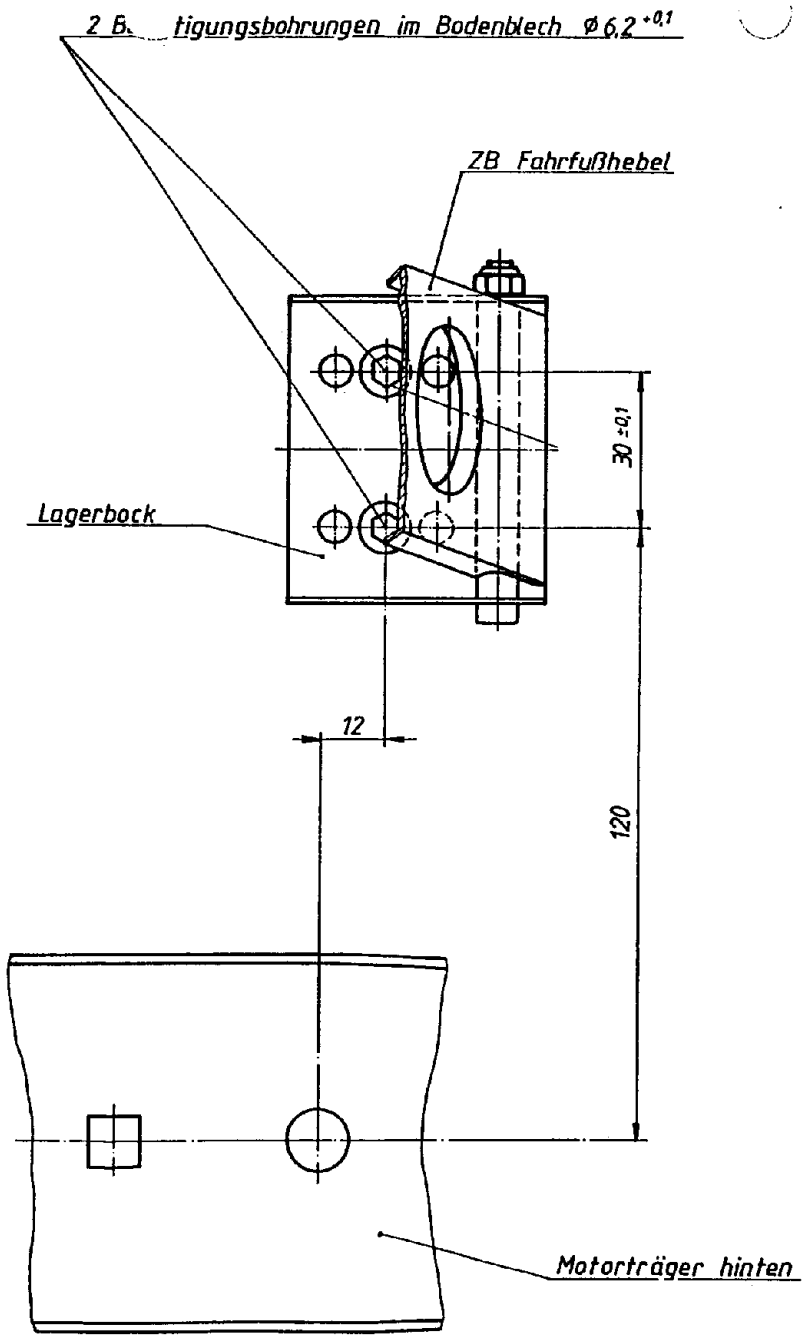
35 004

Because of the eccentric installation, the clutch reservoir must be aligned after installation in such a manner that the reservoir does not contact the clamping strut.



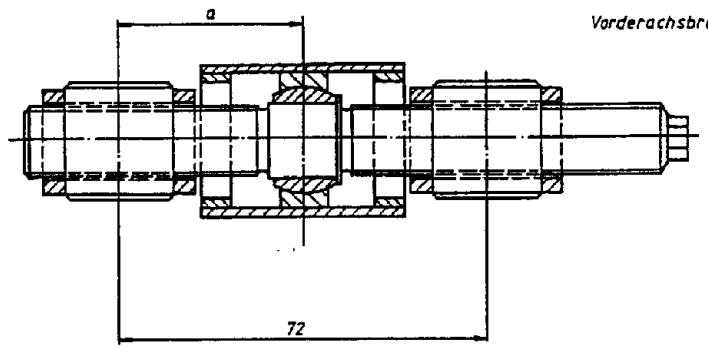
35 005

Important!
A = 72 mm



Benennung: Befestigung Gaspedal an Bodenblech	Zeichnungs-Nr. / Drawing-No. 2 221 537	Format Size 3

Hinterachsbremse



Vorderachsbremse

Vorderachse: überbremst „a" verkleinern
Hinterachse: überbremst „a" vergrößern

Benennung: ZB Waagebalken	Zeichnungs-Nr. / Drawing-No. 2 221 428	Format Size 3

WHEELS

Front Axle

Wheel rim well	1" x 16" outer well 8" x 16" inner well
Wheel rim offset	24 mm
Collar height - spider	62 mm
Tyre size	235/590 – 16"
Max. total width of wheels	10"

Rear Axle

Wheel rim well	1" x 16" outer well 8" x 16" inner well
Wheel rim offset	24 mm
Collar height - spider	62 mm
Tyre size	235/590 – 16"
Max. total width of wheels	10"

IMPORTANT!
The tightening torque (15 – 2 Nm) of the wheel rim bolts must be check prior to each racing event.

RECOMMENDED INSTALLATION OF WHEELS WITH CENTRAL LOCKING

1. First of all it is always necessary to check, whether the wheel supplied to you conforms with all points required for fitting on the vehicle.

2. Please make sure that the threads of the hub are cleaned thoroughly and coated with a suitable lubricant (Caramba, Ultra Term).
It must be possible to turn the nut easily.
The bearing surfaces between the wheel rim spider and nut as well as the machined surfaces on the wheel rim spider and wheel hub must be absolutely clean, dry and free of paint and grease.

   Important!
   Only spray the threads of the central locking shaft.

   Make sure that the mounting bolts of brake discs are recessed in the area of the wheel rim bearing surface and tightened.

3. Before you use a new wheel in a race for the first time, mount it on the vehicle and tighten the central locking nut with the maximum permissible tightening torque about 10 to 20 times. This will match the parts. This will also compress the surface finish of the material, so that the settling normally occurring during operation will already be taken care of.

4. TIGHTENING TORQUE: 700 + 100 Nm.

5. Please make sure that there is conformance with the following recommendations during the use of your wheels.

   – Inspect the wheel for damage before and after each mounting. Damaged wheels must not be mounted again.

   – Check for cracks at regular intervals, so that you are always up-to-date on the condition of safety components.

   – **The wheels may only be installed or removed on a jacked-up vehicle. The wheel may only contact the floor or ground after being tightened to the maximum torque value.**

   – Only checking the tightening torque, which is always necessary, is permitted on a lowered vehicle.

CHANGING WHEELS DURING A RACE

IMPORTANT!

THE FOLLOWING POINTS MUST BE CHECKED TO GUARANTEE THAT THE SPECIFIED MINIMUM TIGHTENING TORQUE OF 700 NM IS REACHED WHEN WORKING WITH IMPACT SPANNERS.

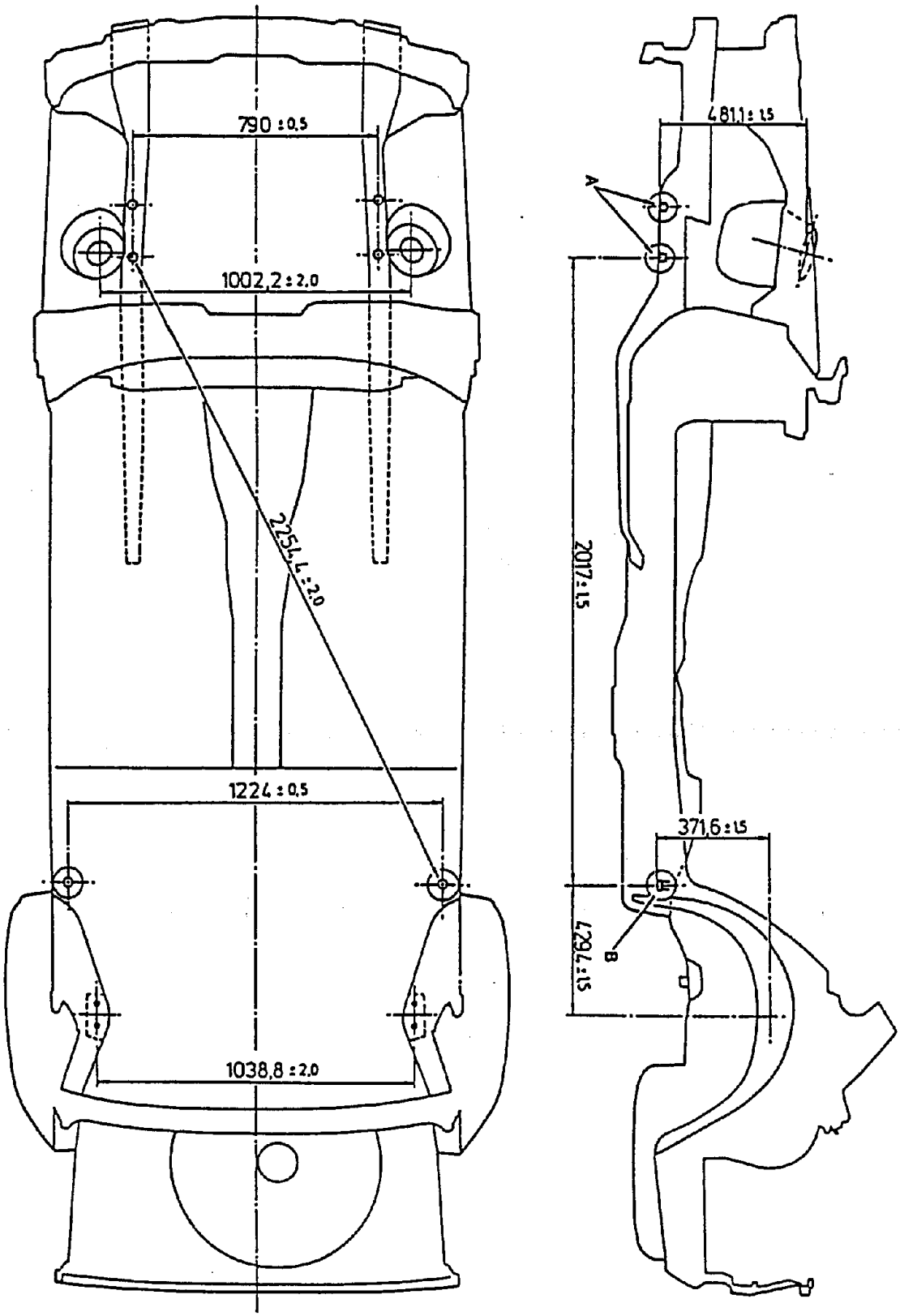
a) Impact Spanner Inspection

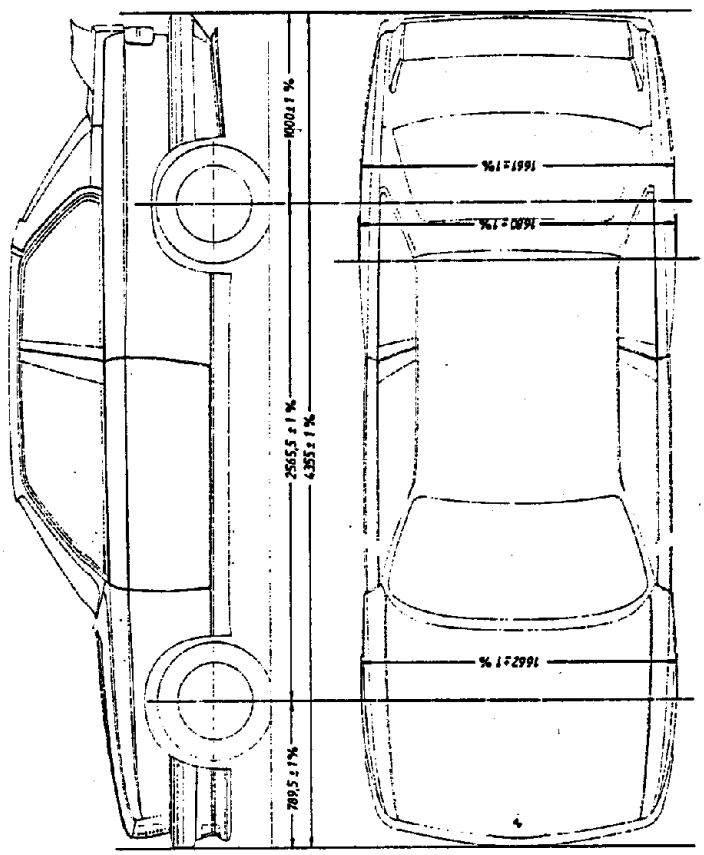
- All spanners must be checked to make sure that the specified tightening torque is reached with sufficient reserve (excessive tightening torque will not damage the connection; insufficient torque leads to failure).
- Please use a high-precision torque wrench with a maximum indicator and an approximately 2 metre long leverage arm for inspections.
- Damaged or faulty spanners must be renewed.

b) Inspection of Air Carrying Lines

Check the following points, if it is determined that the necessary tightening torque is not reached.

