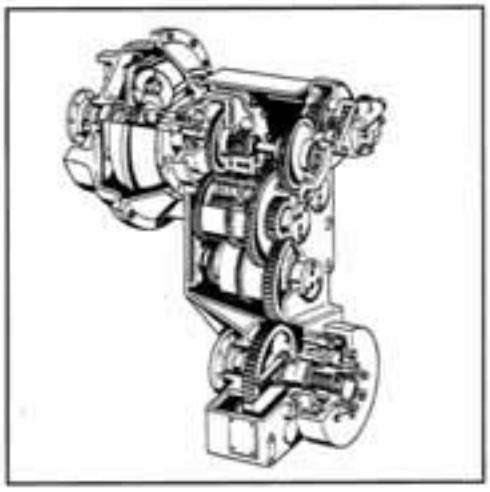
Order No. 5871 162 002 E

ZF - POWERSHIFT TRANSMISSION

WG-180
WG-200



ZF Passau GmbH
Donaustr. 25 - 71
D- 94 034 Passau

05.10.95

WORKSHOP MANUAL FOR ZF-POWERSHIFT TRANSMISSIONS

WG-180 AND WG-200

In this Workshop Manual, the Disassembly and Reassembly of several Transmission Versions as well as Assemblies are treated.

The technical development of the product and the extension of the possible Versions may require varying steps, which can be carried out without great difficulty by trained personnel, consulting the Perspective Illustrations of the corresponding Spare Parts Lists.

Indications regarding Description, Installation, Instructions, Operating and Maintenance, see corresponding Operating Instructions!

ZF Passau GmbH

Donaustr. 25 - 71
D-94 034 Passau

Abt.: ASTDM / Section : ASTDM

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Sous reserve de modification techniques!

Ausgabe / Edition : 1994/02

PREFACE

This documentation has been developped for the skilled Serviceman, trained by the Zahnradfabrik Passau for the Repair and Maintenance operations on ZF-Units.

Treated is a ZF-Serial product according to the design stage of the date of Edition.

However, due to further technical developments of the product, the repair of the unit at your disposal could require differents steps as well as other adjustment and testing specifications.

Therefore, we recommend to commit your ZF-Product to Masters and to Service-men, whose practical and theoretical training is constantly completed to the actual situation in our Training School.

The Service Stations, established by the Zahnradfabrik Friedrichshafen all over the world, offer you:

1. Constantly trained personnel

2. Prescribed installations, e.g. Special Tools

3. Genuine ZF-Spare Parts according to the latest phase of development

Here, all operations are carried out for you with utmost care and realibity.

Repair operations carried out by ZF-Service Stations, are covered additionally within the terms of the actual contractual conditions, by the ZF-Warranty.

Damages caused by inappropriate or inexpert work, carried out by personnel foreign to ZF, and after-expenditures eventually arising from it, are excluded from this contractual responsibility.

This applies also in case of a renouncement of Genuine ZF-Spare Parts.

Zahnradfabrik Passau GmbH

Service Department

GENERAL WORKING INSTRUCTIONS

During all operations, pay attention to cleanliness and skilled working.
Therefore, Transmissions, removed from the vehicle, must be cleaned prior to open them.

We assume that the Special Tools, specified by ZF, will be used.

The Special Tools have a 10-digit Subject-No. and are availabe from ZF-Passau.

After the disassembly, all components must be cleaned, especially corners, cavities and recesses of housing and covers.

The old sealing compound must be carefully removed.

Check lubricating holes, grooves and pipes for free passage. They must be free of residues, foreign material or protective compounds.

The latter refers expecially to new parts.

Parts which have been inevitably damaged in a disassembly operation, must be generally replaced by new ones, e.g. : rotary seal rings, O-Rings, U-Section rings, cap boots, protective caps etc..

Components such as roller bearings, thrust washers, synchronizing parts etc. which are subject to normal wear in automotive operation, must be checked by the skilled Serviceman.
He will decide if the parts can be reused.

For the heating of bearings etc., hot plates, rod heaters or heating furnaces must be used.

Never heat parts directly with the flame. An auxiliary solution would be to immerse the bearing in a vessel filled with oil, which is then heated with the flame.
In this way, damage to the bearings could be avoided.

Ball bearings, covers, flanges and parts like that must be heated to about 90° to 100° C.

Hot-mounted parts must be reset after cooling in order to assure a proper contact.

Before pressing shafts, bearings etc. in position, both parts must be lubricated.

During the reassembly, all specified adjustment values, testing specifications and torque limits must be respected.

After the repair, ZF-Units are filled up with oil.

The procedure and the permitted oil qualities can be taken from the Operator's Manual, resp. from the Lubrication Instructions and the corresponding List of Lubricants.

The Lists of Lubricants are available at all ZF-Service Stations.

After the oil filling, the oil level plugs and oil drain plugs must be tightened to th specified torque limits.

IMPORTANT INSTRUCTIONS

CONCERNING THE LABOUR SAFETY

In principle, Repairers of ZF-Units are themselves responsible for the labour safety.

The observance of all valid Safety Regulations and Legal Rules is a precondition to prevent damage to individuals and products during the Maintenance and Repair operations.

Before starting the work, the Repairers have to make themselves familiar with these Regulatisons.

The proper Repair of these ZF-Products requires especially trained personnel.

The Repairer himself is obliged to provide for the training.

BEZEICHNUNG DER GESETZLICHEN EINHEITEN
DENOMINATION OF STANDARD DIMENSIONS
DENOMINATION DES DIMENSIONSSTANDARDISEES

Hinweis : längenbezogene Maße in kg/m; flächenbezogene Maße in t/m2

Note : linear density in kg/m; areal density in t/m2

Nota : Density lineaire en kg/m; Density superficielle en t/m2

Begriff Unit Unitee	Formelzeichen	neu New Nouveau	alt old Vieu	Umrechnung Conversion Conversion	Bemerkungen Note Nota
Masse Mass Mass	m	kg (Kilogramm)	kg		
Kraft Force Force	F	N (Neweton)	kp	1 kp = 9,81 N	
Arbeit Work Travail	A	J (Joule)	kpm	0,102 kpm = 1J = 1 Nm	
Leistung Power Puissance	P	KW (Kilowatt)	PS(DIN)	1 PS = 0,7355 KW 1 KW = 1,36 PS	
Drehmoment Torque Couple	T	Nm (Newtonmeter)	kpm	1 pkm = 9,81 Nm	T (Nm) = F (N)*r(m)
Kraftmoment Moment (Force) Moment (Force)	M	Nm (Newtonmeter)	kpm	1 pkm = 9,81 Nm	M (Nm) = F (N)*l(m)
Druck (Über-) Pressure (Overpress) Pression (Sur-)	pü	bar	atü	1,02 atü = 1,02 kp/cm2 = 1 bar = 750 torr	
Drehzahl Speed Nombre de Tours	n	min -1			

VERGLEICHSTABELLE FÜR MASSEINHEITEN
CONVERSION TABLE
TABLEAU DE CONVERSION

25,40 mm	=	1 in (inch)
1 kg (Kilogramm)	=	2,205 lb (pounds)
9,81 Nm (1 kpm)	=	7,233 ibf x ft (pound force foot)
1,356 Nm (0,138 kpm)	=	1 lbf x ft (pound force foot)
1 kg / cm	=	5,560 lb / in (pound per inch)
1 bar (1,02 kp/cm^2)	=	14,233 psi (pound force per squar inch lbf/in^2)
0,070 bar (0,071 kp/cm^2)	=	1 psi (lbf/in^2)
1 Liter	=	0,264 Gallon (Imp.)
4,456 Liter	=	1 Gallon (Imp.)
1 Liter	=	0,220 Gallon (US)
3,785 Liter	=	1 Gallon (US)
1609,344 m	=	1 Mile (Landmeile)
0° C (Celsius)	=	+ 32° F (Fahrenheit)
0 ° C (Celsius)	=	273,15 Kelvin

TORQUE LIMITS FOR SCREWS (IN Nm) ACCORDING TO ZF-STANDARDS 148

Coefficient of friction: μ total = 0,12 for screws and nuts without aftertreatments as well as for phosphates nuts. Tighten by hand!
Torque limits, of not exspecially, can be taken from the following list:

Metric ISO-Standard Thread DIN 13, Page 13

Size	8.8		10.9		12.9
M4	2,8		4,1		4,8
M5	5,5		8,1		9,5
M6	9,5		14		16,5
M7	15,5		23		27
M8	23		34		40
M10	46		68		79
M12	79		117		135
M14	125		185		215
M16	195		280		330
M18	280		390		460
M20	390		560		650
M22	530		750		880
M24	670		960		1120
M27	1000		1400		1650
M30	1350		1900		2250
M33	1850		2600		3000
M36	2350		3300		3900
M39	3000		4300		5100

Metric ISO-Fine Tread DIN 13, Page 13

Abmessung	8.8		10.9		12.9
M 8 x 1	24,5		36		43
M 9 x 1	36		53		62
M 10 x 1	52		76		89
M 10 x 1,25	49		72		84
M 12 x 1,25	87		125		150
M 12 x 1,5	83		122		145
M 14 x 1,5	135		200		235
M 16 x 1,5	205		300		360
M 18 x 1,5	310		440		520
M 18 x 2	290		420		490
M 20 x 1,5	430		620		720
M 22 x 1,5	580		820		960
M 24 x 1,5	760		1090		1270
M 24 x 2	730		1040		1220
M 27 x 1,5	1110		1580		1850
M 27 x 2	1070		1500		1800
M 30 x 1,5	1540		2190		2560
M 30 x 2	1490		2120		2480
M33 x 1,5	2050		2920		3420
M 33 x 2	2000		2800		3300
M 36 x 1,5	2680		3820		4470
M 36 x 3	2500		3500		4100
M 39 x 1,5	3430		4890		5720
M 39 x 3	3200		4600		5300

INSCRIPTIONS ON A ZF-MODEL IDENTIFICATION PLATE FOR ZF-HYDROMEDIA-REVERSING-TRANSMISSIONS:

1 = Gearbox type
2 = Gearbox-No.
3 = ZF-Parts List-No.
4 = Total ratio of the Gearbox
5 = Value for the control pressure
6 = ZF-Parts List-No. of the Torque Converter
7 = Type of the ZF-Torque Converter



NOTES REGARDING THE SPARE PARTS ORDERS:

When ordering genuine ZF-Spare Parts, please indicate:

1. Gearbox type
2. Serial-No.
3. ZF-Parts List-No.

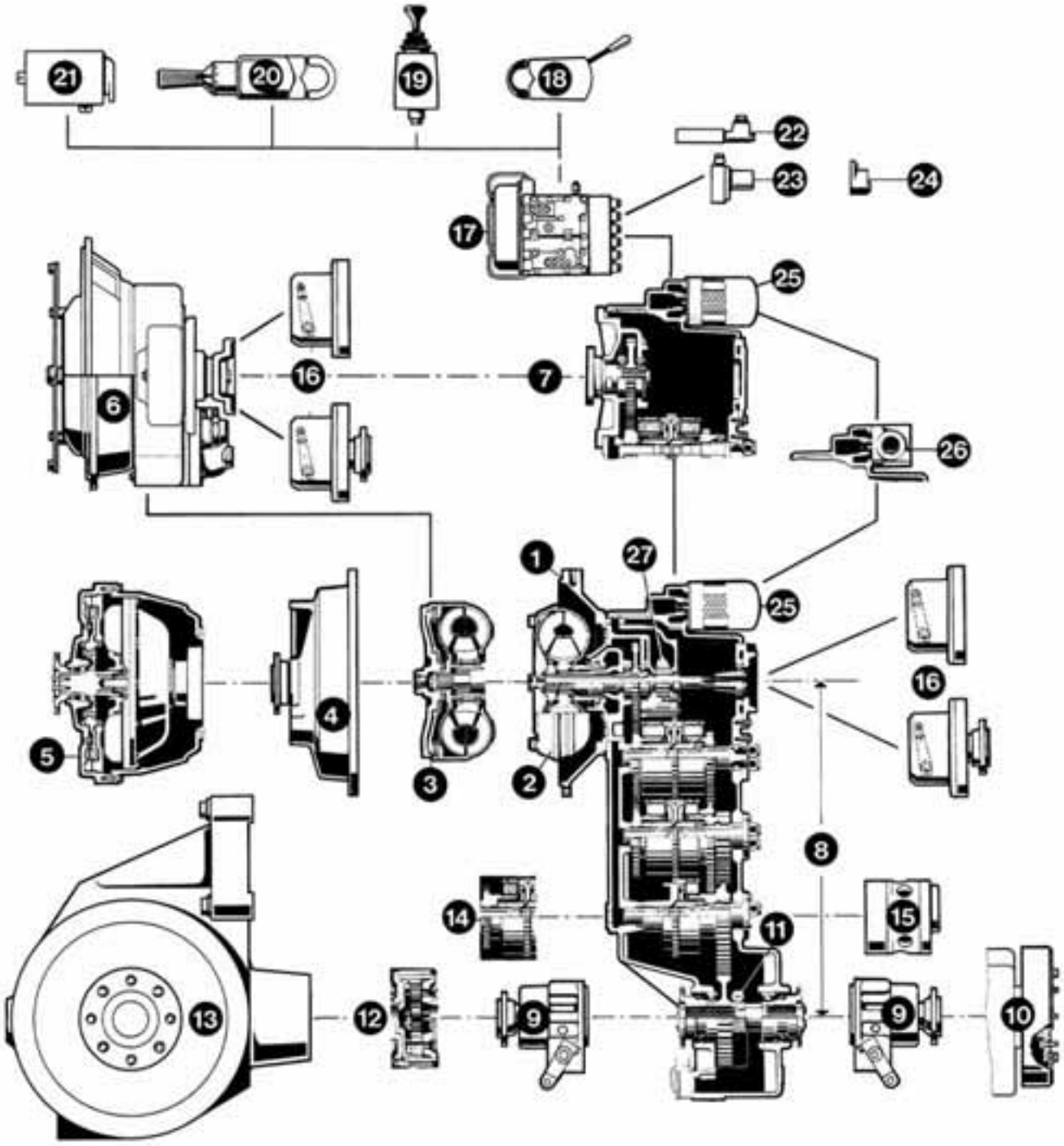
} **See Model Identification Plate!**

4. Mark and type of vehicle
5. Denomination of the spare part
6. Spare parts-No.
7. Way of transport

When all of the above required indications are considered, errors in the delivery of spare part orders can be avoided!

Optional versions and additional equipment

for the transmissions of the WG range



1 Converter housing for direct installation
2 Torque converter
3 Lock-up clutch
4 Cover for separate installation
5 Retarder
6 HN 500 converter transmission
7 Input flange (for separate installation)
8 Centre distance input/ output shafts
9 Axle disconnect unit
10 Parking brake
11 Speedometer connection
12 Inter-axle differential
13 Axle drive, flange-mounted
14 Multi-disc clutch for 4, 5 and 6-speed version
15 Emergency steering pump
16 PTO unit, engine driven
17 Transmission control
18 Steering column switch SG 4/ SG 6
19 Console switch SG 4/ SG 6
20 Rotary reversing switch DW 1
21 Automatic control unit EST 2
22 Inching valve
23 Dual pressure control valve
24 Pressure cut-out
25 Micro-filter
26 Transmission connection for separate filter installation
27 Converter charge and shift pump

Torque converter transmissions for off-road vehicles and machinery (construction plant, special vehicles, lift trucks)

List of Lubricants TE-ML 03

Transmission	Approved lubricants
WG 80/ 81/ 83/ 85 WG 100 WG 120/ 121 WG 150/ 151 WG 180/ 181 WG 200/ 201 WG 250 WG 65 HN 500 PW 45 H (1) PW 25 H PW 18 H HSt 210	**Engine oils** API CD/ CE/ CF/ SF/ SG MIL-L-2104 C/ -D/ -E MIL-L-46152 C/ -D/ -E • SAE 10 W • SAE 10 W-30 • SAE 10 W-40 • SAE 15 W-40 • SAE 20 W-20 For commercial products see overleaf Automatic Transmission Fluids (ATF) only at ambient temperatures below –10 °C

Oil grade	Minimum oil temperature for starting engine	Minimum oil temperature for starting vehicle moving
– Engine oils		
SAE 20 W-20	–10 °C	+5 °C
SAE 15 W-40	–15 °C	0 °C
SAE 10 W, 10 W-30, 10 W-40	–20 °C	–5 °C
– ATF	–30 °C	–10 °C

The minimum oil temperature for starting the vehicle moving can be achieved by:
- at least 20 minutes' warm-up in "Neutral" setting
- preheating

At greasing points, use a multi-purpose grease with the following properties:
lithium soap, drop point above 170 °C, NLGI Class 2.
The grease must be anti-corrosive, water-resistant and walk stable.

Note to lubricant suppliers: Please inform ZF immediately of any changes to the composition or trade names of approved products, and of differences in quality between Germany and other countries.

This list can be obtained through any ZF After-Sales Service point.

Zahnradfabrik Passau GmbH
Postfach 26 40
D-8390 Passau 1

Telephone (08 51) 494-0
Telex 5 78 49 zp d
Telefax (08 51) 45 340

Engine oils API CD/CE/CF/SF/SG, MIL-L-2104 C/-D/-E, MIL-L-46152 C/-D/-E

ADDINOL MINERALÖL GMBH LÜTZKENDORF, KRUMPA/D
ADDINOL MINERALÖL GMBH LÜTZKENDORF, KRUMPA/D
AGIP PETROLI S.P.A., MÜNCHEN/D
AGIP PETROLI S.P.A., MÜNCHEN/D
AGIP SCHMIERTECHNIK AUTOL-WERKE, WÜRZBURG/D
AMALIE REFINING COMPANY, BRADFORD/GB
AMALIE REFINING COMPANY, BRADFORD/GB
AMERICOL B.V., ZAANDAM/NL
AMPOL LIMITED, SYDNEY/AUS
AMPOL LIMITED, SYDNEY/AUS
ANTAR S.A., PARIS/F
ANTAR S.A., PARIS/F
ARAL AG, BOCHUM/D
ASEOL AG, BERN/CH
ASEOL AG, BERN/CH
AVIA MINERALÖL AG, MÜNCHEN/D
BAYWA AG, MÜNCHEN/D

BEVEROL-NEDERLAND B.V., BEVERWIJK/NL
BEVEROL-NEDERLAND B.V., BEVERWIJK/NL
BLASER & CO AG, HASLE-RUEGSAU/CH
BLASER & CO AG, HASLE-RUEGSAU/CH
BP OIL INTERNATIONAL, HAMBURG/D
BP SOUTHERN AFRICA (PTY) LIMITED, CAPE TOWN/SA
BRENNTAG MINERALÖL GMBH & CO, MÜLHEIM/D
BUCHER + CIE AG, LANGENTHAL/CH
BUCHER + CIE AG, LANGENTHAL/CH
BURRENKOPF H.O. & CO. KÖLN/D

BURRENKOPF H.O. & CO, KÖLN/D
CALTEX SERVICES (UK) LIMITED, LONDON/GB
CALTEX SERVICES (UK) LIMITED, LONDON/GB
CASTROL LTD, SWINDON/GB
CASTROL LTD, SWINDON/GB
CENTURY OILS LIMITED, HANLEY/GB
CEPSA, MADRID/E
CERA OIL S.A. (PTY) LTD, BOKSBURG NORTH/SA
CHEMICO, LUIPAARDSVLEI/SA
CHEVRON USA, SAN FRANCISCO/USA

COFRAN RECHERCHE SARL, LA ROCHELLE CEDEX/F
CONDAT, CHASSE SUR RHONE/F
CONDAT, CHASSE SUR RHONE/F
DEA MINERALÖL AG, HAMBURG/D
DEA MINERALÖL AG, HAMBURG/D
DELUXOL OLIE MAATSCHAPPIJ B.V., ROTTERDAM/NL

DEUTSCHE BP AG, HAMBURG/D
DEUTSCHE BP AG, HAMBURG/D
DEUTSCHE BP AG, HAMBURG/D
DEUTSCHE PAM, ASCHAFFENBURG/D
DEUTSCHE SHELL AG, HAMBURG/D
DEUTSCHE SHELL AG, HAMBURG/D
DEUTZER OEL AG, KÖLN/D
DEUTZER OEL AG, KÖLN/D
DIEDERICHS SÖHNE, WUPPERTAL/D
DIEDERICHS SÖHNE, WUPPERTAL/D
DUCKHAMS OILS, BROMLEY/GB
ELEKTRION S.A., GENT/B
ELEKTRION S.A., GENT/B
ELF LUB, PARIS/F
ELF LUB, PARIS/F
ELF LUB, PARIS/F
ELLER-MONTAN-COMP. GMBH, DUISBURG/D
ERTOL S.A., MADRID/E
ESSO AG, HAMBURG/D
ESSO AG, HAMBURG/D
EURO OIL-VERTRIEBS-GMBH, FRANKFURT/D
FIAT LUBRIFICANTI, TORINO/I
FIAT LUBRIFICANTI, TORINO/I
FINA EUROPE S.A., BRÜSSEL/B
FINKE E. GMBH & CO KG, BREMEN/D
FUCHS MINERALOELWERKE GMBH, MANNHEIM/D
FUCHS MINERALOELWERKE GMBH, MANNHEIM/D
GARANTOL AG, MADETSWIL/CH
GPM ESPANOLA S.A., BARCELONA/E
GPM ESPANOLA S.A., BARCELONA/E
GULF OIL LIMITED, CHELTENHAM/GB
HAFA, PARIS/F
HESSISCHE ÖLWERKE, BAD VILBEL/D
HGK GMBH & CO. KG, DÜSSELDORF/D
HGK GMBH & CO. KG, DÜSSELDORF/D
HILBERT T., EMSDETTEN/D

HILBERT T., EMSDETTEN/D
HOMBERG GMBH & CO.KG, WUPPERTAL/D
HUILES RENAULT DIESEL, PARIS/F
HÜRLIMANN E. AG, WÄDENSWIL/CH

ADDINOL TURBO DIESEL

ADDINOL DIESEL SUPER
AGIP SIGMA MULTI
AGIP DIESEL SIGMA S

AUTOL-CPM-HD S3
PRO HIGH PERFORMANCE
XLO
SUPER HD S3
DEULUBE S3
LONGHAUL
MILANTAR 2C
MILANTAR 2B
ARAL TURBORAL MOTORÖL
ASEOL MILOR
ASEOL PERLA
AVIA SPECIAL MOTOR OIL HDC
BAYWA MOTORENÖL HD SUPERIOR
GOLD ARTOL
MAGNA
BLASOL 258
BLASOL 257
VANELLUS C3

BP VANELLUS C3

SILVER STAR MOTORÖL HD-MIL-C
MOTOREX MC PLUS
MOTOREX EXTRA
H.O.B-MULTI-MOTOR-OIL MHC HD TURBO
H.O.B-MOTOR-OIL HD CS III
RPM DELO 450 OIL
RPM DELO 400 OIL
CASTROL CRD
CASTROL RX SUPER
SUPER B
CEPSA SUPER SERIE 3

HONEYLUBE SUPER PLUS
LUBRO "MS" ENGINE OIL
CHEVRON DELO 400 PLUS MOTOR OIL

PLURA / EQUILUX C 2000
VICAM SPECIAL C
VICAM TURBO SHPD
DEA CRONOS SUPER
DEA CRONOS SUPER DX

DELUXOL MOTOR OIL SUPERIOR-EXTRA
VERITAS HDC-F PLUS DB
BP VANELLUS C3 / ARISTOL HDC
BP VANELLUS MULTIGRADE
PAM HD FLEET
MAC HD SUPERIOR MOTORENÖL
SHELL RIMULA X
DEUTZ ÖL SGHD-C
DEUTZ ÖL HD-C
CIDISOL-HD MOTORENÖL 15W-40
CIDISOL-MOTORENÖL HD
FLEETOL 3
ELEKTRION UNI
ELEKTRION HD/S
ELF PERFORMANCE SUPER
ELF PERFORMANCE XC
ELF PERFORMANCE 3D
ELLMOTOL HD C3
ERTOL SUPER SERIE 3
ESSO MOTORENÖL MHC
ESSOLUBE XD-3 PLUS
EURO OIL LD TURBO
URANIA C
URANIA TURBO LD
FINA KAPPA TD MOTOR OIL
AVIATICON HDS-3

RENOLIN HD SUPERIOR

TITAN UNIVERSAL HD
GARANTOL HD DIESEL S-3
HIDROBAK 10W ESPECIAL
MOTOR OIL S-III
GULF SUPER DIESEL (GB)
DETERGENTE S3C
HESSOL SUPERIOR
SVG HD SUPERPLUS S3
SVG UNIVERSAL C3
XORBOL MEHRBEREICHSÖL HDC S3
XORBOL MOTORENÖL HDC
HOMBERG-MOTOR-OEL HD-SC 4
RENAULT DIESEL MVS
ROLLSYNOL HD M.O. S-3

Engine oils API CD/CE/CF/SF/SG, MIL-L-2104 C/-D/-E, MIL-L-46152 C/-D/-E

ICPA, DORDRECHT/NL
IGOL FRANCE, PARIS/F
INA RAFINERIJA RIJEKA, KOSTRENA-URINJ/YU
ITALIANA PETROLI S.P.A., GENOVA/I
KÄPPLER K. GMBH & CO KG, STUTTGART/D

KENDALL REFINING COMPANY, BRADFORD/GB
KENDALL REFINING COMPANY, BRADFORD/GB
KLUTH O., BARGFELD-STEGEN/D

KLUTH O., BARGFELD-STEGEN/D

KOMPRESSOL-OEL VERKAUFS GMBH, KÖLN/D
KOMPRESSOL-OEL VERKAUFS GMBH, KÖLN/D
KRAFFT S.A., ANDOAIN/E
KROON-OIL BV, ALMELO/GB
KUWAIT PETR.RESEARCH & TECHN. B.V., ROTTERDAM/NL
KUWAIT PETR.RESEARCH & TECHN. B.V., ROTTERDAM/NL
LABO INDUSTRIE, NANTERRE/F
LEPRINCE & SIVEKE GMBH, HERFORD/D
LEPRINCE & SIVEKE GMBH, HERFORD/D
LUBRICATION ENGINEERS, INC., TEXAS/USA
MINERALÖLWERK OSNABRÜCK, OSNABRÜCK/D
MOBIL OIL AG, HAMBURG/D
MOBIL OIL AG, HAMBURG/D
MORRIS LUBRICANTS, SHREWSBURY/GB
MOTUL S.A., AUBERVILLIERS/F
NEULING P. MINERALÖLWERK, BERLIN/D
NYNÄS INDUSTRI AB, NYNÄSHAMN/NL
OEL-BRACK AG AARAU, HUNZENSCHWIL/CH
OEST G. MINERALÖLWERK, FREUDENSTADT/D
OEST G. MINERALÖLWERK, FREUDENSTADT/D

ÖMV-AG, WIEN/A
OPAL LUBRIFIANTS, NANTERRE/F
OPTIMOL ÖLWERKE, MÜNCHEN/D
ORLY INTERNATIONAL G.I.E., VIEUX-THANN/F
PANOLIN AG, MADETSWIL/CH
PAZ OIL COMP., HAIFA/IL
PAZ OIL COMP., HAIFA/IL
PENNASOL MINERALÖL GMBH, UETZE/D
PENNASOL MINERALÖL GMBH, UETZE/D
PENNZOIL OVERSEAS B.V., ZAANDAM/NL
PENNZOIL OVERSEAS B.V., ZAANDAM/NL
PETROGAL S.A., LISSABON/P
POLAROIL S.A., ISSOUDUN/F
POLAROIL S.A., ISSOUDUN/F
PRINZ-SCHULTE GMBH & CO KG, FRECHEN/D
RAFFINERIES IMPERATOR, BAISSIEUX/F
RAIFFEISEN HGEG, HANNOVER/D
RAIFFEISEN HGEG, HANNOVER/D
RCG NORDWEST EG, MÜNSTER/D

REPSOL DISTRIBUCION S.A., MADRID/E
RHEINISCHE MOTOR-ÖL, DUISBURG/D
SONOL ISRAEL LTD., HAIFA/IL
SOPROGRASA, S.A., MADRID/E
STRUB & CO. AG, SCHMIERTECHNIK, REIDEN/CH
STRUB & CO. AG, SCHMIERTECHNIK, REIDEN/CH
SUN OIL COMPANY N.V., AARTSELAAR/B
TEBOIL OY AB, HELSINKI/SF
TEXACO SERVICES (EUROPE) LTD., BRÜSSEL/B
TOTAL GROUP, PARIS/F
TURBOTANK BÖSCHE & BÖDEKER, BREMEN-NEUSTADT/D
UK MIN.WERKE WENZEL & WEIDMANN GMBH, ESCHWEILER/D
UNIL DEUTSCHLAND GMBH, HERFORD/D
UNIL DEUTSCHLAND GMBH, HERFORD/D
UNIL INTERNATIONAL, PARIS/F
USOCO B.V., RIDDERKERK/NL

VALVOLINE INTERNATIONAL INC., DORDRECHT/NL
VALVOLINE INTERNATIONAL INC., DORDRECHT/NL
VEBA OEL AG, GELSENKIRCHEN/D
VEEDOL INTERN. LTD., SWINDON/GB
WESTFALEN AG, MÜNSTER/D
WEVAG WEYERS & VAGEDES KG, BOCHOLT/D
WEVAG WEYERS & VAGEDES KG, BOCHOLT/D
WINTERSHALL AG, DÜSSELDORF/D
WISURA MINERALÖLWERK GMBH & CO, BREMEN/D
WISURA MINERALÖLWERK GMBH & CO, BREMEN/D
YACCO SAF, CAUDEBEC-L.-ELBEUF/F
ZELLER & GMELIN GMBH & CO, EISLINGEN/D
ZENEX OIL (PTY) LTD, SANDTON/GB
ZENEX OIL (PTY) LTD, SANDTON/GB

OK SUPER DS.C
IGOL ULTRA DUTY 4D
INA-SUPER 3
IP AXIA D
DRIVOLIN SUPERIOR HD MOTORENÖL S3

GT-1 TURBO HIGH PERFORMANCE

SUPER-D3
KLUTH HOCHLEISTUNGSMOT.ÖL HDC C3
KLUTH MEHRBER.MOT.ÖL HDC-F PLUS DB
KOMPRESSOL-ULTRALUB-C
KOMPRESSOL-HD-S3-C-OEL
MOTOR-OEL DMOK 3040
KROON OIL MULTIFLEET SCD

Q8 T500

Q8 T400
MEGALUB AC3
LEPRINXOL SUPER
LEPRINXOL SUPER S
MONOLEC GFS ENGINE OIL

IROKAL PLUS C
DELVAC 1300
MOBIL DELVAC 1400 SUPER
RING FREE XHD
MOTUL SUPERIOR HP 4D
SUPEROL HD-C-NX SUPER
AJCOL SDS
PERFECTOL / PENTEX HDX-TURBO
OEST DIMO HDC-MOTORÖL
OEST GIGANT UNIVERSAL HD MOTORÖL
ELAN MOTORÖL 104 C
DIESOPAL MC3
OPTIMOL OPTILUB C
ORLY DRACO 2001
PANOLIN HD EXTRA DIESEL S-3
PAZMULAR DX
PAZ CHAMPION SG
PENNASOL MULTIGRADE EXTRA C
PENNASOL MOTOR OIL EXTRA C
LONG-LIFE MOTOR OIL
MULTI DUTY MOTOR OIL
GALP DIESEL
EURALTA MTM
EURALTA TM
AERO-LINE SUPER HD M-C
RAFF GRADE 2104D
HG UNIVERSAL HD
HG C33 HD
RAIFFEISEN MOT.ÖL SUPER UNIV. HDCT
CS-MIZAR SERIE-3
RMV-RHEMOTOL HD-C
SADOL X-400
SOPRAL SUPERDIESEL

STRUB MOTOR OIL TURBO

STRUB SUPER MULTI TURBO
SUNOCO SUPER C
TEBOIL POWER D

URSA SUPER LA
TOTAL RUBIA XT/X

TURBO HD MOTORENÖL CSI

UK-PROMOTOR CONTROL HD
UNIL MULTI D / DS
UNIL MOTOR HP 4D / 4DS
UNIL MEGARA RD
USOCO-EXCELLO HD XXX MOTOROIL

VALVOLINE TOPFLITE C-3

VALVOLINE ALL FLEET PLUS
VEBA MOVARA EXTRA-MOTORÖL
VEEDOL DIESEL HDC
WESTFALEN C3 MOTORÖL
WEVAGOL EXTRA MULTIGRAD
WEVAGOL EXTRA C3
WINTERSHALL REKORD

WISURA MULTI HD-C

WISURA MULTI HD-C PLUS
YACCO AS3 SERIE Y, YY, M, X
DIVINOL MULTIMAX
ZENEX MULTIGRADE MOTOR OIL
ZENEX SINGLEGRADE MOTOR OIL

1. ELECTRO-HYDRAULIC GEARBOX CONTROL

ATTENTION :

In case of malfunctions of the Transmission because of a defective gearbox control, we recommend the replacement of the complete gearbox control.

The pressure-control curve of the replacement-gearbox control (see corresponding Spare Parts List) has been accordingly adapted to the Transmission Version, resp. to the Vehicle type.

Modifications concerning the pressure-control curve may not be carried out without agreement of ZF. Therefore, the repair of gearbox control units should be carried out by ZF-Service stations only.

The relative shop equipment of our Service stations (gearbox control resp. transmission test benches) as well as constantly trained personnel ensure a professional repair.

The following Disassembly and Reassembly Instructions (Page 1.01 - 1.73) will therefore be useful only as an Information for ZF-Service stations as well as for the Manufacturer of the vehicle, which are disposing of the required workshop equipment and especially trained personnel.

Note regarding the pressure control:

Diagram 1 (Basic diagram)

Pressure-control curve gear case

p = Pressure in bar
t = Time in seconds

p^1 = Modulation start
p^2 = Modulation end
p^3 = Modulation start only in dependence with 2-stage pressure control valve
ps = Control pressure
ΔtF = Filling time
Δt1 = Modulation time
Δt3 = Modulation time in dependence with 2-stage pressure control valve

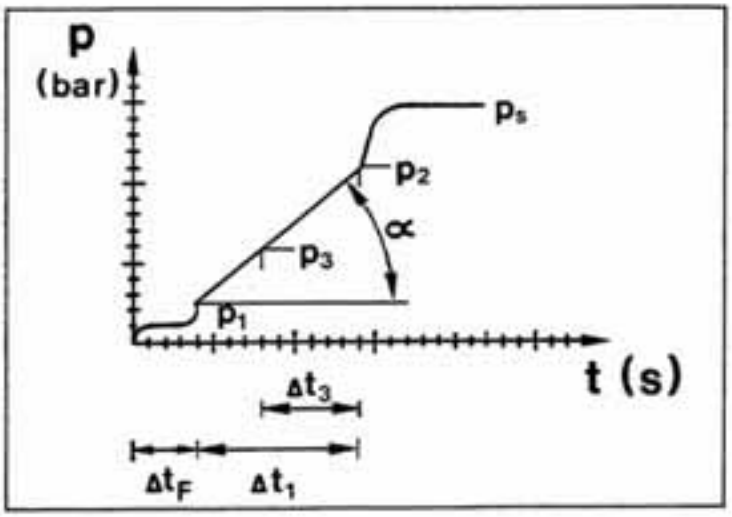
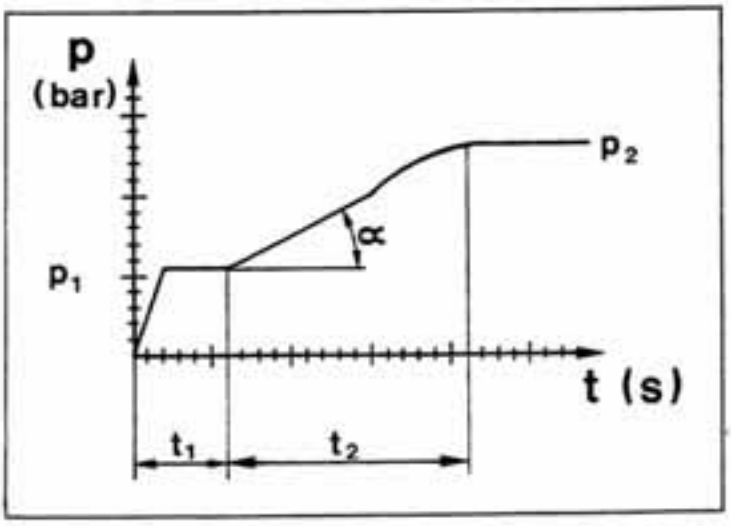


Diagram 2 (Basic diagram)

Pressure-control curve WK

p^1 = Modulation start
p^2 = Modulation end
t1 = Filling time
t2 = Modulation time



ATTENTION:

The pressure-control curve is different according to the Transmission Version, resp. the vehicle type and will be adjusted by means of corresponding shims and diaphragms (optional)!

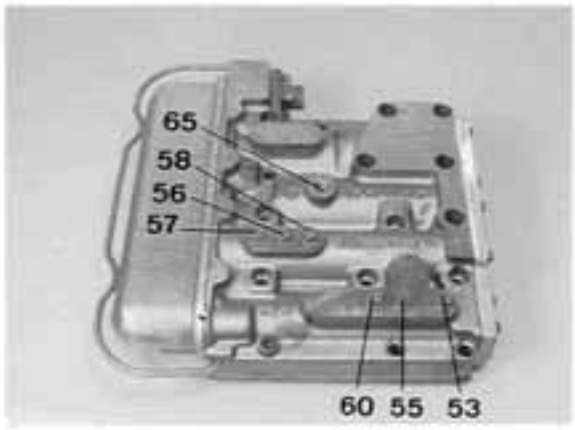
Note:

In the following Disassembly and Reassembly Instructions are three different gearbox control Variants treated.

1.1 Cast-iron gearbox control
1.2 Aluminium sand-casting gearbox control
1.3 Aluminium die-cast gearbox control with WK-Valve

With the help of the following Figures, the coordination of the single gearbox control variants can be visually identified because of the different casting contours!

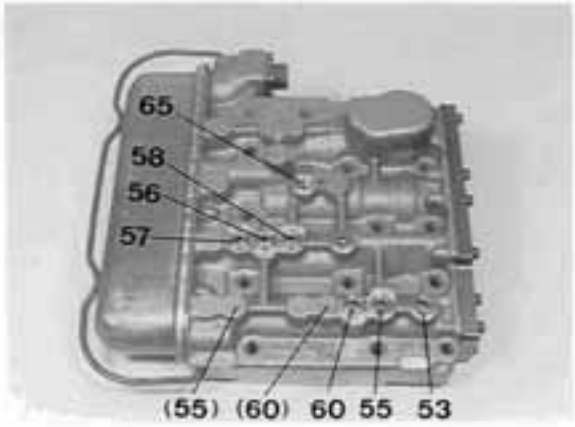
1.1 Cast-iron gearbox control



Measuring points for pressure oil:

65 = Central measuring point for system pressure (control pressure)
53 = Clutch KV
55 = Clutch KR
56 = Clutch K1
57 = Clutch K2
58 = Clutch K3
60 = Clutch K4

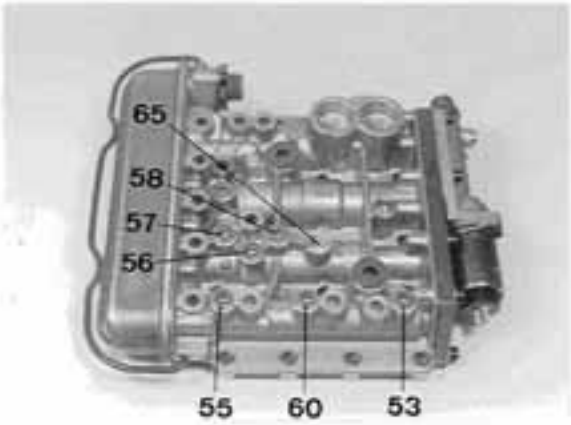
1.2 Aluminium sand-casting gearbox control (e.g. 4 magnets)



Measuring points for pressure oil:

65 = Central measuring point for system pressure (control pressure)
53 = Clutch KV
55 = Clutch KR
(55) = Clutch KR (in case of 5-magnet Version)
56 = Clutch K1
57 = Clutch K2
58 = Clutch K3
60 = Clutch K4
(60) = Clutch K4 (in case of 5-magnet Version)

1.3 Aluminium die-cast gearbox control



Measuring points for pressure oil:

65 = Central measuring point for system pressure (control pressure)
53 = Clutch KV
55 = Clutch KR
56 = Clutch K1
57 = Clutch K2
58 = Clutch K3
60 = Clutch K4

Furthermore, the single gearbox control units can include WK-Valve, 2-stage pressure control valve as well as 4, resp. 5 magnets (only for gearbox control 1.2).
Different steps resulting from this, can be carried out without great difficulty by qualified personnel, consulting the Perspective Illustrations in the corresponding Spare Parts List!

1.1 CAST-IRON GEARBOX CONTROL

1.1.1 Version I : Standard Version (without WK and 2-stage pressure control valve)

1.1.1.1 DISASSEMBLY

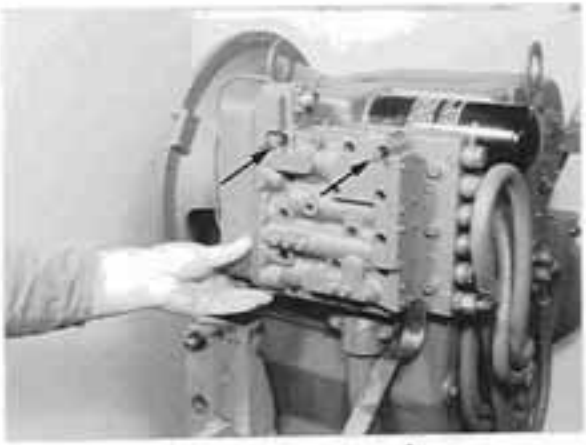
Separate shift-control housing and channel plate from gear case (Figure 1 ... 3).