- The inside diameter of all air-carrying components must not be smaller than 13 mm.
- Only couplings and connectors of large cross section opening size may be used. (Please ask the suppliers for information, whether the air flow rate is sufficient.) Impact spanners require an air flow rate of approximately 2,000 liters/minute.
- Are the cross section openings in the "gallows" okay?


790 ±0,5
1002,2 ±2,0
2254,4 ±2,0
1224 ±0,5
1038,8 ±2,0
481,1 ±1,5
A
2017 ±1,5
371,6 ±1,5
B
762,7 ±1,5


1000 ± 1%
1667 ± 1%
1680 ± 1%
2565,5 ± 1%
4355 ± 1%
1662 ± 1%
789,5 ± 1%

BODY

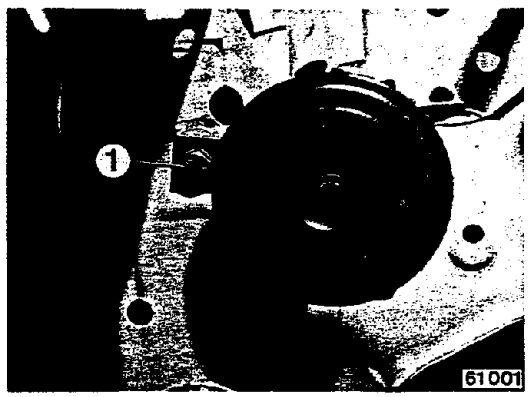
The windscreen and rear window are cemented with a polyurethane cement, in order to improve the torsional strength of the body.

Cementing Procedures:
- Clean the edge of the window glass and the window flange to remove grease.
- Coat the edge of the window glass and the window flange with a primer.
- Mount the window rubber frame.
- Apply a coat (10 mm diameter bead) of cement on the edge of the window glass and body flange.
- Place the window in the body and load down all 4 corners (clamps, sacks of sand, etc.).

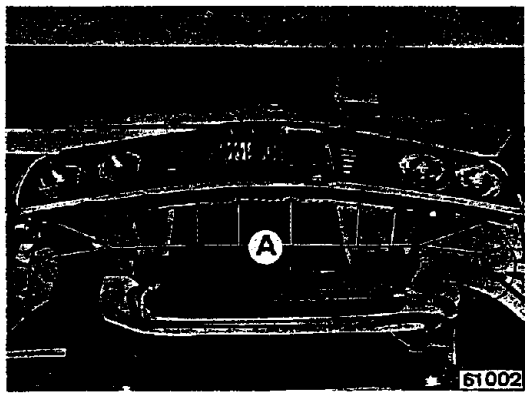
Number of cement kit: 51 31 2 220 708.

IMPORTANT!

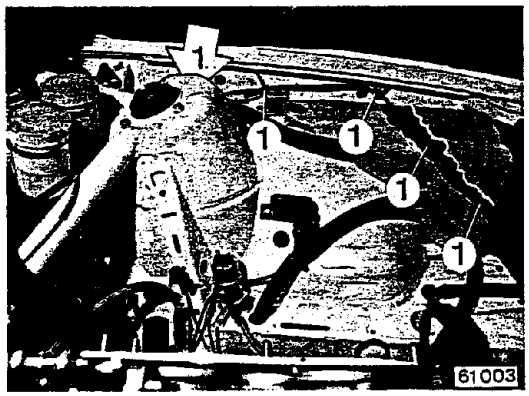
For safety reasons a fire-proof, flame and liquid-proof wall must separate the passenger compartment from the fuel tank. For this reason the rear wall between the luggage compartment (boot) and passenger compartment must be sealed with a petrol-rejecting sealing compound in the area of the wheel housings, wings and C pillars after painting.



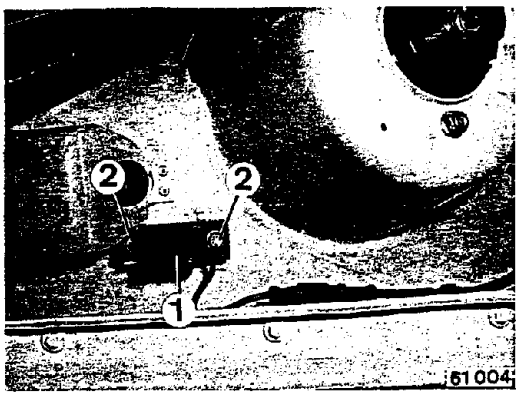
Installation of horn with a M 8 hexagon head bolt (1).



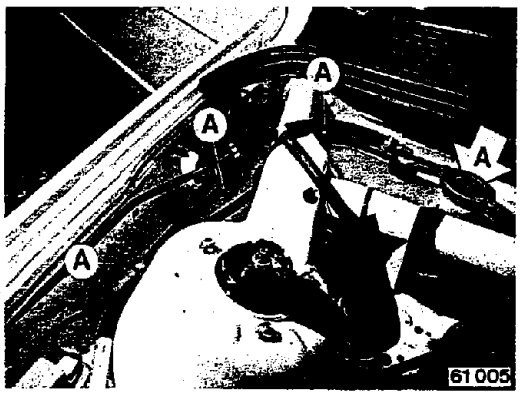
Installation of wire harness on the front panel with nine wire straps at the points provided for this purpose.



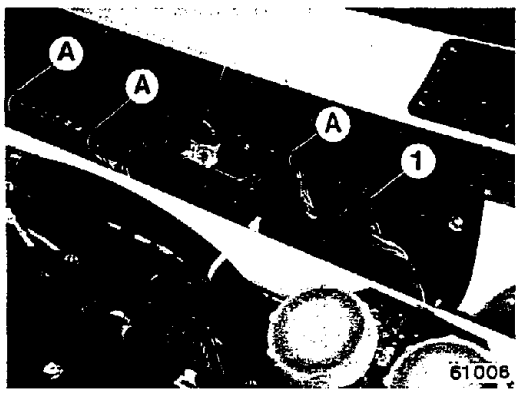
Installation of wire harness on inside of the wheel house with five wire straps (1).



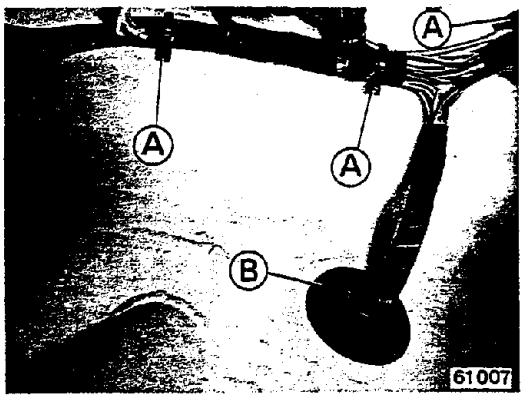
Installation of airbag crash sensor (1) on wheel house with two M 6 hexagon head screws (2) and two washers.
(installation on righthand side of vehicle is identical)



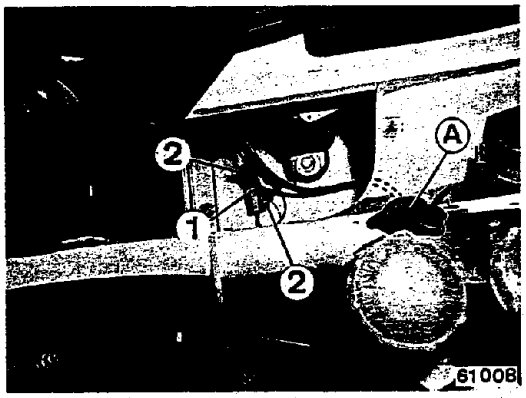
Installation of wire harness on righthand side of firewall and right wheel house with four mounting sockets, four rivets and four wire straps.
This requires drilling four 4.1 mm diameter holes (A).



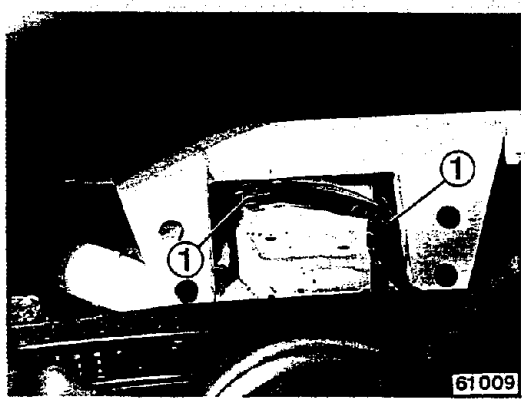
Installation of wire harness on heater separating wall with two mounting sockets, two rivets and two wire straps in holes (A) provided for this purpose.
Installation of plug connector by clipping in the adapter located on the heater separating wall.



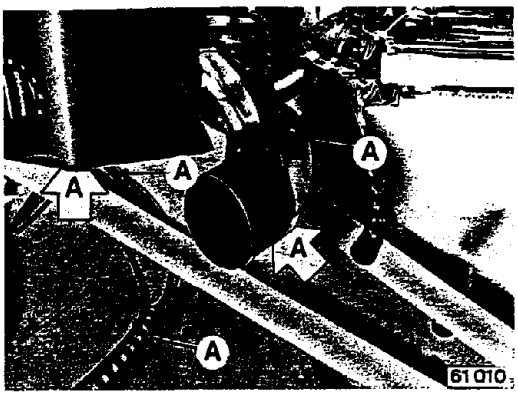
A 36 mm diameter hole must be drilled in the firewall to be able to route the wire harness into the passenger compartment.
Installation of wire harness on lefthand inside of firewall with three mounting sockets, three rivets and three wire straps. This requires drilling three 4.1 mm diameter holes.



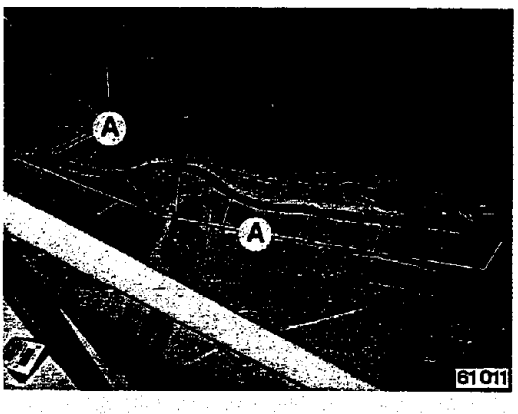
Drill two holes for installation of resistor (1) on the firewall at the top and screw on the resistor with two M 3 oval head screws (2).
A 30 mm diameter hole (A) must be drilled to be able to insert the tap for the wiper motor.



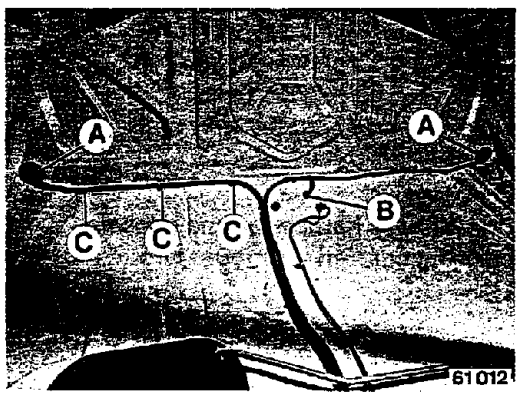
Installation of wire harness on the console for the steering column with two wire straps (1).



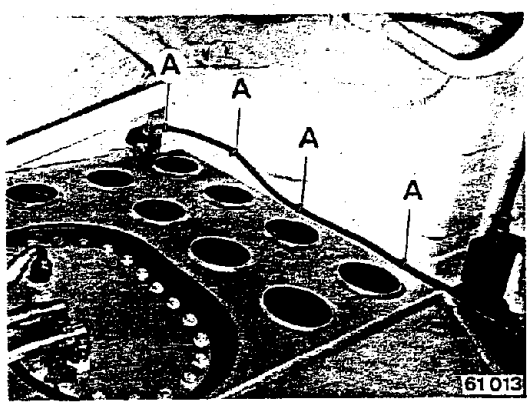
Installation of wire harness on inside of firewall at the middle and righthand side with six mounting sockets, six rivets and six wire straps.
This requires drilling six 4.1 mm diameter holes.



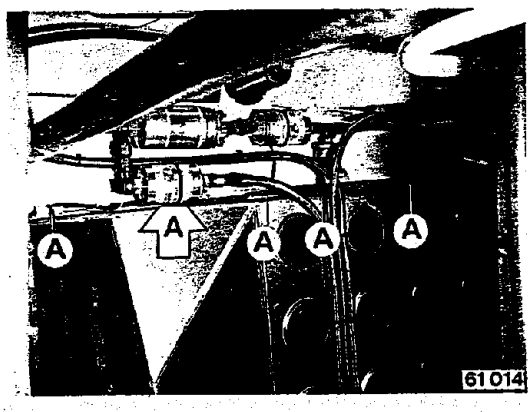
Installation of wire harness on tunnel, rear floor plate and boot separating wall at lefthand side with twelve mounting sockets, twelve rivets and twelve wire straps.
This requires drilling twelve 4.1 mm diameter holes.



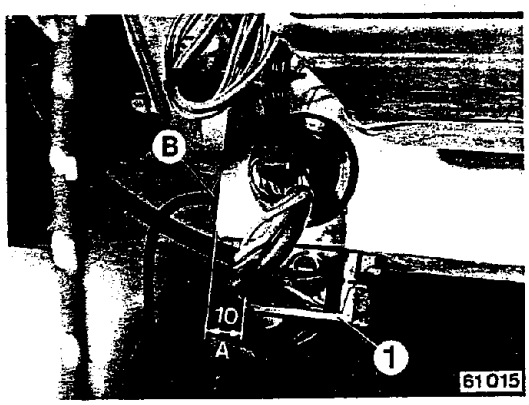
One each 36 mm diameter hole (A) must be drilled in the boot separating wall to be able to route the wire harness and battery positive cable into the boot.
A 13.5 mm diameter hole (B) must be drilled in the rear floor plate to be able to route in the tap for the temperature sensor of the final drive.
Installation of battery positive cable with three mounting sockets, three rivets and three wire straps.
This requires drilling three 4.1 mm diameter holes.



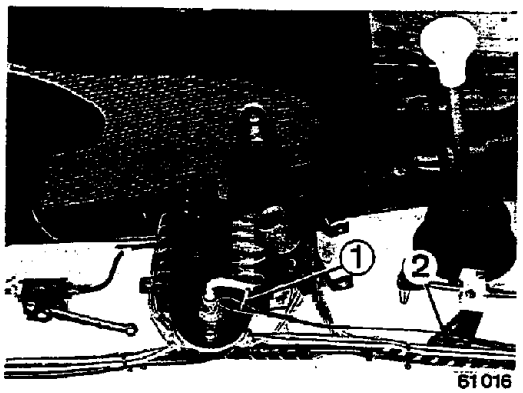
Installation of battery positive cable on wheel house with four mounting sockets, four rivets and four wire straps.
This requires drilling four 4.1 mm diameter holes.



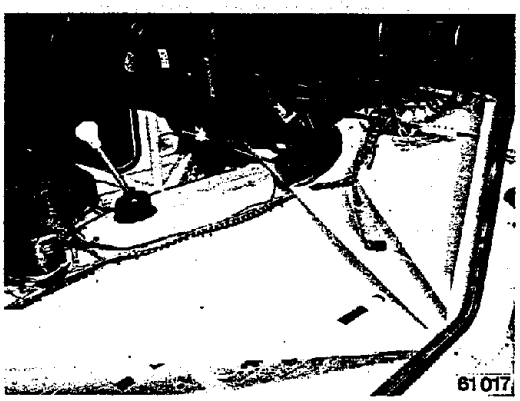
Installation of wire harness on boot floor plate with six mounting sockets, six rivets and six wire straps.
This requires drilling six 4.1 mm diameter holes.



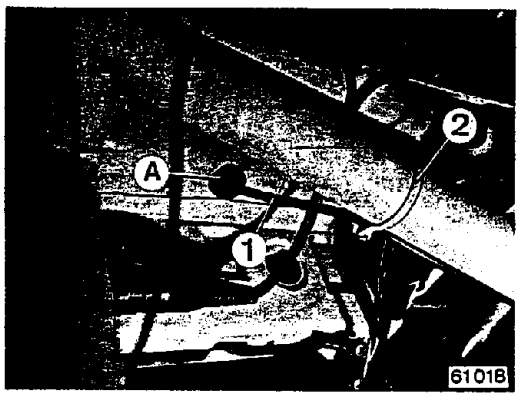
Installation of wire connector (1) on inside of firewall at righthand side with two blind rivet nuts M 4, two M 4 oval head screws and two washers.
This requires drilling two 7.9 mm diameter holes to positioning (A).
A 17 mm diameter hole (B) must be drilled for the routing of the airbag tap.



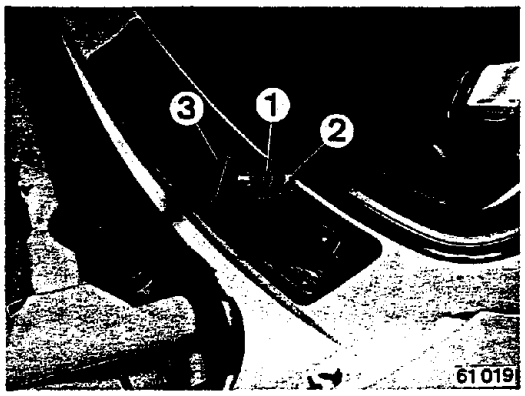
Connect the cable for the master switch in ring (1) and in the console for the brake force control (2).



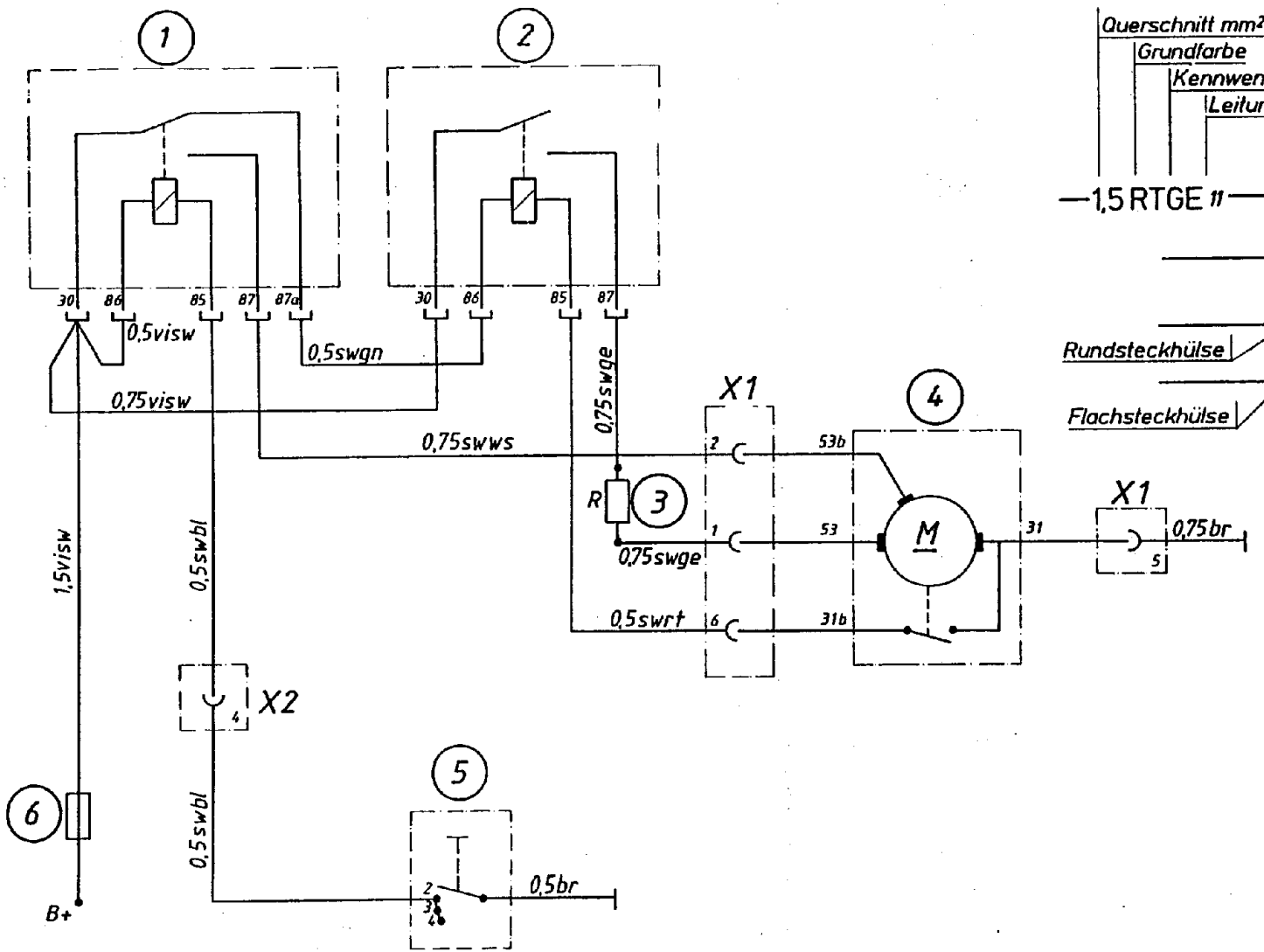
Route the cable along the wire harness and secure it on the harness.

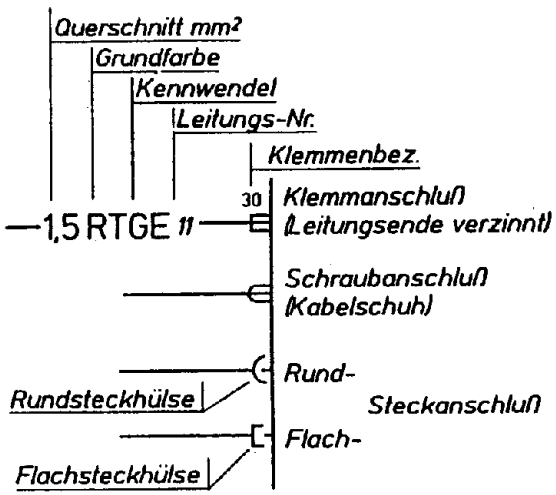


A 15.5 mm diameter hole (A) must be drilled to be able to route cable (1) through the firewall.
Install the cable with cable strap (2).