Loosen socket head screws, install two adjusting screws (Arrows) and remove shift-control housing.

Now, remove gaskets and intermediate plate.

(S) Adjusting screws (M8) 5870 204 011

Now, remove gaskets and intermediate plate.



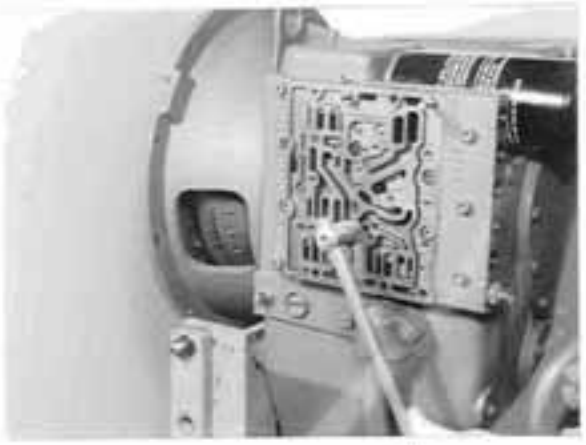
1

Remove delivery lines.

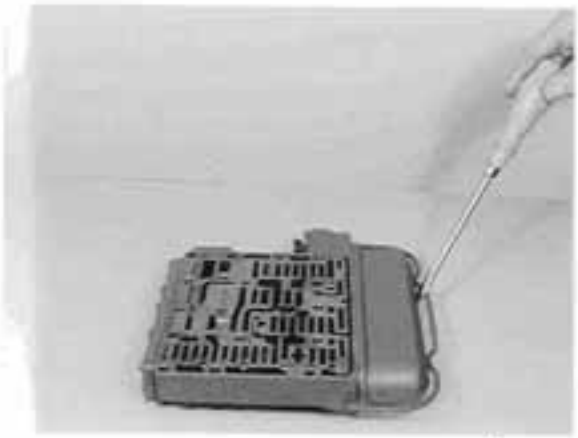


2

Loosen socket head screws and separate channel plate as well as gaskets and intermediate plate from the gear case.

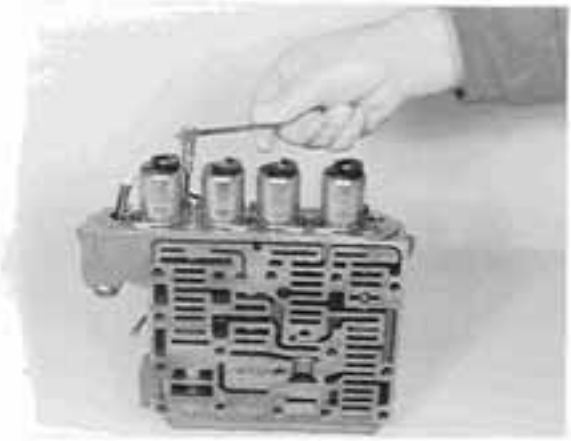


3



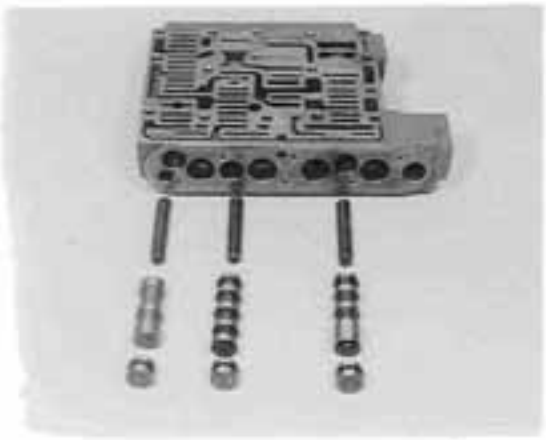
4

Relax spring clip and remove cover.



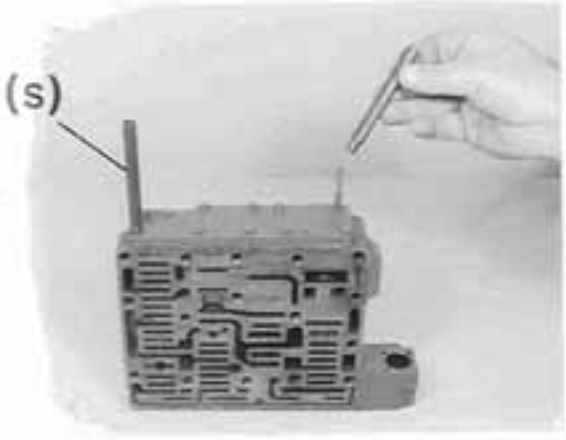
5

Pull off cable shoes, loosen the socket head screws and remove solenoid valves.



6

Remove components, see Figure on the left!



7

Loosen two hex. head screws and fix shift-control housing provisionally, using Special Tool (S).
Now, loosen the remaining hex. head screws and separate cover (is spring-loaded) from the valve body by uniform loosening of the nuts (S).

(S) Adjusting screws (M5) with nut 5870 204 036
(S) Adjusting screws (M6) with nut 5870 204 049

Remove components, see Figure on the right !

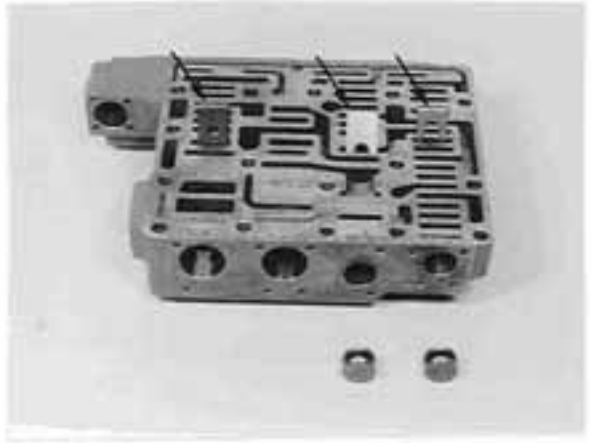


8

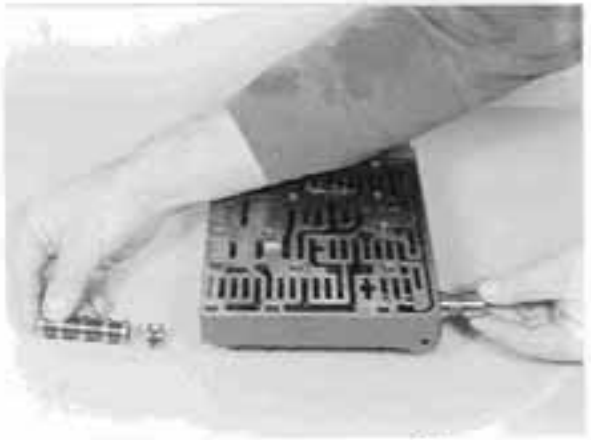
Remove stop plates (Arrows) and demount detent blocks.

NOTE :

The use of two spools in order to fix the detent block provisionally axially (Figure 10), avoids the tilting of the detent blocks, thus facilitating the disassembly !



9



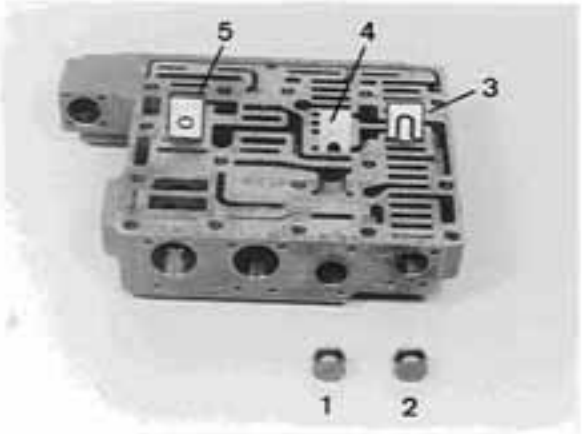
10

1.1.1.2 REASSEMBLY

see also Illustrated Tables, Page 1.14 and 1.15 !

NOTE :

Check all components for damage and renew if necessary !
Check free travel of the moving parts in the housing prior to the installation !
Spools can be exchanged individually !
Oil components prior to the reassembly !



15

Introduce detent blocks (1 and 2) into the bores and fix them by means of stop plates (3 and 4).
Install stop plate (5).

NOTE :

Pay attention to the installation position of the various stop plates, see Figure on the left !

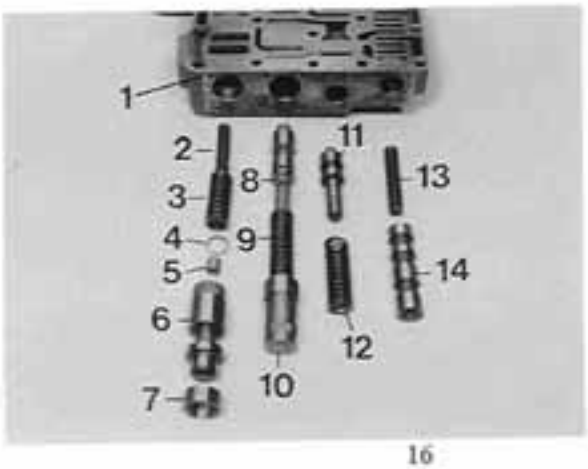
Install components :

1 =	Valve body	
2 =	Spring	(L_o = 88,6 mm)
3 =	Spring	(L_o = 52,0 mm)
4 =	Disk	(optional)
5 =	Spacer	
6 =	Spool	
7 =	Sleeve	
8 =	Spool	
9 =	Spring	(L_o = 81,7 mm)
10 =	Spool	
11 =	Spool	
12 =	Spring	(L_o = 65,4 mm)
13 =	Spring	(L_o = 72,5 mm)
14 =	Spool	(total length 86,0 mm)

NOTE :

L_o = Length of the unloaded spring !

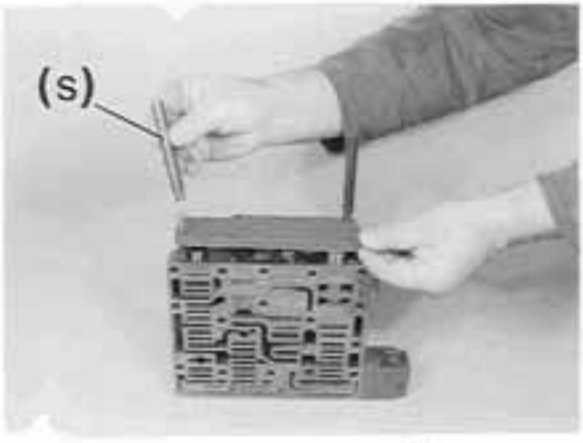
ps (control pressure) is determined by the disk (4)! Pay attention to the General Instructions, Page 1.01 ... 1.03 !



16

Install two adjusting screws (S) and mount flat gasket.
Place cover against shoulder, using nuts (S). Now, fasten cover by means of screws.

Torque limit (M5/8.8)		5,5 Nm
(S)	Adjusting screws (M5) with nut	5870 204 036
(S)	Adjusting screws (M6) with nut	5870 204 049



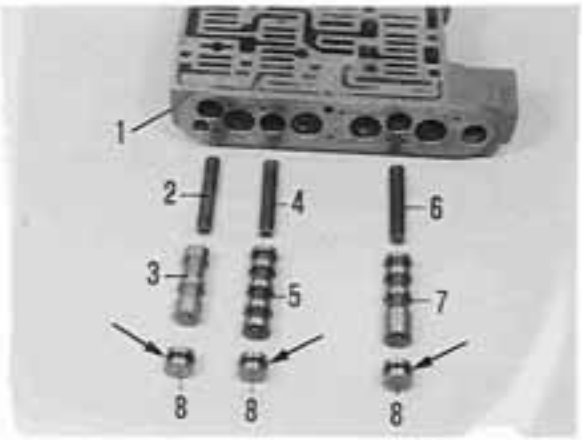
17

Install components :

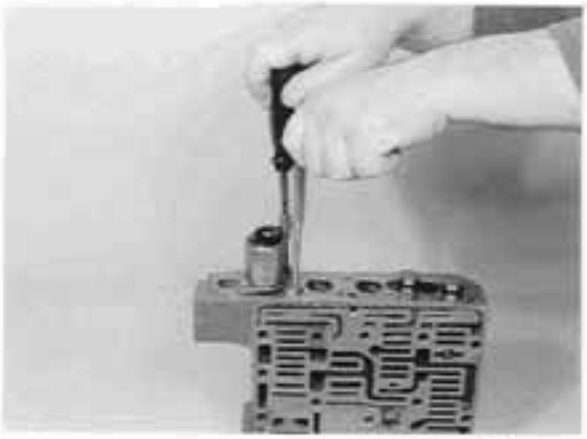
1 =	Valve body	
2 =	Spring	(L_o = 72,5 mm)
3 =	Spool	(3 control surfaces)
4 =	Spring	(L_o = 72,5 mm)
5 =	Spool	(5 control surfaces)
6 =	Spring	(L_o = 72,5 mm)
7 =	Spool	(total length 72,0 mm)
8 =	Detent block	(3 pieces)

NOTE :

Install new O-Rings, see Arrows !



18

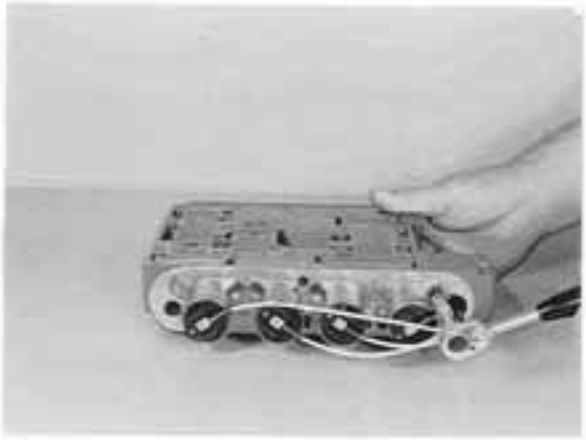


19

Preload detent block and install solenoid valve.
Install remaining solenoid valves accordingly.

NOTE :

Employ new O-Rings for solenoid valves !
Pay attention to the radial installation position of the solenoid valves, see Figure 21 !



20

Install cable harness (mount new gaskets), fasten ground cable and connect solenoid valves (Figure 20).

NOTE :

Pay attention to the location of the plug nose, see Arrow/Figure 21 !



21



22

Mount new O-Ring (164,2 x 5,7) and fix cover by means of clamping collar.

Pre-assemble channel plate (Figure 23 and 24)

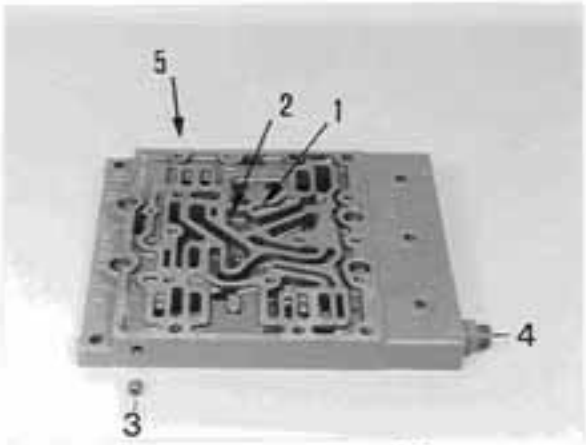
NOTE :

According to the gearshift Version, different channel plate variants are possible !
Pay attention to the Perspective Illustrations in the corresponding Spare Parts List !
The following Reassembly Instruction is treating the Standard Version (with control diaphragm and diaphragm for the backfeed) !

Wet thread of control diaphragm with Loctite (Type-No. 270), install control diaphragm (Position, see Arrow 1), and secure it additionally by means of center punch.
Now, clean diaphragm from Loctite residues by means of compressed air.

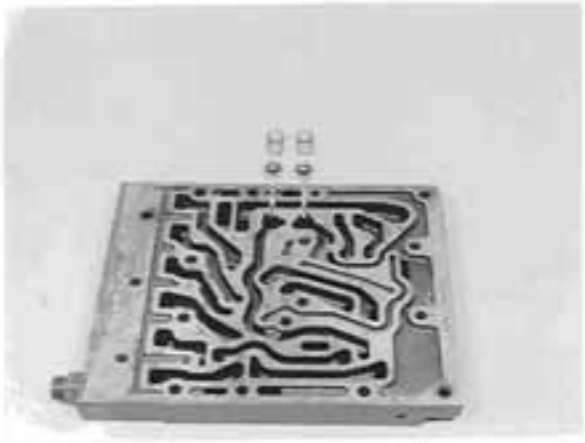
Install diaphragm for the backfeed (Position, see Arrow 2) accordingly.

Insert thread plug (3) with Loctite (Type-No. 270).
Employ new sealing ring for connecting plug (4) and screw plug (Position, see Arrow 5), and install them.



23

Insert the two check valves (composed of balls and springs) in the channel plate.


24

Attach channel plate and gearbox control (Figure 25 ... 30)

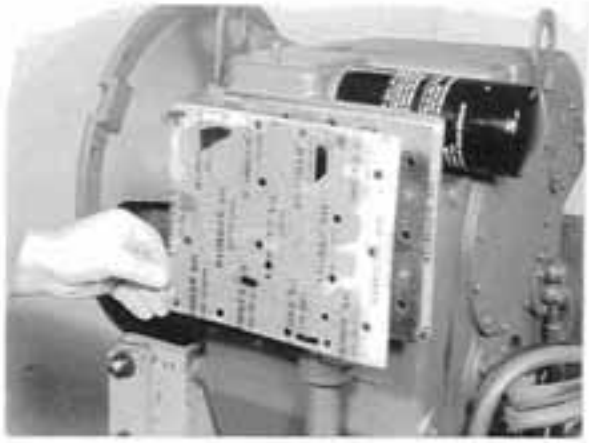
Install housing gasket.

NOTE :

Pay attention to the different gaskets, see Figure 25 and 26 !

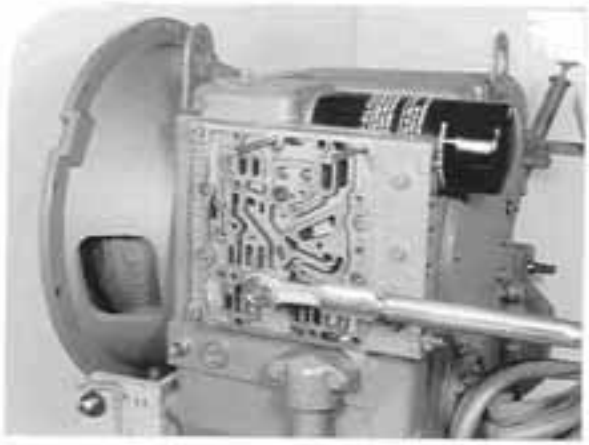
(S) Adjusting screws (M8) 5870 204 011


25



26

Install intermediate plate and 2nd gasket.



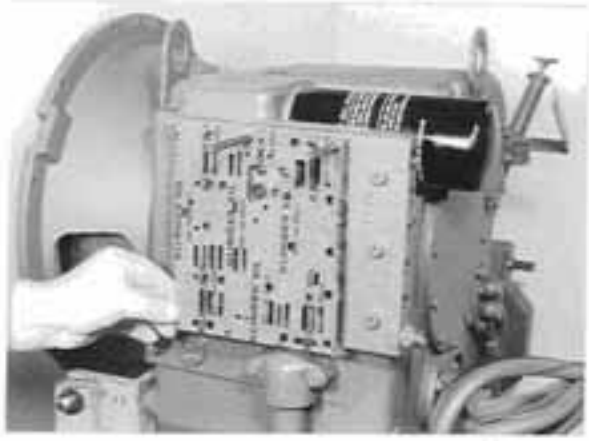
27

Assemble channel plate and fasten it by means of socket head screws.

Torque limit (M8/8.8) 23 Nm

NOTE :

Pay attention to a correct position of the ball seat valves !
Pay attention to the position of the various screws, see corresponding Spare Parts List !

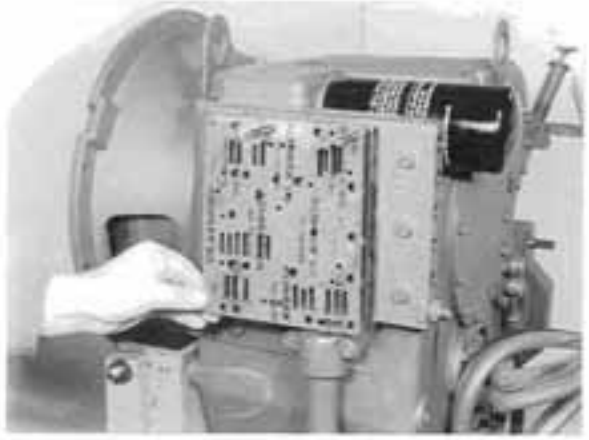


28

Assemble 1st gasket.

NOTE :

Pay attention to the different gaskets, see Figure 28 and 29 !



29

Install intermediate plate and 2nd gasket.

Place gearbox control assembly against shoulder and fasten it by means of socket head screws.

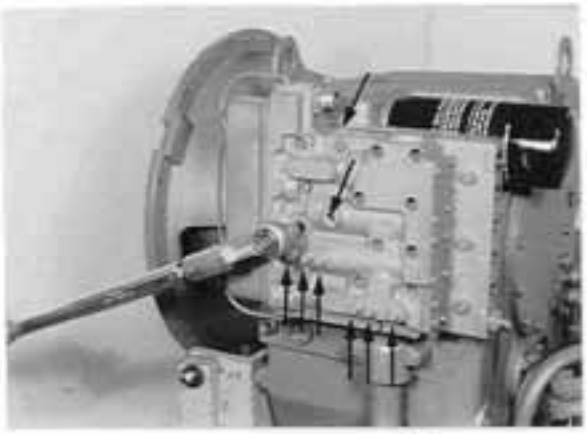
Torque limit (M8/8.8) 23 Nm

NOTE :

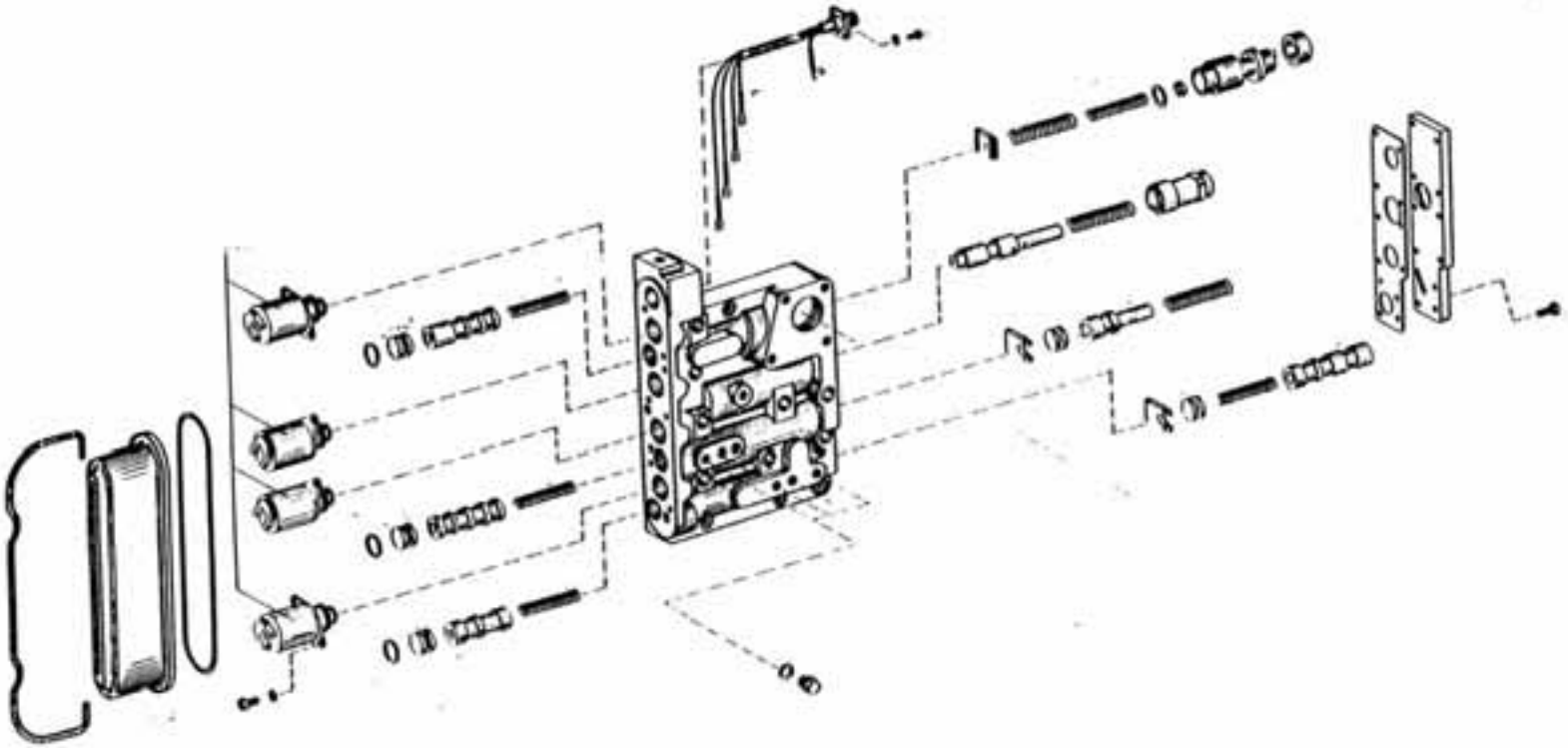
Pay attention to the position of the different screws (lengths) !

Employ new sealing rings for the screw plugs (see Arrows) and install them !

Now, install delivery lines, see Perspective Illustrations in the corresponding Spare Parts List !



30



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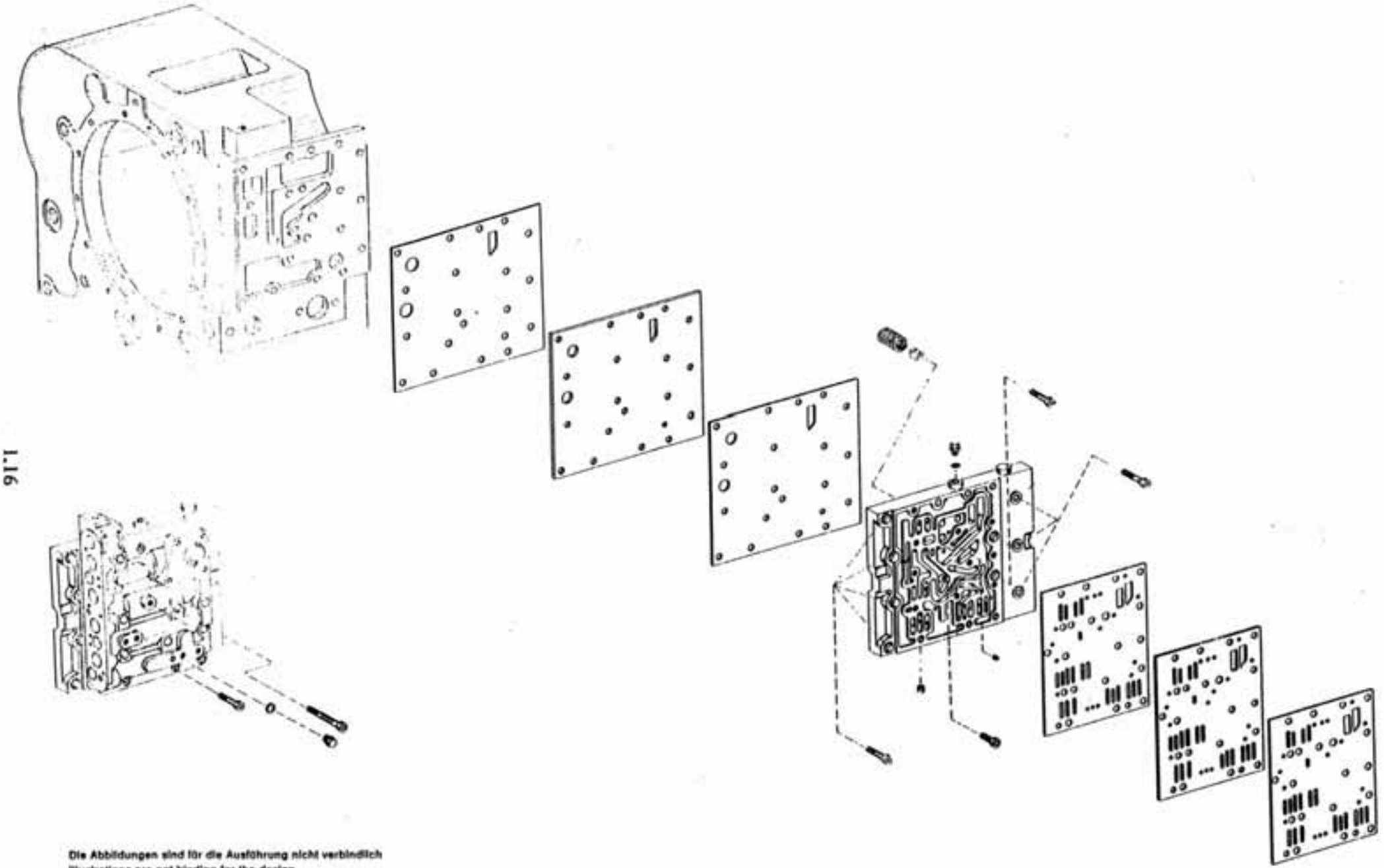
Les illustrations ne sont pas obligatoires pour l'exécution



Die Abbildungen sind für die Ausführung nicht verbindlich
Illustrations are not binding for the design
Les illustrations ne sont pas obligatoires pour l'exécution

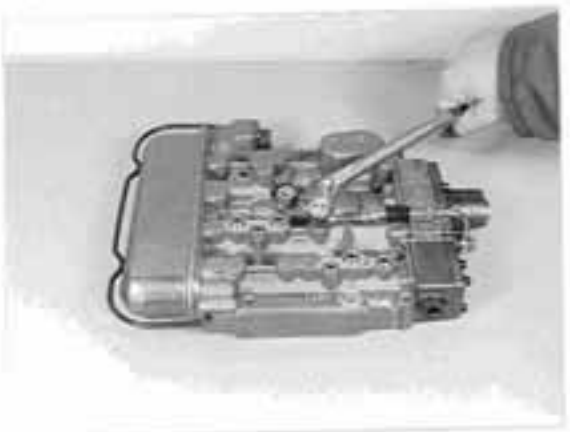
1.2 ALUMINIUM SAND-CASTING GEARBOX CONTROL

1.2.1 Version I : With 4 Solenoid valves and attached 2-stage pressure control valve !

1.2.1.1 DISASSEMBLY

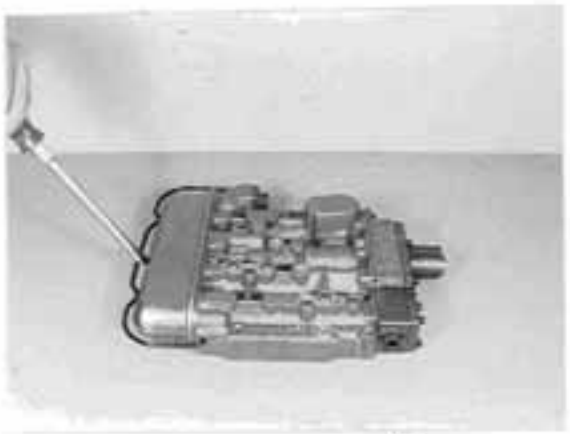
Remove delivery line.

(S) Adjusting screws (M8) 5870 204 011



35

Relax spring clip and remove cover.



36

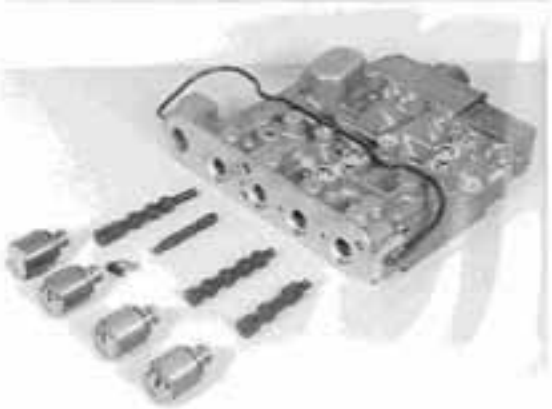
Pull off cable shoes and remove cable harness.

Loosen socket head screws and remove solenoid valves.

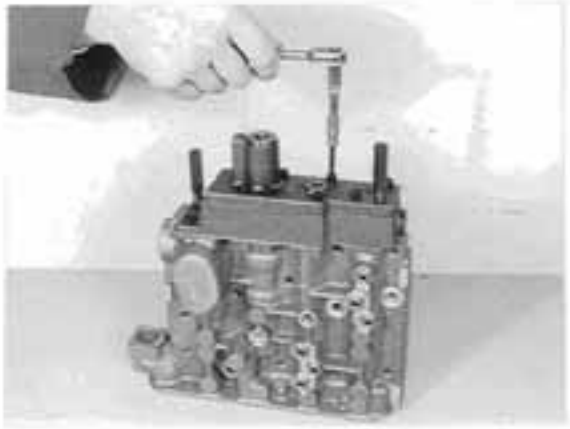


37

Remove components, see Figure on the right !



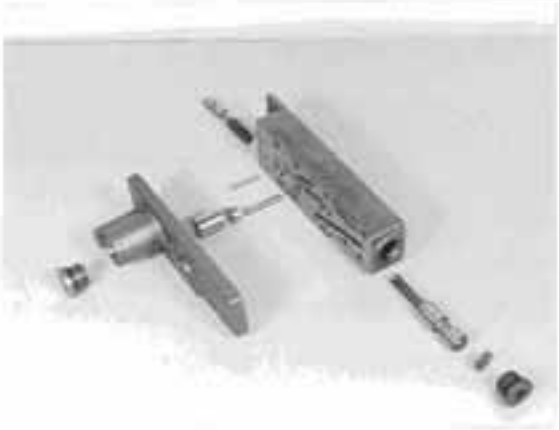
38



39

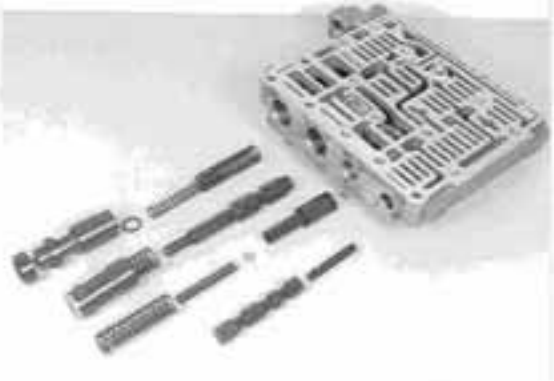
Loosen two socket head screws and fix shift-control housing provisionally, using a Special Tool (S).
Now, loosen the remaining socket head screws and separate shift-control housing (is spring-loaded) from the valve body by uniform loosening of the nuts (S).

(S) Adjusting screws (M5) with nut 5870 204 036
(S) Adjusting screws (M6) with nut 5870 204 049



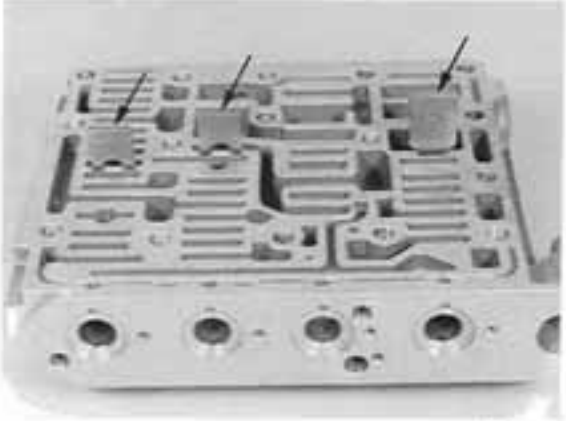
40

Dismantle pressure control valve.



41

Remove components.



42

Remove stop plates (Arrows) and demount detent blocks (2x).

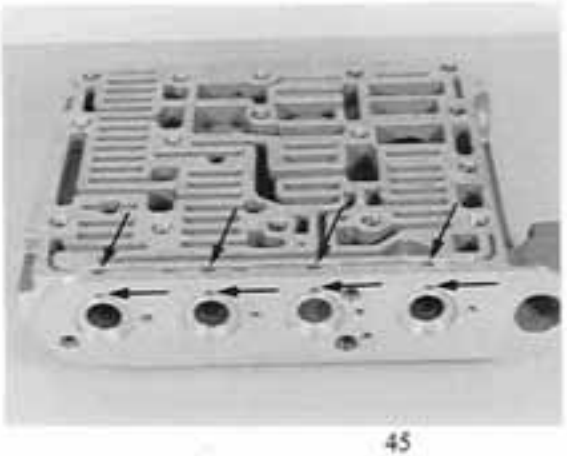
1.2.1.2 REASSEMBLY

see also Illustrated Tables, Page 1.26 and 1.27 !

NOTE :

Check all components for damage and renew if necessary !
Check free travel of the moving parts in the housing prior to the installation !
Spools can be exchanged individually !
Oil components prior to the reassembly !

Close the bores by means of balls (8 pieces ø 4,50 mm).



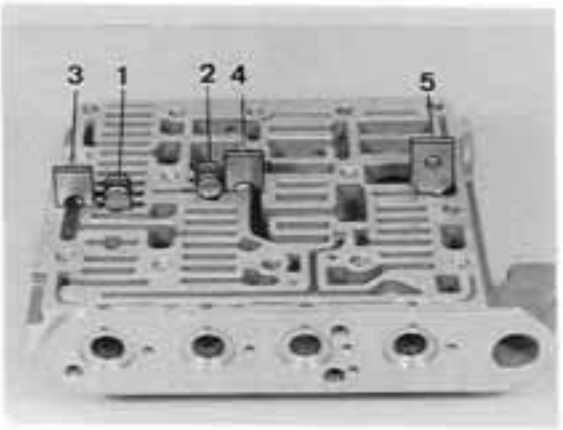
45

Introduce detent blocks (1 and 2) into the bores and fix them by means of stop plates (3 and 4).

Install detent block (5).

NOTE :

Pay attention to the installation position !



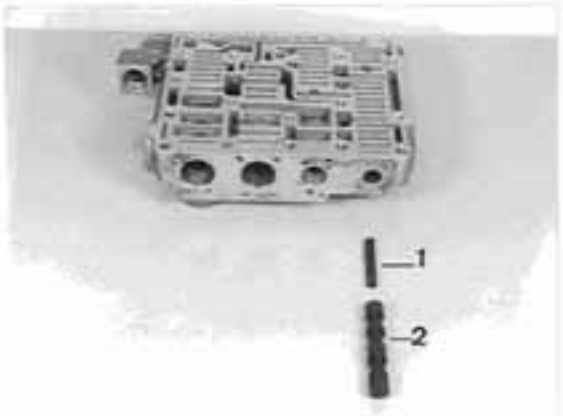
46

Install components :

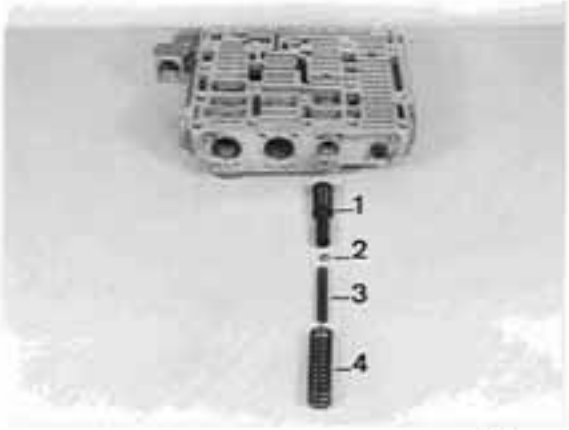
1 = Spool (total length = 86,00 mm)
2 = Spring (L_o = 53,40 mm)

NOTE :

L_o = Length of the unloaded spring !



47



48

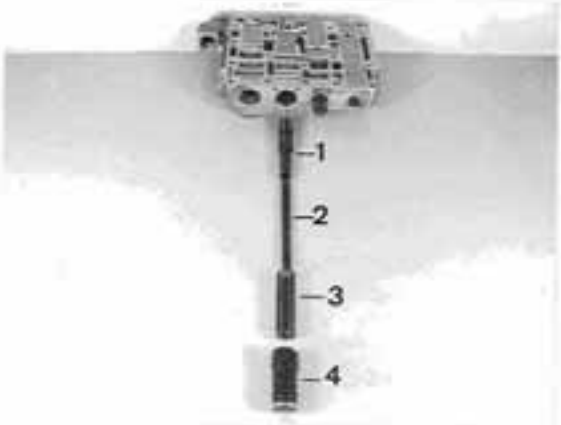
Reset valve :

Install components.

1 = Spool
2 = Disk(s) (optional)
3 = Spring (L_o = 58,00 mm)
4 = Spring (L_o = 65,40 mm)

NOTE :

p2 is determined by the disk 4
(pay attention to Notes, Page 1.01 ... 1.03) !

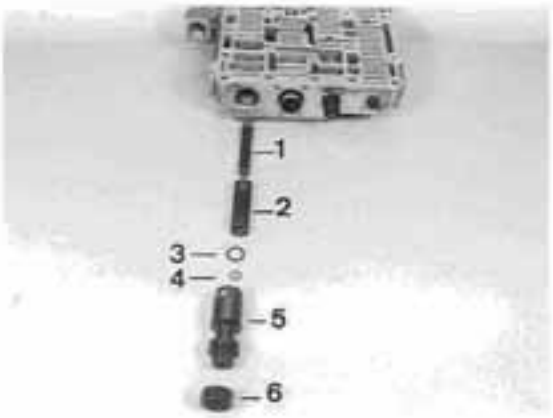


49

Pressure control valve :

Install components.