Install mount (1) on the cowl panel with a M 12 x 1.5 hexagon nut (2).
This requires drilling a 12.5 mm diameter hole.
Solder on grip (3) after installation of the pulling cable.





Kennzeichnung

BL = blau
BR = braun
GE = gelb
GN = grün
GR = grau
RT = rot
SW = schwarz
VI = violett
WS = weiß
TR = transparent

Lötstelle oder Verbinder

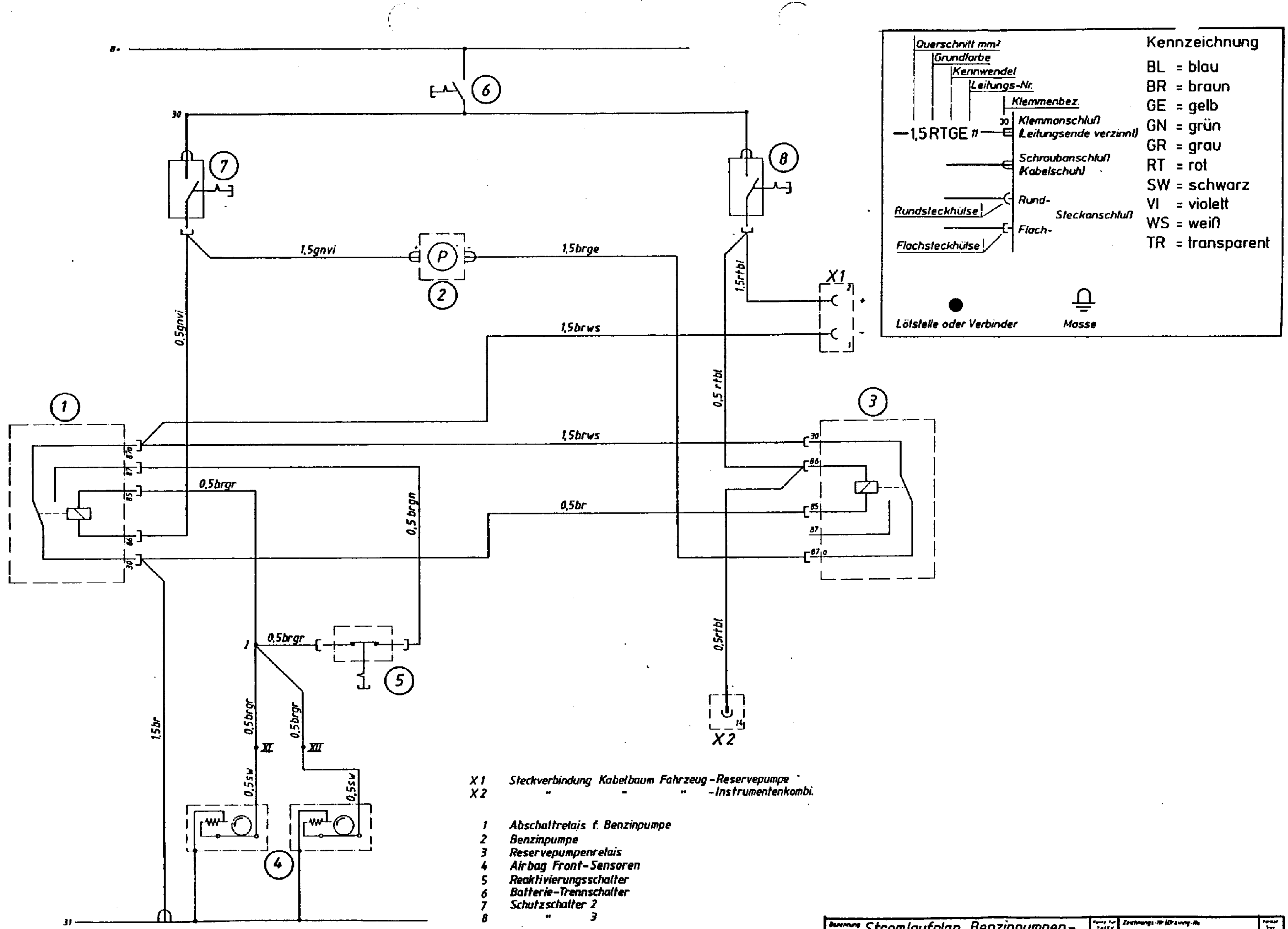
Masse

6-19

1 Wischerrelais
2 Wischer-Abschaltrelais
3 Widerstand 30hm 50 Watt
4 Wischermotor
5 Wischerschalter
6 Schutzschalter 8
'1 Steckverbindung Kabelbaum Fahrzeug - Wischermotor
'2 " " " - Fahrtr.-Abblend-Scheibenwischerschalter

Benennung: Stromlaufplan Wischersteuerung	Zeichnungs-Nr. / Drawing-No. 2 230 292	Format Size 3

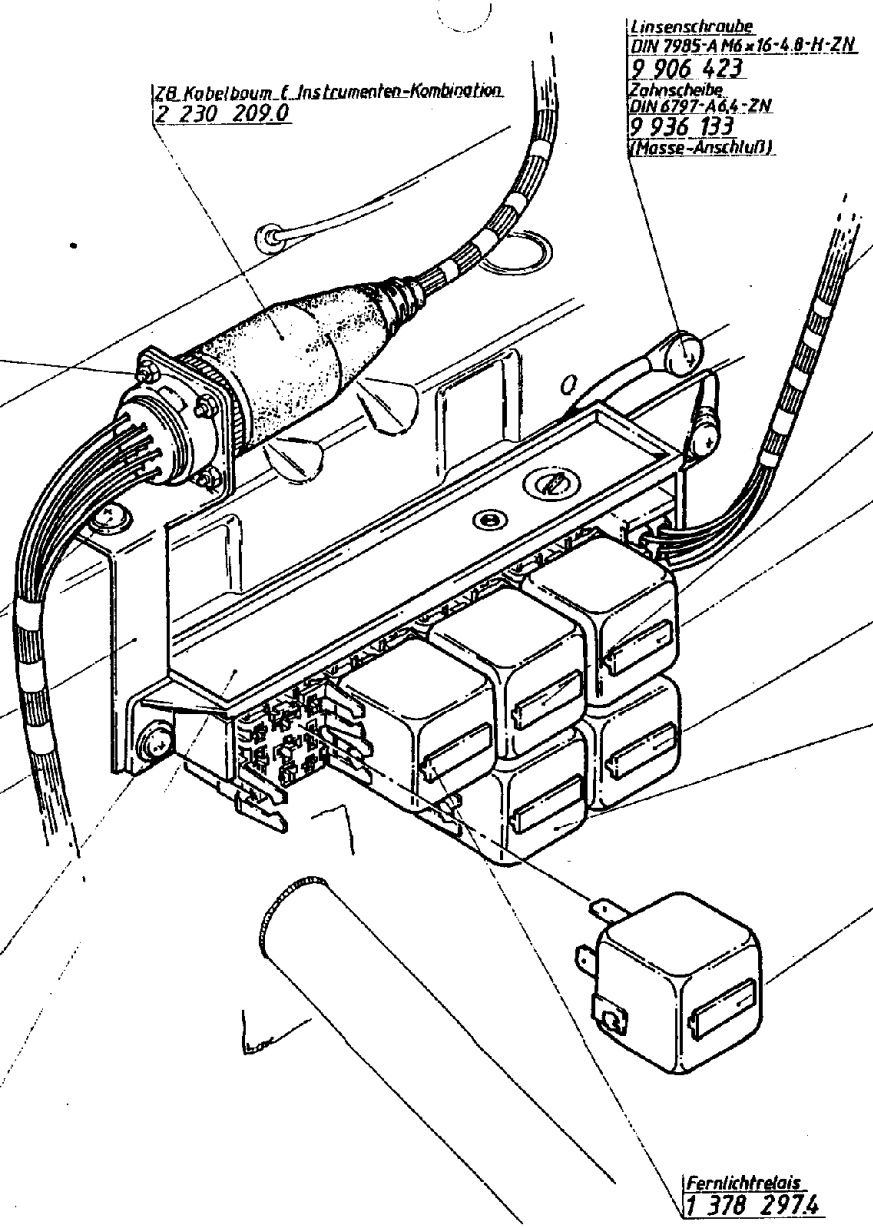
BMW 5003/F04 . 84K



X1 Steckverbindung Kabelbaum Fahrzeug - Reservepumpe
X2 " " " - Instrumentenkombi.

1 Abschaltrelais f. Benzinpumpe
2 Benzinpumpe
3 Reservepumpenrelais
4 Airbag Front-Sensoren
5 Reaktivierungsschalter
6 Batterie-Trennschalter
7 Schutzschalter 2
8 " 3

Benennung		Zeichnungs-Nr.	Format
Stromlaufplan Benzinpumpensteuerung m. Sicherheitsabschaltung	ZAITY	2 230 293	2



4-Linsenschraube
DIN 7985-A M3 x 16-4.8-H-ZN
9 906 432
4-Scheibe
DIN 125-A3,2-St ZN
9 931 015
4-Federscheibe
DIN 137-B3-ZN
9 932 013
4-Sechskantmutter
DIN 970-M3-6-ZN
9 922 795

ZB Kabelbaum f. Instrumenten-Kombination
2 230 209.0

Linsenschraube
DIN 7985-A M6 x 16-4.8-H-ZN
9 906 423
Zahnscheibe
DIN 6797-A6,4-ZN
9 936 133
(Masse-Anschluß)

ZB Scheibenwischer- Fahrtrichtungs- Abblendschalter
2 230 211.3

Scheibenwischerrelais
1 378 786.3

Abschaltrelais Benzinpumpe
1 378 786.3

Reservepumpenrelais
1 378 786.3

Scheibenwischer - Abschaltrelais
1 378 297.4

Nebelscheinwerferrelais
1 378 297.4

Linsenschraube
DIN 7985-A M5 x 20-4.8-H-ZN
9 907 633
Scheibe
DIN 125-A5,3-St ZN
9 931 036
Blindnietmutter M5
51.12-1 967 507.9

Halter
2 230 208.3

ZB Kabelbaum Fahrzeug
2 230 205.0

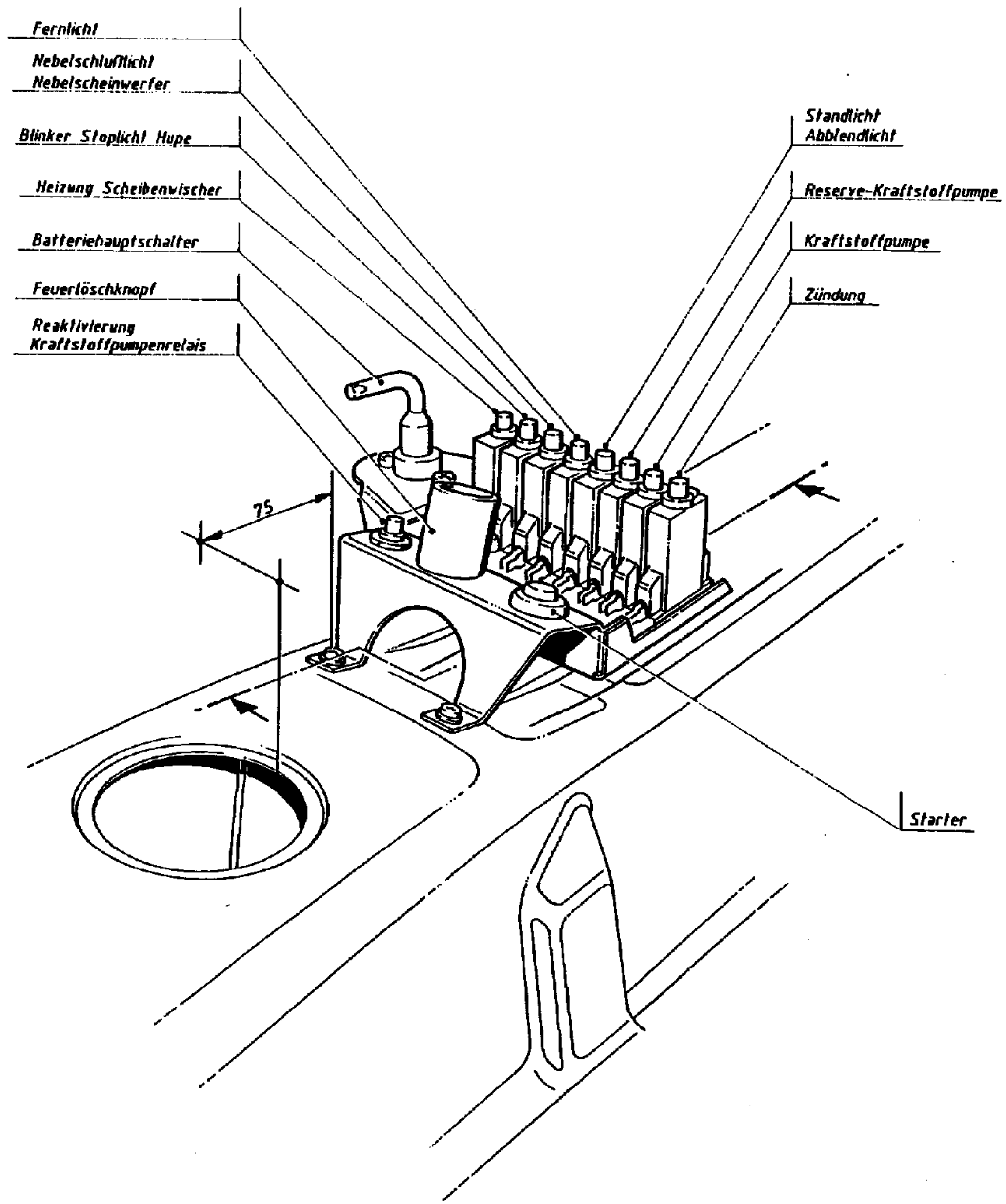
2-Linsenschraube
DIN 7985-A M6 x 16-4.8-H-ZN
9 906 423
2-Scheibe
DIN 125-A6,4-St ZN
9 931 044

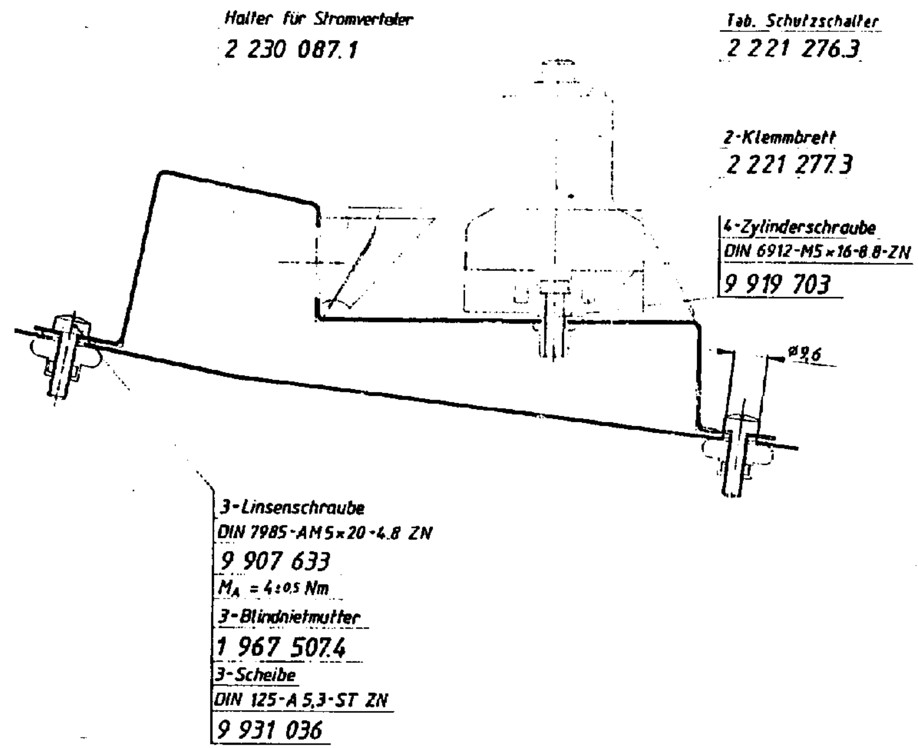
Relaisträger
1 711 257.1

Fernlichtrelais
1 378 297.4

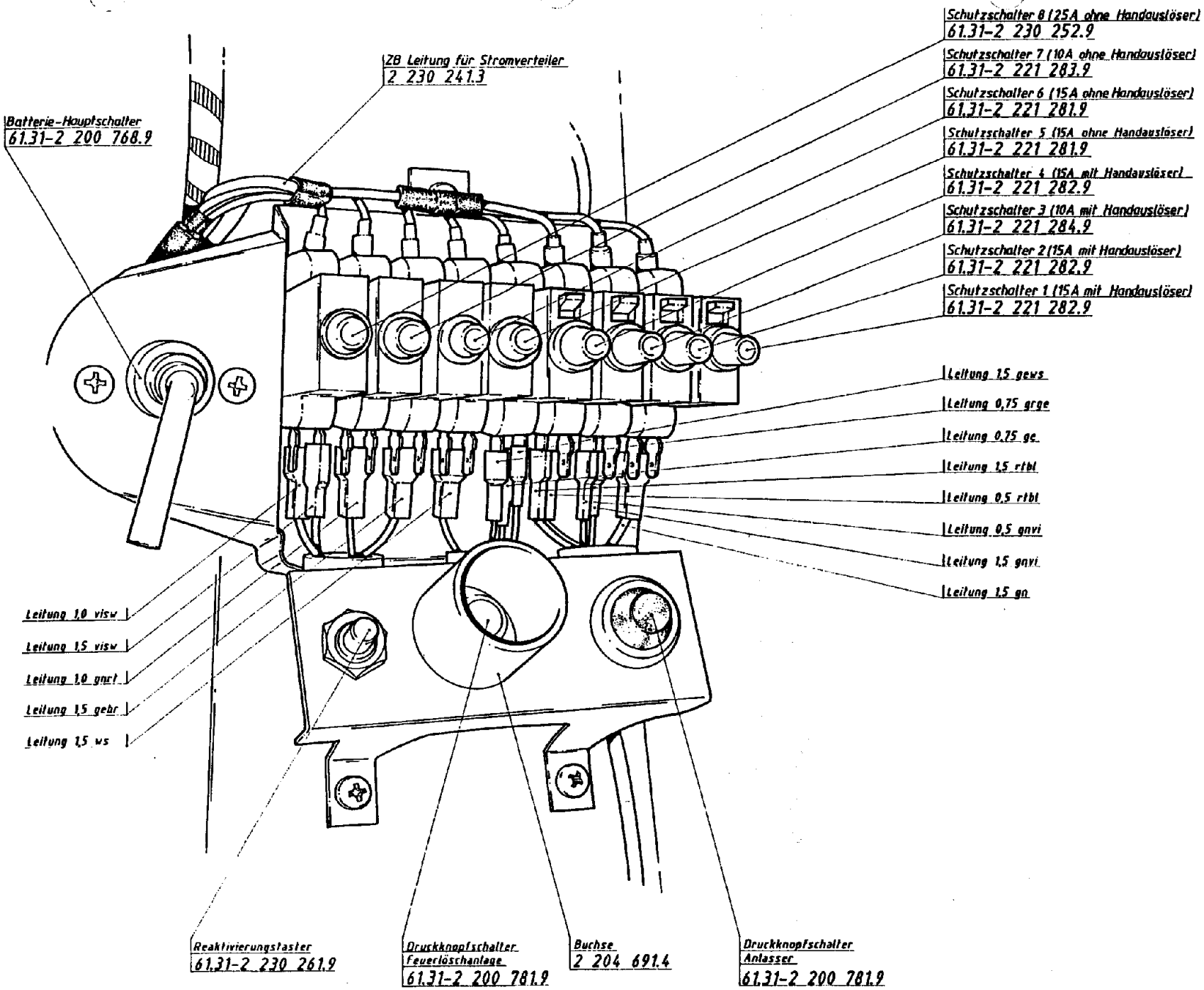
61-11

Benennung	Maßst.	Zeichnungs-Nr. (Drawing-No.)	Format
AO Relaisträger		2 230 296	2



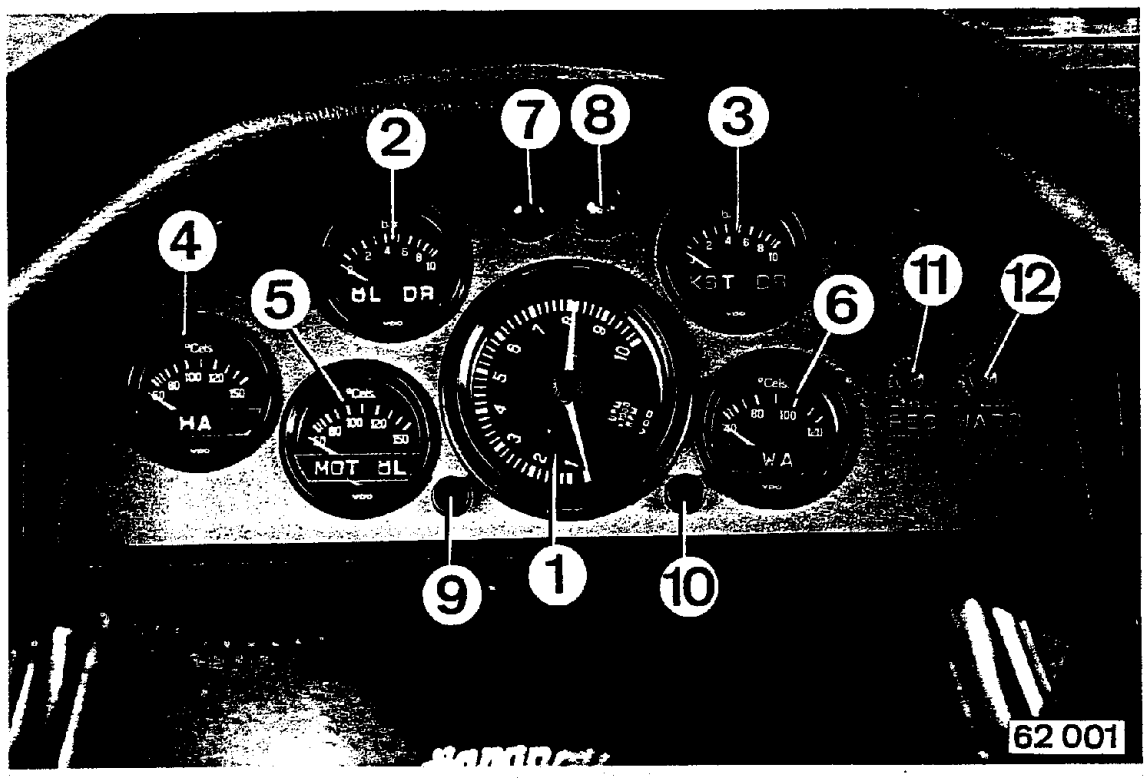


Benennung		Zeichnungs-Nr.	
AO Stromverteiler	Blatt 1 von 2	2 230 086	2



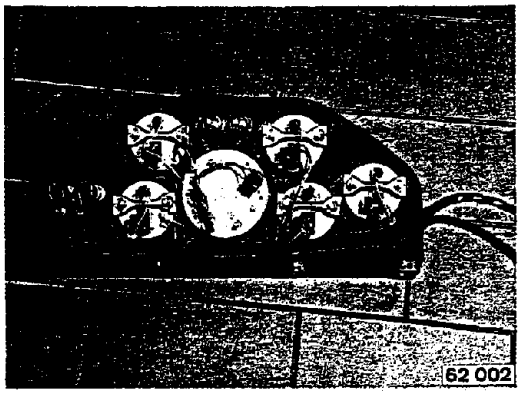
Benennung	Blatt 2 von 2	Zeichnungs-Nr. / Drawing-No.	Format
AO Stromverteiler		2 230 086	2

INSTRUMENTS



Arrangement of Instruments

1 Rev counter
2 Oil pressure gauge
3 Fuel pressure gauge
4 Final drive temperature gauge
5 Engine oil temperature gauge
6 Water temperature gauge
7 Oil pressure warning lamp
8 Charge warning lamp
9 Turn signal indicator
10 High beam indicator
11 Fuel warning lamp
12 Water pressure warning lamp



Routing of wire harness for instrument cluster.