1 = Spool
2 = Spring (L_o = 132,40 mm)
3 = Spring (L_o = 76,70 mm)
4 = Spool



50

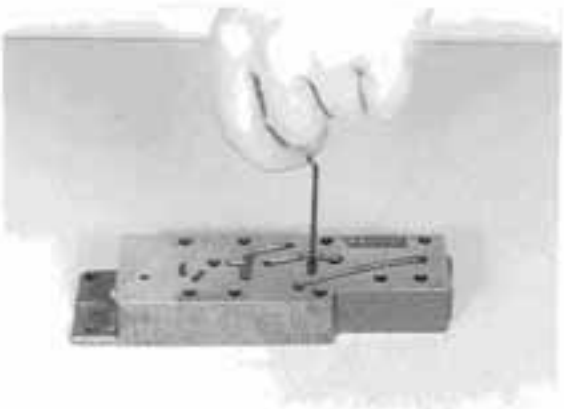
Control pressure valve :

Install components.

1 = Spring (L_o = 78,60 mm)
2 = Spring (L_o = 65,40 mm)
3 = Disk(s) (empirical value s = 3,00 mm)
4 = Disk(s) (empirical value s = 1,00 mm)
5 = Spool
6 = Sleeve

NOTE :

ps is determind by the disks 3 and 4
(pay attention to Notes, Page 1.01 ... 1.03) !



51

Pre-assemble 2-stage pressure control valve (Figure 51 ... 53) :

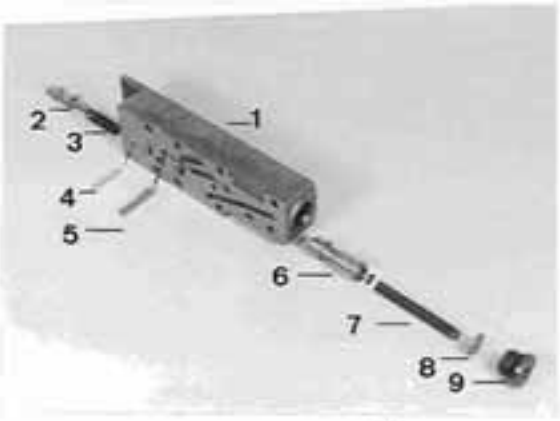
Install diaphragm (optional).

NOTE :

Wet thread of diaphragm with Loctite (Type No. 270) !
Δ t1 is determined by the diaphragm
(pay attention to Notes, Page 1.01 ... 1.03)!

Install components :

1 = Intermediate plate
2 = Valve
3 = Compression spring (L_o = 29,90 mm)
4 = Straight pin
5 = Roller
6 = Spool
6a = Disk (s = 2,5 mm/empirical value)
7 = Spring (L_o = 70,90 mm)
8 = Disk(s)
9 = Screw plug (mount new O-Ring)



52

NOTE :

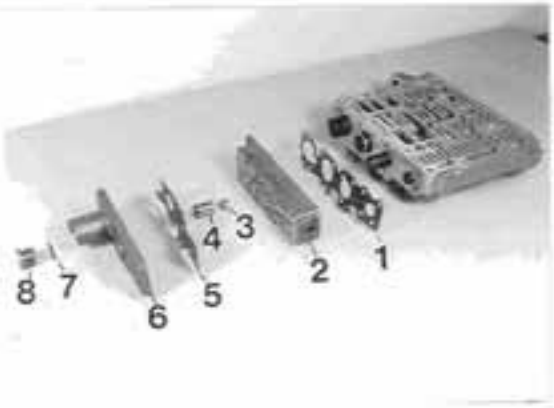
Insert compression spring (3) and valve (2) in the bore, preload and fix by means of straight pin (4) !
p3 is determined by the disk(s) 6a
(pay attention to Notes, Page 1.01 ... 1.03) !

Close the bore by means of ball (ø 5 mm), see Arrow !


53

Install components and fix them by means of socket head screws and flat washers (Figure 54 and 55).

1 = Gasket
2 = Housing assembly
3 = Ring (optional)
4 = Spool
5 = Gasket
6 = Cover
7 = O-Ring
8 = Screw plug



54

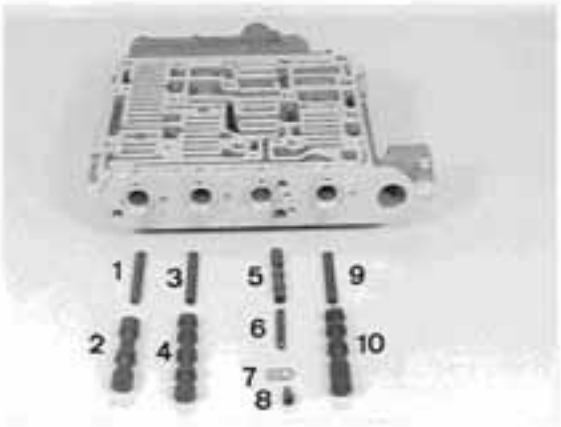
NOTE :

Δ t3 is determined by the ring (3)
(pay attention to Notes, Page 1.01 ... 1.03) !

Torque limit (M5/8.8) 5,5 Nm

(S) Adjusting screws (M5) with nut 5870 204 036
(S) Adjusting screws (M6) with nut 5870 204 049


55



56

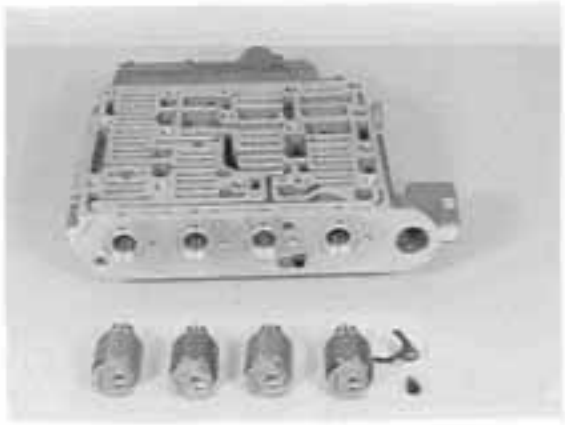
Install components :

1 = Spring (L_o = 53,40 mm)
2 = Spool
3 = Spring (L_o = 53,40 mm)
4 = Spool
5 = Spool (reducing valve)
6 = Spring (L_o = 37,10 mm)
7 = Retaining plate
8 = Socket head screw
9 = Spring (L_o = 53,40 mm)
10 = Spool

NOTE :

Pay attention to the installation position of the components, see Figure 56 !

Torque limit (M5/8.8) 5,5 Nm



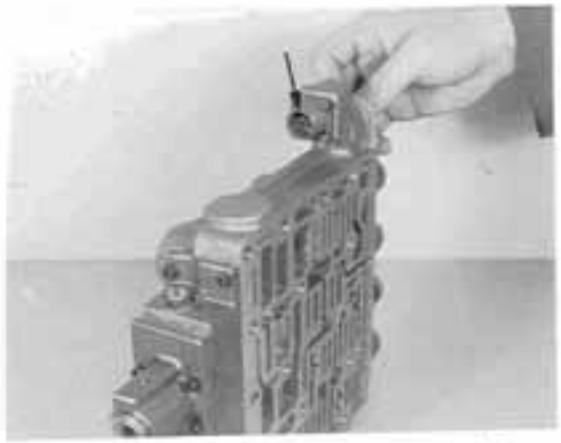
57

Insert the solenoid valves and fix them by means of retaining plate and socket head screws.

Torque limit (M5/8.8) 5,5 Nm

NOTE :

Pay attention to the radial installation position of the solenoid valves, see Figure 59 !



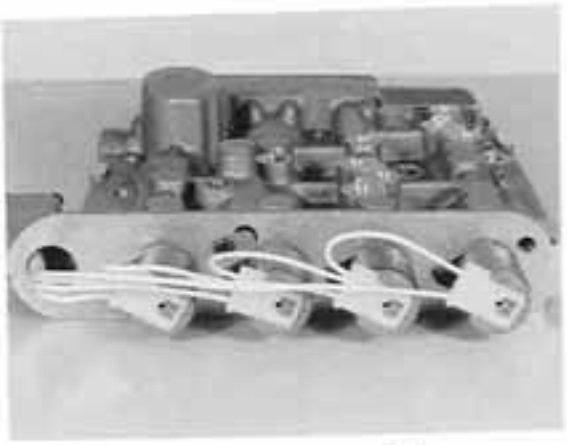
58

Install cable harness.

NOTE :

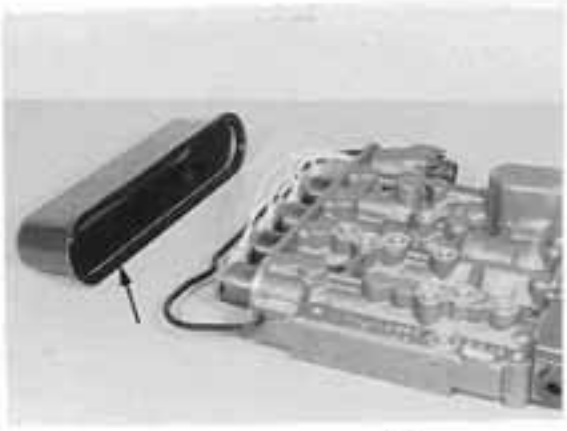
Mount new gaskets !
Pay attention to the location of the plug nose, see Arrow !

Connect solenoid valves according to the Illustration on the right.



59

Mount new O-Ring (164,2 x 5,7 mm), see Arrow and fix cover by means of clamping collar.



60

Intall delivery line 1, control pressure sender 2 (according to the Version) as well as screw plug.

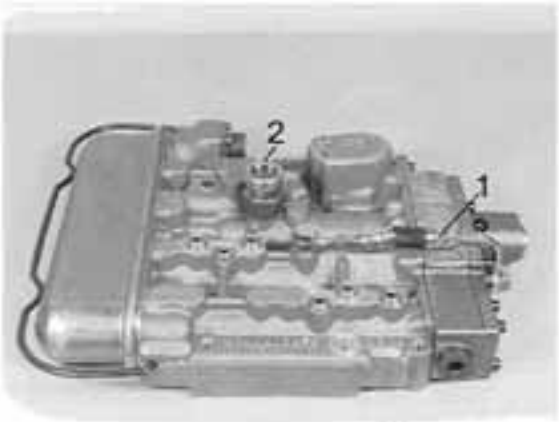
NOTE :

Mount new sealing rings and O-Rings !
Pay attention to the Perspective Illustration of the corresponding Spare Parts List !

Pre-assemble channel plate (Figure 62 ... 64) :

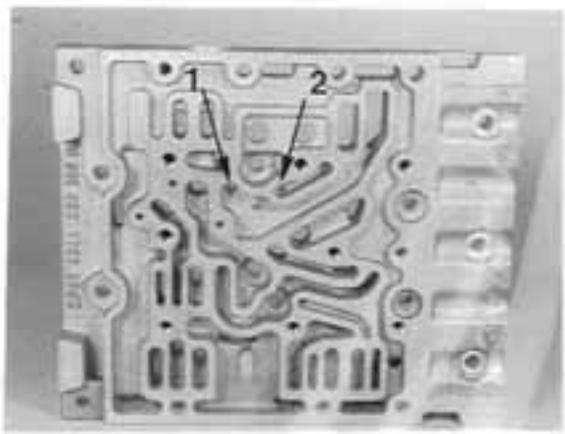
NOTE :

According to the gearshift Version, different channel plate variants are possible ! Pay attention to the Perspective Illustration of the corresponding Spare Parts List !
The following Reassembly Instruction is treating the Version with diaphragm for the backfeed (without control diaphragm) !

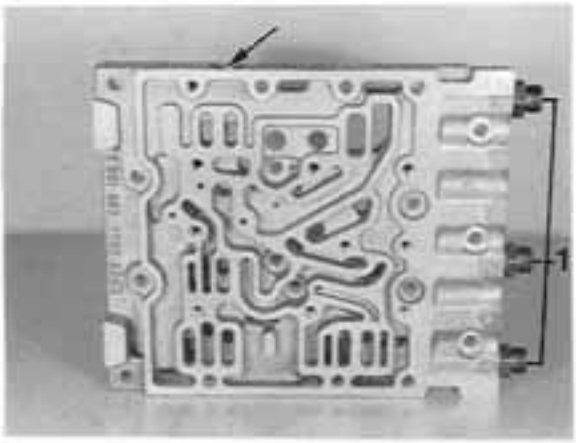


61

Wet thread of diaphragm with Loctite (Type No. 270), install diaphragm (Position, see Arrow 1) and secure it additionally by means of center punch.
Now, clean diaphragm from Loctite residues by means of compressed air.
Install thread plug (Position, see Arrow 2) accordingly.



62

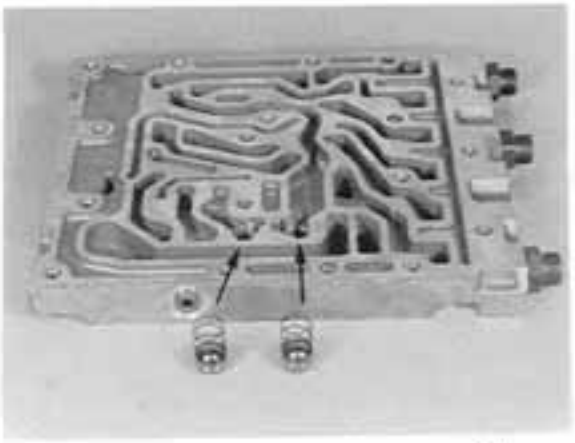


63

Install connecting pipe (1) and screw plug (Arrow).

NOTE :

Mount new O-Rings !



64

Insert the two check valves (composed of balls and springs) with grease in the countersinking of the channel plate (see Arrows).

NOTE :

Use only oil soluble grease !



65

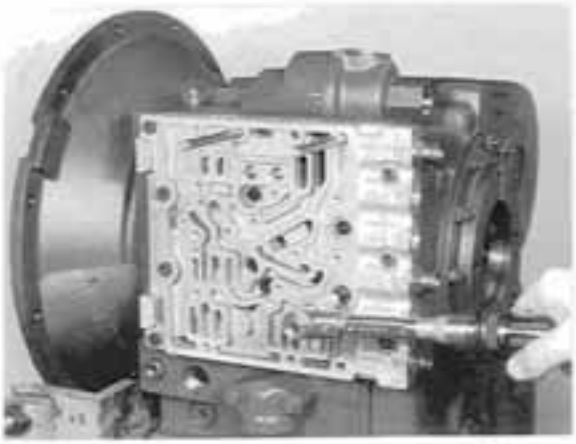
Attach channel plate and gearbox control (Figure 65 ... 68) :

NOTE :

Pay attention to the installation position of the components, see corresponding Spare Parts List !

Install two adjusting screws.
Assemble housing gasket, intermediate plate and gasket.

(S) Adjusting screws (M8) 5870 204 011



66

Assemble channel plate and fasten it by means of socket head screws.

Torque limit 20 Nm

NOTE :

Pay attention to the installation position of the different socket head screws, see corresponding Spare Parts List !

Assemble 1st gasket, intermediate plate and 2nd gasket.

NOTE :

Pay attention to the various gaskets, see corresponding Spare Parts List !



67

Place control unit against shoulder until contact is obtained and fasten it by means of hex. head screws (mount flat washers).

Torque limit 20 Nm

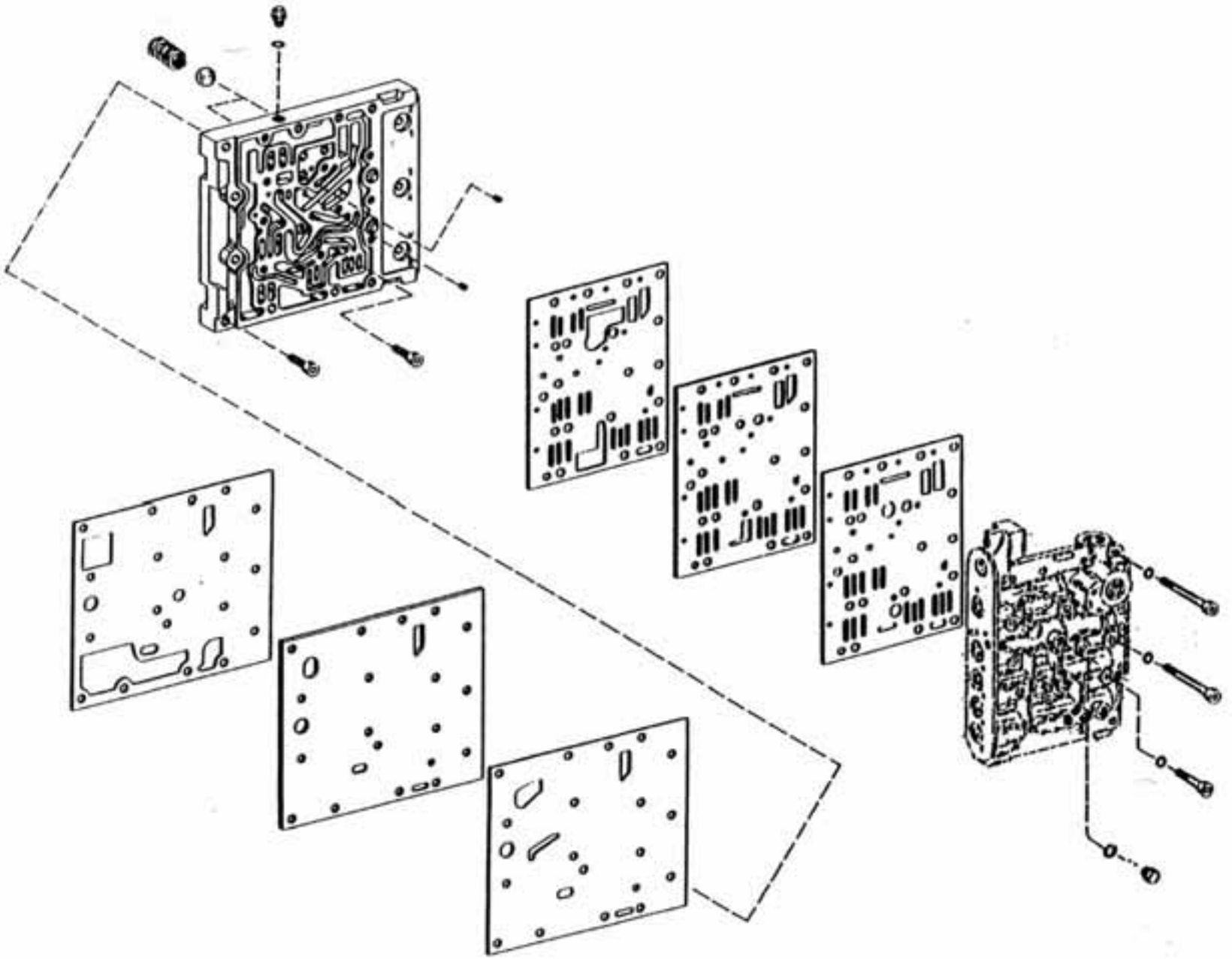
Install delivery lines according to the Illustration in the Spare Parts List !

NOTE :

Mount new sealing rings !



68



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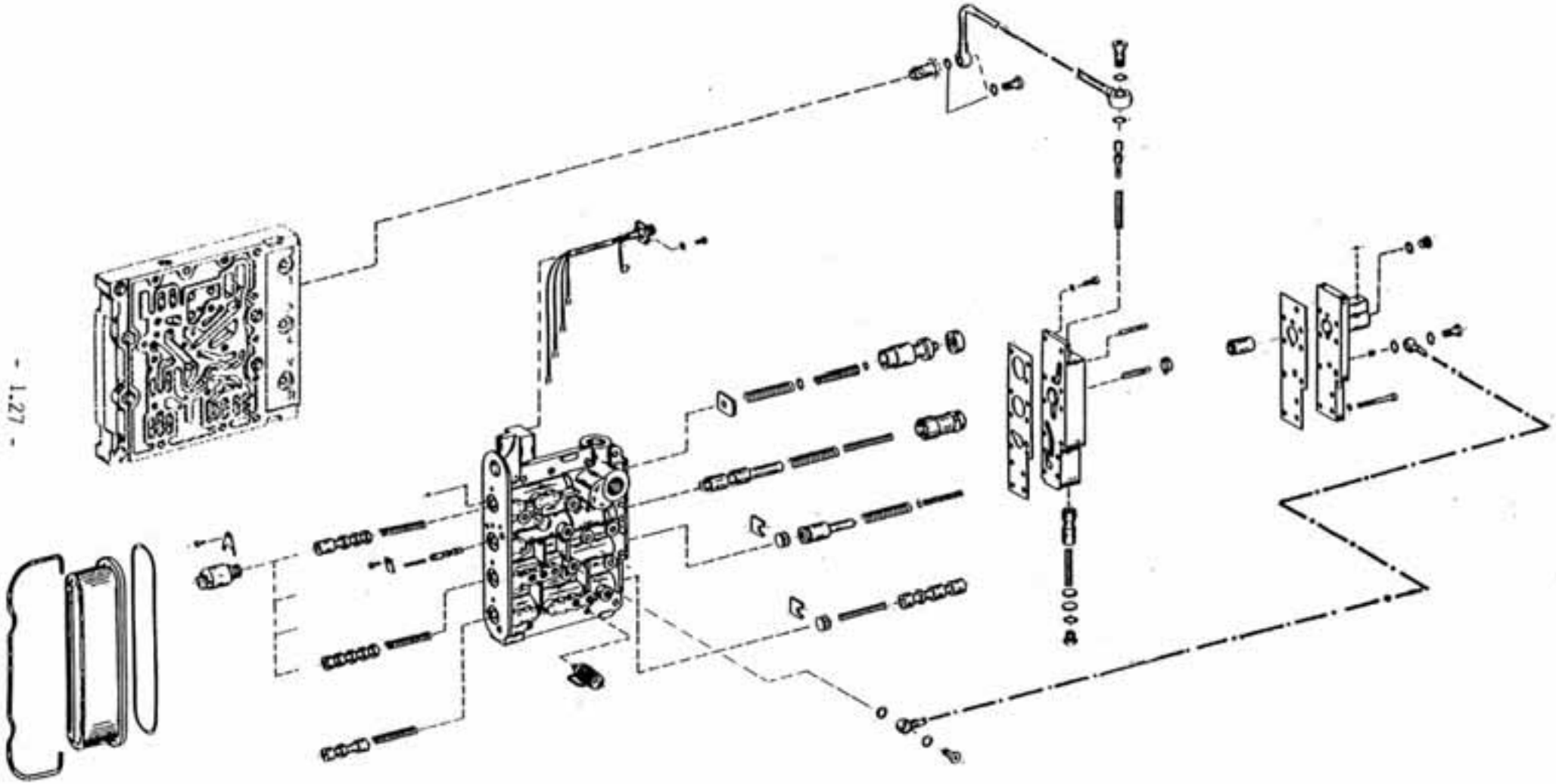
Illustrations are not binding for the design
Les illustrations ne sont pas obligatoires pour l'execution



Die Abbildungen sind für die Ausführung nicht verbindlich
Illustrations are not binding for the design
Les illustrations ne sont pas obligatoires pour l'exécution

1.2.2 Version II : With 5 Solenoid valves and attached WK-Valve

1.2.2.1 DISASSEMBLY

Relax spring clip and remove cover.



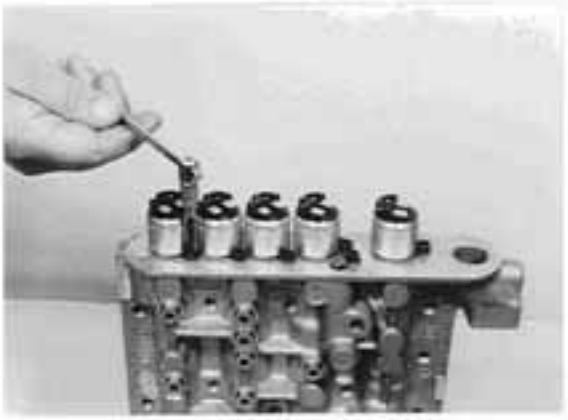
75

Pull off cable shoes.



76

Loosen socket head screws and remove solenoid valves.

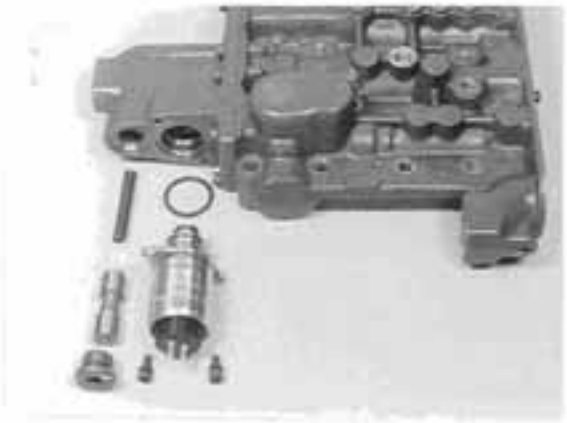


77

Remove components.



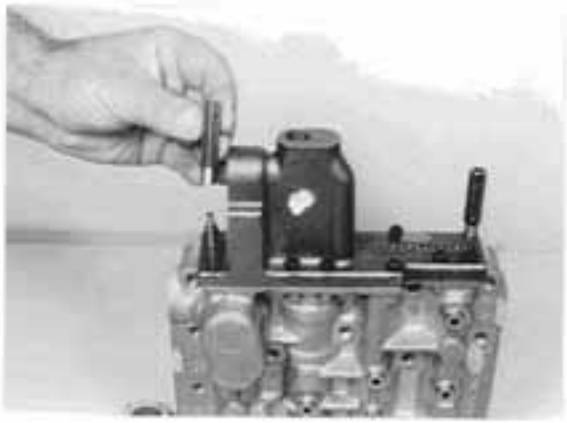
78



79

WK-Valve :

Remove components.



80

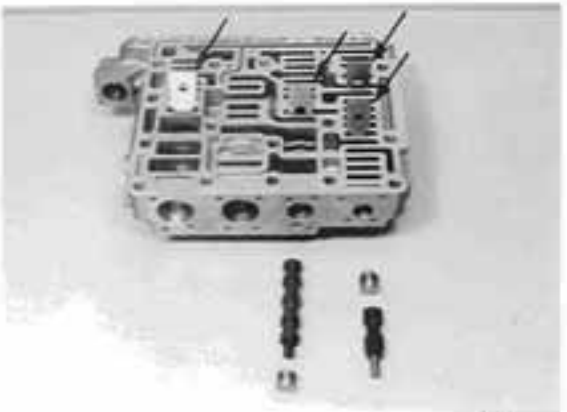
Loosen two socket head screws and fix shift-control housing provisionally, using a Special Tool (S).
Now, loosen the remaining socket head screws and separate shift-control housing (is spring-loaded) from the valve body by uniform loosening of the nuts (S).

(S)	Adjusting screws (M5) with nut	5870 204 036
(S)	Adjusting screws (M6) with nut	5870 204 049



81

Remove components.



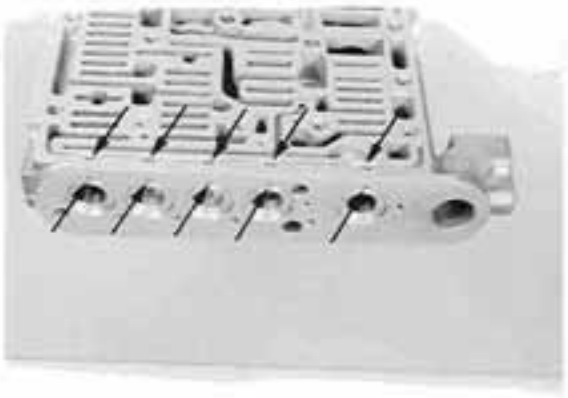
82

Remove stop plates (see Arrows) and demount the remaining components.

1.2.2.2 REASSEMBLY
see also Illustrated Tables, Page 1.35 and 1.37 !

NOTE :

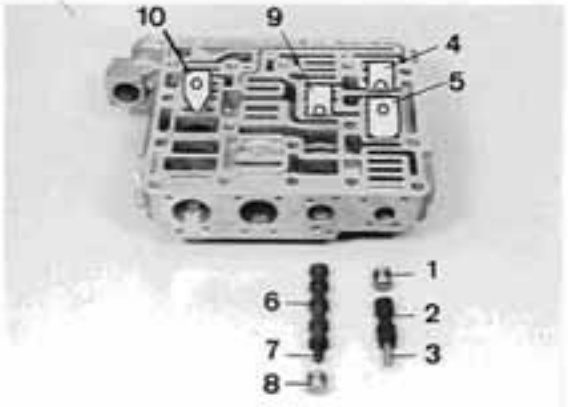
Check all components for damage and renew if necessary !
Check free travel of the moving parts in the housing prior to the installation !
Spools can be exchanged individually !
Oil components prior to the reassembly !



83

Close the bores by means of balls (10 pieces ø 4,50 mm) !

Introduce detent block 1 and fix it by means of the stop plate 4.
Install subsequently spool 2 and spring 3 (Lo = 51,3 mm), and fix them by means of the stop plate 5.
Install spool 6, spring 7 (Lo = 53,4 mm) and detent block 8, and fix them by means of the stop plate 9.
Insert detent block 10.



84

NOTE :

Pay attention to the installation position of the different stop plates, see Figure on the right !

Gearshift valve :

Install components.

1 = Spring (L_o = 53,40 mm)

2 = Spool



85

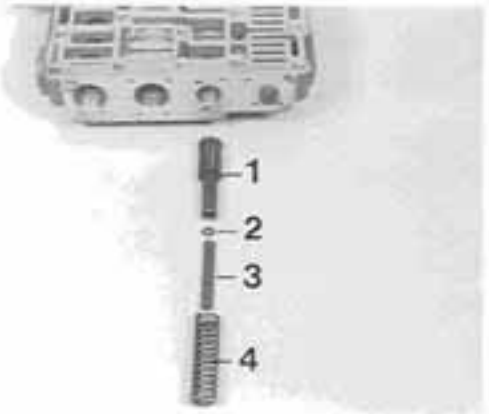
Reset spool :

Install components.

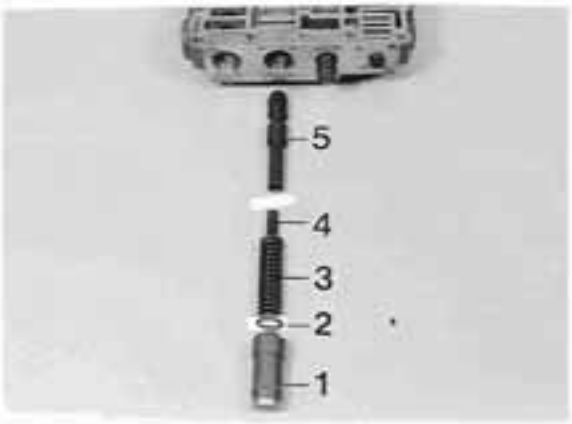
1 = Spool
2 = Disk(s) (optional)
3 = Spring (L_o = 58,00 mm)
4 = Spring (L_o = 65,40 mm)

NOTE :

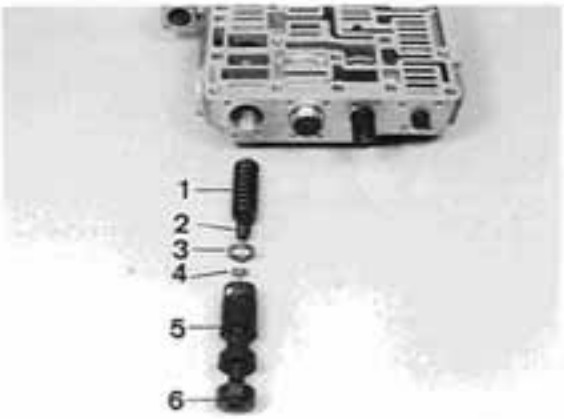
p2 is determined by the disk 4
(pay attention to Notes, Page 1.01 ... 1.03) !



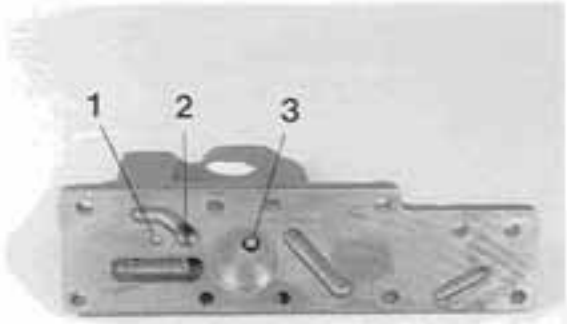
86



87



88



89



90

Pressure control valve :

Install components.

1	=	Spool	
2	=	Disk	(optional)
3	=	Spring	(L_o = 76,70 mm)
4	=	Spring	(L_o = 132,40 mm)
5	=	Spool	

NOTE :

p1 is determined by the disk 2
(pay attention to Notes, Page 1.01 ... 1.03) !

Control pressure valve :

Install components.

1	=	Spring	(L_o = 65,40 mm)
2	=	Spring	(L_o = 78,60 mm)
3	=	Disk(s)	(optional)
4	=	Disk(s)	(optional)
5	=	Spool	
6	=	Sleeve	

NOTE :

ps is determined by the disks 3 and 4
(pay attention to Notes, Page 1.01 ... 1.03) !

Pre-assemble and attach shift-control housing (WK) (Figure 89 ... 92) :

Close the two bores by means of balls and install diaphragm.

1	=	Ball	(ø 4,50 mm)
2	=	Diaphragm	(optional)
3	=	Ball	(ø 7,00 mm)

NOTE :

Secure diaphragm by means of Loctite (Type No. 270) !
Now, clean diaphragm from Loctite residues by means of compressed air !
t2 (Modulation time-WK) is determined by the diaphragm 2
(pay attention to Notes, Page 1.01 ... 1.03) !

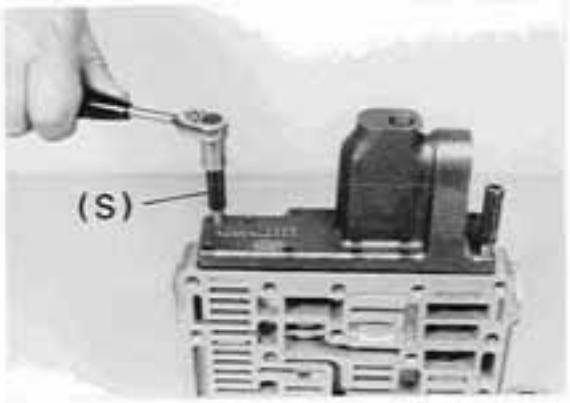
Install two adjusting screws (S) and mount gasket (Arrow).

(S)	Adjusting screws (M5) with nut	5870 204 036
(S)	Adjusting screws (M6) with nut	5870 204 049

Pull shift-control housing by means of threaded bushings (S) against shoulder.

Now, fasten housing by means od socket head screws.

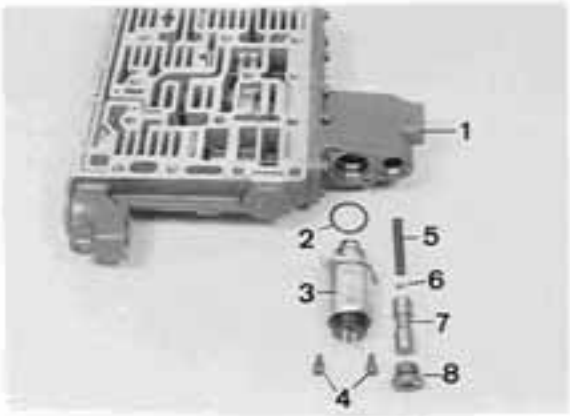
Torque limit	(M5/8.8)	5,5 Nm
(S) Adjusting screws with nut	(M5)	5870 204 036
(S) Adjusting screws with nut	(M6)	5870 204 049



91

Install components :

1 = Shift-control housing
2 = O-Ring
3 = Solenoid valve
4 = Socket head screws (with spring washer)
5 = Spring (L_o = 53,40 mm)
6 = Disk(s) (optional)
7 = Spool
8 = Screw plug (with O-Ring)



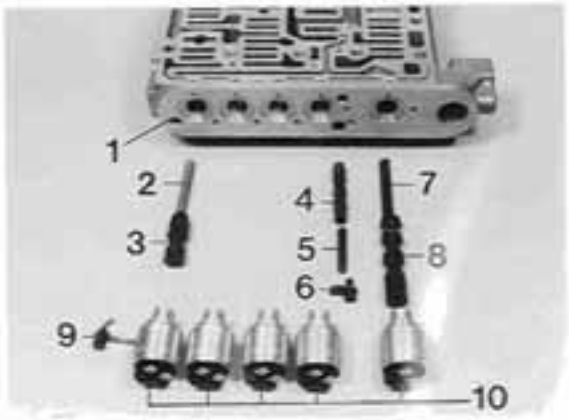
92

NOTE :

p2 is determined by the disk 6
(pay attention to Notes, Page 1.01 ... 1.03) !

Install components :

1 = Shift-control housing
2 = Spring (L_o = 51,30 mm)
3 = Spool
4 = Spool
5 = Spring (Lo = 37,10 mm)
6 = Spool fixing (retaining plate and socket head screw)
7 = Spring (L_o = 53,40 mm)
8 = Spool
9 = Retaining plate and socket head screw
10 = Solenoid valves (5x)



93

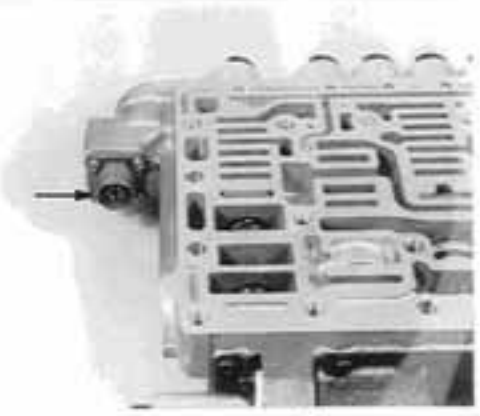
NOTE :

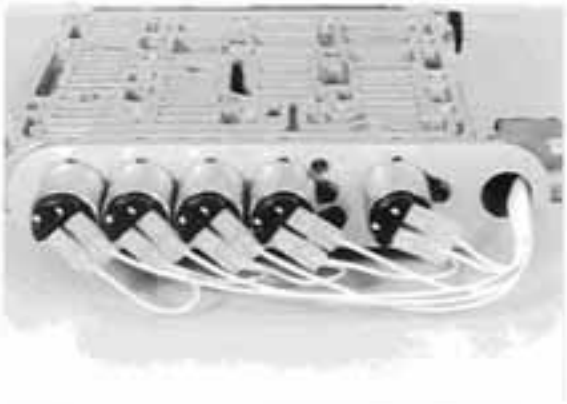
Pay attention to the installation position of the solenoid valves, see Figure 95 !

Install cable harness.

NOTE :

Mount new gaskets !
Pay attention to the location of the plug nose see Arrow !


94



95

Connect solenoid valves according to the Illustration on the left.



96

Mount new O-Ring (164,2 x 5,7) and fix cover by means of clamping collar.



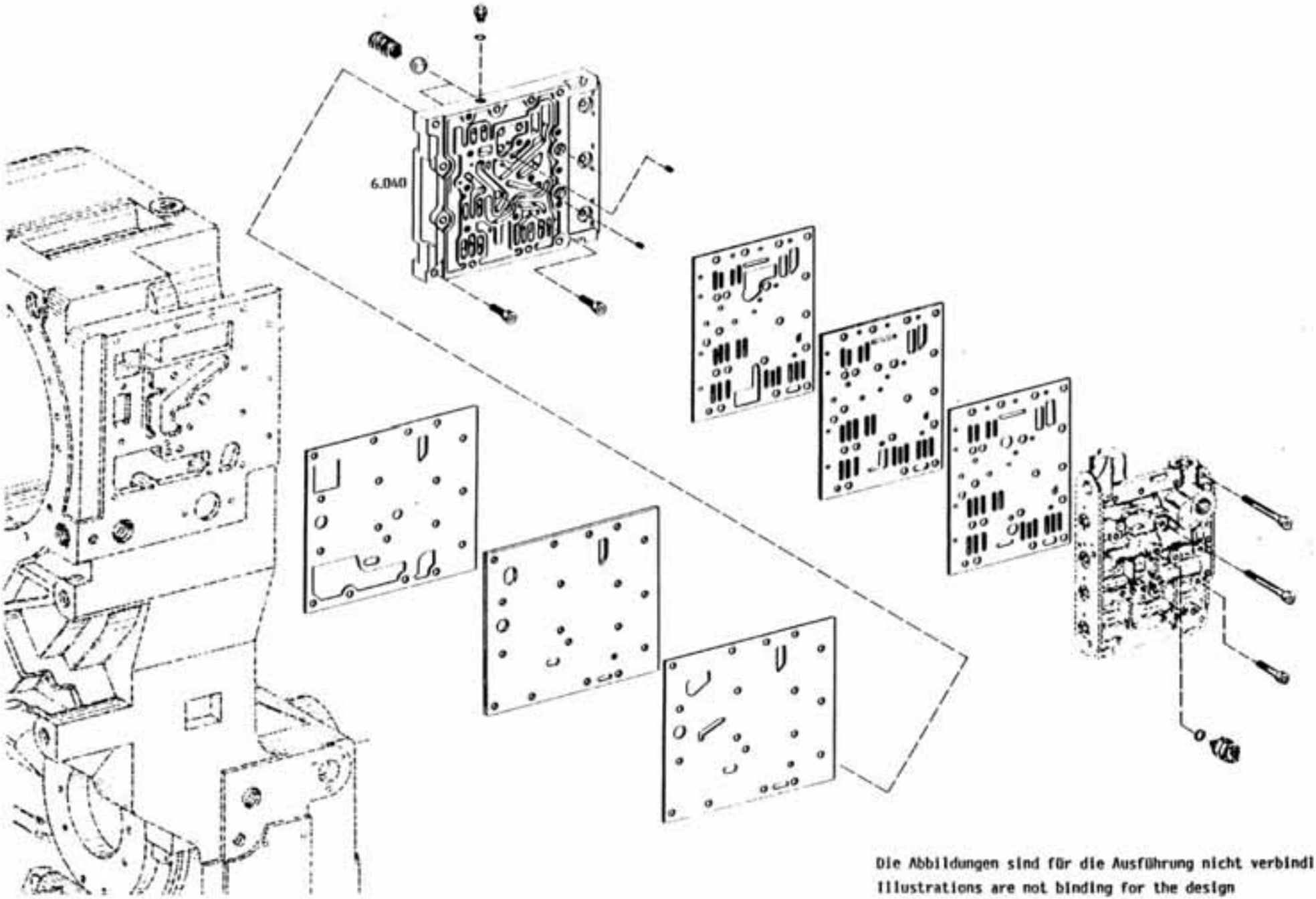
97

Install screw plugs as well as control pressure sender (according to the Version).