Öldruckkontrolleuchte rot
62.14-2 200 746.9

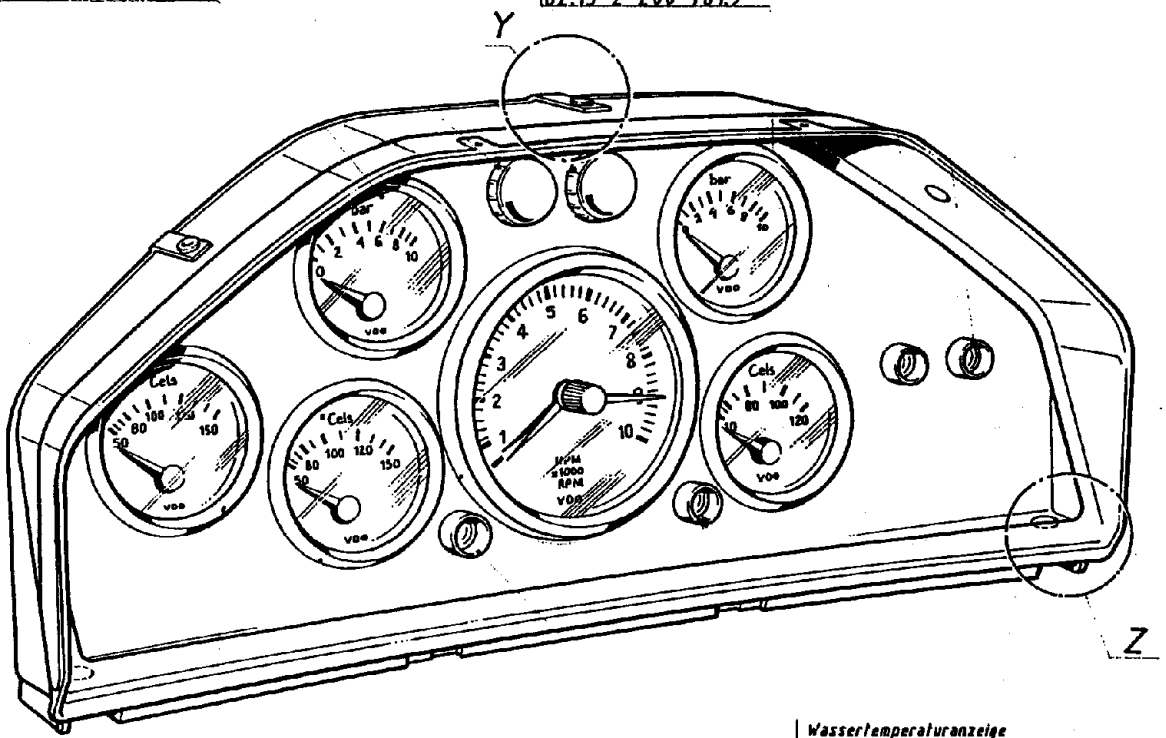
Ladekontrolleuchte gelb
62.14-2 200 747.9

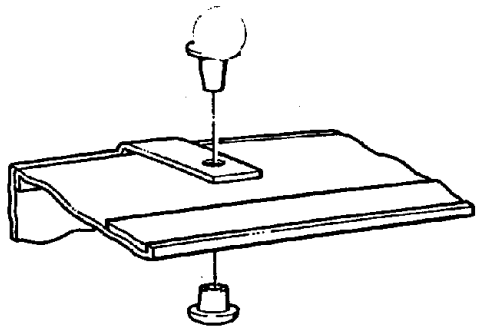
Öldruckanzeige
62.13-2 200 761.9

Wasserdruckkontrolleuchte gelb
62.14-2 230 248.9

Kraftstoffreserve-Kontrolleuchte gelb
62.14-2 230 248.9

Kraftstoffdruckanzeige
62.13-2 200 761.9



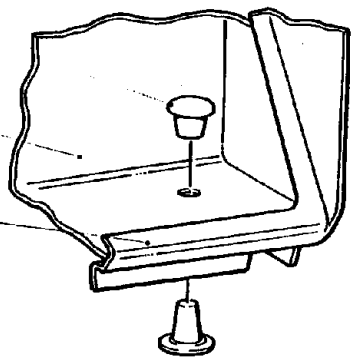


Einzelheit Y

3-Niet A 4x8x8
DIN 7331 - MU St 3G
9 949 018

Instrumenten-Kombitafel
2 230 089.1

Blende für Kombi
1 368 872.0



Einzelheit Z

Wassertemperaturanzeige
62.13-2 230 251.9

Fernlichtkontrolleuchte blau
62.14-2 230 250.9

Blinkerkontrolleuchte grün
62.14-2 230 249.9

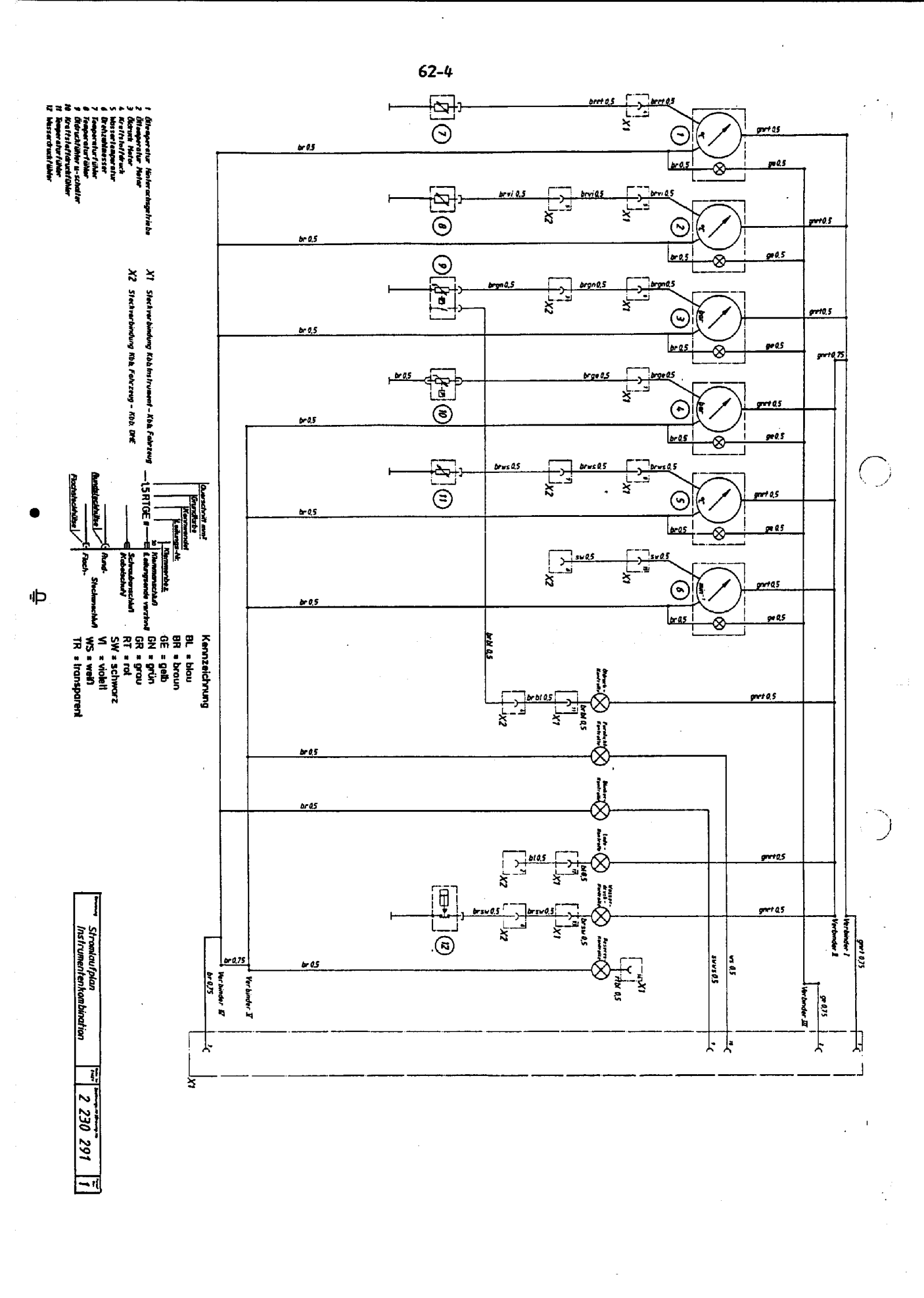
HA-Getriebeöltemperaturanzeige
62.13-2 200 757.9