NOTE :

The Reassembly of the channel plate as well as the attachment of the gearbox control is treated on Page 1.23 ... 1.25 !
Pay attention to the Perspective Illustration of the corresponding Spare Parts List !

(S) Adjusting screws (M8) 5870 204 011



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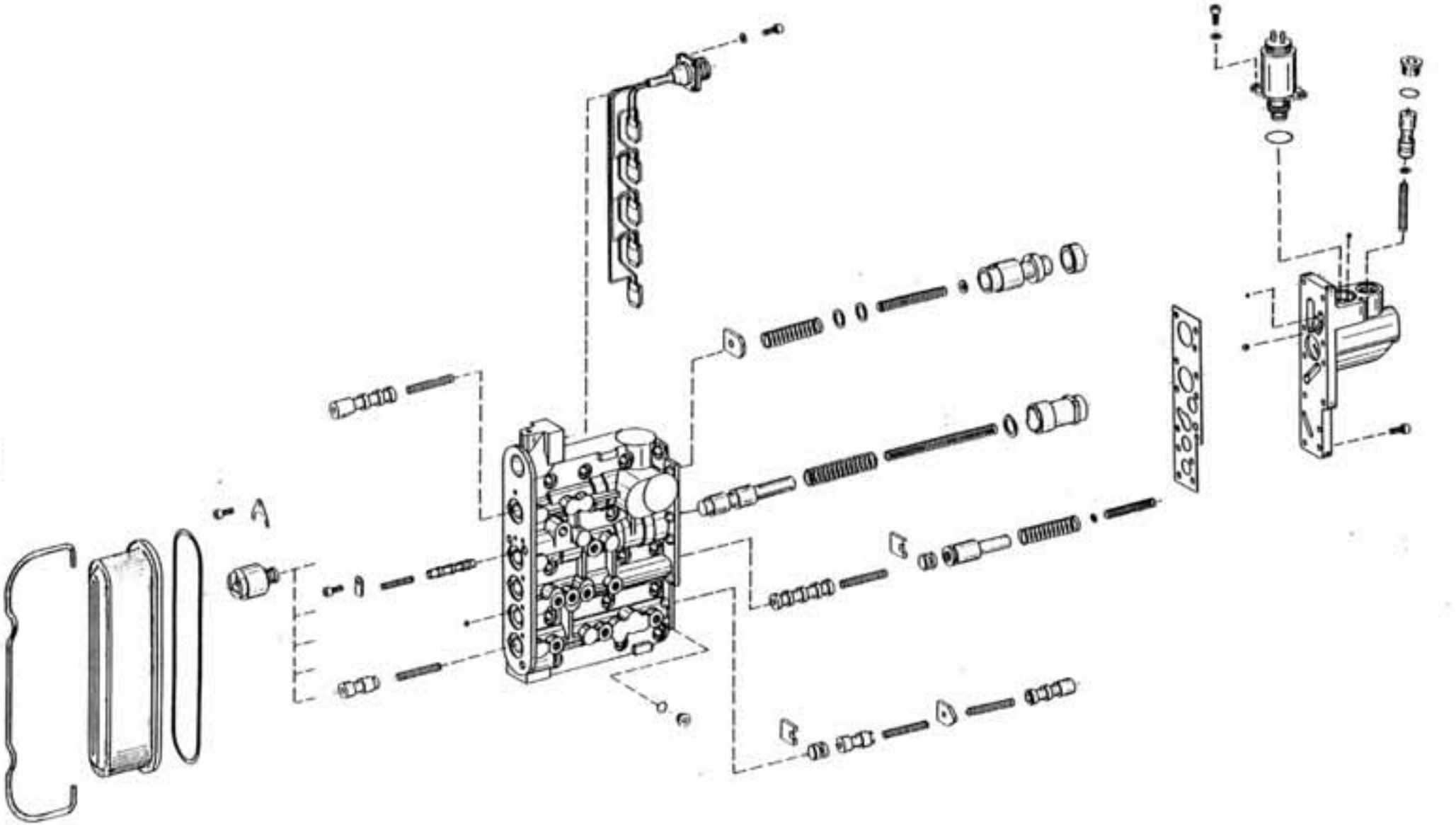

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Les illustrations ne sont pas obligatoires pour l'execution

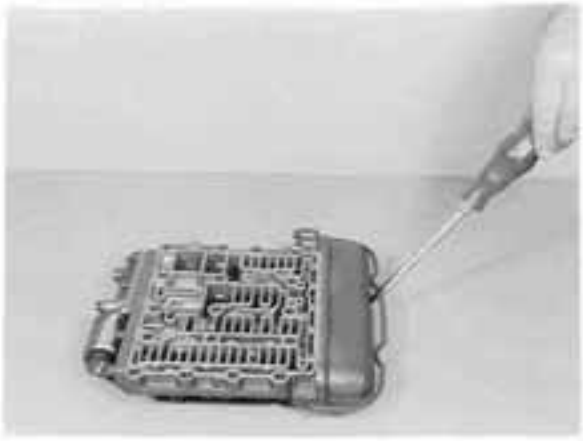
1.3 ALUMINIUM DIE-CAST GEARBOX CONTROL

1.3.1 Version I : With WK-Valve

1.3.1.1 DISASSEMBLY

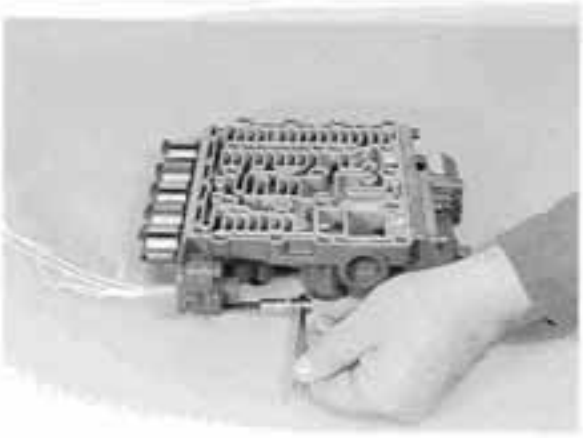
(S) Adjusting screws 5870 204 011

Relax spring clip and remove cover.



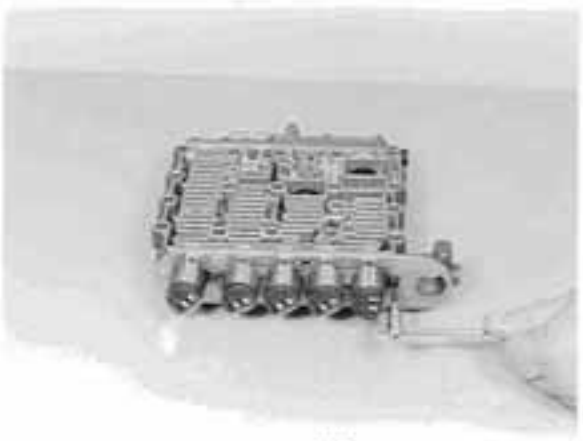
100

Pull off the cable shoes, loosen socket head screws and remove cable harness.



101

Loosen socket head screws and demount solenoid valves.

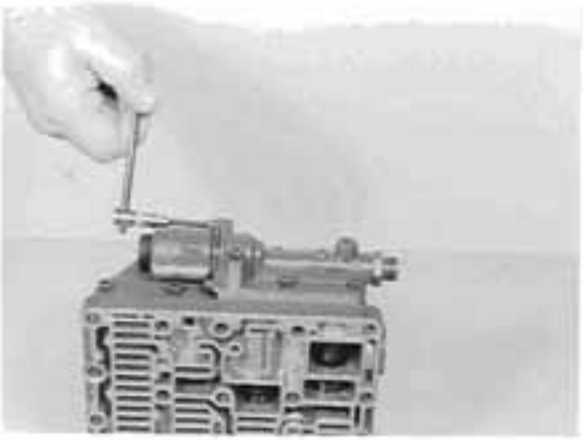


102



103

Remove components, see Figure on the left!

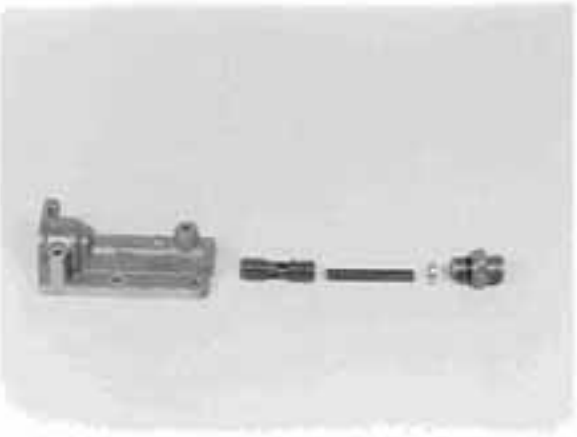


104

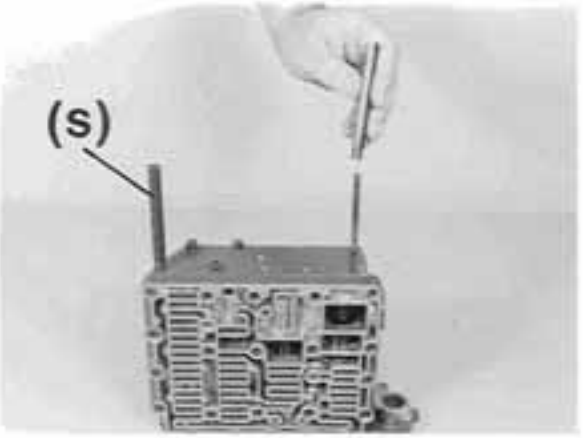
Remove and dismantle WK-Valve :

Loosen socket head screws and disassemble solenoid valve.

Separate WK-Shift-control housing from the valve body and dismantle it, see Figure on the left !



105

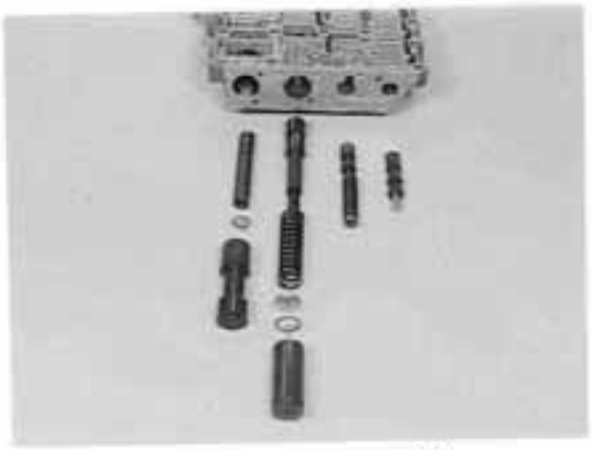


106

Loosen two socket head screws and fix the shift-control housing provisionally, using a Special Tool (S).
Now, loosen the remaining socket head screws and separate cover (is spring-loaded) from the valve body by uniform loosening of the nuts (S).

(S) Adjusting screws (M6) 5870 204 049
with nut

Remove components, see Figure on the right !

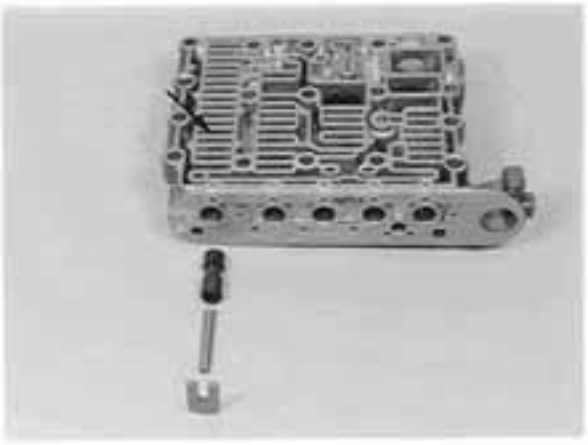


107

Remove stop plate and demount spring as well as spool.

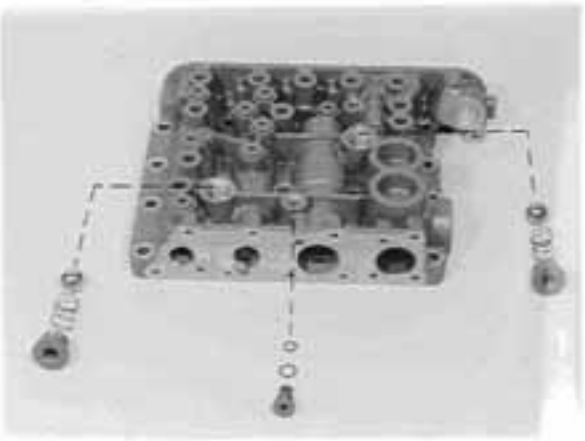
NOTE :

Installation position of the stop plate, see Arrow !



108

Remove diaphragm and check valves.



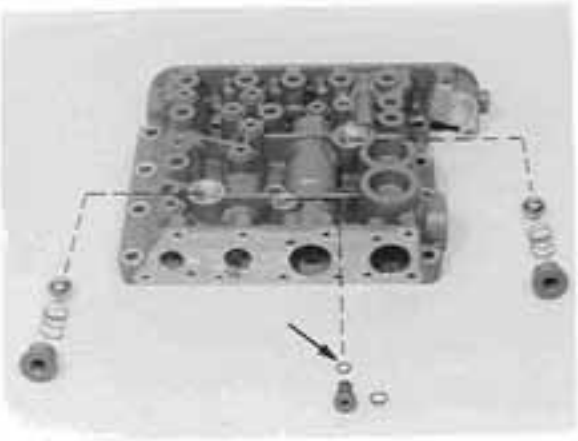
109

1.3.1.2 REASSEMBLY

see also Illustrated Tables, Page 1.49 and 1.51 !

NOTE :

Check all components for damage and renew if necessary !
Check free travel of the moving parts in the housing prior to the installation !
Spools can be exchanged individually !
Oil components prior to the reassembly !



110

Employ new O-Rings for all screw plugs (8 pieces) and install them.
Install check valves and diaphragm (optional).

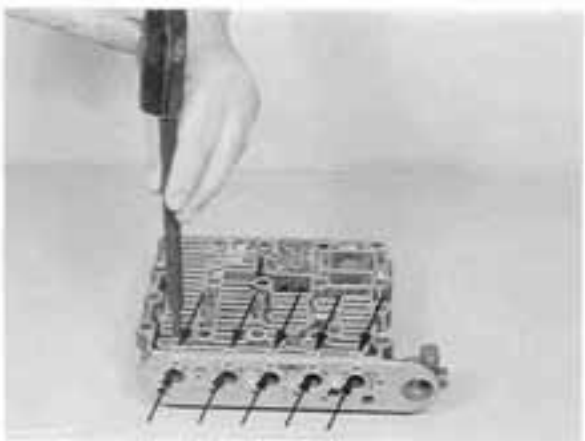
NOTE :

Mount new O-Rings !
Fasten O-Ring 6 x 1,5 mm (Arrow) with grease on the end face of the diaphragm - makes the reassembly easier !
Use only oil soluble grease for the reassembly !
Δ t1 is determined by the diaphragm
(pay attention to Notes, Page 1.01 ... 1.03)!

Torque limit :

Screw plug M10x1	20 Nm
Screw plug M18x1,5	35 Nm
Diaphragm	20 Nm

Close the bores by means of balls (10 pieces, ø 4,50 mm).



111

Control pressure valve :

Install components.

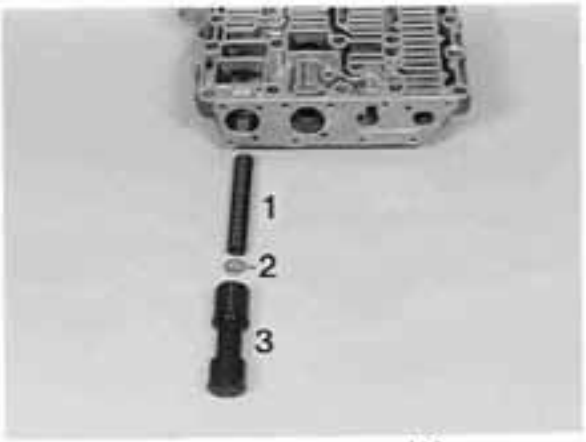
1 = Spring (L_o = 96,20 mm)

2 = Disk(s) (optional)

3 = Spool

NOTE :

ps is determined by the disk
(pay attention to Notes, Page 1.01 ... 1.03) !



112

Pressure control valve :

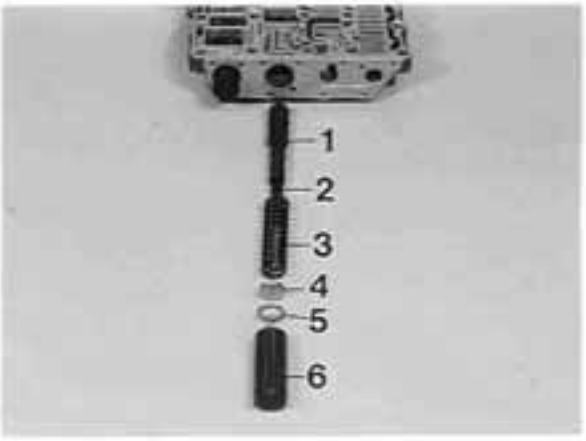
Install components.

1 = Control spool
2 = Spring (L_o = 124,10 mm)
3 = Spring (L_o = 77,10 mm)
4 = Disk
5 = Disk(s) (optional)
6 = Displacement spool

NOTE :

Install disk 4, with the countersinking facing the compressison spring !

p1 is determined by the disk 5
(pay attention to Notes, Pages 1.01 ... 1.03) !



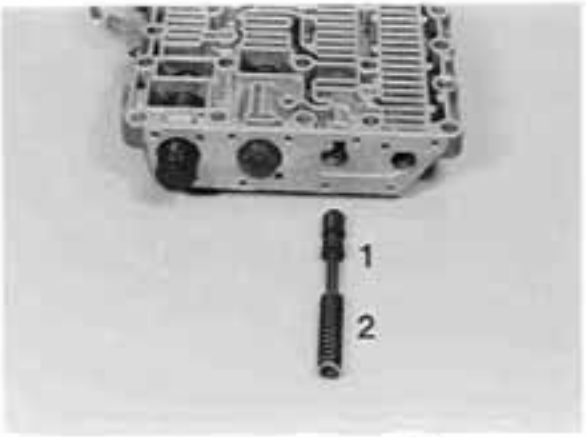
113

Reversing valve :

Install components.

1 = Reversing spool

2 = Spring (L_o = 56,30 mm)



114

Control spool KV :

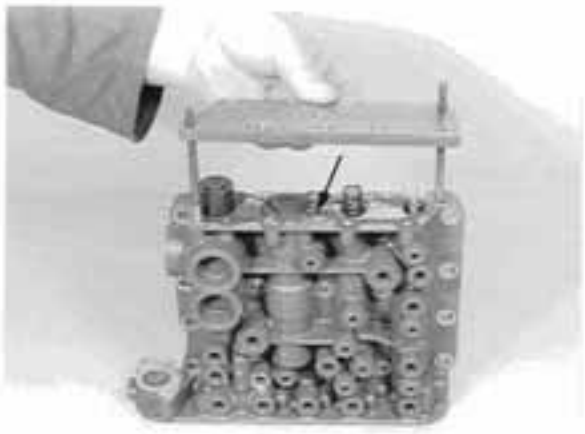
Install components.

1 = Spool (total length = 55,50 mm)

2 = Spring (L_o = 51,30 mm)



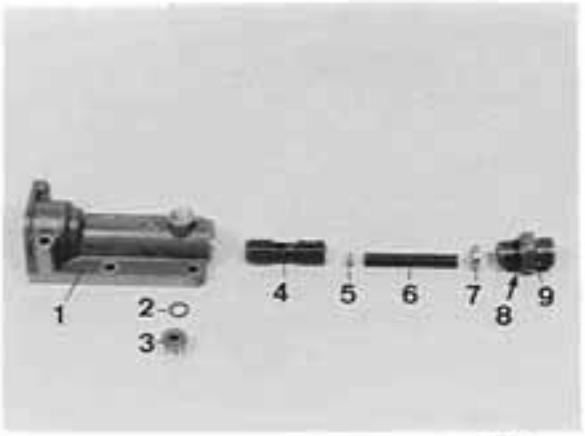
115



116

Install two adjusting screws (S) and assemble flat gasket (Arrow).
Now, pull cover against shoulder, using nuts (S) and fix it provisionally by means of socket head screws (4 pieces, see Figure 118).

(S) Adjusting screws (M6) with nut 5870 204 049



117

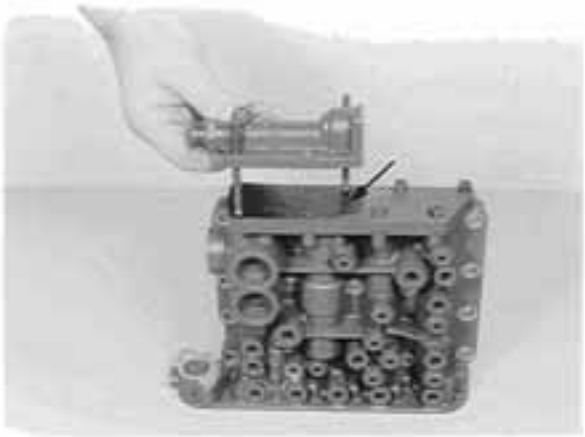
WK-Valve :

Install components.

1 = Shift-control housing
2 = O-Ring
3 = Screw plug
4 = Spool
5 = Disks (optional)
6 = Spring (L_o = 53,40 mm)
7 = Detent block (spring guide)
8 = O-Ring
9 = Connecting piece

NOTE :

Install detent block 7 with the countersinking facing the spring !
p2 is determined by the disk 5
(pay attention to Notes, Page 1.01 ... 1.03 !



118

Install two adjusting screws and assemble flat gasket (Arrow).
Fasten shift-control housing and cover by means of socket head screws (mount flat washers).

Torque limit (M6/8.8) 9,5 Nm

(S) Adjusting screws (M6) with nut 5870 204 049

Mount new O-Rings (Arrows) and fasten solenoid valve by means of socket head screws (mount flat washers).

Torque limit (M5/8.8) 5,5 Nm

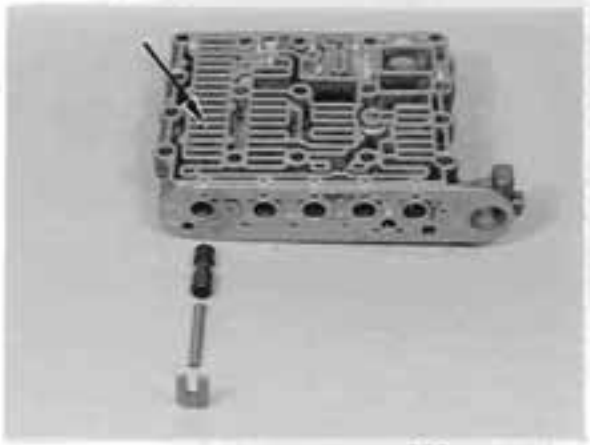


119

Introduce control spool (K4/KR) and compression spring (Lo = 51,30 mm), and fix them by means of stop plate.

NOTE :

Position of the stop plate, see Arrow !



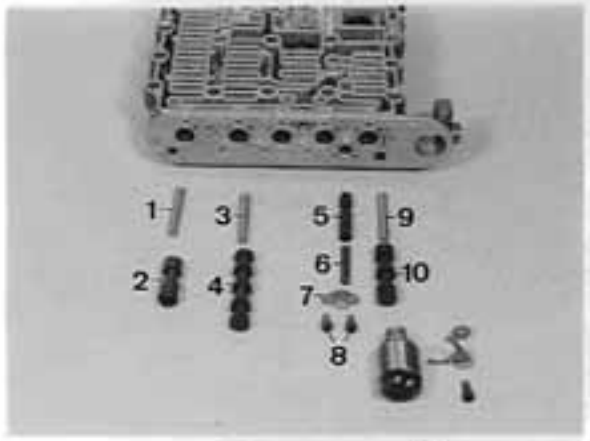
120

Install components (1 ... 10) :

1 = Spring (L_o = 51,30 mm)
2 = Control spool K4/KR
3 = Spring (L_o = 51,30 mm)
4 = Control spool K1/K2/K3

5 = Spool
6 = Spring (Lo = 37,10 mm)

7 = Retaining plate
8 = Socket head screws
9 = Spring (Lo = 51,30 mm)
10 = Pilot spool (total length = 52,50 mm)



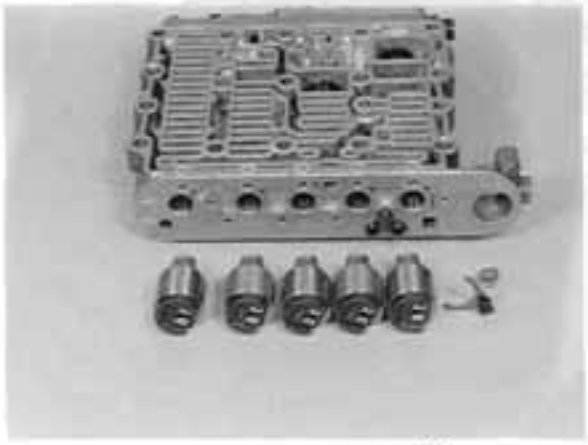
121

Insert solenoid valves and fix them by means of disks, retaining plates and socket head screws.

Torque limit (M5/8.8) 5,5 Nm

NOTE :

Pay attention to the installation position of the disks (mount between valve body and retaining plate), see Arrow !
Pay attention to the radial installation position of the solenoid valves, see also Figure 124 !



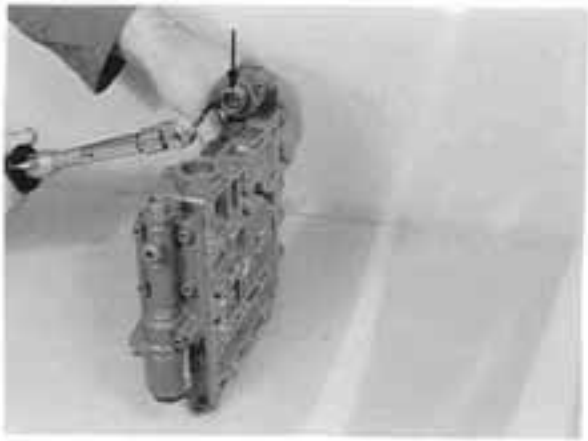
122

Install cable harness.

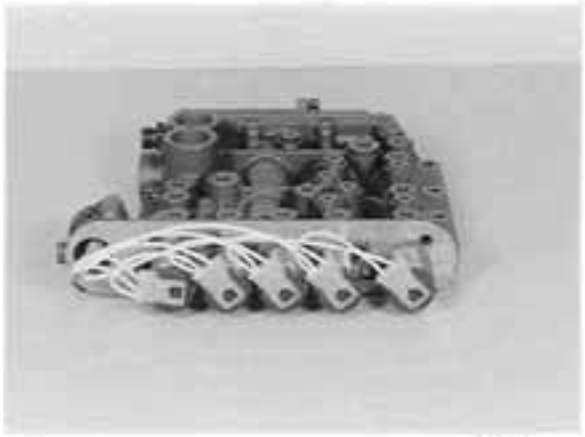
Torque limit (M6/8.8) 9,5 Nm

NOTE :

Mount new gaskets !
Pay attention to the location of the plug nose see Arrow !

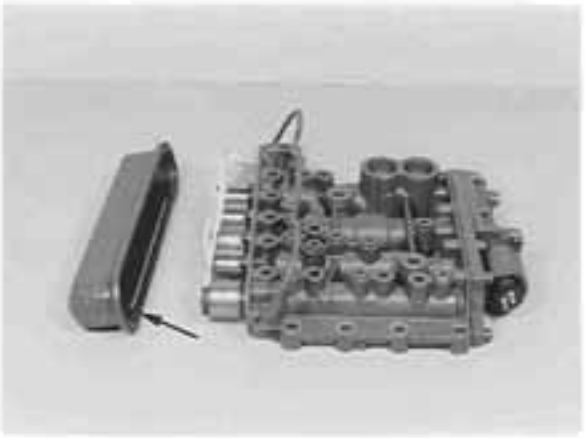


123



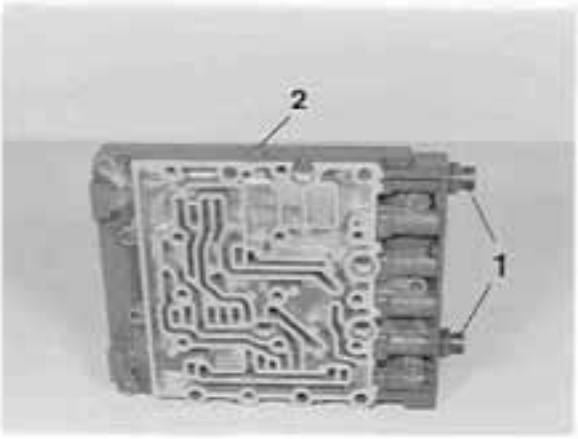
124

Connect solenoid valves according to the Figure on the left.



125

Mount new O-Ring (Arrow) and fix cover by means of clamping collar.



126

Pre-assemble and attach channel plate (Figure 126 ... 129) :

Mount connecting pipe (1) and screw plug (2).



127

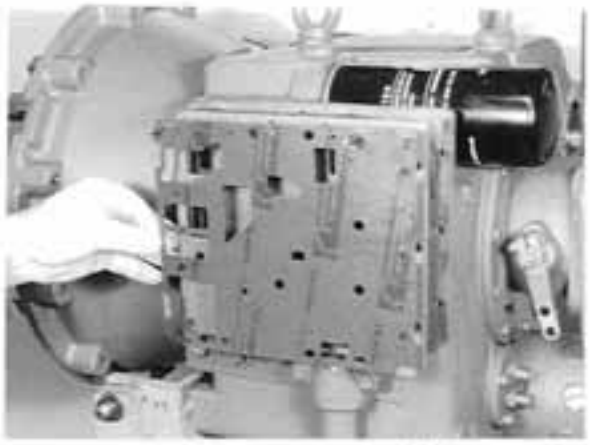
Install two adjusting screws and assemble housing gasket.

NOTE :

Pay attention to the different gaskets, see Figure 127 and 128 !

(S) Adjusting screws (M8) 5870 204 011

Install intermediate plate and 2nd gasket.



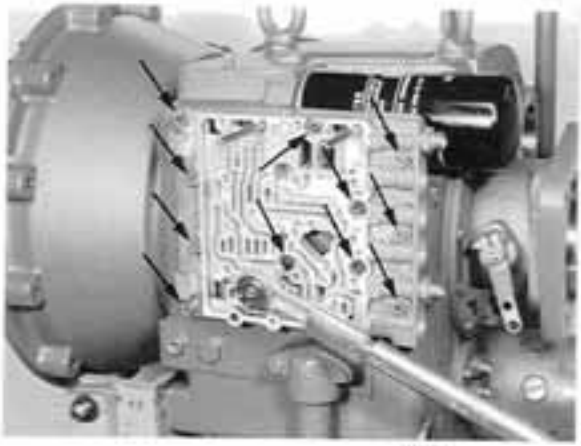
128

Assemble channel plate and fasten by means of socket head screws (mount flat washers).

Torque limit 20 Nm

NOTE :

Use only socket head screws, M8 x 35, DIN 6912 (with low head) !
Position of screws, see Arrows !



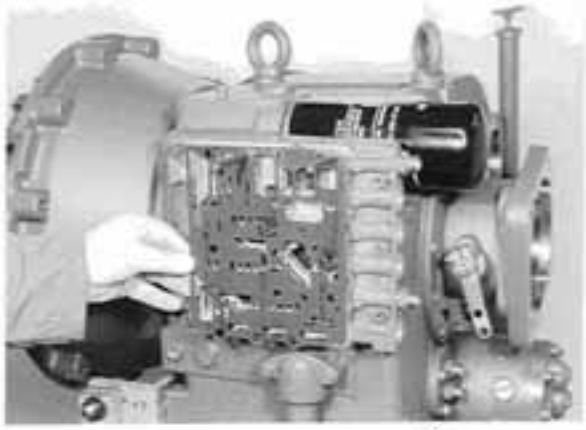
129

Attach gearbox control (Figure 130 ... 132) :

Assemble 1st gasket.

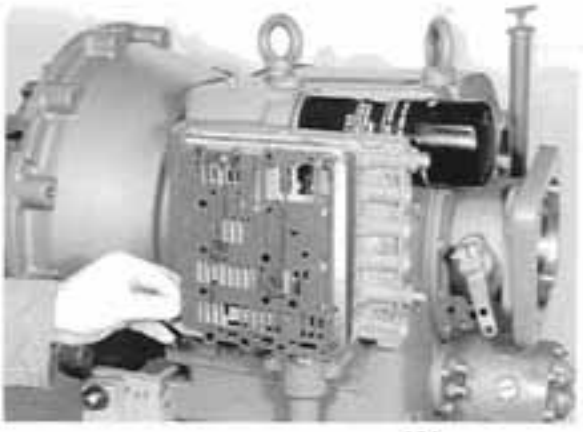
NOTE :

Pay attention to the different gaskets, see Figure 130 and 131 !



130

Assemble intermediate plate and 2nd gasket.



131



132

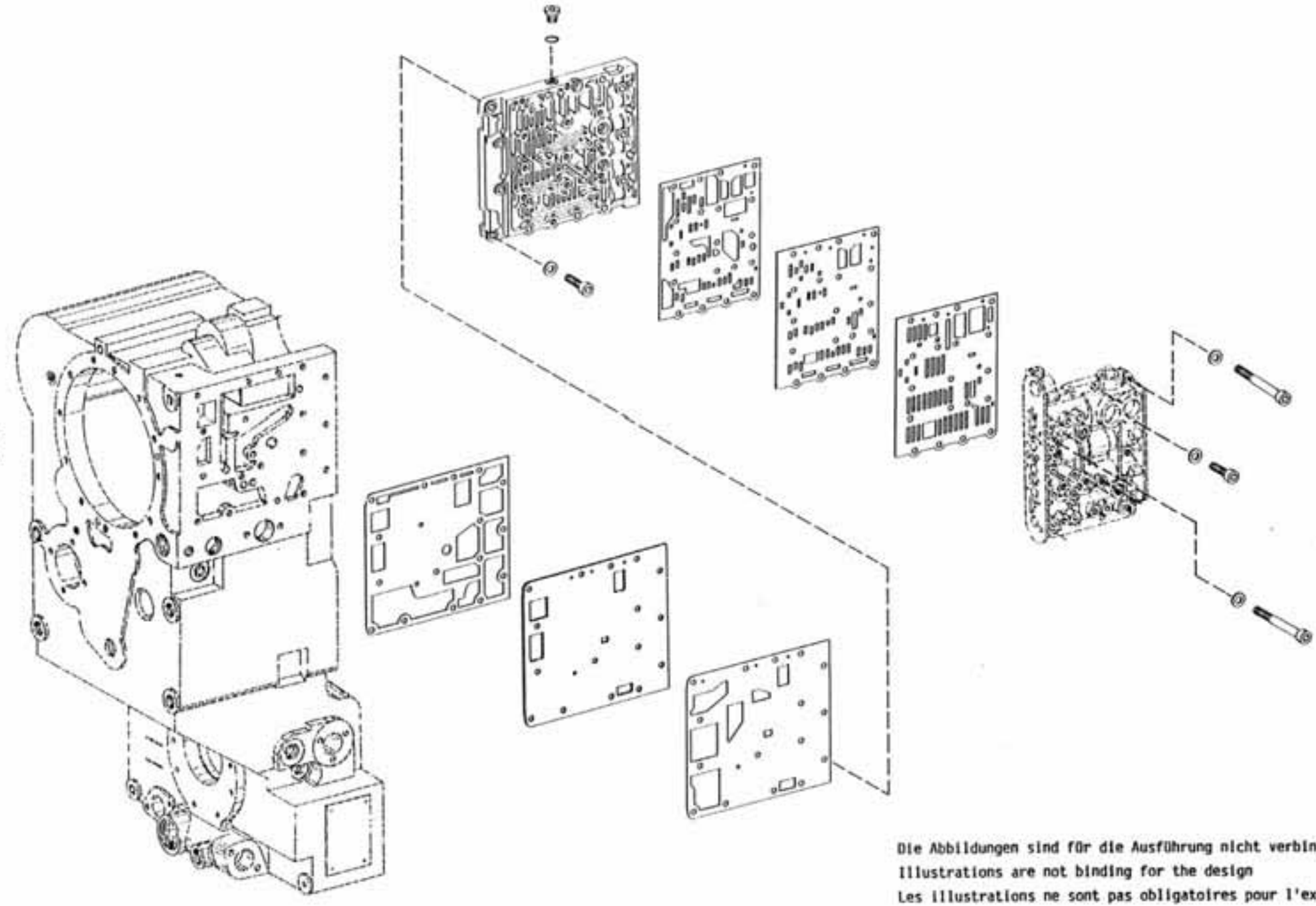
Assemble gearbox control and fasten it by means of socket head screws (8 pieces M8 x 65, 11 pieces M8 x 35 and 1 piece M8 x 60 mm).

Torque limit 20 Nm

NOTE :

Mount flat washers !
Position of the socket head screw M8 x 60 mm, see Arrow !

Install delivery lines, see Perspective Illustration in the corresponding Spare Parts List !



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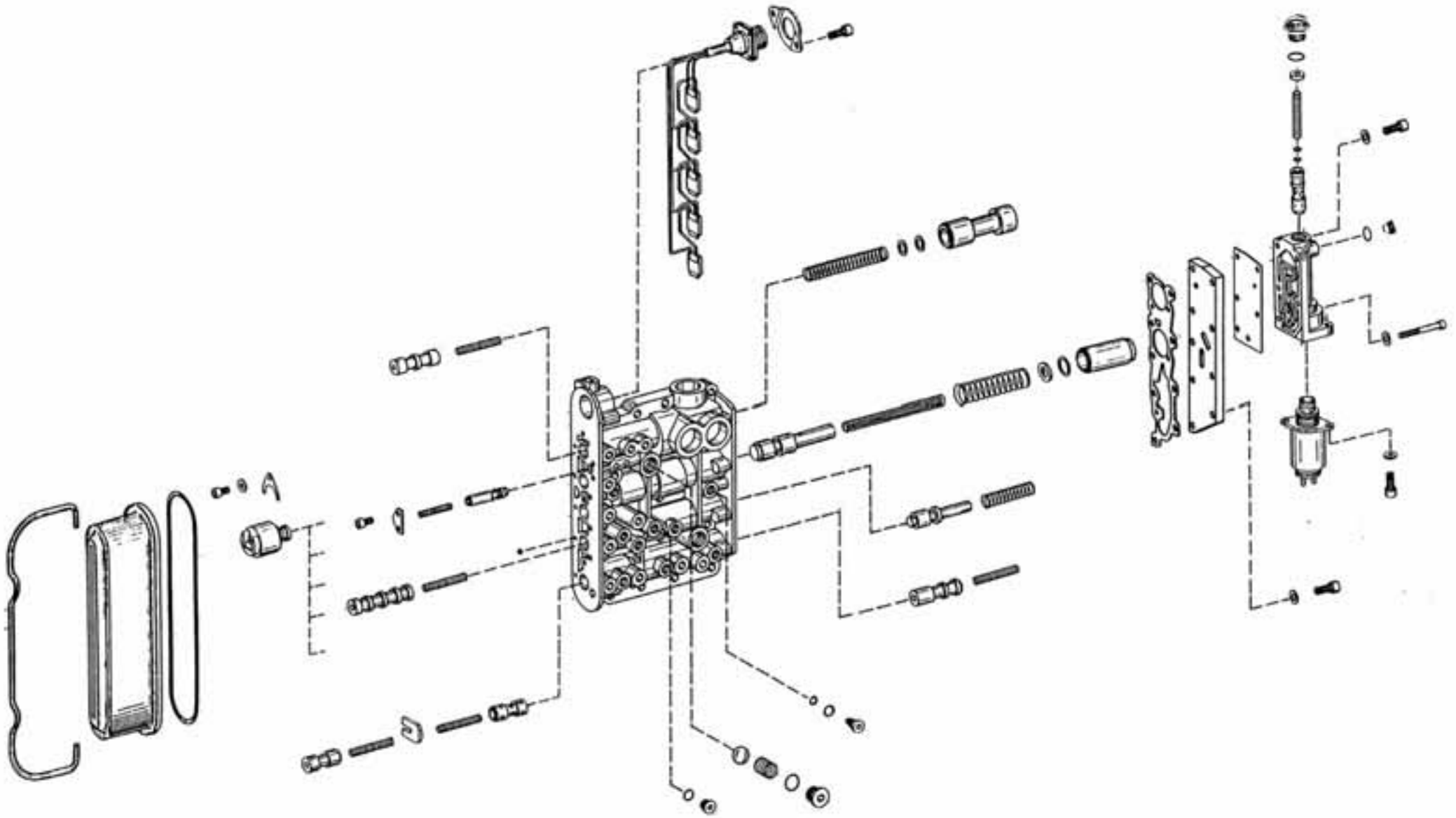
Les illustrations ne sont pas obligatoires pour l'execution

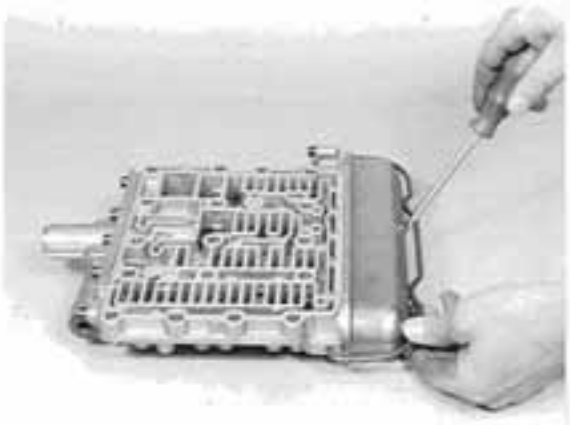


Die Abbildungen sind für die Ausführung nicht verbindlich
Illustrations are not binding for the design
Les illustrations ne sont pas obligatoires pour l'execution

1.3.2 Version II : With 2-stage pressure control valve

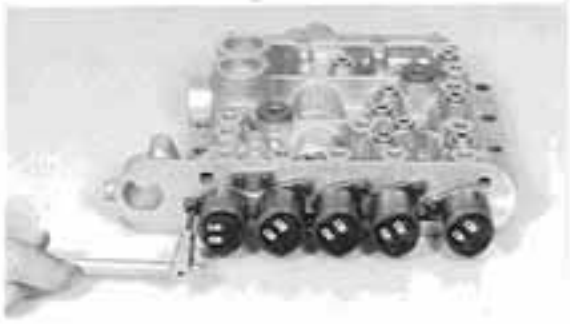
1.3.2.1 DISASSEMBLY

Relax spring clip and remove cover.



135

Pull off cable shoes, loosen the socket head screws and demount solenoid valves.



136

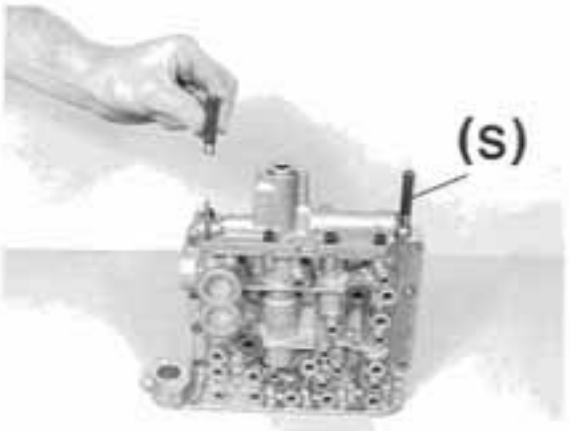
Remove components, see Figure on the right.



137

Loosen two socket head screws and fix shift-control housing provisionally, using a Special Tool (S).
Now, loosen the remaining socket head screws and separate shift-control housing (is spring-loaded) from the valve body by uniform loosening of the nuts (S).

(S) Adjusting screws (M6) with nut 5870 204 049

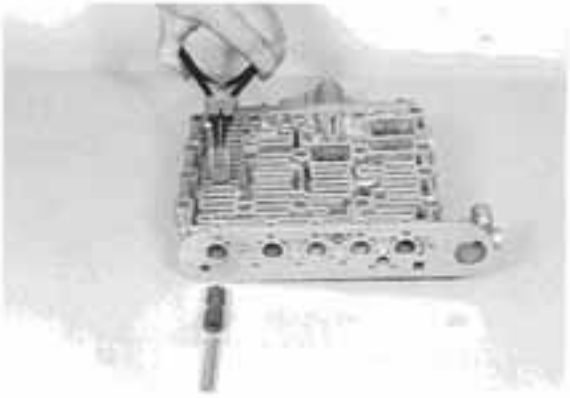


138



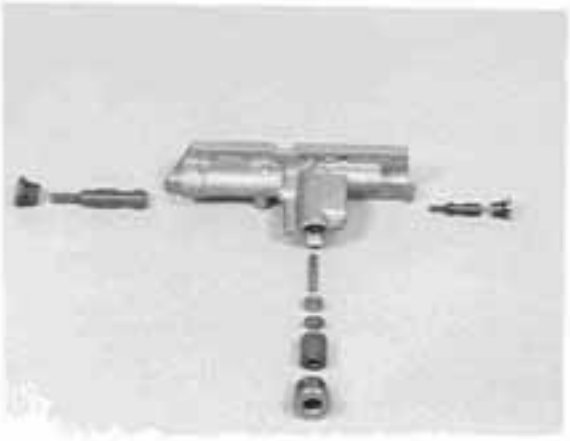
139

Remove components.



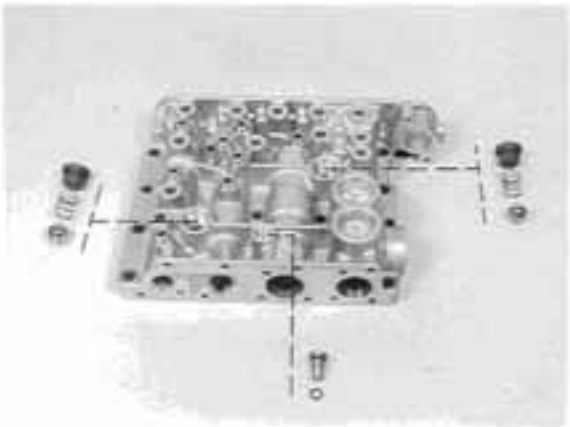
140

Remove stop plate and demount spool as well as spring.



141

Dismantle pressure control valve, see Figure on the left.



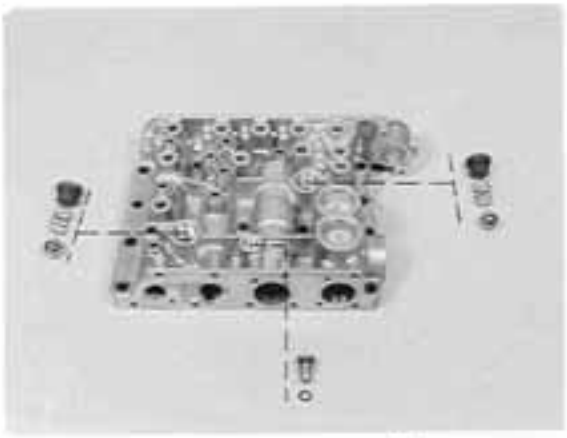
142

Remove diphragm and check valves.

1.3.2.2 REASSEMBLY
see also Illustrated Tables, Page 1.59 and 1.61 !

NOTE :

Check all components for damage and renew if necessary !
Check free travel of the moving parts in the housing prior to the installation !
Spools can be exchanged individually !
Oil components prior to the reassembly !



143

Employ new O-Rings for all screw plugs and install them.
Install check valves and diaphragm (optional).

NOTE :

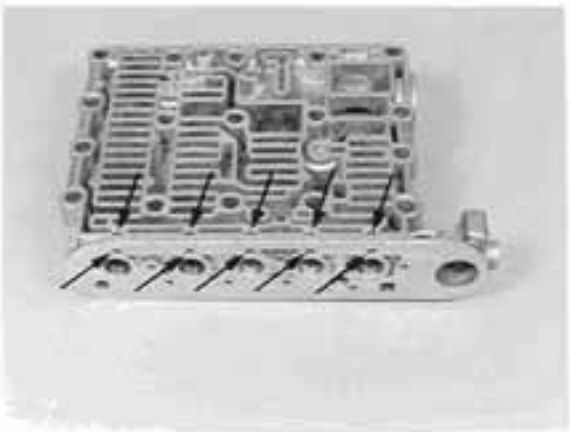
Mount new O-Rings !
Fasten O-Ring 6x1,5 mm (Arrow) with grease on the end face of the diaphragm - makes the reassembly easier !

$\Delta t1$ is determined by the diaphragm
(pay attention to Notes, Page 1.01 ... 1.03) !

Torque limit :

Screw plugs M10x1	20 Nm
Screw plugs M18x1,5	35 Nm
Diaphragm	20 Nm

Close the bores by means of balls (10 pieces, ø 4,50 mm).



144

Control pressure valve :

Install components.

1 = Spring (L_o = 96,20 mm)
2 = Disk(s) (optional)
3 = Spool



145

NOTE :

ps is determined by the disk 2
(pay attention to Notes, Page 1.01 ... 1.03) !



146

Install components :

1 = Control spool
2 = Spring (L_o = 124,10 mm)
3 = Spring (L_o = 77,10 mm)
4 = Displacement spool



147

Install components :

1 = Reversing spool
2 = Disk(s) (optional)
3 = Spring (L_o = 56,30 mm)

NOTE :

p2 is determined by the disk 2
(pay attention to Notes, Page 1.01 ... 1.03) !



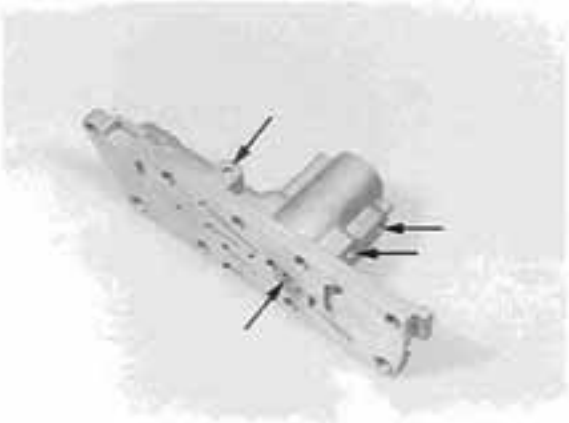
148

Install components :

1 = Control spool (total length = 55,50 mm)
2 = Spring (L_o = 51,30 mm)

NOTE :

Pay attention to the installation position of the spool, see Figure !



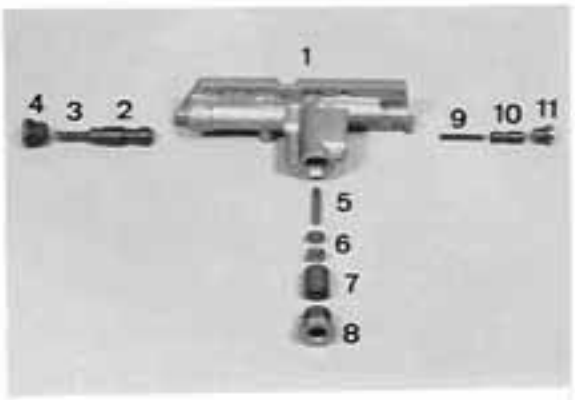
149

Pre-assemble and attach 2-stage pressure control valve (Figure 149 ... 151) :

Close the bores by means of balls (4 pieces, ø 4,50 mm).

Install components :

1 = Shift-control housing
2 = Spool
3 = Spring (L_o = 70,90 mm)
4 = Screw plug
5 = Cylindrical roller (6 x 32 mm)
6 = Ring(s) (optional)
7 = Spool
8 = Screw plug
9 = Spring (L_o = 34,90 mm)
10 = Spool
11 = Screw plug



150

NOTE :

p3 is determined by the ring 6
(pay attention to Notes, Page 1.01 ... 1.03) !

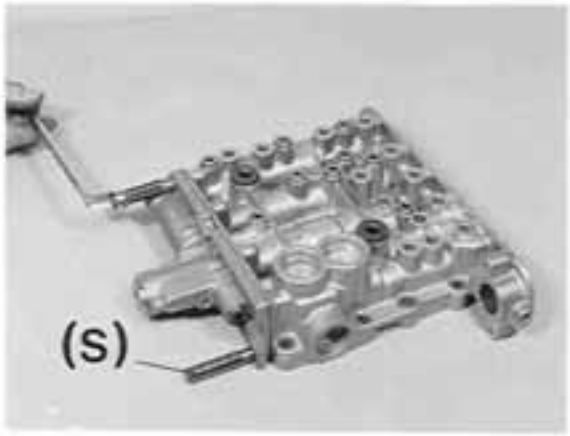
Pay attention to the installation position of the spool (7), bore is facing the screw plug ! Employ new O-Rings for screw plugs !

Install two adjusting screws (S) and assemble flat gasket.

Pull pre-assembled pressure control valve by means of nuts (S) against shoulder and fasten it subsequently by means of socket head screws (mount flat washers).

Torque limit (M6/8.8) 9,5 Nm

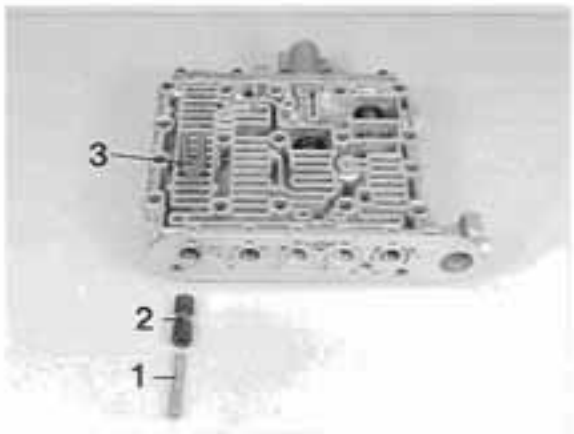
(S) Adjusting screw (M6) with nut 5870 204 049



151

Introduce spool (2) and spring (1), preload and fix them by means of stop plate (3).

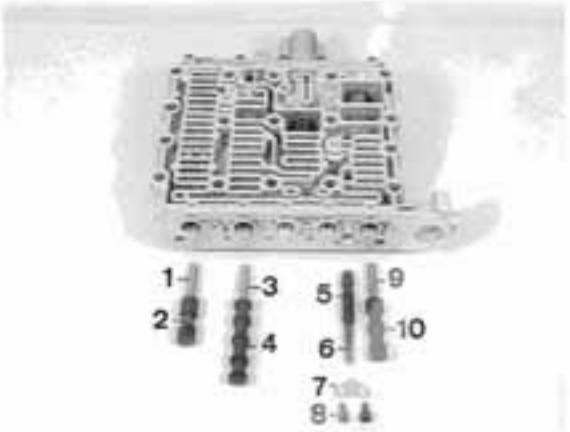
1 = Spring (L_o = 51,30 mm)
2 = Control spool (total length = 39,50 mm)
3 = Stop plate



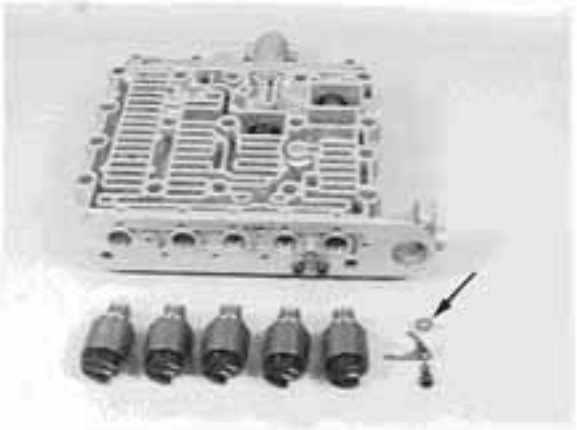
152

Install components :

1 = Spring (L_o = 51.30 mm)
2 = Control spool (total length = 39,50 mm)
3 = Spring (L_o = 51,30 mm)
4 = Control spool
5 = Spool (reducing valve)
6 = Spring (L_o = 37,10 mm)
7 = Retaining plate
8 = Socket head screws (2 pieces)
9 = Spring (L_o = 51,30 mm)
10 = Pilot spool (total length = 52,50 mm)



153



154

Insert the solenoid valves and fix them by means of disks, retaining plates and socket head screws.

Torque limit (M5/8.8) 5,5 Nm

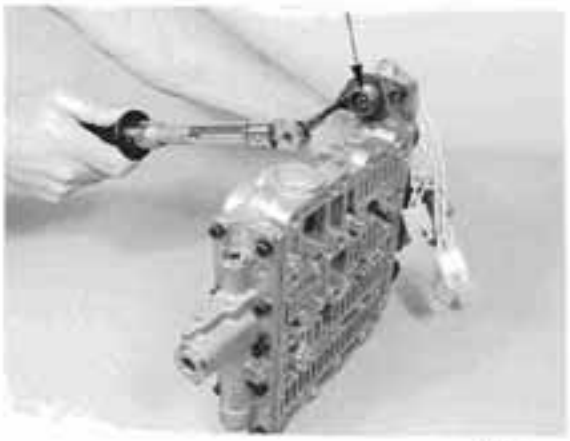
NOTE :

Pay attention to the installation position of the disk (mount between valve body and retaining plate), see Arrow !
Pay attention to the radial installation position of the solenoid valves, see Figure 156 !

Install cable harness.

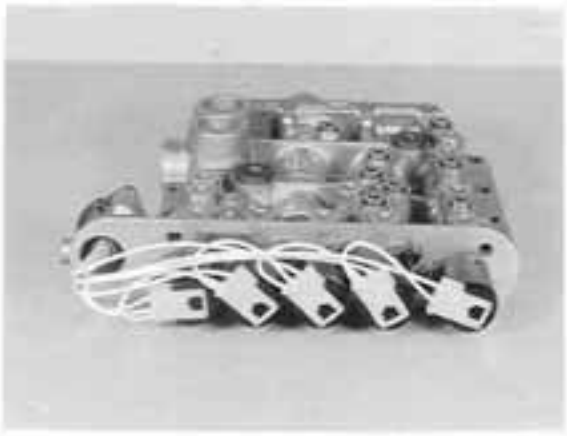
NOTE :

Mount new gaskets !
Pay attention to the location of the plug nose, see Arrow !



155

Connect the solenoid valves according to the Illustration on the left.



156

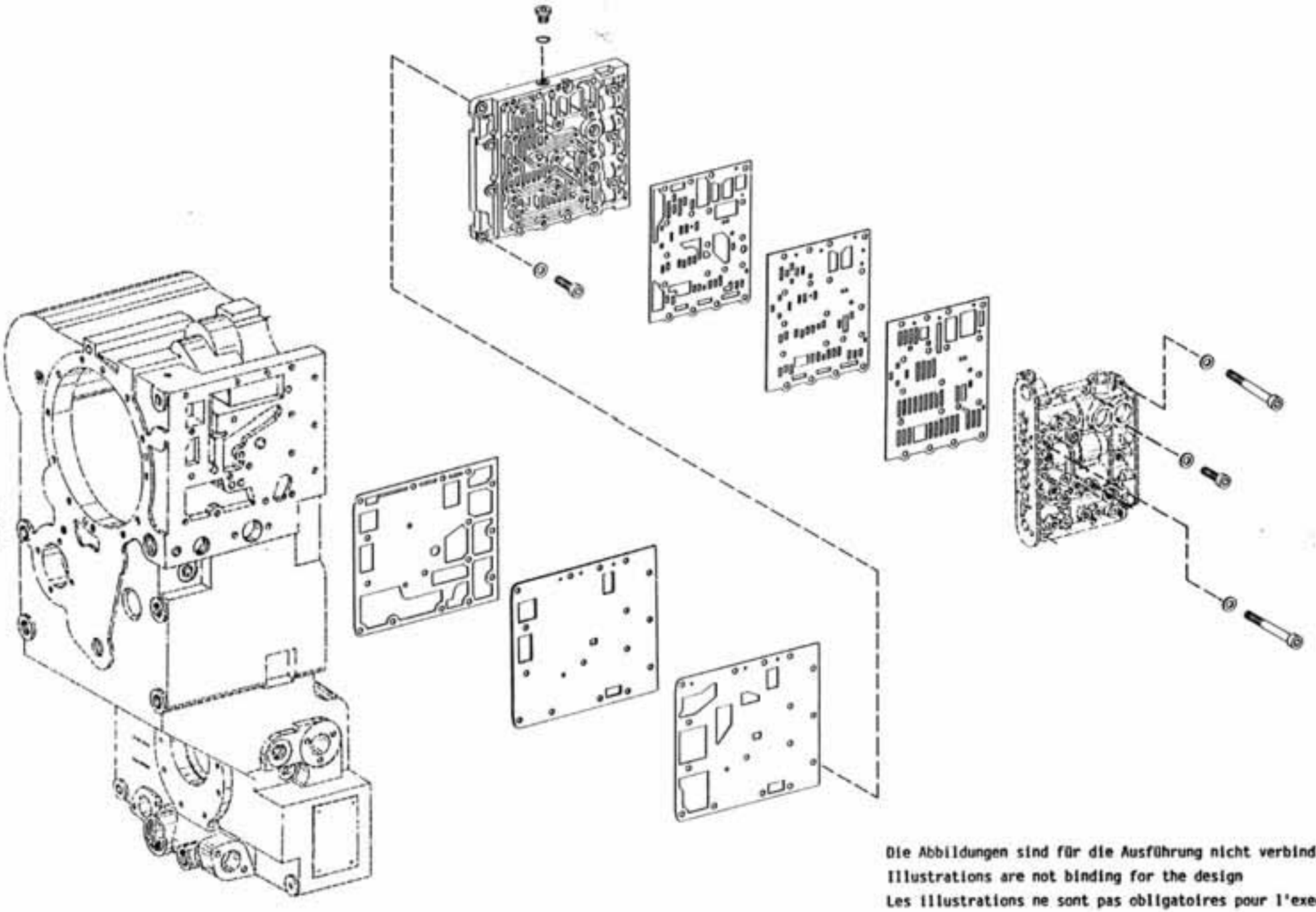
Mount new O-Ring, see Arrow, and fix the cover by means of clamping collar.

NOTE :

The Reassembly of the channel plate as well as the attachment of the gearbox control are treated on Page 1.46 ... 1.48 !
Pay attention to the Perspective Illustrations of the corresponding Spare Parts List !



157



1.59

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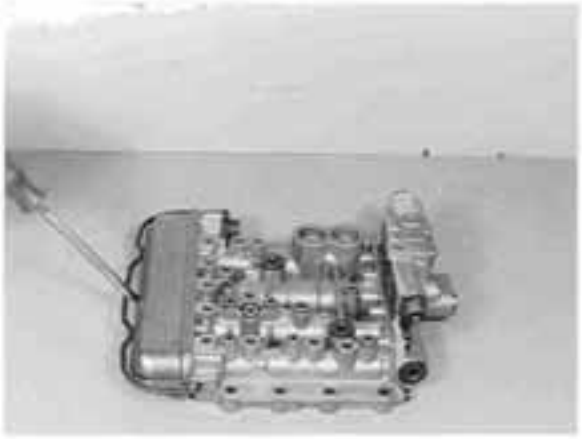
1.3.3 Version III : With WK-Valve and variable 2-stage pressure control valve.

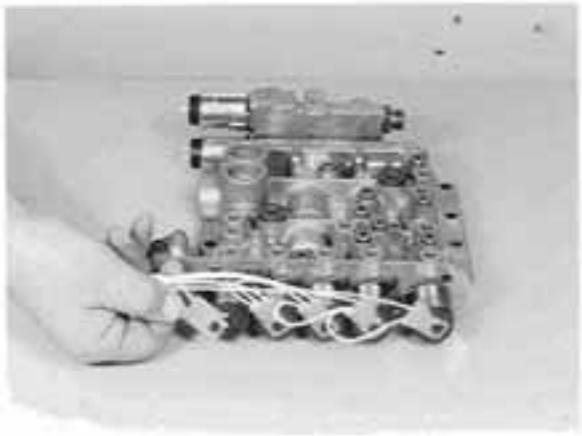
1.3.3.1 DISASSEMBLY

Relax spring clip and remove cover.



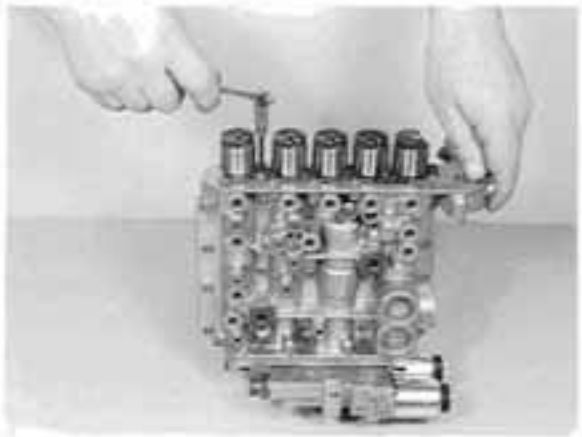
160

Pull off the cable shoes and remove cable harness.

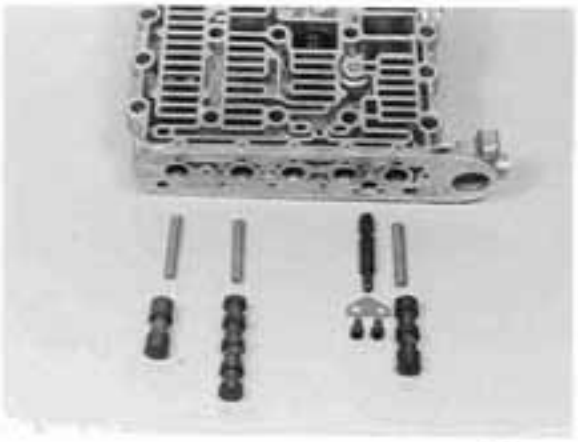


161

Loosen socket head screws and remove solenoid valves.

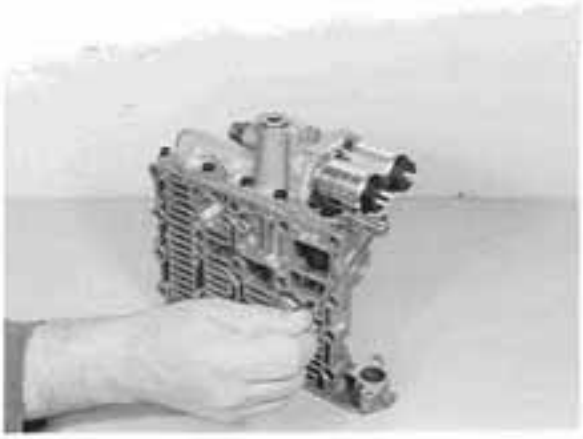


162



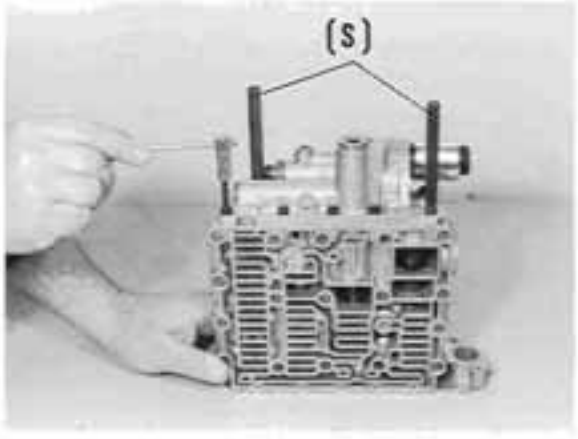
163

Remove components, see Figure on the left.



164

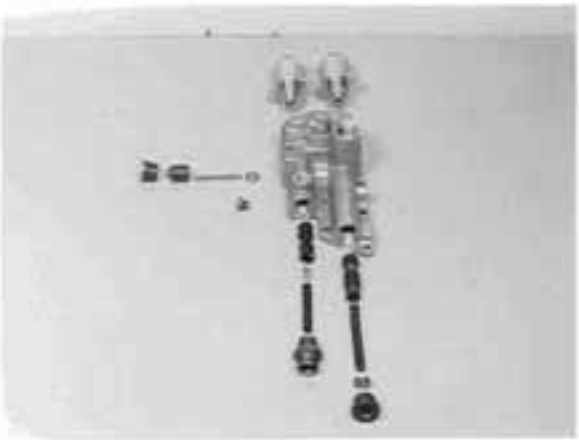
Loosen socket head screws and remove solenoid valve (2-stage pressure control valve).



165

Loosen two socket head screws and fix shift-control housing provisionally, using a Special Tool (S).
Now, loosen the remaining socket head screws and separate shift-control housing (is spring-loaded) from the valve body by uniform loosening of the nuts (S).

(S) Adjusting screws (M6) with nut 5870 204 049



166

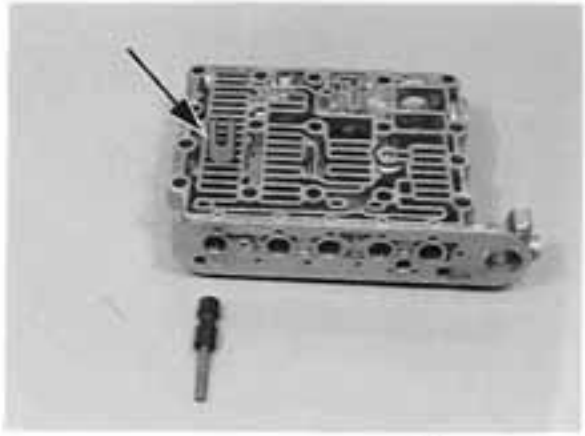
Remove components of the WK-Valve as well as of the 2-stage pressure control valve.

Remove components, see Figure on the right!



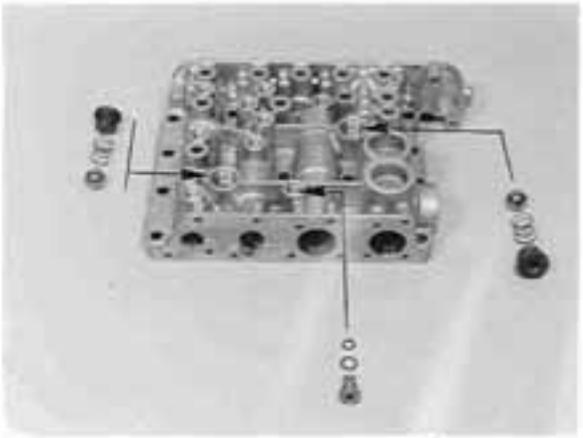
167

Remove stop plate (Arrow) and spool as well as spring.



168

Remove diaphragm and check valves.



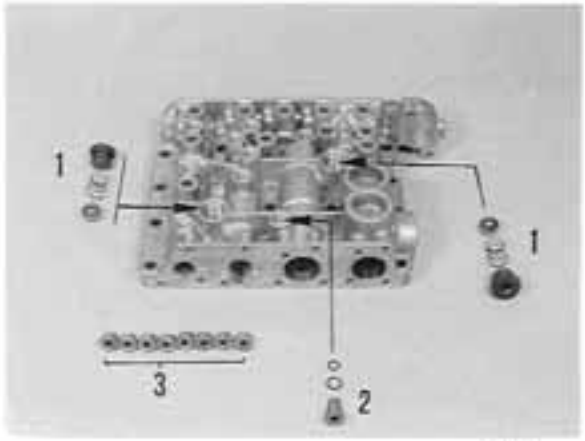
169

1.3.3.2 REASSEMBLY

see also Illustrated Table, Page 1.72 and 1.73 !

NOTE :

Check all components for damage and renew if necessary !
Check free travel of the moving parts in the housing prior to the installation !
Spools can be exchanged individually !
Oil components prior to the reassembly !



170

Ref. Figure 170 :
1 = Check valve (2x)
2 = Diaphragm
3 = Screw plugs

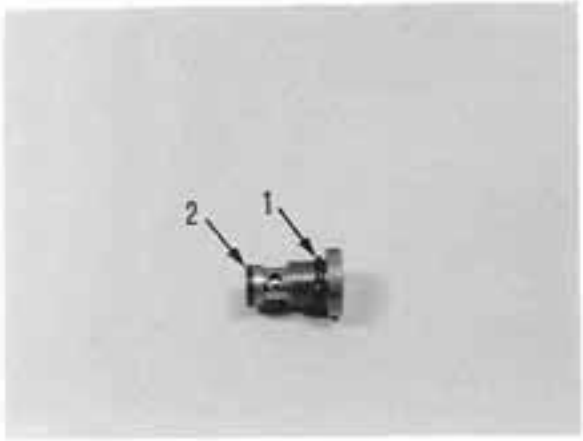
Install components according to the Illustration on the left.

NOTE :

Employ new O-Rings for all screw plugs.
Figure 171 shows the positions of the O-Rings on the diaphragm 2.
(Fasten O-Ring 6 x 1,5 mm/Arrow 2 with grease) !
$\Delta t1$ is determined by the diaphragm 2
(pay attention to Notes, Page 1.01 ... 1.03) !

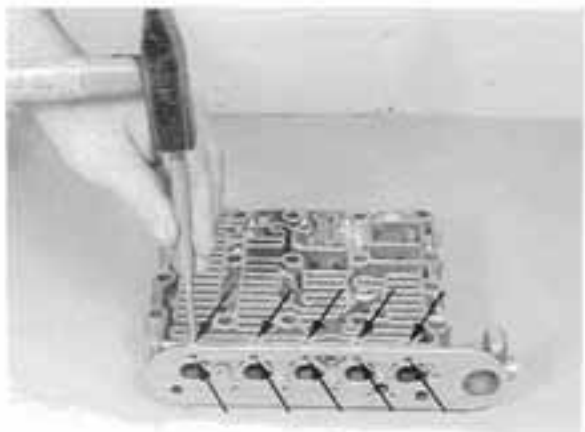
Torque limit :

Screw plug M10x1	20 Nm
Screw plug M18x1,5	35 Nm
Diaphragm	20 Nm



171

Close the bores by means of balls (10 pieces ø 4,50 mm).



172

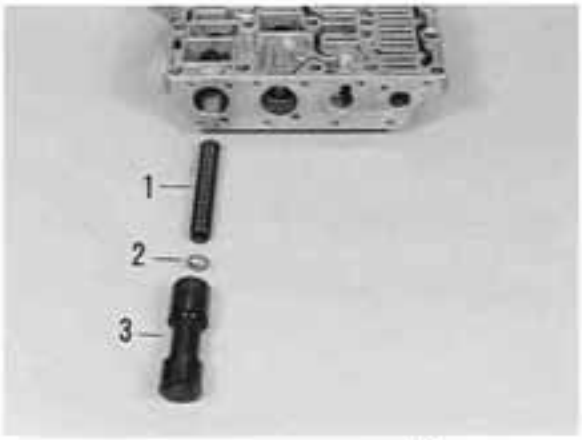
Control pressure valve :

Install components :

1 = Spring (L_o = 96,20 mm)
2 = Disk(s) (optional)
3 = Spool

NOTE :

ps is determined by the disk 2
(pay attention to Notes, Page 1.01 ... 1.03) !

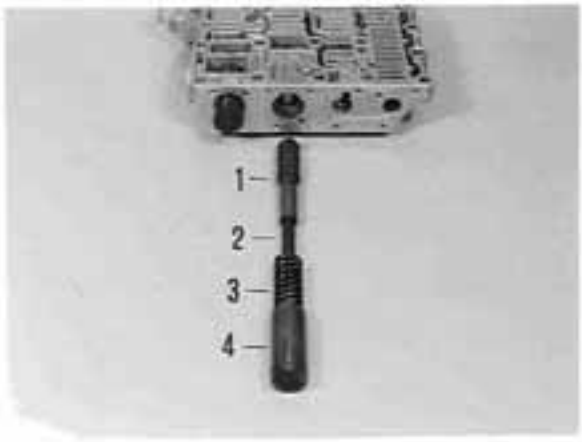


173

Pressure control valve :

Install components :

1 = Control spool
2 = Spring (L_o = 124,10 mm)
3 = Spring (L_o = 77,10 mm)
4 = Displacement spool

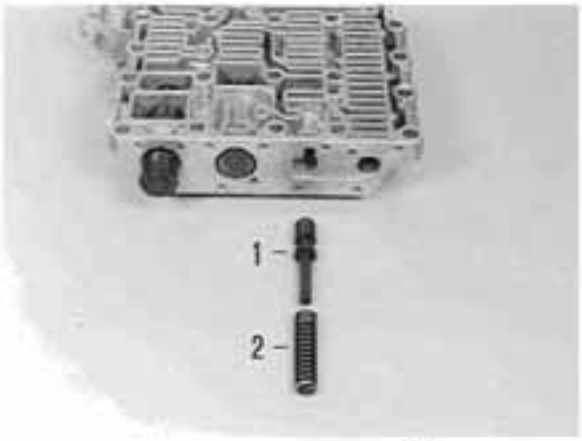


174

Reversing valve :

Install components :

1 = Spool
2 = Spring (L_o = 56,30 mm)

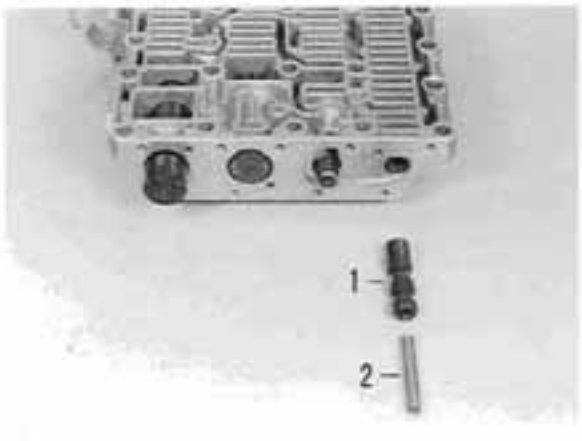


175

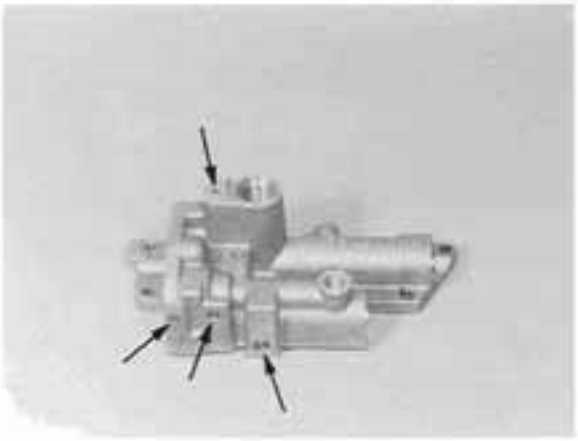
Control spool KV :

Install components :

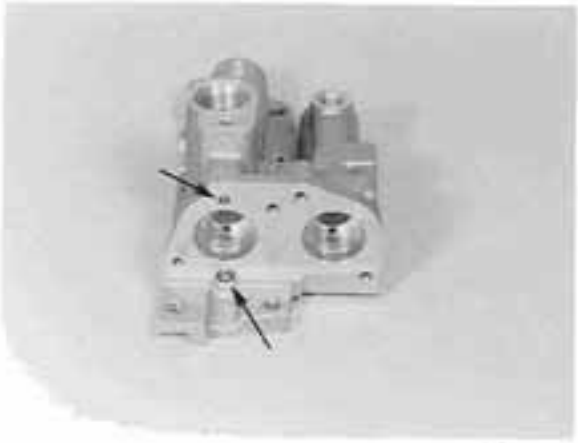
1 = Spool (total length = 55,50 mm)
2 = Spring (L_o = 51,30 mm)



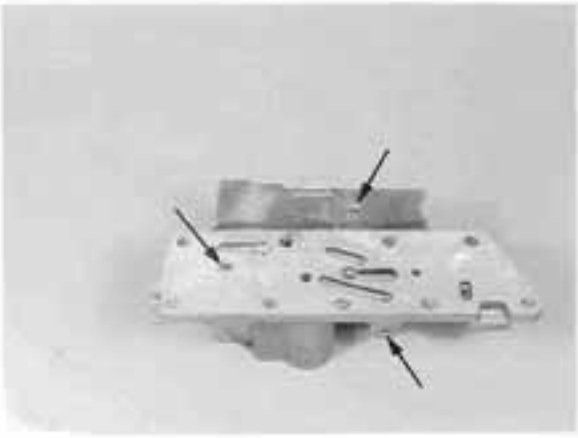
176



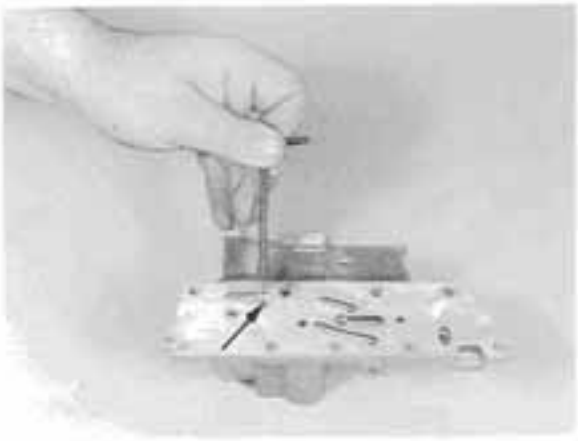
177



178



179



180

Pre-assemble shift-control housing (WK and pressure control valve) (Figure 177 ... 184) :

Close the bores according to Figures 177 ... 179 by means of balls, see Arrows !

6 pieces = Ball diameter 4,50 mm
2 pieces = Ball diameter 7,50 mm
1 piece = Ball diameter 6,00 mm

Screw diaphragm (wet thread with Loctite Type-No. 270) into the bore (Arrow) and fix it additionally by means of center punch.
Now, clean the diaphragm from Loctite residues by means of compressed air.