Motoröltemperaturanzeige
62.13-2 200 757.9

Drehzahlmesser
62.13-2 230 247.9

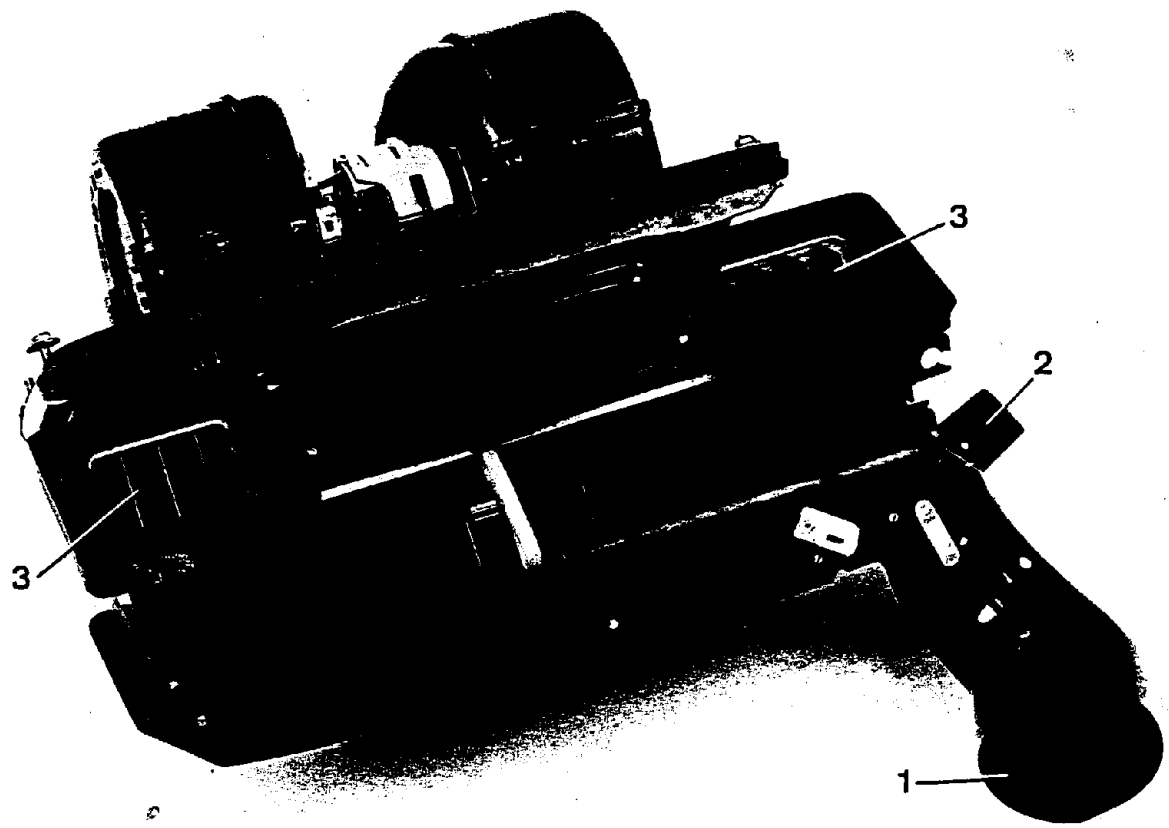
62-3

Benennung	Norm-Nr.	Zeichnungs-Nr.	Format
AO-Instrumenten-Kombi		2 230 090	2



Stromlaufplan Instrumentenkombination			
		2 230 291	1

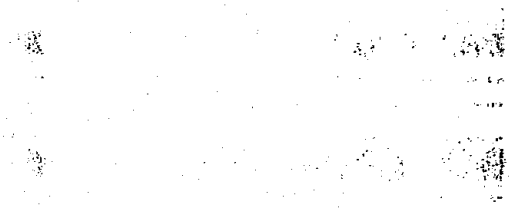
VENTILATION



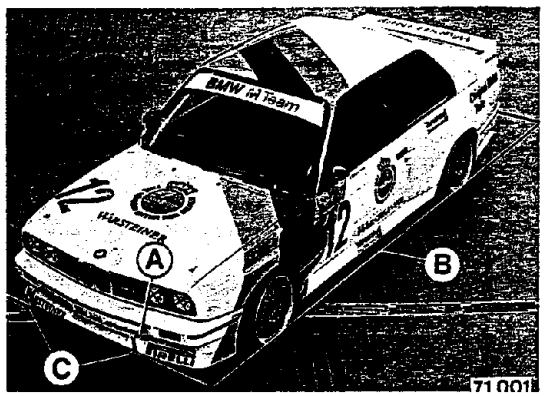
64 001

Ventilation

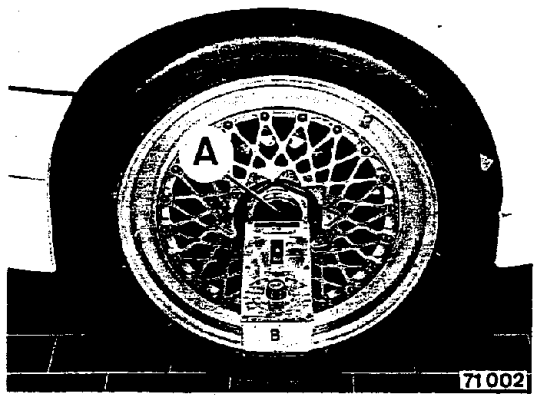
1. Ventilation for driver
2. Ventilation for switchgear
3. Ventilation for windscreen



TOOLS



Measuring square for checking track values on racing circuit.
A = Threaded sleeve
B = Plastic string
C = Slots for centering vehicle and square

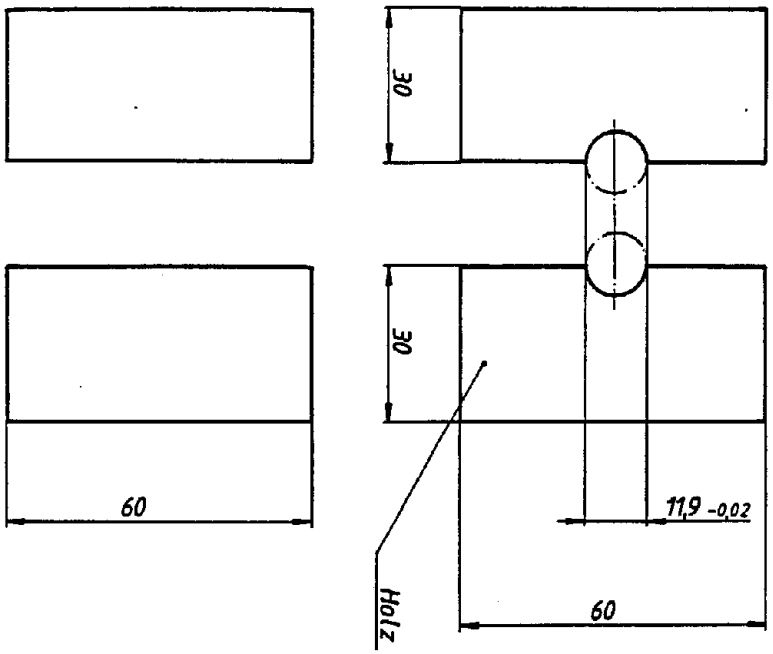


A = Adapter for Beissbarth wheel alignment tools
B = Camber and caster measuring tool (see drawing)

Wheel Alignment Measuring Equipment Recommended by BMW Motorsport:

2 rotary plates with scale	P 1/03
2 compensating bridges	P 1/5
1 projector for camber and caster (projector can be used for measuring toe curves)	P 8/20
2 scale holders	P 11/08–09

SUPPLIER: Beissbarth KFZ-Werkstattausrüstung
Postfach 50 01 45
D–8000 Munich 50
Phone: 089/14901–1
Telex: 5215043

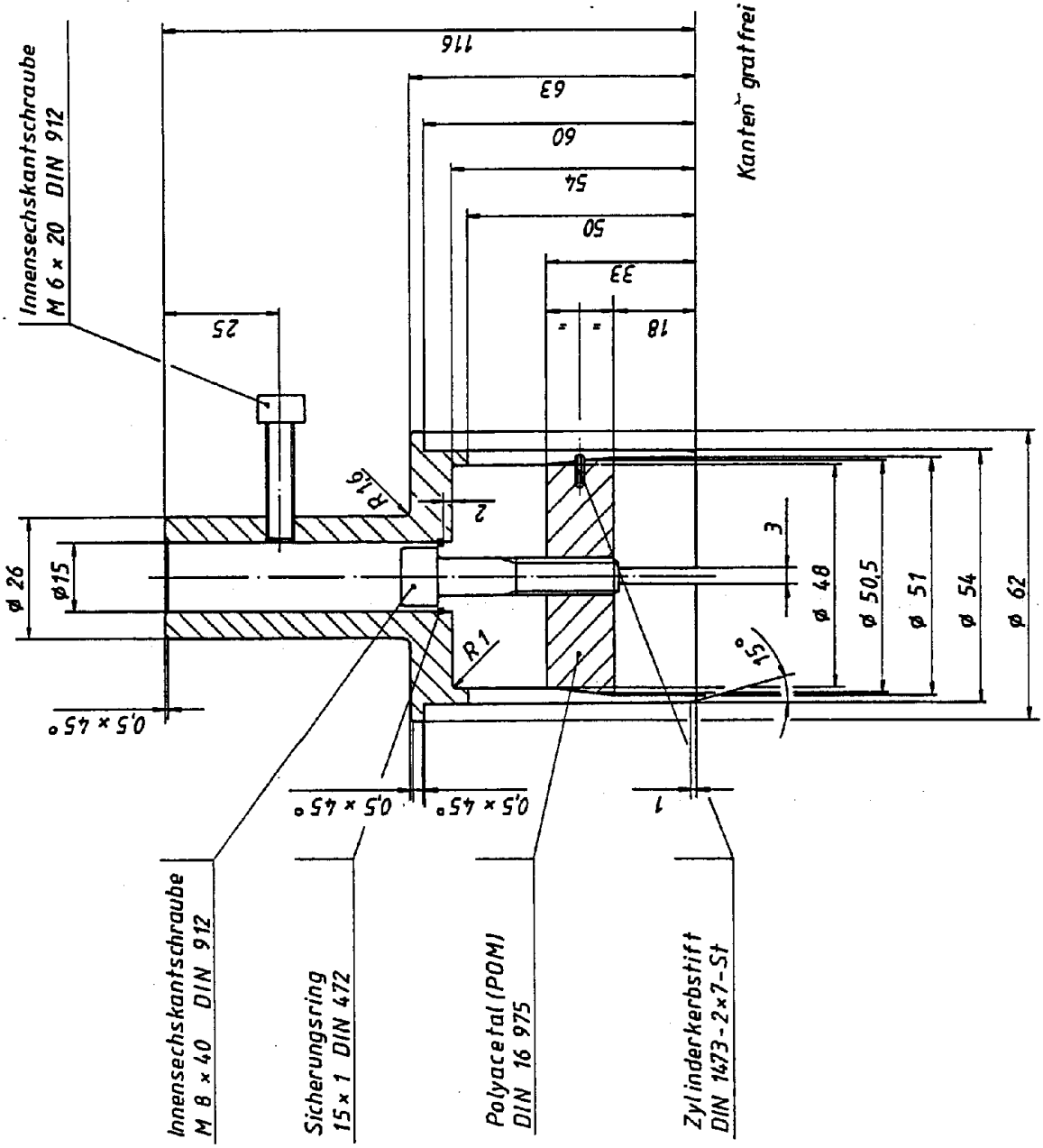


Bezeichnung / Klemmwerkzeug f. Druckleitung

Tecalan PA 11 WLT

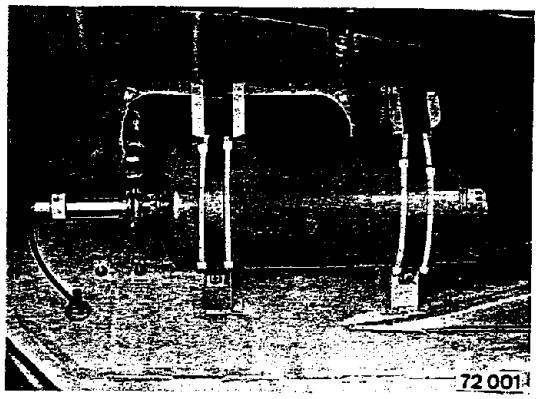
Zeichnungs-Nr. / Drawing-No. 2 221 512

Format Size 3

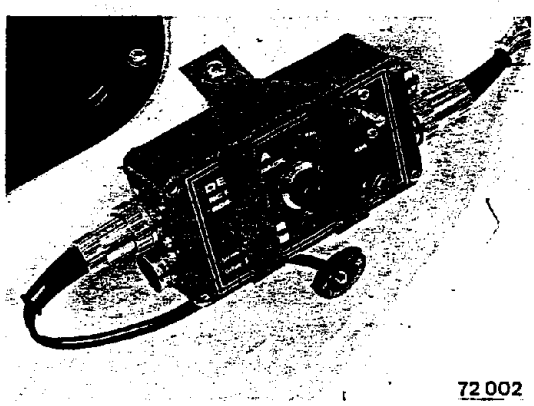


Benennung:	Zeichnungs-Nr. / Drawing-No.	Format Size
ZB. Adapter für Beissbarth - Meßgerät	2 221 523	3

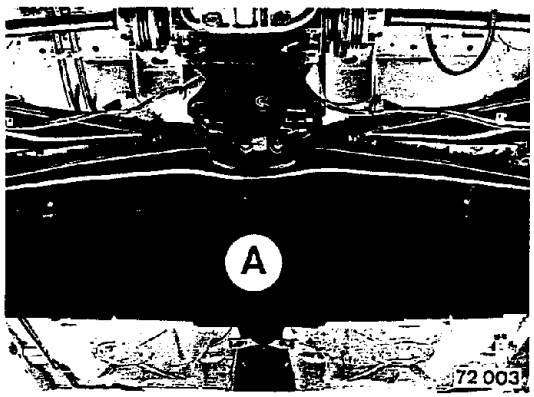
FIRE EXTINGUISHING SYSTEM



Position of fire extinguisher on righthand side underneath the rear seat.

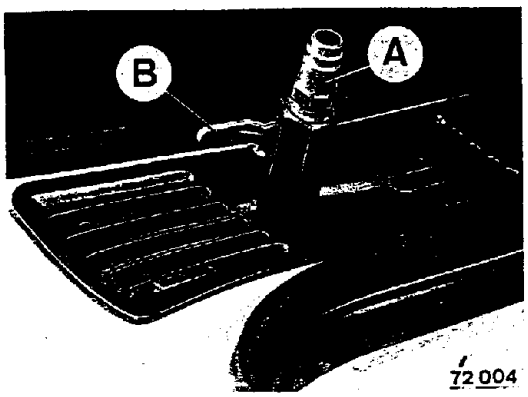


Position of switchgear for the fire extinguisher.