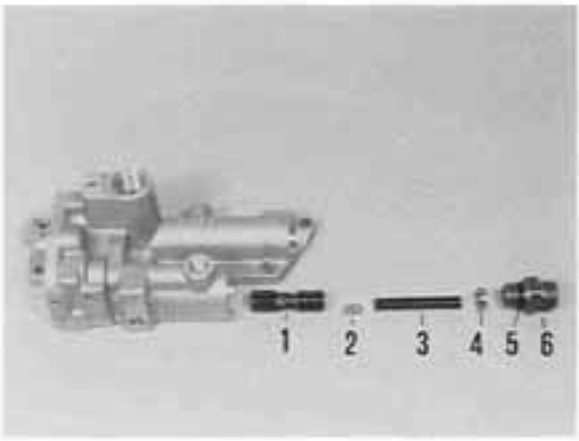
NOTE :

t2 is determined by the diaphragm
(pay attention to Notes, Page 1.01 ... 1.03) !

WK-Valve :

Install components :

1 = Spool
2 = Disk(s) (optional)
3 = Spring (L_o = 53,40 mm)
4 = Detent block
5 = O-Ring
6 = Connecting piece

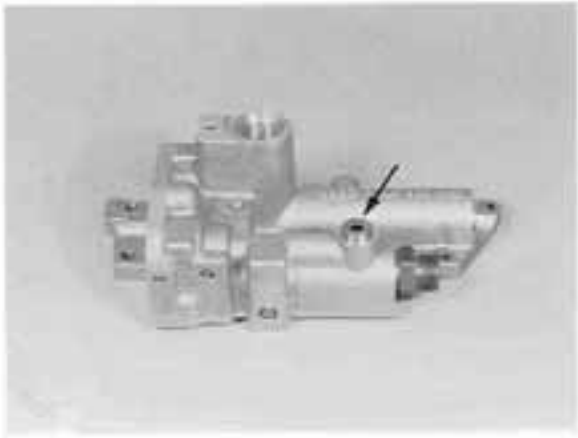


181

NOTE :

Intall detent block with the countersinking facing the spring !
p2 (WK) is determined by the disk 2
(pay attention to Notes, Page 1.01 ... 1.03) !

Install screw plug (Arrow).


182

NOTE :

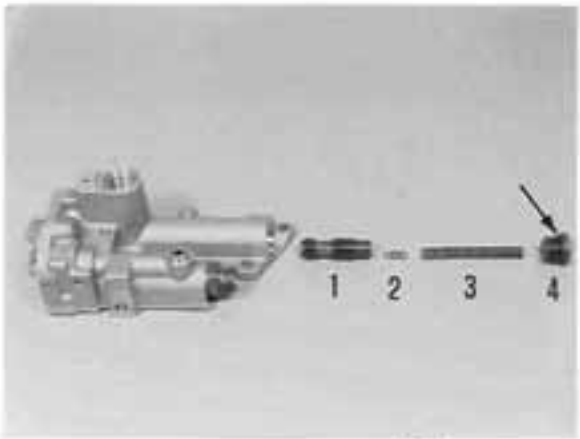
Assemble new O-Ring !

Torque limit (M10x1) 20 Nm

2-stage Pressure control valve (Figure 183 and 184) :

Install components :

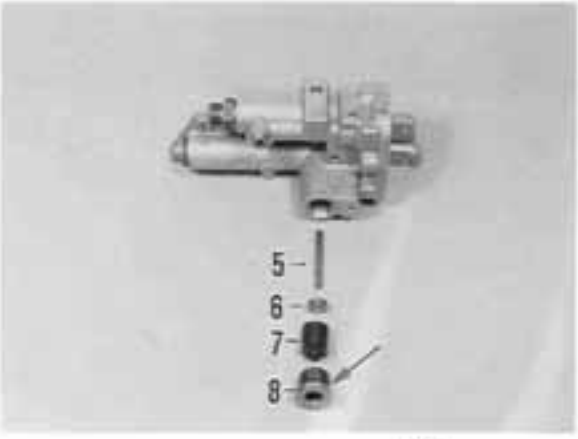
1 = Spool
2 = Disk(s) (optional)
3 = Spring (L_o = 70,90 mm)
4 = Screw plug
5 = Needle roller
6 = Ring(s) (total thickness s = 5,00 mm/ empirical value)
7 = Spool
8 = Screw plug



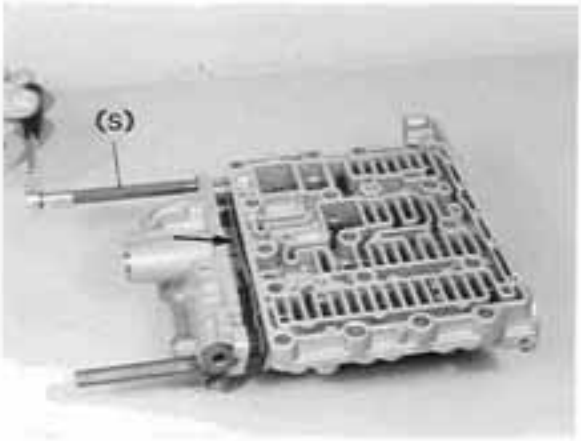
183

NOTE :

Mount new O-Rings, see Arrows !
Δp3 is determined by the disk 2
p3 is determined by the ring 6
(pay attention to Notes, Page 1.01 ... 1.03) !



184

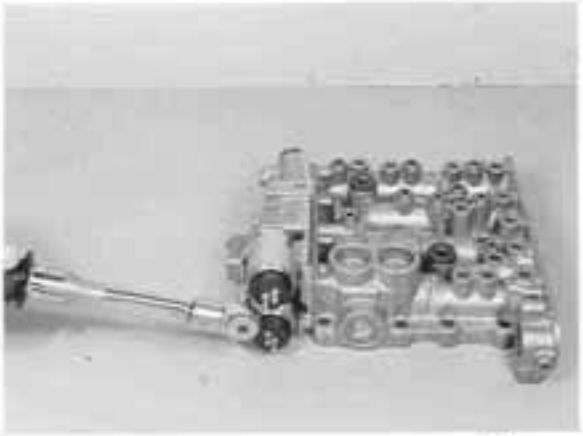


185

Install two adjusting screws (S) and assemble flat gasket (Arrow).
Pull shift-control housing against shoulder, using nuts (S).
Now, fasten shift-control housing by means of socket head screws (mount flat washers).

Torque limit (M6/8.8) 9,5 Nm

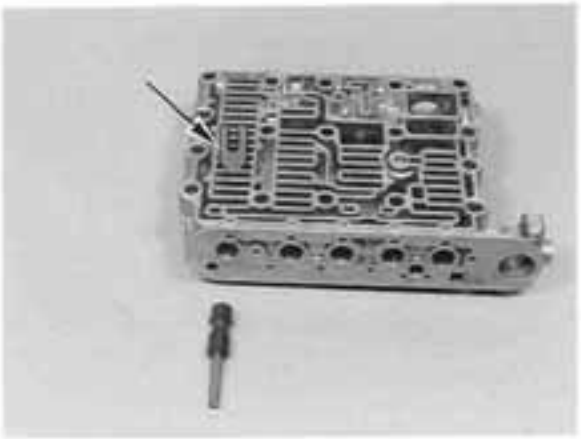
(S) Adjusting screws (M6) with nut 5870 204 049



186

Fasten the two solenoid valves by means of socket head screws.

Torque limit (M5/8.8) 5,5 Nm

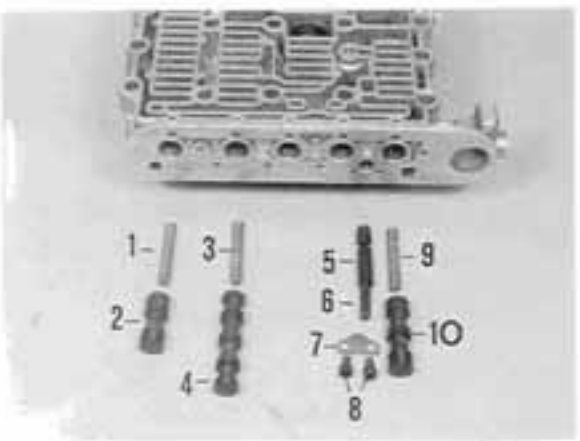


187

Assemble control spool (K4/KR) and compression spring (L_o = 51,30 mm) and fix them by means of stop plate.

NOTE :

Position of stop plate, see Arrow !



188

Install components :

1 = Spring (L_o = 51,30 mm)
2 = Control spool (K4/KR)
3 = Spring (L_o = 51,30 mm)
4 = Control spool (K1/K2/K3)
5 = Spool
6 = Spring (L_o = 37,10 mm)
7 = Retaining plate
8 = Socket head screws
9 = Spring (L_o = 51,30 mm)
10 = Pilot spool (total length = 52,50 mm)

Insert solenoid valves and fix them by means of disks, retaining plates and socket head screws.

Torque limit (M5/8.8) 5,5 Nm

NOTE :

Pay attention to the installation position of the disks (mount between valve body and retaining plate), see Arrow !

Pay attention to the installation position of the solenoid valves, see also Figure 191 !



189

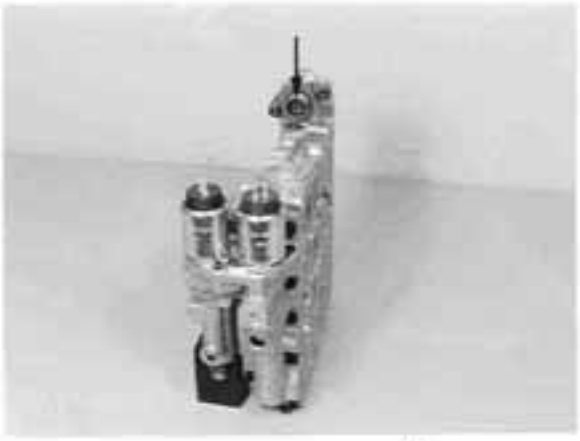
Install cable harness.

Torque limit (M6/8.8) 9,5 Nm

NOTE :

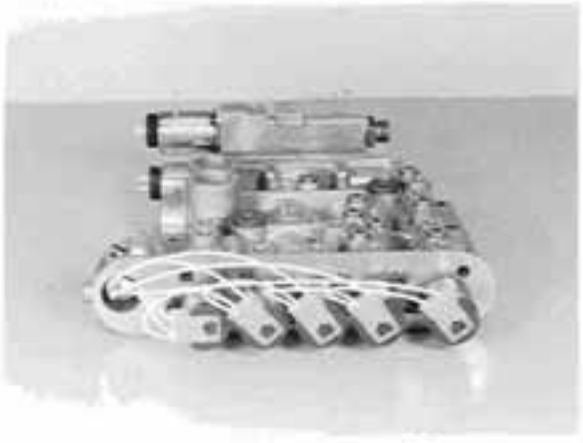
Mount new gaskets !

Pay attention to the location of the plug nose see Arrow !



190

Connect solenoid valves according to the Illustration on the right.



191

Mount new O-Ring (Arrow) and fix cover by means of clamping collar.

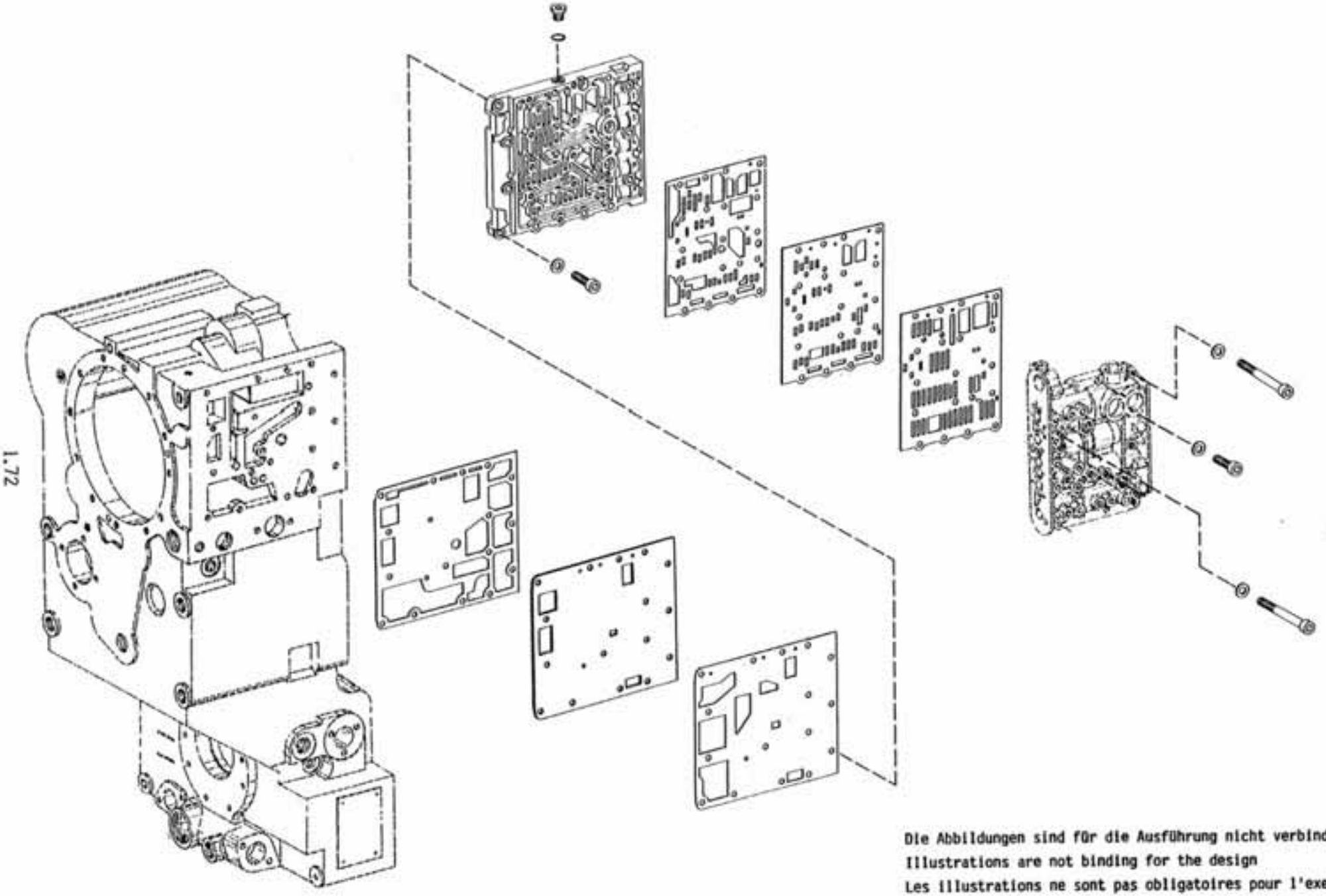
NOTE :

The reassembly of the channel plate as well as the attachment of the gearbox control, are treated on Page 1.46 ... 1.48 !

Pay attention to the Perspective Illustration of the corresponding Spare Parts List !



192



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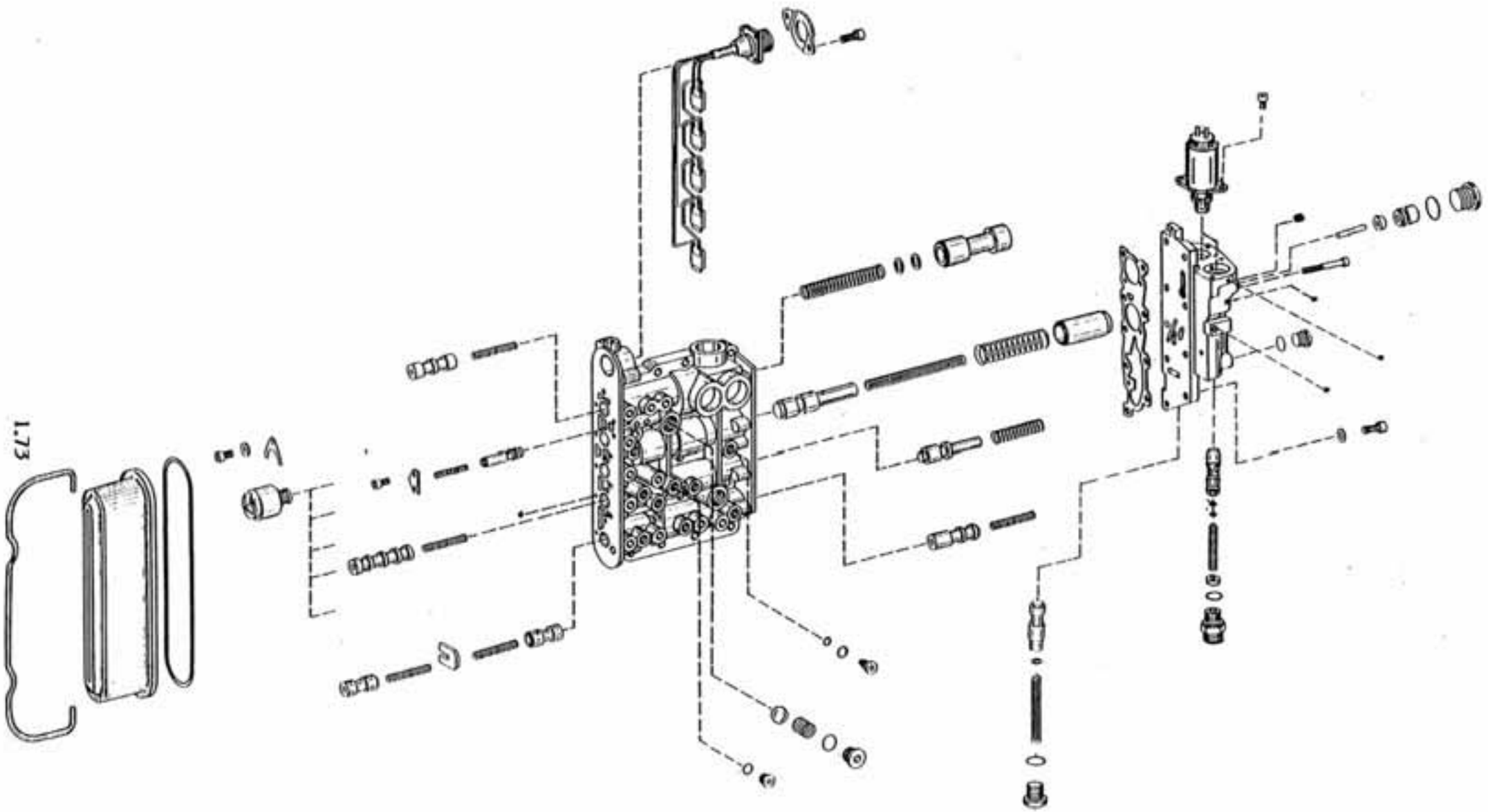
Les illustrations ne sont pas obligatoires pour l'execution



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Illustrations are not binding for the design
Les illustrations ne sont pas obligatoires pour l'execution

2. TORQUE CONVERTER

Version : With converter connecting clutch (WK)

2.1 DISASSEMBLY

Separate the complete converter from the transmission by means of lifting device.

(S) Assembly car compl. with tilting device	5870 350 000
(S) Basic support	5870 350 014
(S) Support	5870 350 036
(S) Set of eye bolts	5870 204 002



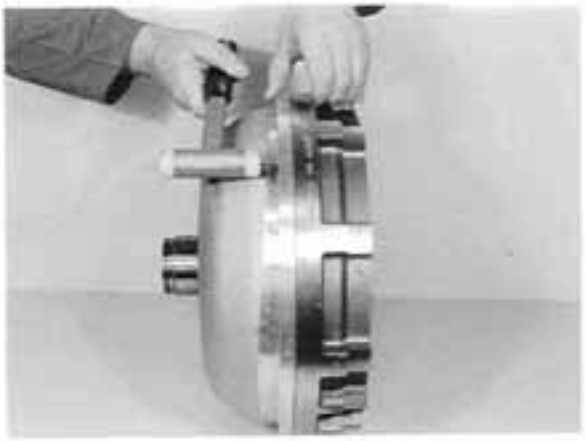
1

Loosen screwed connection.



2

Install hex. head screw, tap impeller wheel loose and separate it from converter impeller cover, see Figure !



3

Loosen hex. head screws and remove impeller wheel flange.



4



5

Press free wheel inner ring out of the stator and remove released components.



6

Squeeze out snap ring.



7

Press free wheel outer ring out of the stator.



8

Separate turbine wheel from converter impeller cover.

Loosen hex. head screws, remove backing plate and plate pack.



9

Remove cup spring and demount all driving pins (Arrow).



10

Separate piston from converter impeller cover by means of compressed air.

(S) Rubber cap 5870 509 009



11

Press profiled bush out of the converter impeller cover.

NOTE :

The profiled bush is axially fixed by means of a snap ring which will be destroyed at the pressing out. !



12



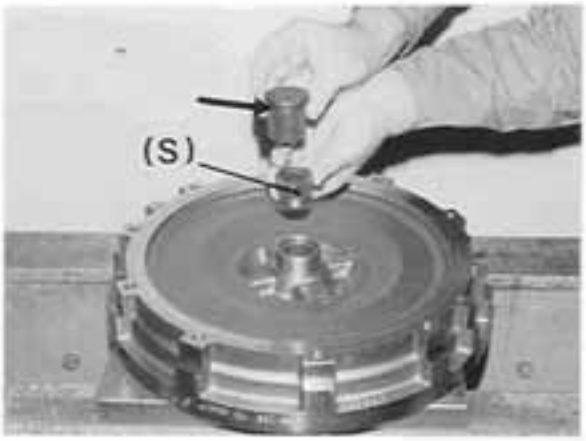
13

2.2 REASSEMBLY

Squeeze snap ring into the annular groove (Arrow) of the converter impeller cover.

NOTE :

Grease and align snap ring radially prior to reassemble the profiled bush (Figure 14) !



14

Install O-Ring (Arrow) and grease it.
Thread up profiled bush (S) and press the drive dog in until the snap ring engages in the annular groove.

NOTE :

The snap ring is expanded by means of the profiled bush (S), thus allowing the reassembly of the drive dog !

(S) Profiled bush 5870 345 073



15

Install the two rectangular rings, see Arrows !

Oil piston bearing surfaces as well as rectangular rings and insert piston in the converter impeller cover until contact is obtained.

NOTE :

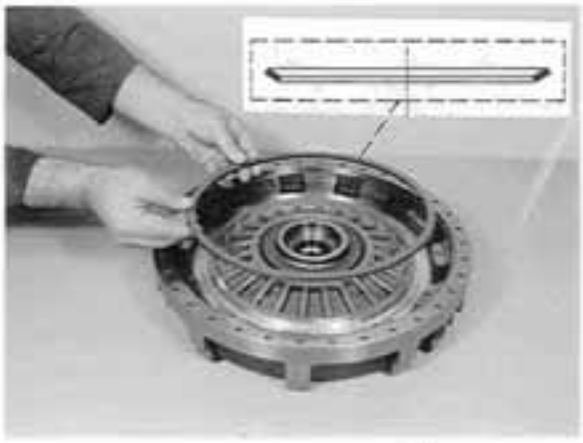
Expand the inner rectangular ring (140 x 149 x 2 mm) slightly, to ensure a correct contact in the piston recess !



16

Install all driving pins (12 pieces) into the bores.

Insert cup spring, with the concave side showing upwards (see draft, fig 17).

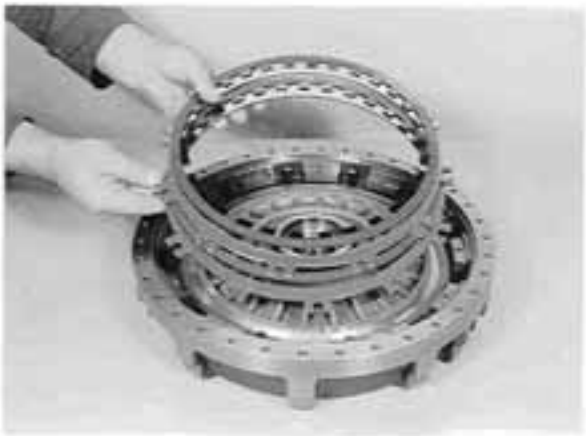


17

Install alternating outer and inner plates (2 pieces each), starting with one outer plate.

NOTE :

In case of Versions with three outer and one inner plate, two outer plates have to be installed at first, followed by one inner plate and one outer plate as last plate !

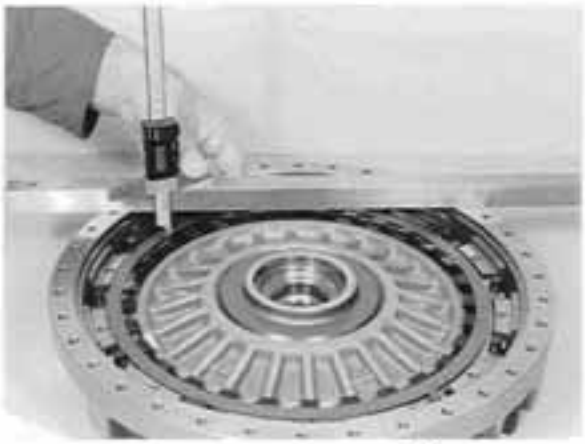


18

Check Clearance WK 0,4 ... 0,6 mm
(Figure 19 ... Example "A")

Determine Dimension I from the straightedge to the outer plate.

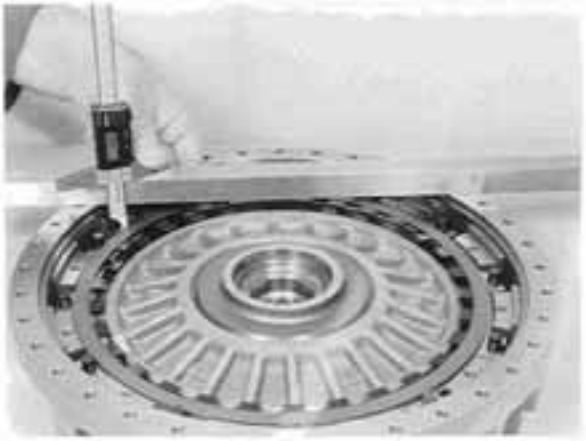
Dimension I e.g.	44,0 mm
(S) Straightedge	5870 200 022
(S) Digital depth gauge	5870 200 072



19

Determine Dimension II from the straightedge to the contact surface of the backing plate.

Dimension II e.g. 43,5 mm



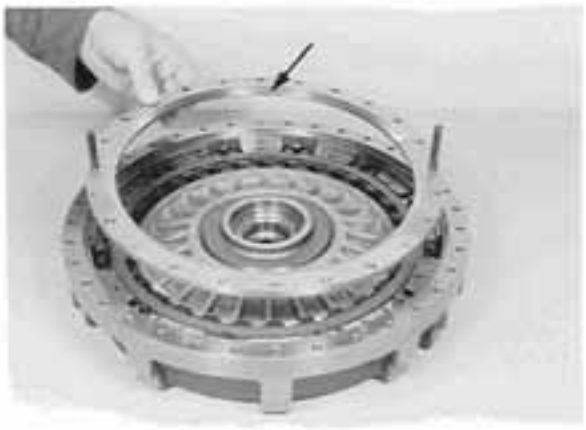
20

Example "A" :

Dimension I	44,0 mm
Dimension II	- 43,5 mm
Difference = Clearance	= 0,5 mm

NOTE :

Carry out any corrections by means of corresponding pistons (s = 9,2 mm, 9,8 mm and 10,5 mm) !



21

Assemble backing plate with the chamfering (Arrow) showing upwards and fasten it by means of hex. head screws.

Torque limit (M8x25/10.9) 34 Nm

(S) Adjusting screw (M8) 5870 204 011



22

Fasten turbine wheel hub by means of hex. head screws (mount flat washers).

Torque limit (M8x18/8.8) 23 Nm

NOTE :

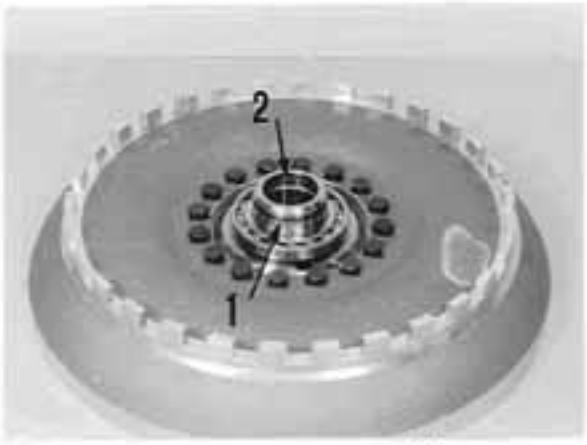
Secure hex. head screws with Loctite (Type-No. 270) !



23

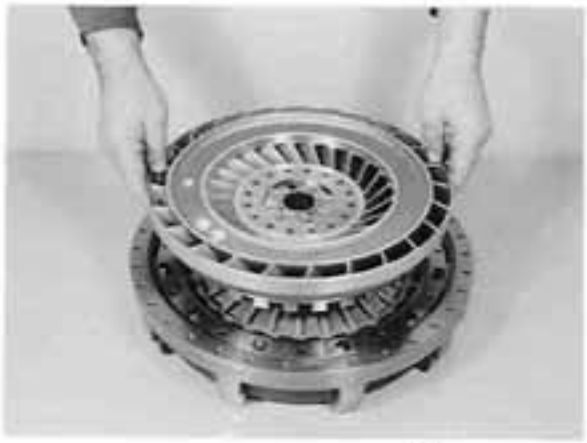
Heat the ball bearing and mount it against shoulder until contact is obtained.

Squeeze in rectangular ring (Arrow 1) and engage it.
Insert O-Ring (Arrow 2) in the recess of the turbine wheel hub and grease it.



24

Thread up pre-assembled turbine wheel until the inner plates have been received.



25

Heat stator and insert free wheel outer ring until contact is obtained.

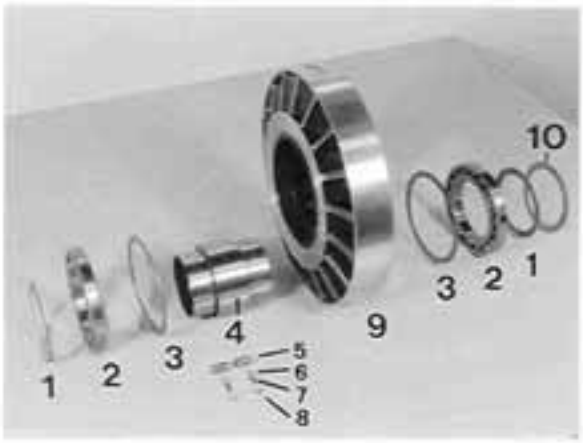


26

Fix free wheel outer ring by means of snap ring.



27



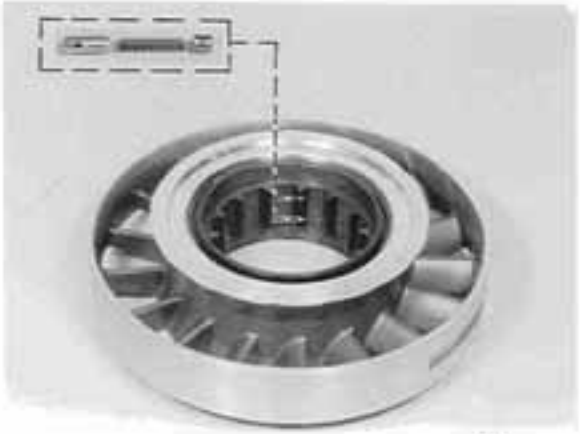
28

The Illustration on the left shows the components of the stator.

1 = Shim (constant, s = 1,0 mm)
2 = Ball bearing
3 = Thrust washer (s = 1,5 mm)
4 = Free wheel inner ring
5 = Cylindrical rollers (28 pieces)
6 = Spring cap (28 pieces)
7 = Compression spring (28 pieces)
8 = Bearing roller (28 pieces)
9 = Stator
10 = Shim (optional, e.g. s = 0,2 mm)

NOTE :

The stator end play is determined by means of shim 10, see Example "B" !



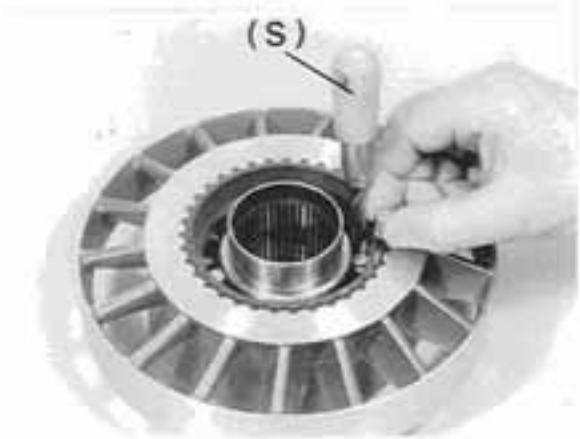
29

Insert bearing rollers, springs and spring caps (8, 7, and 6) according to the Illustration on the left with grease into the bores of the free wheel hub.



30

Place ball bearing (2) on the long hub side (24 mm) against shoulder, install thrust washer (3) s = 1,5 mm and press free wheel inner ring against shoulder.



31

Press spring caps by means of guide plate (S) into the free wheel ring until the cylindrical roller pairs (5) can be installed.

NOTE :

The second roller pair has to be installed opposite to the first roller pair - makes the installation of the remaining roller pairs easier !

(S) Guide plate 5870 345 020

Mount thrust washer (3) s = 1,5 mm and press bearing against shoulder.



32

Install shim (1) s = 1,0 mm and shaft washer (60x85x4,75).



33

Opposite side :

Install shim (1) s = 1,0 mm, shim (10) (optional e.g. s = 0,5 mm) and shaft washer (60x85x 4,75).

NOTE :

The end play of the stator is determined by means of shim (10) (e.g. s = 0,5 mm/empirical value) !

However, a later check (Figure 39 ... Example "B") is absolutely essential !



34

Mount housing washer (62x85x4,75 mm) and axial needle bearing (60x85x3 mm).



35



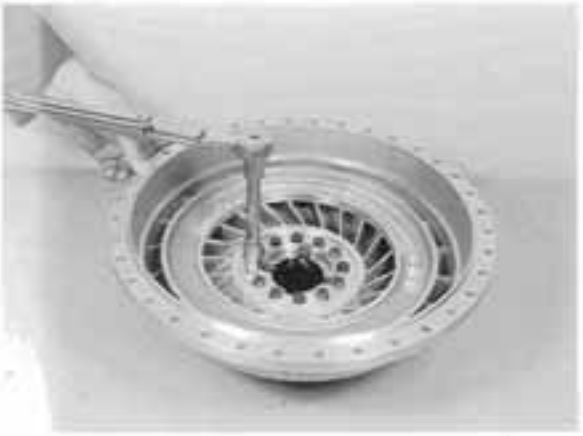
36

Insert stator with the reduced plane surface (Arrow) showing upwards until contact is obtained.



37

Install axial roller bearing and housing washer (62x85x4,75 mm).



38

Mount new flat gasket and fasten flange by means of hex. head screws (mount flat washers) on the impeller wheel.

Torque limit (M8x18/8.8) 23 Nm

NOTE :

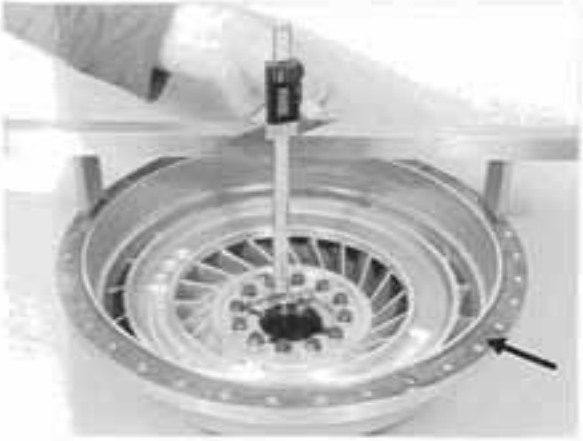
Pay attention to the radial installation position !
Secure hex. head screws with Loctite (Type-No. 270) !

Check end play - Stator max. 0,2 mm
(Figure 39 ... Example "B")

Mount flat gasket (Arrow).
Determine Dimension I from the flange-mounted surface (gasket) to the plane surface/impeller wheel flange.

Dimension I e.g. 88,05 mm

(S)	Straightedge	5870 200 022
(S)	Gauge blocks	5870 200 066
(S)	Digital depth gauge	5870 200 072



39

Measure Dimension II from the flange-mounted surface (converter impeller cover) to the housing washer.

Dimension II e.g. 87,95 mm



40

Example "B" :

Dimension I	88,05 mm
Dimension II	- 87,95 mm
Difference = End play	0,10 mm

NOTE :

In case of deviations from the permitted end play (max. 0,2 mm) correct by means of corresponding shim !
The shim is illustrated on Figure 34 !

Screw two adjusting screws into the converter impeller cover and mount flat gasket.

Place impeller wheel against shoulder and fasten it by means of hex. head screws.

Torque limit (M8x32/8.8) 23 Nm

NOTE :

Install flat washers !
Pay attention to the radial position, see markings !

(S) Adjusting screw (M8) 5870 204 011



41

Squeeze the rectangular ring into the annular groove (Arrow) and engage it.

NOTE :

Install converter, see Page 3.77 !



42

3. GEARBOX

3.1 DISASSEMBLY

3.1.1 CONVERTER CHARGE PUMP and CONTROL PRESSURE PUMP

Loosen hollow screw and remove delivery line.



1

Loosen screwed connection (Figure 2) and separate engine connecting case from gear case by means of pry bars (Figure 3).

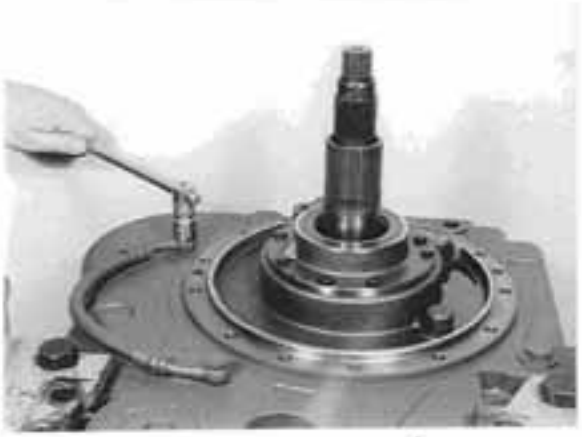


2



3

Loosen hollow screw and remove delivery line.



4



5

Loosen hex. head screws.



6

Tap loose and remove bearing cap.



7

Fasten puller device at the oil supply flange by means of hex. head screws.
Pull converter charge pump and control pressure pump (complete) out of the housing bore.

(S) Back-off device 5870 000 062

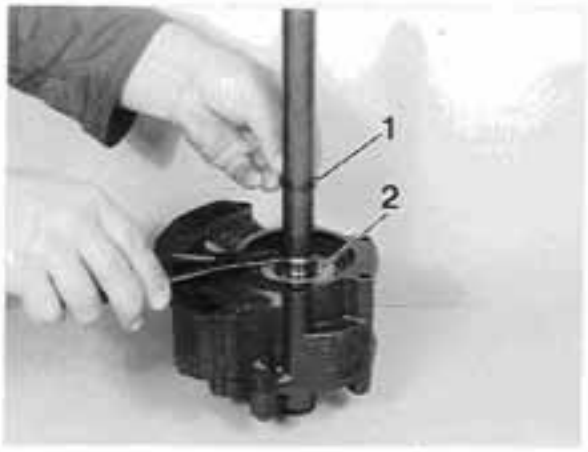


8

Loosen hex. head screws and separate pump from oil supply flange.

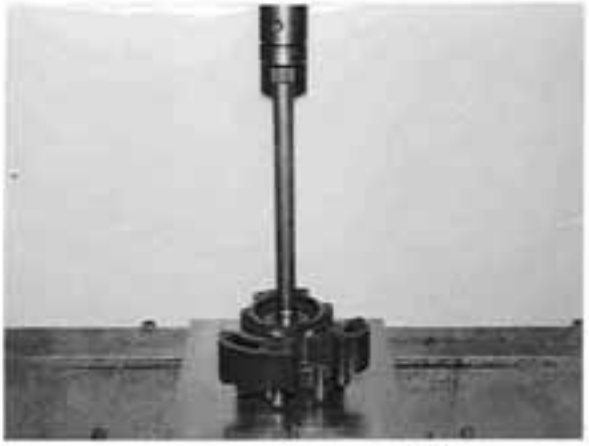
Remove rectangular ring (1) and circlip (2).

(S) Set of external snap ring pliers 5870 900 016



9

Press shaft out of the pump case.



10

Check converter charge pump and control pressure pump (Figure 11 ... 14) :

Remove the two straight pins by means of striker (Figure 11), loosen hex. head screws and remove cover (Figure 12) !

(S) Striker 5870 650 001



11

NOTE :

If traces of wear should be encountered in the pump case or on the housing cover, the complete pump has to be renewed !



12



13

Install rotor set, fix cover provisionally by means of hex. head screws and insert the straight pins (with the tapped hole showing upwards) until contact is obtained.



14

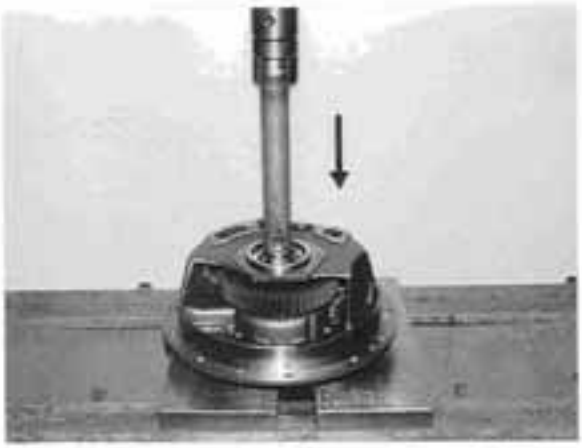
Fix the straight pins axially by means of caulkings (2x) and tighten hex. head screws finally.



15

Remove converter relief valve (ball and spring).
Squeeze out circlip.

(S) Set of external snap ring pliers — 5870 900 016



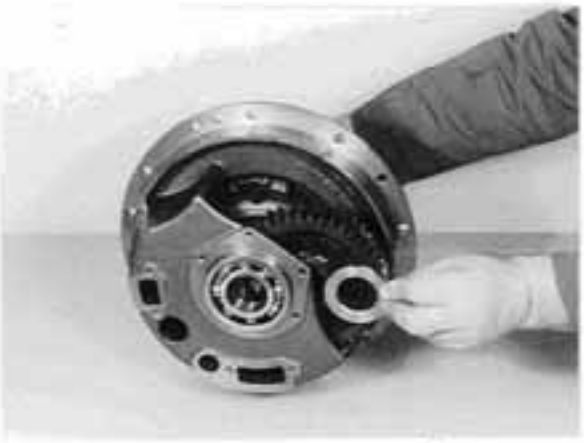
16

Press drive shaft in direction of Arrow until the spur gear is released.

Remove disk and spur gear.

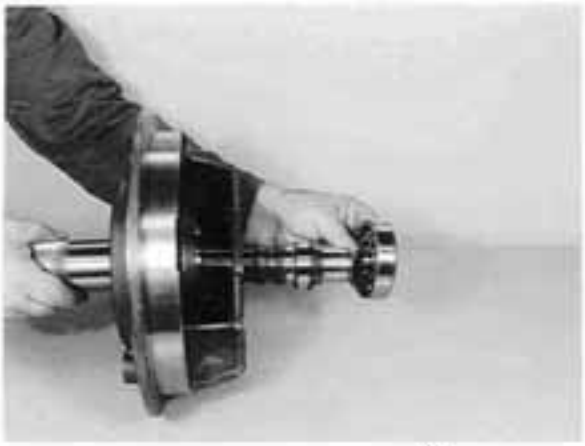
NOTE :

According to the Version, with or without disk see corresponding Spare Parts List !



17

Remove ball bearing and drive shaft.



18

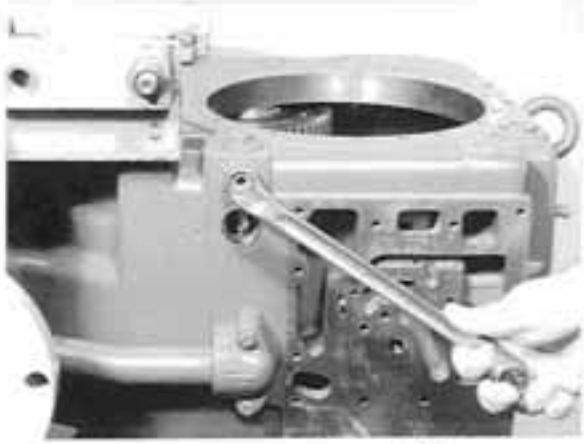
Pull roller bearing out of the bore.

(S)	Internal puller	5870 300 014
(S)	Back-up tool	5870 300 003



19

Remove temperature connection.



20



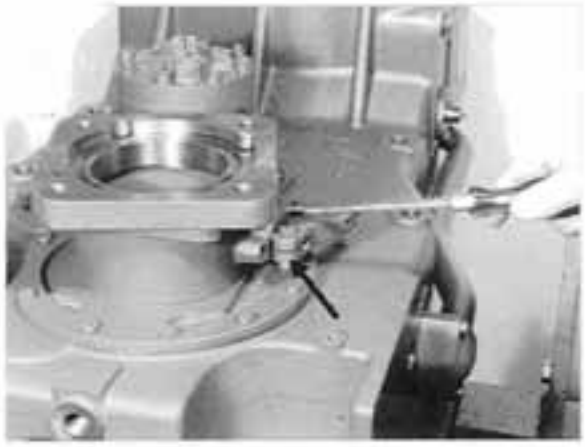
21

Loosen screw plug and remove converter control valve, composed of disk, compression spring, spool and valve sleeve.



22

Remove drive side inductive transmitter.



23

3.1.2 COAXIAL POWER TAKE-OFF (mechanical control)

Loosen clamping screw and remove lever (Arrow).



24

Remove Woodruff key and shift lever.

Remove locking device.



25

Loosen socket head screws and remove housing.



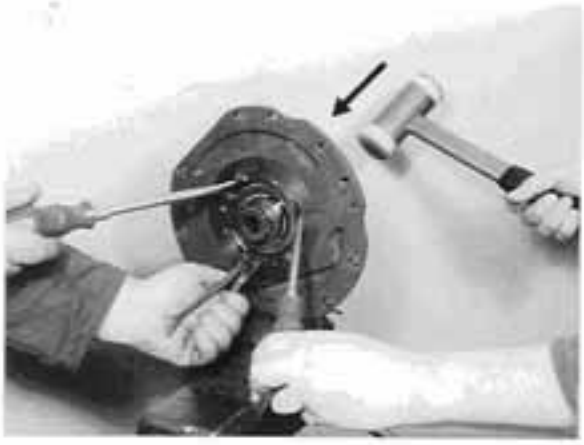
26

Loosen hex. head screws and lift complete power take-off housing out of the bore.

(S) Set of eye bolts 5870 204 002



27



28

Fasten power take-off in a vise.
Expand the two snap rings, align them centrically and drive the drive dog provisionally about 5 ... 10 mm ahead (direction of Arrow).

NOTE :

For this step, an assistant is absolutely necessary !

(S) Circlip pliers 5870 900 026



29

Squeeze out snap ring (Figure 29), tap the drive dog loose and drive it out of the spur gear, resp. housing bore (Figure 30).

NOTE :

Pay attention to the released components !



30

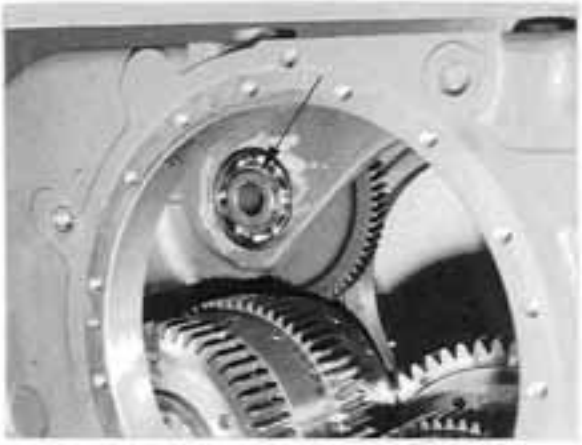
3.1.3 LATERAL POWER TAKE-OFF

Loosen socket head screws and remove pump flange.



31

Squeeze out circlip (housing interior).



32

Pull drive dog by means of internal puller out of the ball bearing, resp. spur gear and remove released spur gear.

(S)	Internal puller	5870 300 006
(S)	Back-up tool	5870 300 003



33

Expand snap rings, align them centrically, tap the ball bearing loose and drive it out of the housing bore.

NOTE :

Assistant necessary !



34



35

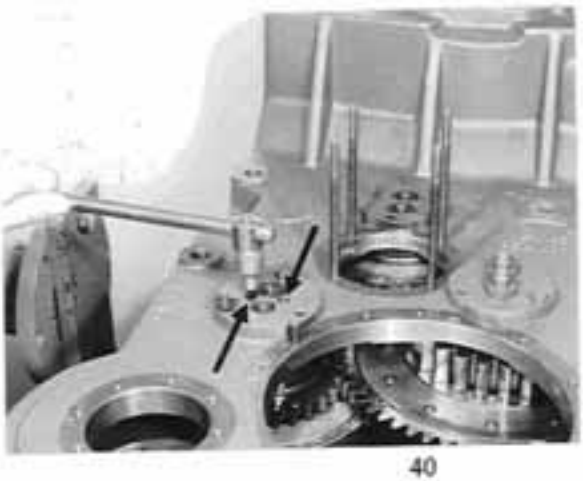
3.1.4 REMOVE EMERGENCY STEERING PUMP

Loosen hex. nuts and separate emergency steering pump from gear case.

3.1.5 REMOVE MULTI-DISK CLUTCHES

NOTE :

In case of Versions with Spur gear fixing K1, the two set screws (Arrows) have to be removed prior to the disassembly of the axle, see Figure on the right !



40

Loosen hex. nuts and pull axle by means of Special device out of the clutch, resp. gear case.

(S) Puller 5870 000 069



41

Lift clutch out of the gear case and deposit it.

NOTE :

Use lifting device !
Remove clutch KR/K2 accordingly.
In the case of clutch K4/K3, push the lower spacing washer to the rear. Only then, the clutch can be removed.

(S) Lifting device 5870 350 041



42

3.1.6 REMOVE COUNTERSHAFT ASSEMBLY

Remove closing cover.



43



44

Loosen socket head screw.



45

Pull axle by means of Special device out of the housing bore, resp. spur gear bearing.

(S) Puller 5870 000 083



46

Remove spur gear and disk.

3.1.7 DISMANTLE MULTI-DISK CLUTCH

Remove spur gear K1 and demount components.



50

Squeeze out snap ring.



51

Remove plate pack.



52

Preload compression spring, squeeze out circlip and remove components.

(S) Assembly jig 5870 345 028



53



54

Remove piston by means of clamping pliers.

(S) Clamping pliers 5870 900 007



55

Pull needle bush out of the bore, using internal puller.

NOTE :

The disassembly of the clutch KV, KR/K2 and K4/K3 has to be carried out accordingly.

(S) Internal puller 5870 300 014
(S) Back-up tool 5870 300 003

3.1.8 FINAL DRIVE - VERSION WITH DRUM BRAKE

Remove lock plate and loosen hex. head screws.



60

Pry output flange off the shaft.

(S) Pry bar 5870 345 065



61

Tilt gear case 180°.
Loosen hex. head screws.



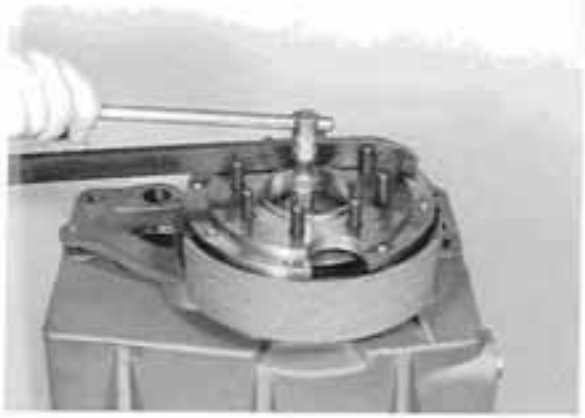
62

Separate brake drum from output flange.

(S) Crow bar 5870 345 071



63



64

Remove lock plate and loosen hex. head screws.



65

Pull output flange from the shaft.

(S) Two-leg puller 5870 970 004



66

Unhook return springs and remove brake shoes.

(S) Brake spring pliers 5870 900 006



67

Pry shaft seal out of the housing bore.

(S) Crow bar 5870 345 071

Squeeze out circlip and remove shim.

(S) Circlip pliers 5870 900 021



68

Loosen the two closing covers by central tapping and remove them.



69

Loosen the two hex. head screws and remove them along with flat washers.



70

Remove upper oil retainer.



71



72

Drive output shaft by means of striker out of the output gear and remove it.

ATTENTION :

In case of the Version with a mechanical speedometer, the speedometer-drive shaft (complete) has to be removed prior to the disassembly of the output shaft !

(S)	Puller	5870 023 017
(S)	Puller	5870 023 026
(S)	Striker	5870 650 001



73

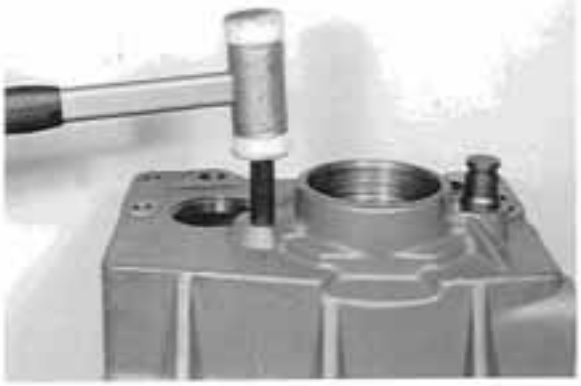
Remove output gear and plate.



74

Squeeze out circlip and remove brake cam.

(S)	Set of external snap ring pliers	5870 900 015

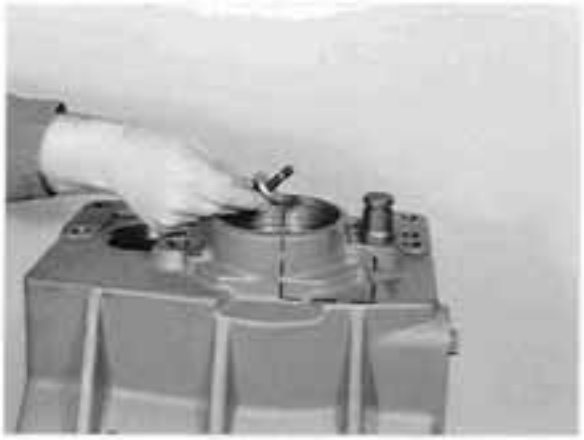


75

Drive the pin out of the housing bore and remove it.

Loosen hex. head screws (Figure 76) and pull pin by means of Special device out of the housing bore (Figure 77).

(S) Puller device 5870 000 066



76



77

Tilt gear case 180°.
Pry shaft seal out of the housing bore.



78

Squeeze out circlip and remove spacing washer.

(S) Circlip pliers 5870 900 021



79

3.2 REASSEMBLY

3.2.1 Final drive - Version with Drum brake

Install O-Ring (Arrow), insert pin until contact is obtained and fasten by means of housing washer, flat washer and hex. head screw.

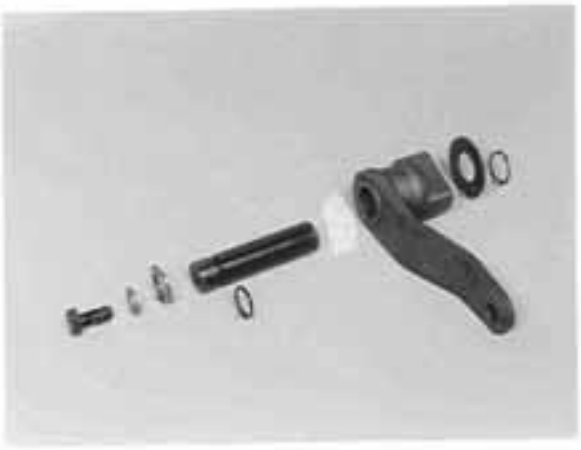
NOTE :

Secure hex. head screw with Loctite (Type-No. 270) !



90

Illustration on the right shows the components of the brake cam.



91

Pre-assemble brake cam according to Figure 91 and insert it in the housing bore until contact is obtained.
Now, tighten hex. head screw until the brake cam has got contact on the housing without play and pressure.

NOTE :

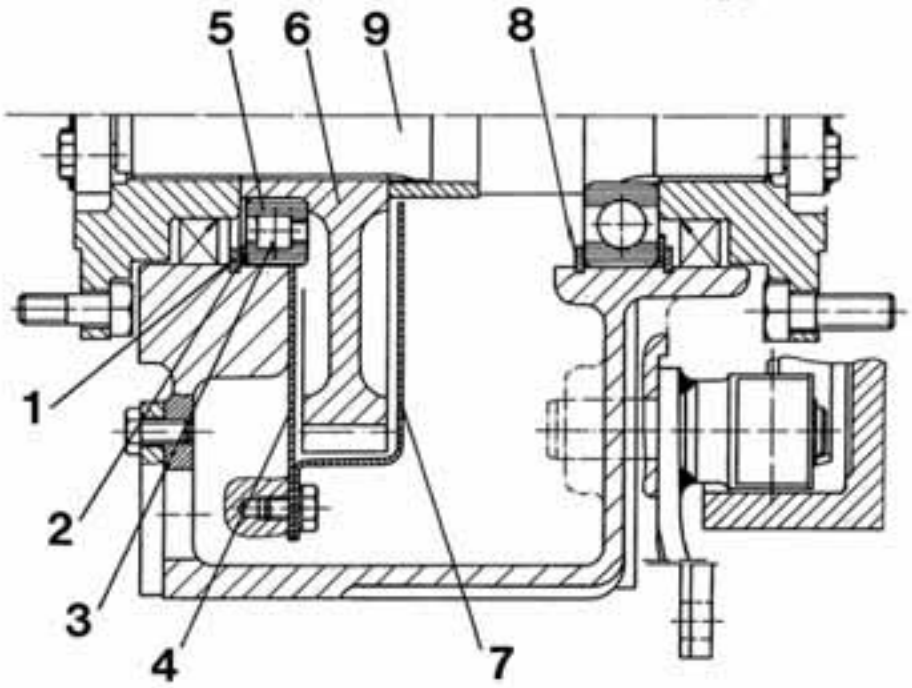
Secure hex. head screw with Loctite (Type-No. 270) !
Grease O-Ring (Arrow/Figure 92) !



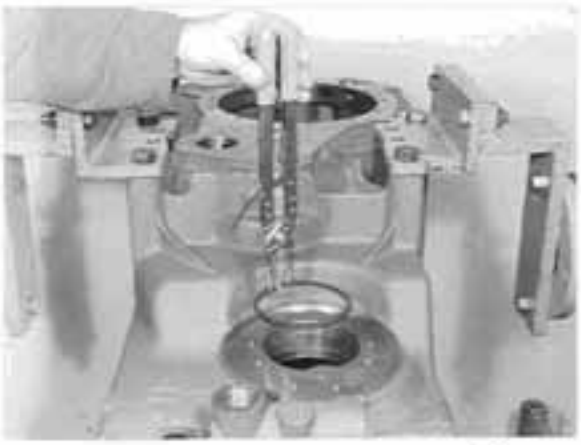
92

NOTE :

For the following steps pay attention to the Draft (Figure 93) !



93



94

Squeeze in circlip 1.
Tilt gear case 180°.

(S) Clamping pliers 5870 900 021



95

Lay shim 2 (e.g. s = 0,7 mm/empirical value) and roller bearing 3 upon circlip 1.

NOTE :

The end play of the output shaft bearing is determined by means of shim 2.
However, a later check of the end play (Figure 104 to Example "A") is absolutely essential !

Introduce plate 4 through the large housing bore and lay it over the roller bearing 3.



96

Heat bearing inner race 5 and assemble it until contact is obtained.



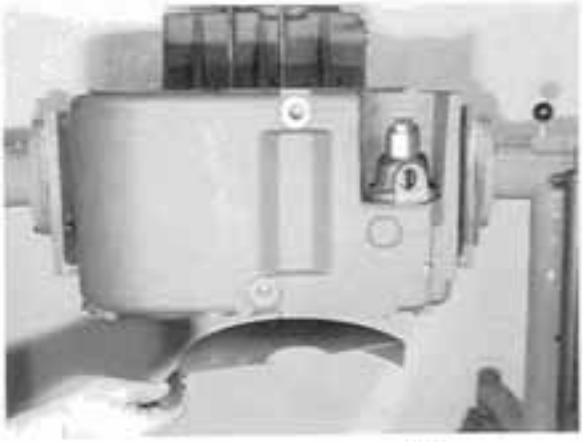
97

Position spur gear 6, see Draft !



98

Position oil retainer 7, see Draft !



99



100

Fasten both plates by means of hex. head screws (install flat washers).

Torque limit (M8/8.8) 23 Nm

NOTE :

Secure hex. head screws with Loctite (Type-No. 270).



101

Squeeze in circlip 8.

(S) Clamping pliers 5870 900 021



102

Press the speedometer-drive worm against shoulder.

NOTE :

In case of a Version without mechanical speedometer, a spacer has to be installed instead of the speedometer-drive worm !



103

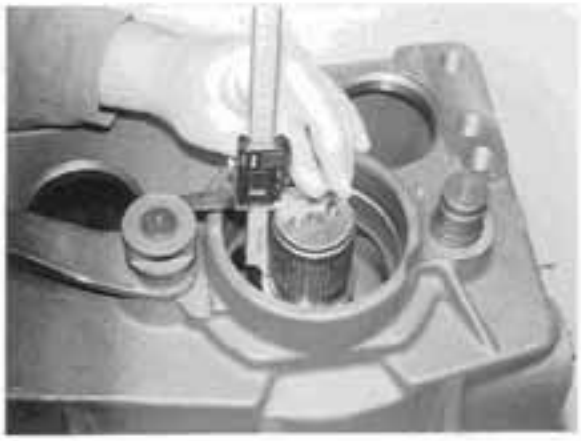
Thread up output shaft 9 until contact is obtained.

Check end play of the output shaft bearing = 0,3 ... 0,5 mm (Figure 104 ... Example "A"):

Measure Dimension I from the end face/output shaft to the contact face (ball bearing).

Dimension I e.g. 79,60 mm

(S) Digital depth gauge 5870 200 072



104

Determine Dimension II from the end face/output shaft to the upper plane surface of the circlip.

Dimension II e.g. 79,10 mm



105

Example "A" :

Dimension I	79,60 mm
Dimension II	- 79,10 mm
Difference = End play	= 0,50 mm

NOTE :

In case of deviations from the required end play, correct by means of a corresponding shim (2), see Figure 95 !

Press ball bearing against shoulder.



106



107

Heat housing bore and thread up output shaft until contact is obtained.



108

Fix ball bearing free of play by means of shim and circlip.

(S) Clamping pliers 5870 900 021



109

Install shaft seal with the sealing lip facing the oil chamber.

NOTE :

The exact installation position is obtained by application of the prescribed driver !
If the outer diameter of the shaft seal is rubberized, wet the sealing surface with spirit !
If not, use sealing compound (Curil T) !
Grease sealing lip !

(S) Driver 5870 048 067



110

The Figure on the left shows a Version with two shaft seals (Version with fording ability)

Installation position : Sealing lip of inner shaft seal is facing the oil chamber. Sealing lip of outer shaft seal is showing outwards.
The installation depth is given by application of the prescribed driver !

NOTE :

Fill space between upper and lower sealing lip with grease !

(S) Driver 5870 048 067

Install the two closing covers.

NOTE :

Wet sealing surfaces with Loctite (Type-No. 270) !

(S) Driver	5870 057 015
(S) Handle	5870 260 002



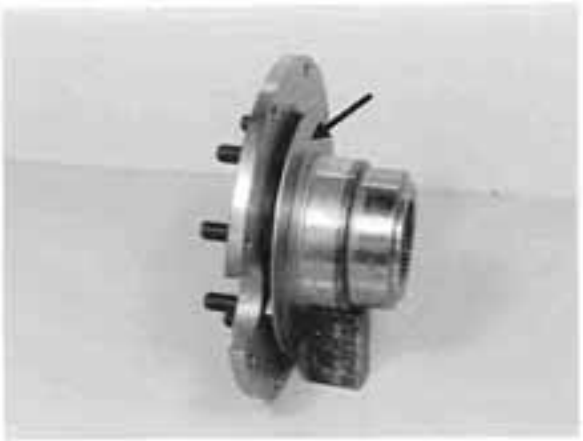
111

Install brake shoes and engage return springs.



112

Insert hex. head screws in the bores of the output flange and press retaining plate (Arrow) against shoulder.



113

Heat output flange and assemble it until contact is obtained.



114



115

Fasten output flange by means of disk and hex. head screws.

NOTE :

Wet the contact surface of disk and screw heads with sealing compound !

Torque limit (M10/8.8) 46 Nm



116

Fix hex. head screws by means of lock plate

(S) Driver 5870 057 009
(S) Handle 5870 260 002



117

Assemble brake drum and fasten it by means of hex. head screws (mount flat washers).

Torque limit (M10/10.9) 68 Nm

(S) Adjusting screws (M10) 5870 204 007



118

Tilt gear case 180°.
Install shaft seal (Arrow) with the sealing lip facing the oil chamber.

NOTE :

The exact installation position is obtained by application of the prescribed driver !
If the outer diameter of the shaft seal is rubberized, wet the sealing surface with spirit !
If not, use sealing compound (Curil T) !
Grease sealing lip !

(S) Driver 5870 048 067

Figure 119 shows a Version with 2 shaft seals (Version with fording ability).
Installation position : Sealing lip of inner shaft seal is facing the oil chamber !
Sealing lip of outer shaft seal is showing outwards.
The installation depth is obtained by application of the prescribed driver !

NOTE :

Fill space of upper and lower sealing lip with grease !

(S) Driver 5870 048 067

Insert hex. head screws in the bores, heat the output flange and assemble it until contact is obtained.



119



120

Fasten output flange by means of disk and hex. head screws.

NOTE :

Wet contact areas of disk and screw heads with sealing compound !

Torque limit (M10/8.8) 46 Nm



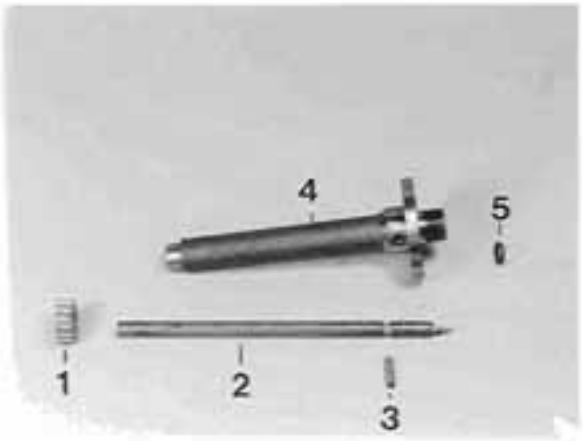
121

Fix hex. head screws by means of lock plate.

(S) Driver 5870 057 009
(S) Handle 5870 260 002



122



123

3.2.2 Speedometer

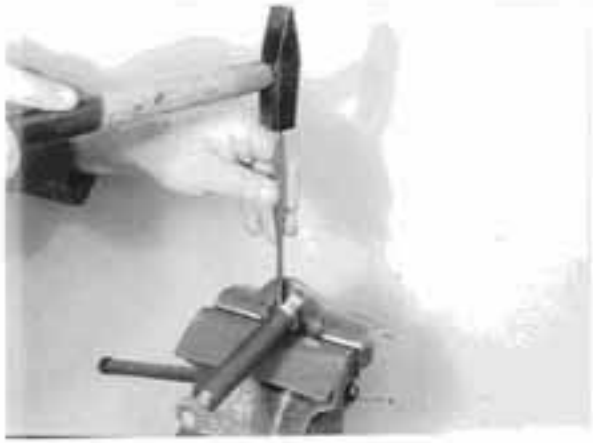
The Illustration on the left shows the components.

1 = Speedometer-drive gear
2 = Speedometer-drive shaft
3 = Straight pin
4 = Speedometer connecting piece
5 = Shaft seal



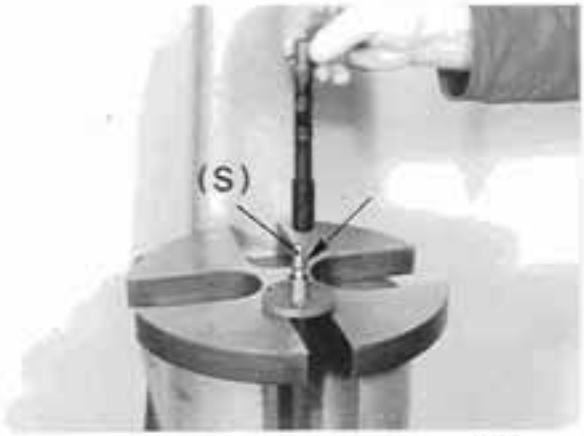
124

Press drive gear flat against the end face/ speedometer-drive shaft.



125

Introduce speedometer-drive shaft and fix it by means of straight pin.



126

Guide installer (S) over the speedometer-drive shaft and install shaft seal (Arrow) with the sealing lip facing the oil chamber.

(S) Driver 5870 048 072

Assemble flat gasket and fasten pre-assembled speedometer by means of hex. head screws.

Torque limit (M8/8.8) 23 Nm

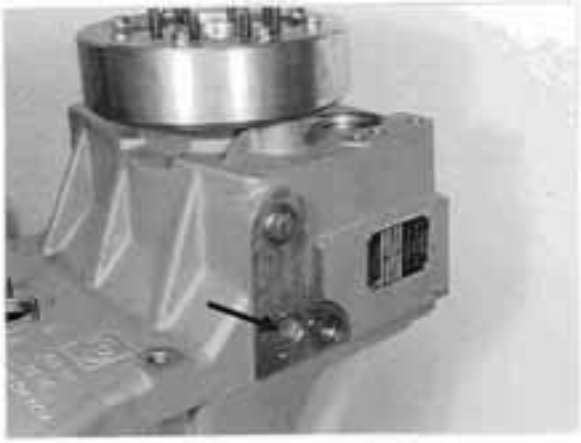


127

In case of the Version without speedometer, close the bore by means of cover (Arrow).

NOTE :

Wet sealing surfaces with Loctite (Type-No. 270) !



128

3.2.3 CLUTCH K4/K3

3.2.3.1 Pre-assemble plate carrier K4/K3

NOTE :

The following steps (Figure 132 ... 138) have to be carried out on both sides of the plate carrier !

Press needle bush carefully against shoulder, using drift (S).

NOTE :

The needle bush is marked on one end face. At the pressing in, the marking must be showing upwards (to the drift) !

(S) Drift 5870 506 055

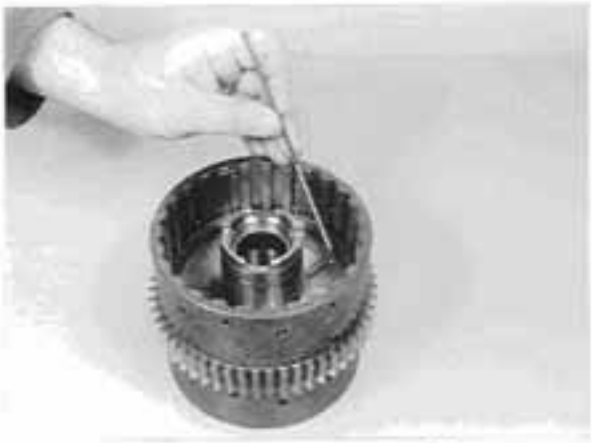
Check operation of the bleeder valves.

NOTE :

Ball may not stick, if necessary, clean it by means of compressed air or renew it !



132

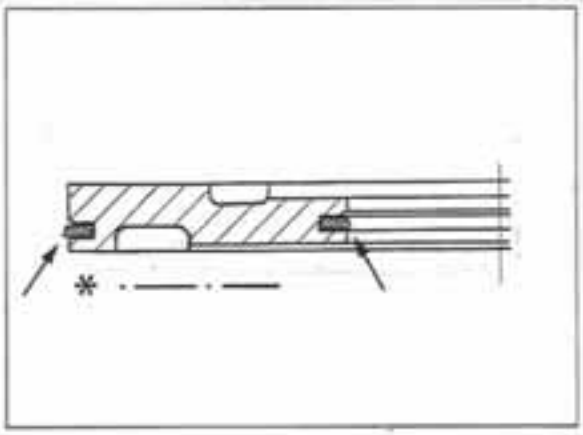


133

Insert the profiled sealing rings (Arrows) in the recesses of the piston with the sealing lip facing the pressure chamber.

NOTE :

* — . — . — = Pressure side !



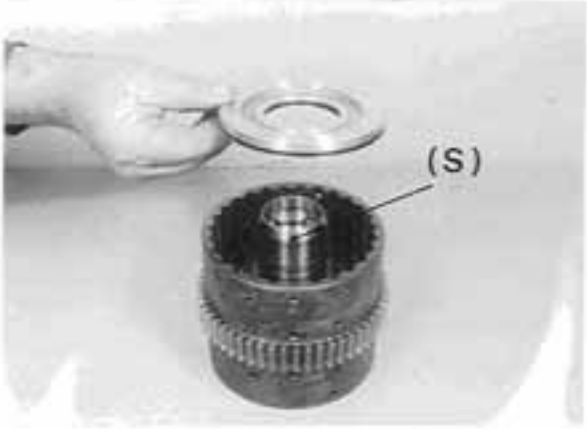
134

Oil profiled sealing rings and insert piston until contact is obtained.

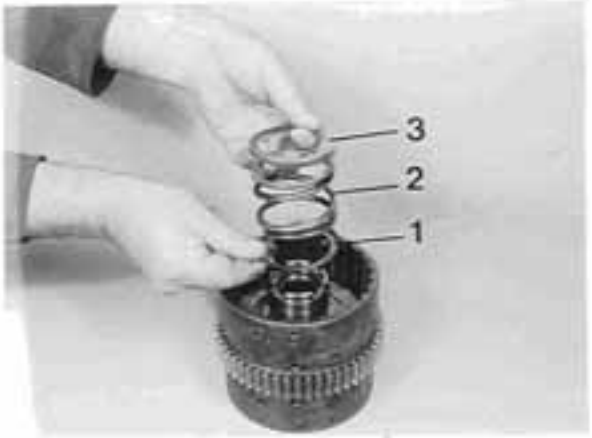
NOTE :

Use installer (S) !

(S) Installer 5870 651 023



135



136

Assemble lower spring guide (1), compression spring (2) and upper spring guide (3).



137

Mount guide ring (4) and circlip (5) (Figure 137), preload compression spring and fix the components by means of circlip (Figure 138).

Assembly jig 5870 345 028



138

PLATE INSTALLATION

I. Determine Plate installation-No. (Page 3.35)

II. Table for plate installation (Page 3.36 ... 3.36c)

III. Example with Draft (Page 3.36d)

Ref. I: Determine Plate installations-No. with the aid of the corresponding Spare Parts List.
The following List shows the abstract from a Spare Parts List.

A = Transmission Parts List
B = Group 151, Clutch KV/K1
C = Assembly Note - Plate installation
D = Plate installation-No.

Gruppe 4644 151 Kupplung
Group Coupling
Groupe B Embrayage

Stückzahl nach Ausführung / Quantity per model / Nombre par modele

A

Bild No. Fig.No. Fig.No.	Teilnummer Partnumber No. de pièce	Benennung	Description	Désignation	Änderung Modification Modification	alle all tous	4644 024 077						
		Lamelleneinbau Nr. 40	**Assembling of I. and**	**Installation des**									
360	0750 116 100	Kugellager	Ball Bearing	Roule.A. Billes			1						
390	4644 251 037	Lamellenträger	Disc Carrier	Porte Disques			1						
		Kupplung KV	**Coupling KV**	**Embrayage**									
420	0501 309 541	Außenlamelle	O.Clutch Disc	Disque ext.			8						
434	4644 308 330	Innenlamelle s = 2,5	I.Clutch Disk	Disque int.			7						
436		Außenlamelle wahlweise	O.Clutch Disc	Disque ext.									
	4644 308 014	s = 2,0					1						
	4644 308 115	s = 1,5					1						
		Kupplung K1	**Coupling K1**	**Embrayage K1**									
440	0501 309 541	Außenlamelle	O.Clutch Disc	Disque ext.			7						
442	0501 312 283	Außenlamelle	O.Clutch Disc	Disque ext.			1						
450	4644 308 329	Innenlamelle s = 2,0	I. Clutch Disc	Disque int.			3						
452	4644 308 330	Innenlamelle s = 2,5	I. Clutch Disc	Disque int.			3						
456		Innenlamelle wahlweise	I. Clutch Disc	Disque int.									
	4644 308 329	s = 2,0					1						
	4644 308 330	s = 2,5					1						
	C	**Montagehinweis** Lamelleneinbau	**Assembly Note** Assembling of I. and O.Clutch Discs	**Indication d'installation** Installation des Disques									
	D	KV-Nr. 12 K1-Nr. 22	KV-No. 12 K1-Nr. 22	KV-No. 12 K1-No. 22									

Attention:

The Transmission Parts List (see Model Identification Plate) must be identical with the corresponding Parts List of the Spare Parts List!
The Plate installations-No. can be found on the left Table margin of the following Pages (3.36a ... 3.36c)!

II. Table for Plate installation

Clutch KV and KR

		Type of plate	Quantity (n)	s (mm)	n s (mm)	ZF-No.
Plate installation-No. 10	WG-180/181 Loader Version	Outer plate	9	2,0	18	0501 309 330
		Inner plate	4	2,0	8	4644 308 329
		Inner plate	3	2,5	7,5	4644 308 330 *)
		Compensating plate (Inner plate)	1	2,0 or 2,5	2,0 or 2,5	4644 308 329 4644 308 330
		No. of friction surfaces	16			
		Plate clearance	2,2 ... 2,4			
Plate installation-No. 11	WG-200/201 Loader Version	Outer plate	12	2,0	24	0501 309 330
		Inner plate	9	2,0	18	4644 308 329
		Inner plate	1	2,5	2,5	4644 308 330 *)
		Compensating plate (Inner plate)	1	2,0 or 2,5	2,0 or 2,5	4644 308 329 4644 308 330
		No. of friction surfaces	22			
		Plate clearance	2,6 ... 2,8			
Plate installation-No. 12	WG-180 bis 201 Truck crane	Outer plate	8	2,0	16	0501 309 541
		Inner plate	7	2,5	17,5	4644 308 330
		Inner plate				
		Compensating plate (Outer plate)	1	1,5 or 2,0	1,5 or 2,0	4644 308 115***) 4644 308 014***)
		No. of friction surfaces	14			
		Plate clearance	2,2 ... 2,4			
Plate installation-No. 13	WG-180 bis 201 Truck crane without WK	Outer plate	8	2,0	16	0501 309 330
		Inner plate	7	2,5	17,5	4644 308 330
		Inner plate				
		Compensating plate (Outer plate)	1	1,5 or 2,0	1,5 or 2,0	4644 308 115***) 4644 308 014***)
		No. of friction surfaces	14			
		Plate clearance	2,2 ... 2,4			
Plate installation-No. 14	WG-200/201 Loader Version	Outer plate	10	2,0	20	0501 309 330
		Inner plate	8	3,0	24	4644 308 365
		Inner plate				
		Compensating plate (Inner plate)	1	2,0 or 2,5 or 3,0	2,0 or 2,5 or 3,0	4644 308 329 4644 308 330 4644 308 365
		No. of friction surfaces	18			
		Plate clearance	2,6 ... 2,8			
Plate installation 15	WG-200 Graphite plate Loader Version	Outer plate	10	2,0	20	0501 314 311
		Inner plate	8	3,0	24	0501 314 391
		Inner plate				
		Compensating plate (Inner plate	1	2,0 or 2,5 or 3,0	2,0 or 2,5 or 3,0	0501 314 389 0501 314 388 0501 314 391
		No. of friction surfaces	18			
		Plate clearance	2,6 ... 2,8			

Clutch K1 and K2

		Type of plate	Quantity (n)	s (mm)	n s (mm)	ZF-No.
Plate installation-No. 20	Standard WG-180 bis 201	Outer plate	8	2,0	16	0501 309 330
		Inner plate	4	2,0	8	4644 308 329
		Inner plate	2	2,5	5	4644 308 330 *)
		Compensating plate	1	2,0	2,0	4644 308 329
		(Inner plate)		or 2,5	or 2,5	4644 308 330
		No. of friction surfaces			14	
		Plate clearance			2,2 ... 2,4	
Plate installation-No. 21	WK-Version WG-180 bis 201	Outer plate	8	2,0	16	0501 309 541
		Inner plate	4	2,0	8	4644 308 329
		Inner plate	2	2,5	5	4644 308 330 *)
		Compensating plate	1	2,0	2,0	4644 308 329
		(Inner plate)		or 2,5	or 2,5	4644 308 330
		No. of friction surfaces			14	
		Plate clearance			2,2 ... 2,4	
Plate installation-No. 22	WK-Vers. WG-180 to 200 GD-Shift control	Outer plate	7	2,0	14	0501 309 541
		Outer plate	1	2,0	2,0	0501 312 283 **)
		Inner plate	3	2,0	6	4644 308 329
		Inner plate	3	2,5	7,5	4644 308 330 *)
		Compensating plate	1	2,0	2,0	4644 308 329
		(Inner plate)		or 2,5	or 2,5	4644 308 330
		No. of friction surfaces			14	
		Plate clearance			2,2 ... 2,4	
Plate installation-No. 23	WG-200 Graphite plate Loader Version	Outer plate	8	2,0	16	0501 314 311
		Inner plate	4	2,0	8	0501 314 389
		Inner plate	2	2,5	5	0501 314 388
		Compensating plate	1	2,0	2,0	0501 314 389
		(Inner plate)		or 2,5	or 2,5	0501 314 388
		No. of friction surfaces			14	
		Plate clearance			2,2 ... 2,4	

Clutch K3

		Type of plate	Quantity (n)	s (mm)	n s (mm)	ZF-No.
Plate installation-No. 30	Standard WG-180 to 201	Outer plate	10	2,0	20	0501 309 329
		Inner plate	1	1,5	1,5	4642 308 330
		Inner plate	6	2,0	12	4642 308 332
		Inner plate	1	2,5	2,5	4642 308 331*)
		Compensating plate		1,5	1,5	4642 308 330
		(Inner plate)	1	or 2,0	or 2,0	4642 308 332
				or 2,5	or 2,5	4642 308 331
		No. of friction surfaces		18		
		Plate clearance		2,2 ... 2,4		
Plate installation-No. 31	WG-180 to 201 GD-Shift control	Outer plate	10	2,0	20	0501 309 329
		Outer plate	1	2,0	2,0	0501 312 280**)
		Inner plate	8	1,5	12	4642 308 330
		Inner plate	1	2,5	2,5	4642 308 331
		Compensating plate		1,5	1,5	4642 308 330
		(Inner plate)	1	or 2,0	or 2,0	4642 308 332
				or 2,5	or 2,5	4642 308 331
		No. of friction surfaces			20	
		Plate clearance			2,2 ... 2,4	
Plate installation-No. 32	WG-200 Graphite plate Loaderversion	Outer plate	10	2,0	20	0501 314 310
		Inner plate	1	1,5	1,5	0501 314 387
		Inner plate	6	2,0	12	0501 314 385
		Inner plate	1	2,5	2,5	0501 314 386*)
		Compensating plate		1,5	1,5	0501 314 387
		(Inner plate)	1	or 2,0	or 2,0	0501 314 385
				or 2,5	or 2,5	0501 314 386
		No. of friction surfaces			18	
		Plate clearance			2,2 ... 2,4	

Clutch K4

		Type of plate	Quantity	s (mm)	n s (mm)	ZF-No.
Plate installation-No. 40	Standard WG-180 to 201	Outer plate	9	2,0	18	0501 309 329
		Inner plate	4	1,5	6	4642 308 330
		Inner plate	2	2,0	4	4642 308 332
		Inner plate	1	2,5	2,5	4642 308 331*)
		Compensating plate (Inner plate)	1	1,5 or 2,0 or 2,5	1,5 or 2,0 or 2,5	4642 308 330 4642 308 332 4642 308 331
		No. of friction surfaces	16			
		Plate clearance	2,2 ... 2,4			
Plate installation-No. 41	WG-200/201 Grader (Gear step)	Outer plate	9	2,0	18	0501 309 329
		Outer plate	1	2,0	2,0	0501 312 280**)
		Inner plate	7	2,0	14	4642 308 332
		Inner plate	1	2,5	2,5	4642 308 331*)
		Compensating plate (Inner plate)	1	1,5 or 2,0 or 2,5	1,5 or 2,0 or 2,5	4642 308 330 4642 308 332 4642 308 331
		No. of friction surfaces	18			
		Plate clearance	2,2 ... 2,4			
Plate installation-No. 42	WG-200 Graphite plate Loaderversion	Outer plate	9	2,0	18	0501 314 310
		Inner plate	4	1,5	6	0501 314 387
		Inner plate	2	2,0	4	0501 314 385
		Inner plate	1	2,5	2,5	0501 314 386*)
		Compensating plate (Inner plate)	1	1,5 or 2,0 or 2,5	1,5 or 2,0 or 2,5	0501 314 387 0501 314 385 0501 314 386
		No. of friction surfaces	16			
		Plate clearance	2,2 ... 2,4			

Note ref. *) — ***Install inner plate close to the piston.***

Note ref. **) — ***Outer plate one-sided coated -***
Install plate with the uncoated side facing the piston.