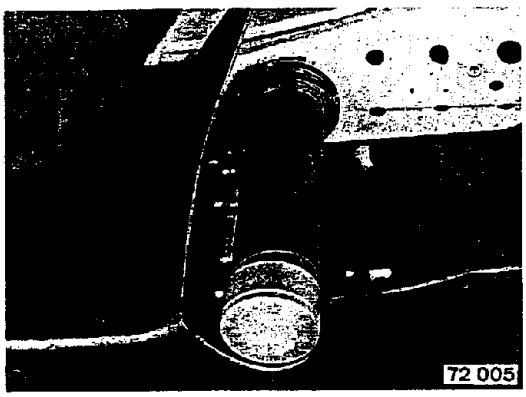


Cover of standard tank well (A).

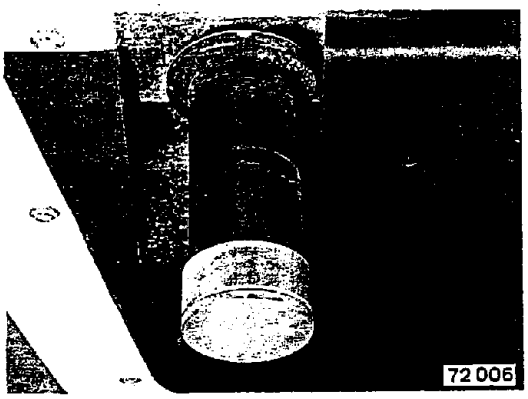
PNEUMATIC VEHICLE JACK



A = Air pressure connection for pneumatic vehicle jack system.
B = Lever for shutoff valve.



Position of pressure cylinder for the front axle.



Position of pressure cylinder for the rear axle.

APPLICATION INSTRUCTIONS FOR TECALAN PIPES
(Pipes for Pneumatic Vehicle Jack)

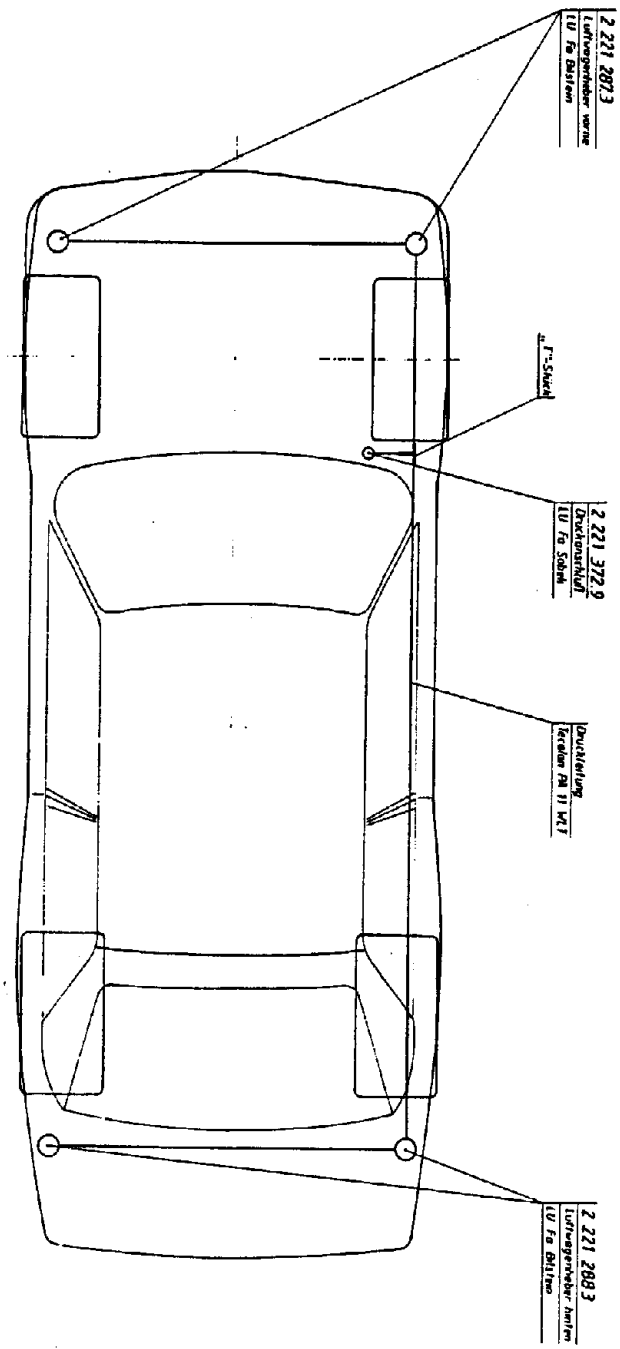
Installation Procedures:

1. Place clamping jaws in a vise.
   Clamp a Tecalan pipe in the jaws in such a manner, that the end of the pipe protrudes upward approximately 5 mm longer than the length of the connecting mandrel.

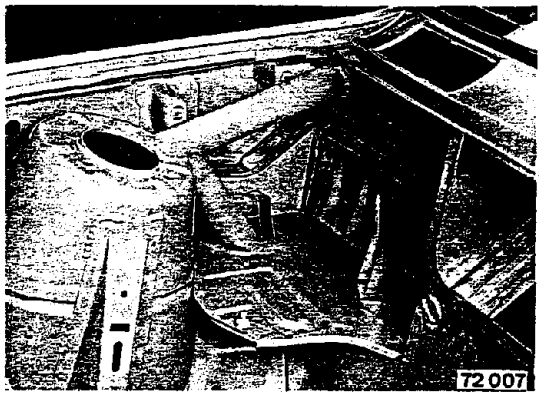
2. Knock the connector into the end of the pipe against the stop with a plastic hammer.

IMPORTANT!

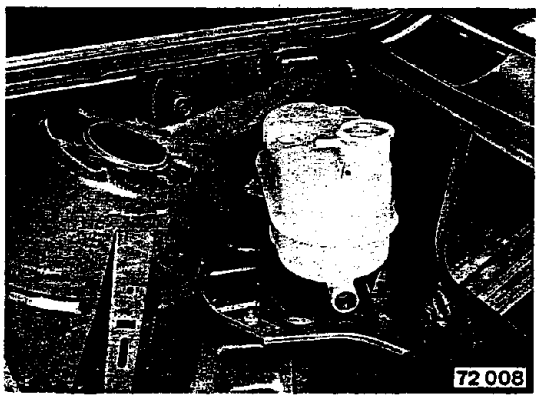
Do not heat the end of the pipe. The tip of the mandrel may be lubricated lightly with oil first in case of pipes with thin walls and small size, in order to make knocking-in easier.



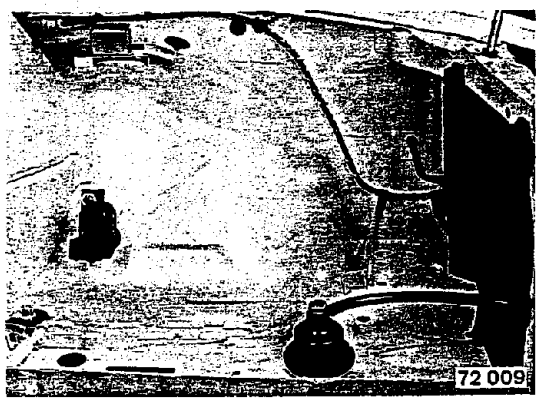
AO Luftwagenheber	2 221 349	1



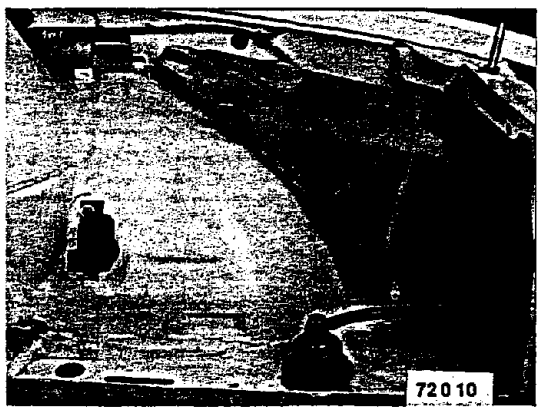
Position of holder for coolant expansion tank.



Position of coolant expansion tank.



Position of holder for oil collecting tank.



Position of oil collecting tank.

CHECKLIST

The parts listed below should be inspected after each training and race, and renewed whenever necessary.

Front Axle – Steering:

Spring strut connection points	cracks, deformation, tightness
Control arms and universal bellows joints	cracks, deformation, tightness
Wheel carriers	cracks
Spring retainers and locknuts	tightness
Stabilizers, bearings, suspension, joints	easy movement, play, tightness
Brake caliper installation	tightness
Brake pistons	leakage
Brake linings	thickness, contact pattern
Brake hoses and pipes	tightness, leakage, routing
Brake master cylinder	leakage, tightness
Balance arms	function, adjustment, movement
Supply reservoir	liquid level, leakage
Brake discs	condition, cracks
Brake disc shells	cracks, tightness of brake disc
Wheel nuts	contact pattern and seat of taper
Wheel bearings	play
Steering arms	deformation, cracks, tightness
Tie rods	deformation, cracks, tightness, position of universal bellows joints

...

Steering gear	play, movement
Universal steering joint	tightness, lock
Steering column and steering wheel control	tightness
Wheels and tyres	air pressure, tightening torque, cracks, deformation

Rear Axle:

Rear axle carrier	connection points, cracks, deformation, tightness
Semi-trailing arms	cracks, deformation, tightness
Adjusting fixture, joint mounts	cracks, deformation, tightness, play
Shock absorber connection points	cracks
Shock absorber bolts and nuts	tightness
Shock absorber mounts	play, movement
Spring retainers and locknuts	tightness
Stabilizer, bearings, suspension, joints	movement, play, tightness
Brake calipers	tightness
Brake pistons	leakage
Brake linings	thickness, contact pattern
Brake hose and pipes	tightness, leakage, routing, rubbing spots
Brake discs	condition, cracks
Brake disc shells	cracks, tightness of brake disc
Stub axles	play, tightness, bolts
Wheel bearings	play

. . .

Wheel nuts	contact pattern and seat of taper
Wheel and tyres	air pressure, tightening torque, cracks, deformations
Gearbox housing	cracks, leakage
Gearbox bolts	connection on engine
Clutch bell housing	cracks, tightness
Engine mounts, gearbox mounts	cracks, tightness
Clutch cylinders	leakage of master and slave cylinders, hose
Clutch hydraulic fluid supply reservoir	level
Exhaust manifold and tailpipe	cracks, tightness, locks
Oil filter	tightness, leakage
Oil hoses	bends, tightness, leakage
Oil cooler, engine and gearbox, rear axle	leakage, tightness
Radiator	level, leakage
Fuel tank	leakage, tightness
Fuel pipes	tightness, leakage, routing, tank venting
Fuel pumps	tightness, leakage, function
Fuel filter	leakage
Body	cracks, breaks
Doors	locks, hinges, windows, tightness
Ventilation	brakes, passenger compartment, windscreen
Spoilers	tightness
Fire extinguisher	tightness, contents

. . .

Fire extinguishing system	routing, tightness, test switch function
Pedals	play, tightness, movement, brake pressure, clutch stop, accelerator pedal stop
Accelerator cable	tightness, routing
Shift	shift lever lock, tightness, movement, adjustment, locks, cracks
Driver's seat	tightness, adjustability
Seat belts	tightness, routing
Mirrors	tightness
Revolution counter	function
Battery	charged condition, acid level, tightness, connections, installation
Generator	connections, function, tightness of wires
Starter motor	connections, function, tightness
Windscreen wipers	bearings, wire connections, function
Lights	aiming, tightness, connections, opening mechanism, stop lights, turn signals
Electrical system	charge indicator, oil indicator, rev counter, oil pressure gauge, oil temperature gauge, ignition switch, automatic cutouts