Note ref. ***) — ***Outer plate uncoated - install plate facing the piston.***
As second plate, a lining outer plate has to be installed.

Attention! — ***In case of plates with different thicknesses,***
the thinner plates must be always installed on the backing plate side!

III. EXAMPLE FOR PLATE INSTALLATION

The following Draft shows the plate installation of the Clutch KV and K1 !

Ref. Draft :

A = Clutch KV
(Plate installation-No. e.g. 12)

B = Clutch K1
(Plate installation-No. e.g. 22)

1 = Plate carrier

2 = Backing plate

3 = Piston

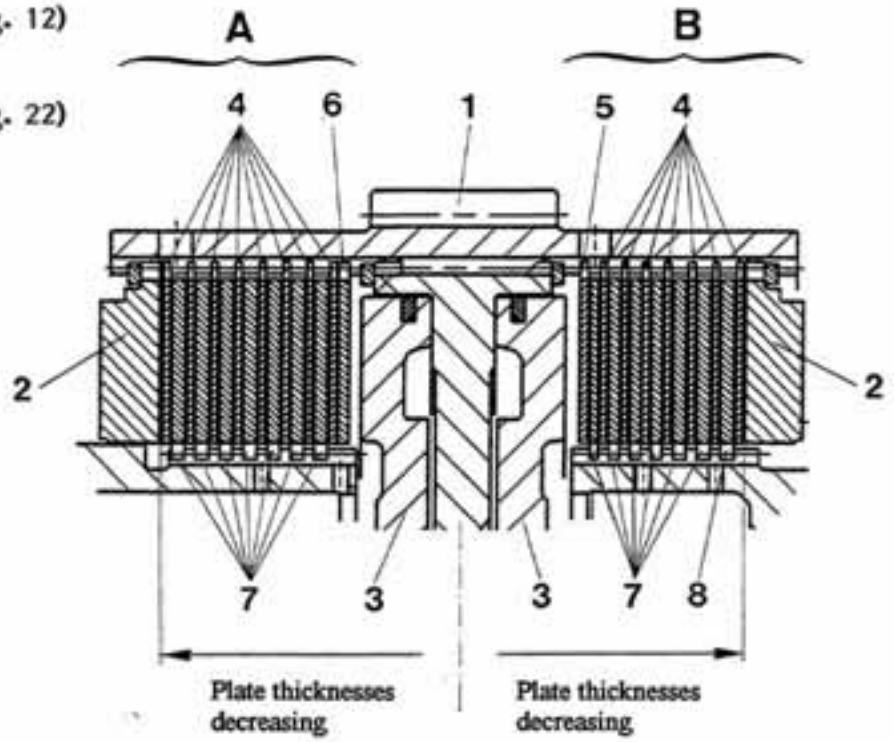
4 = Outer plates

5 = Outer plates
(one-sided coated)

6 = Compensating plate
(Outer plate uncoated)

7 = Inner plates

8 = Compensating plate
(Inner plate)



Attention :

In principle, the arrangement of the outer and inner plates has to be carried out alternately.
Starting with the piston side, the first plate must be one double-sided coated outer plate (Standard Version).

Exception "A" :

In case of Plate installation-No. 22, 31 and 41, the first plate must be one one-sided coated outer plate, and in this case, the plate must be always installed with the uncoated side facing the piston !

Exception "B" :

In case of Plate installation-No. 12 and 13, the first plate must be one double-sided uncoated outer plate (compensating plate).
As second plate, one coated outer plate has to be installed.
Now, pile up the inner and outer plates alternately again !

3.2.3.2 Install plate pack K4

Install plate pack and replace backing plate.

NOTE :

Plate arrangement, see
Plate installation, Page 3.35 ... 3.36 d !



139

Fix plate pack by means of snap ring.



140

Check plate clearance (Figure 141 to Example "B")

NOTE :

The plate clearance of the different clutches can be taken from the Table, Page 336 a ... 3.36 c !
In case of Plate installation-No. 40, e.g. = 2,0 ... 2,4 mm !

Measure Dimension I from the end face of the plate carrier to the backing plate.

Dimension I e.g. 5,3 mm



141

Place backing plate against snap ring until contact is obtained (upwards), and determine Dimension II.

Dimension II e.g. 3,2 mm



142

Example "B" :

Dimension I	5,3 mm
Dimension II	- 3,2 mm
Difference = Plate clearance	2,1 mm

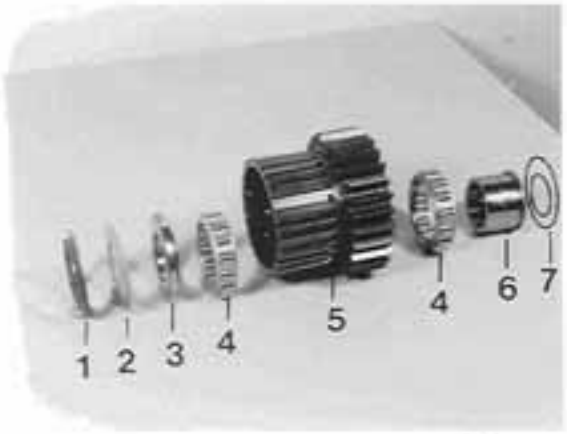
NOTE :

In case of deviations from the required plate clearance, correct by means of corresponding compensating plates.
The pre-assembly of the remaining clutches (K3, KV/K1 and KR/K2) has to be carried out accordingly.

3.2.3.3 Pre-assemble and install spur gear K4

ATTENTION :

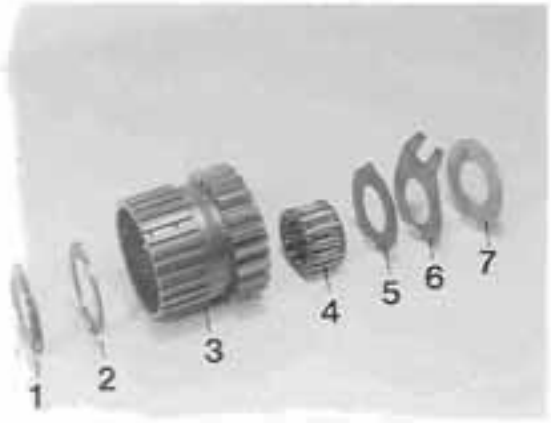
According to the Transmission Version, resp. operating conditions, different spur gear bearings are possible, see corresponding Spare Parts List as well as Figures 143 and 144 !



143

Spur gear K4, Version "A" (Figure 143)

1 = Thrust plate
2 = Thrust washer
3 = Collar shim
4 = Roller cage (2x)
5 = Spur gear
6 = Bearing inner race
7 = Shim



144

Spur gear K4, Version "B" (Figure 144)

1 = Thrust plate
2 = Thrust washer
3 = Spur gear
4 = Needle cage
5 = Thrust washer
6 = Thrust washer
7 = Compensating plate (optional)



145

Install components 2 ... 6 (Figure 143), resp. 2 ... 4 (Figure 144), replace thrust plate (1) and introduce spur gear until all inner plates are received.

NOTE :

Make thrust plate (2) adhere with grease !

3.2.3.4 Install plate pack K3

Install plate pack and check clearance.

NOTE :

Plate arrangement, see plate installation, Page 3.35 ... 3.36 d !



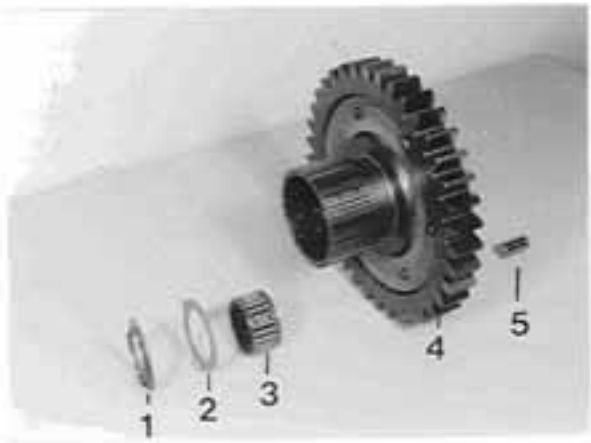
146

3.2.3.5 Pre-assemble and install spur gear K3

1 = Thrust plate
2 = Thrust washer
3 = Needle cage
4 = Spur gear
5 = Cylindrical rollers

NOTE :

Exchange cylindrical rollers 5 in sets only !



147 a

Install components 2 ... 5, replace thrust plate 1 (Arrow) and introduce spur gear until all inner plates are received.

NOTE :

Make thrust washer 2 and cylindrical rollers 5 adhere with grease.



147 b

3.2.3.6 Install clutch K4/K3

Adjust end play of clutch 0,1 ... 0,3 mm (Figure 148 to Example "E")

Determine Dimension I from the flange-mounted surface/axle to the plane surface/housing (Arrow).

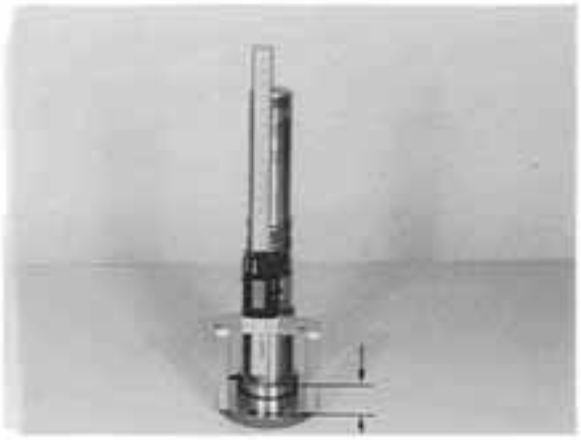
Dimension I e.g. 251,15 mm

NOTE :

In case of spur gear bearing K4, Version "B" (Figure 144), lay forked washer and thrust washer upon the plane surface of the housing and measure up to the thrust washer.



148



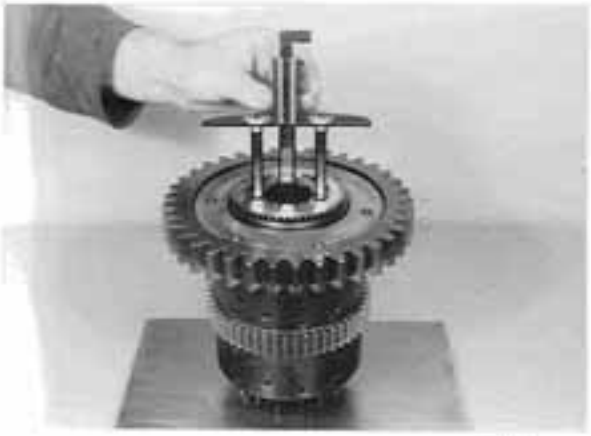
149

Measure Dimension II from the butting face /bearing rollers to the flange-mounted surface.

Dimension II e.g.	21,00 mm

Example "C", for the determination of the housing dimension

Dimension I e.g.	251,15 mm
Dimension II e.g.	- 21,00 mm
Difference = Housing dimension e.g.	230,15 mm



150

Place clutch on a suitable surface plate and determine Dimension III from the end face/ cylindrical rollers to the surface plate.

Dimension III e.g.	227,20 mm

Example "D", for the determination of the installation dimension

Dimension III e.g.	227,20 mm
End play e.g.	+ 0,20 mm
gives installation dimension - Clutch	227,40 mm

Example "E", for the determination of the shim

Housing dimension e.g.	230,15 mm
Installation dimension - Clutch	- 227,40 mm
Difference = Shim e.g.	2,75 mm



151

Insert clutch K4/KR by means of lifting device into the housing and position it.

(S) Lifting device	5870 350 041

Align clutch by means of drift and fix it provisionally.

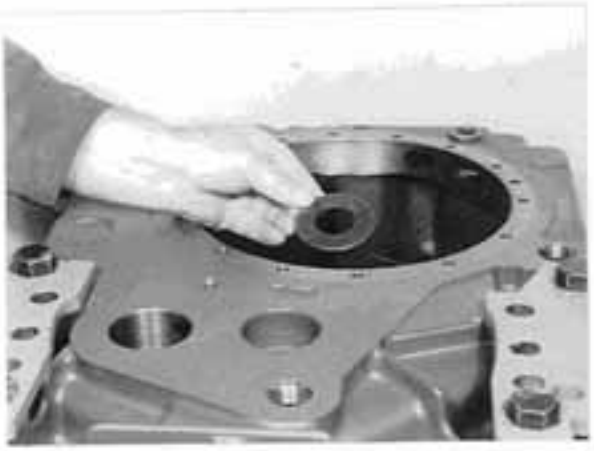
(S) Drift 5870 345 025



152

For the moment, tilt gear case 90° and push the compl. clutch opposite to the drive side against shoulder until contact is obtained.
Now, tilt gear case forward in the horizontal position.

Pull drift downwards until the shim (e.g. s = 2,75 mm, see Example "E") can be installed. Now, align the complete clutch as well as the shim by means of drift again and fix it.



153

NOTE :

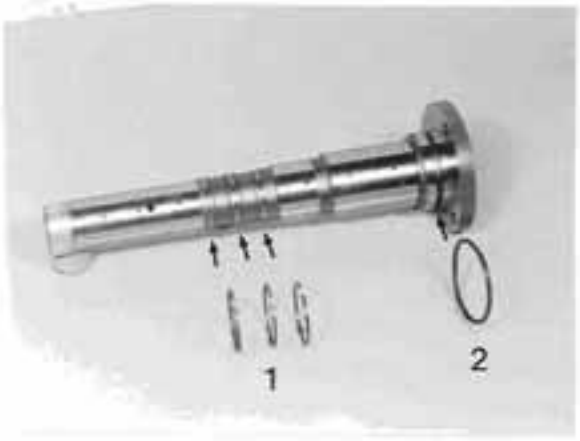
In case of spur gear bearing K4, Version "A", without forked washer and thrust washer (Figure 153) !

In case of spur gear bearing K4, Version "B", another forked washer as well as one thrust washer have to be installed in addition to the shim.

ATTENTION :

Pay attention to the radial installation position of the forked washer !

Now, tilt gear case back in the original position (180°).



155

Squeeze in and engage rectangular rings (1). Install O-Ring (2).

NOTE :

Grease and align rectangular rings centrically.

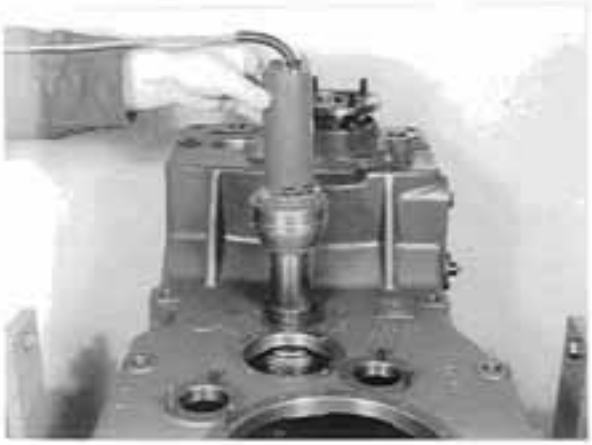


156

Install stud bolts, see Arrows !

NOTE :

Secure the stud bolts with Loctite (Type-No. 270) !



157

Heat housing bores (about 90° C).

(S)	Hot-air blower	220 V	5870 221 500
(S)	Hot-air blower	110 V	5870 221 501



158

Thread up axle (compl.) until contact is obtained.

Fasten axle by means of hex. nuts.

Torque limit (M8/ 8.8) 23 Nm



159

Check end play of the clutch 0,1 ... 0,3 mm again and correct if necessary.

(S)	Magnetic base	5870 200 055
(S)	Dial indicator	5870 200 057
(S)	Crow bar	5870 345 071



160

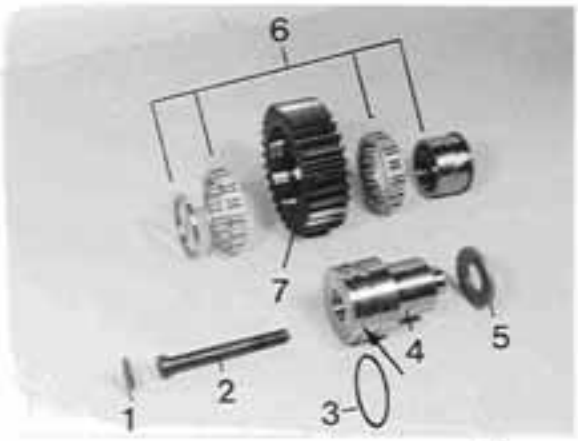
Check operation of the clutches K4 and K3 by means of compressed air.

NOTE :

If the components are correctly installed, the closing, resp. opening of the clutches is clearly audible !



161



162



163



164



165

3.2.4 Pre-assemble and install countershaft assembly

The Illustration on the left shows the components.

1 = Closing cover
2 = Socket head screw
3 = O-Ring (installation position, see Arrow)
4 = Axle
5 = Shim
6 = Roller bearing
7 = Spur gear

NOTE :

The countershaft gear is marked on the end face. In the installed condition, the marking must be facing the drive side (upwards).

Insert shim and pre-assembled spur gear (Figure 163).

NOTE :

Pay attention to the installation position of the collar shim (Arrow) - radius on the inner diameter must show upwards !

Heat bearing bores and bearing inner race (about 90° C).

(S)	Hot-air blower	220 V	5870 221 500
(S)	Hot-air blower	110 V	5870 221 501

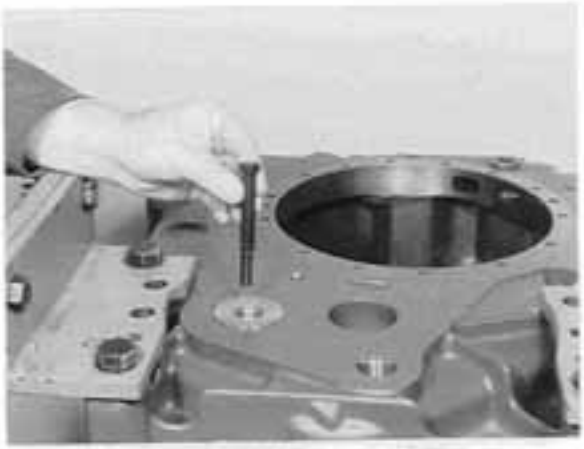
Insert axle until contact is obtained.

Fix the axle by means of socket head screw.

Torque limit (M12/10.9, DIN 7984) 80 Nm

NOTE :

Secure socket head screw with Loctite (Type-No. 242).

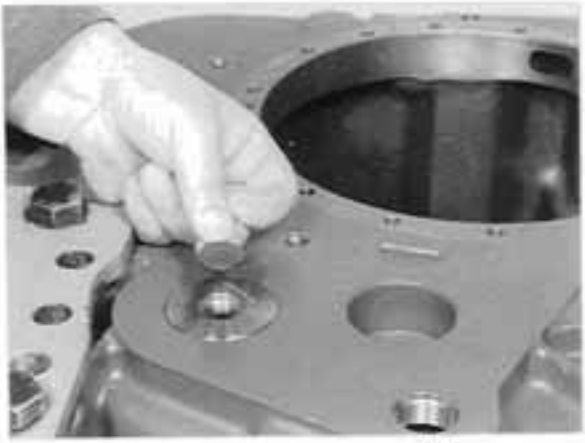


166

Install closing cover.

NOTE :

Wet contact areas with Loctite (Type-No.270).

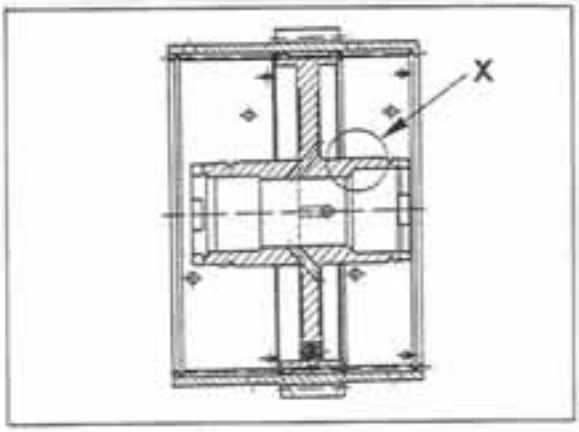


167

3.2.5 Clutch KR/K2

NOTE :

The pre-assembly of the plate carrier KR/K2 has to be carried out accordingly like that of the plate carrier K4/K3, see Page 3.33 and 3.34 !



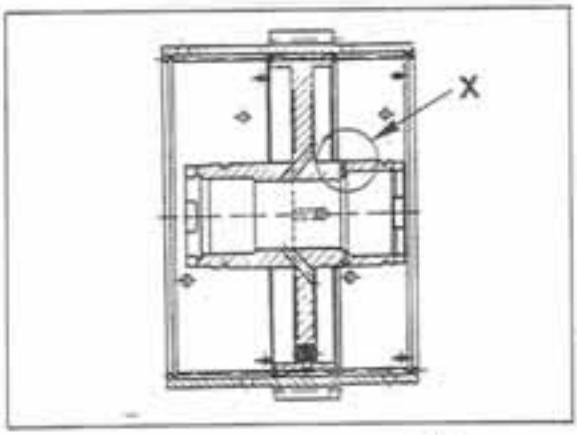
168

ATTENTION :

Pay attention to the different plate carriers !

Plate carrier KR/K2 in the zone X without oil hole (Figure 168).

Plate carrier KV/K1 in the zone X, with oil hole (Figure 169).



169



170

3.2.5.1 Plate pack KR

Install plate pack and check clearance.

NOTE :

Plate arrangement, see
Plate installation, Page 3.35 ... 3.36 d !

3.2.5.2 Pre-assemble and install spur gear KR

NOTE :

According to the Transmission Version, resp. operating conditions, different spur gear bearings are possible, see corresponding Spare Parts List, as well as Fig. 171, 172 a and 172 b !



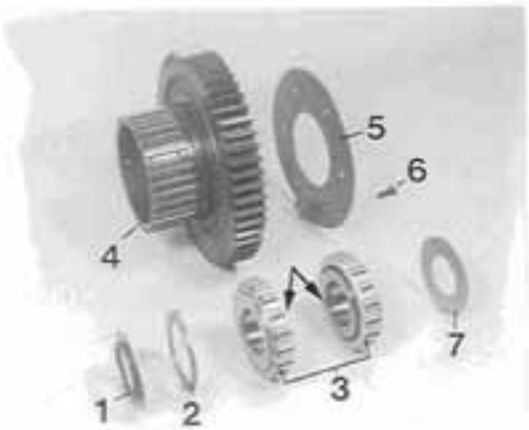
171

Spur gear bearing KR, Version "A" Fig. 171

1 = Thrust plate
2 = Thrust washer
3 = Needle cage
4 = Spur gear
5 = Plate
6 = Hex. head screws
7 = Thrust washer
8 = Forked washer
9 = Shim (optional)

NOTE :

Secure hex. head screws (M6/8.8 = 9,5 Nm) with Loctite (Type-No. 270) !



172 a

Spur gear bearing KR, Version "B" Fig. 172a

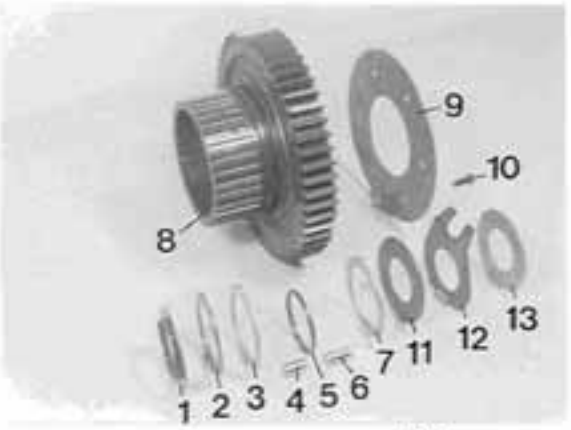
1 = Thrust plate
2 = Thrust washer
3 = Roller bearing (compl.)
4 = Spur gear
5 = Plate
6 = Hex. head screw
7 = Shim (optional)

NOTE :

Secure hex. head screws (M6/8.8 = 9,5 Nm) with Loctite (Type-No. 270) !
Pay attention to the installation position of the bearing inner races (oil grooves), see Arrows !

Spur gear bearing KR, Version "C" Fig. 172 b)

1 = Thrust plate
2 = Thrust washer
3 = Thrust washer
4 = Cylindrical rollers (short)
5 = Disk
6 = Cylindrical rollers (long)
7 = Thrust washer
8 = Spur gear
9 = Plate
10 = Hex. head screws
11 = Thrust washer
12 = Forked washer
13 = Shim (optional)

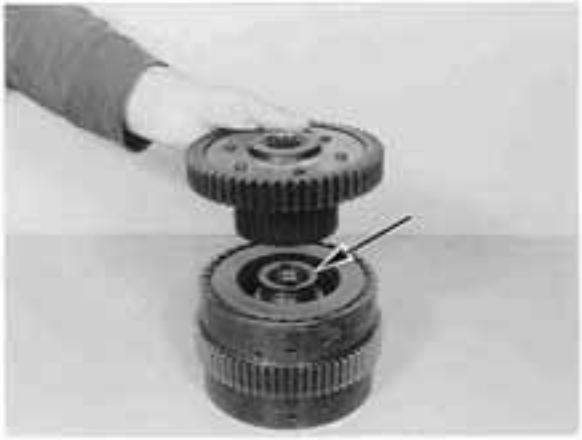


172 b

NOTE :

Secure hex. head screws (M6/8.8 = 9,5 Nm) with Loctite (Type-No. 270) !

Install components 2 ... 6 (Fig. 171 and 172 a) resp. 2 ... 10 (Fig. 172 b).
Replace thrust plate 1 (Arrow) and thread up spur gear until all inner plates are received.



173

NOTE :

Make thrust washers and cylindrical rollers adhere with grease !

3.2.5.3 Plate pack K2

Install plate pack and check clearance.

NOTE :

Plate arrangement, see
Plate installation, Page 3.35 ... 3.36 d !

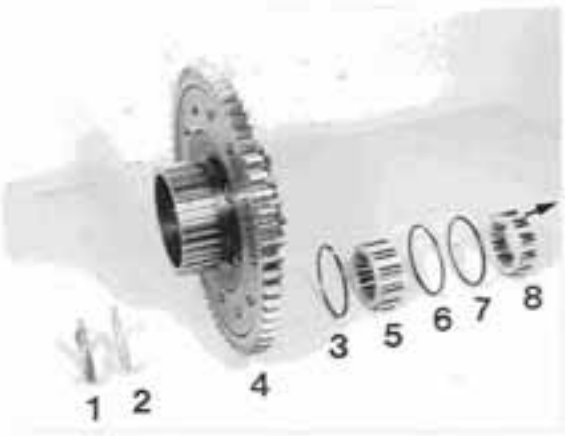


174

3.2.5.4 Pre-assemble and install spur gear K2

NOTE :

According to the Transmission Version, resp. operating conditions, different spur gear bearings are possible, see corresponding Spare Parts List as well as the following Figures (175 and 176) !



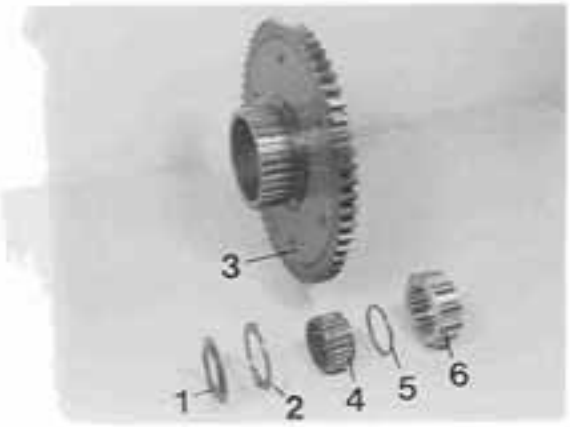
175

Spur gear bearing K2, Version "A" Fig. 175

1 = Thrust plate
2 = Thrust washer
3 = Angle ring
4 = Spur gear
5 = Roller cage (long)
6 = Angle ring
7 = Angle ring
8 = Roller cage (short)

NOTE :

Pay attention to the installation position of the roller cage (8), the larger inner diameter of the brass cage is showing outwards (Arrow) !
The broad butting faces of the angle rings are always facing the bearing rollers !
Make thrust washer (2) adhere with grease !



176

Spur gear bearing K2, Version "B" Fig. 176

1 = Thrust plate
2 = Thrust washer
3 = Spur gear
4 = Needle cage
5 = Ring
6 = Roller cage

NOTE :

Pay attention to the installation position of the roller cage (5), the larger inner diameter of the brass cage is showing outwards (Arrow) !
In case of an equal inner diameter, the installation position is optional.
Make thrust washer adhere with grease !

Install components 2 ... 8 (Figure 175), resp. 2 ... 6 (Figure 176).
Replace thrust plate 1 (Arrow) and thread up spur gear until all inner plates are received.

NOTE :

Make thrust washer adhere with grease !



177

3.2.5.5 Install clutch KR/K2

Adjust end play of the clutch 0,1 ... 0,3 mm (Figure 178 ... Example "H")

Insert forked washer and thrust washer (Arrow) and measure Dimension I from the flange-mounted surface to the thrust washer.

Dimension I e.g. 252,20 mm

Now, remove forked washer and thrust washer again.

NOTE :

In case of spur gear bearing KR, Version "B" (Figure 172 a), measure up to the plane surface/housing (without forked washer and thrust washer) !



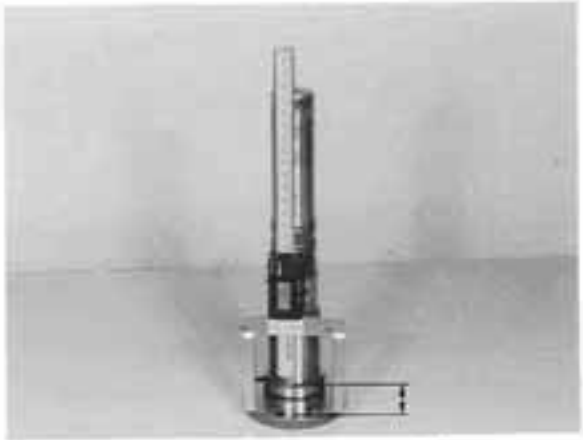
178

Measure Dimension II from the butting face/ bearing rollers to the flange-mounted surface.

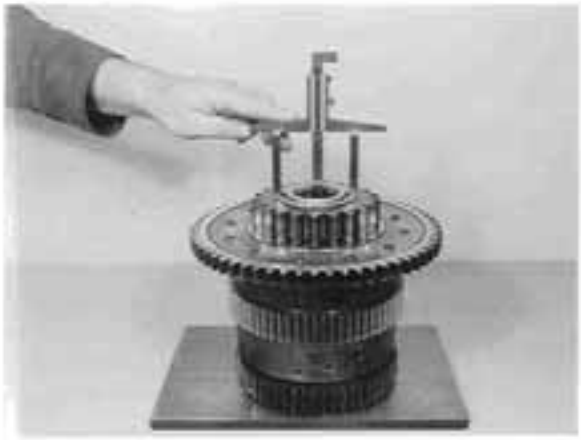
Dimension II e.g. 22,55 mm

Example "F" for the determination of the housing dimension

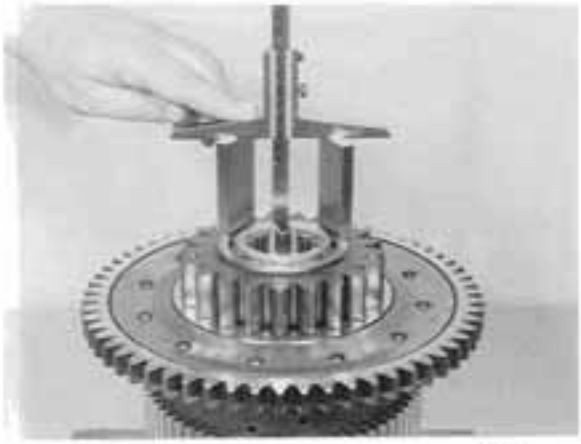
Dimension I e.g.	252,20 mm
Dimension II e.g.	- 22,55 mm
Difference = Housing dimension e.g.	229,65 mm



179



180



181

Put the clutch on a suitable surface plate and determine Dimension III from the end face/cylindrical rollers to the surface plate, see Figures 180 and 181 !

Dimension III e.g. 227,65 mm

Example "G" for the determination of the installation dimension

Dimension III e.g.	227,65 mm
End play e.g.	+ 0,20 mm
gives Installation Dimension	
- Clutch e.g.	227,85 mm

Example "H" for the determination of the shim

Housing dimension e.g.	229,65 mm
Installation dimension	
- Clutch e.g.	- 227,85 mm
Difference = Shim e.g.	s = 1,80 mm



182

Insert clutch KR/K2 in the housing, using lifting device.

NOTE :

The installation of the shims and the fixing of the clutch has to be done along with the clutch KV/K1 !

(S) Lifting device 5870 350 041

3.2.6 Clutch KV/K1

NOTE :

The pre-assembly of the plate carrier KV/K1 has to be carried out accordingly like that of the plate carrier K4/K3, see Page 3.33 and 3.34.

ATTENTION :

Pay attention to the different plate carriers, see Figure 168 and 169 !

3.2.6.1 Plate pack KV

Install plate pack and check clearance.

NOTE :

Plate arrangement, see
Plate installation, Page 3.35 ... 3.36 d !

3.2.6.2 Pre-assemble and install spur gear KV

NOTE :

According to the Transmission Version, resp. operating conditions, different spur gear bearings are possible, see corresponding Spare Parts List as well as Figures 184 and 185 !

Spur gear bearing KV, Version "A" (Fig. 184)

1 = Thrust plate
2 = Thrust washer
3 = Roller bearing
4 = Spur gear
5 = Plate
6 = Hex. head screws (M6/8.8 = 9,5 Nm)
7 = Shim (optional)

NOTE :

Secure hex. head screws (5) with Loctite (Type-No. 270) ! Pay attention to the installation position of the bearing inner races (oil grooves), see Arrows !

Spur gear bearing KV, Version "B" (Fig. 185)

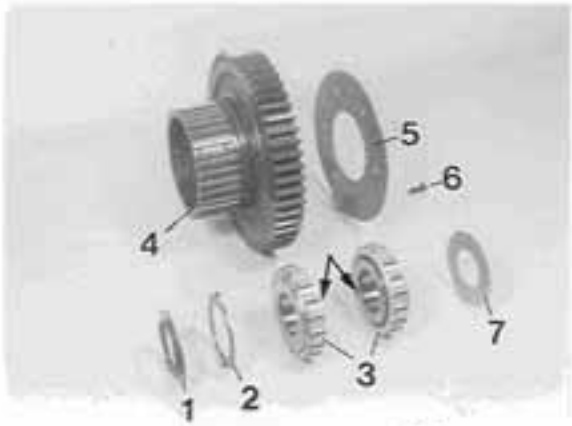
1 = Thrust plate
2 = Disk
3 = Thrust washer
4 = Cylindrical rollers (short)
5 = Disk
6 = Cylindrical rollers (long)
7 = Thrust washer
8 = Spur gear
9 = Plate
10 = Hex.head screws (M6/8.8= 9,5 Nm
11 = Thrust washer
12 = Forked washer
13 = Shim (optional)

NOTE :

Secure hex. head screws (10) with Loctite (Type-No. 270) !
Install long cylindrical rollers (according to the Version) on the converter side !



183



184



185



186

Install components 2 ... 6 (Figure 184), resp. 2 ... 10 (Figure 185).
Replace thrust plate 1 and thread up spur gear until all inner plates are received.

NOTE :

Make thrust washers as well as cylindrical rollers adhere with grease.



187

3.2.6.3 Plate pack K1

Install plate pack and check clearance.

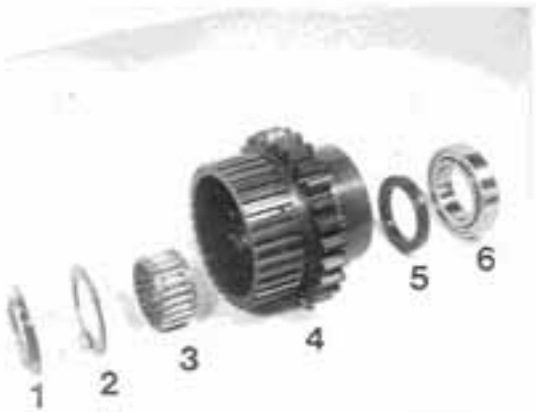
NOTE :

Plate arrangement, see
Plate installation, Page 3.35 ... 3.36 d !

3.2.6.4 Pre-assemble and install spur gear K1

NOTE :

According to the Transmission Version, resp. operating conditions, different spur gear bearings are possible, see corresonding Spare Parts List as well as the following Figures (188 ... 190) !



188

Spur gear bearing K1, Version "A" Fig. 188

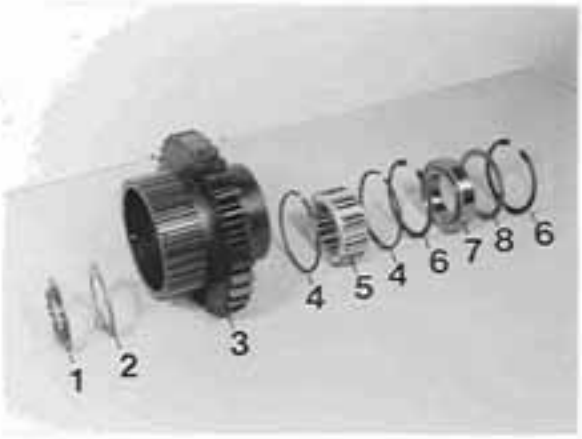
1 = Thrust plate
2 = Thrust washer
3 = Needle cage
4 = Spur gear
5 = Sleeve
6 = Ball bearing

Spur gear bearing K1, Version "B" Fig. 189

1 = Thrust plate
2 = Thrust washer
3 = Spur gear
4 = Angle ring
5 = Roller cage
6 = Circlip (2x)
7 = Ball bearing
8 = Disk (optional)

NOTE :

Make thrust washer (2) adhere with grease. Install broad butting faces of angle rings (4) always facing the bearing rollers. Adjust ball bearing (7) free of play by means of disk !



189

Spur gear bearing K1, Version "C" (K1-Fixing, Figure 190 and 191)

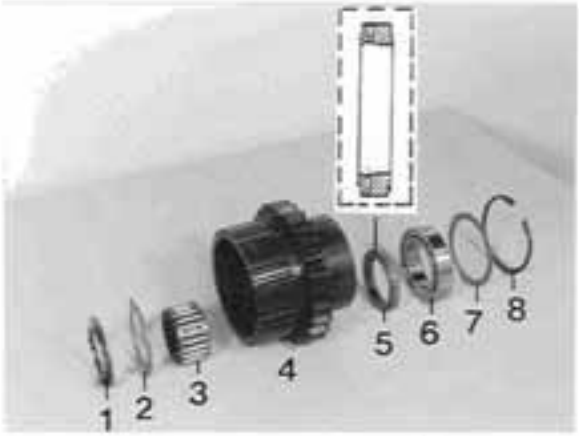
1 = Thrust plate
2 = Thrust washer
3 = Needle cage
4 = Spur gear
5 = Sleeve
6 = Ball bearing
7 = Disk (optional)
8 = Circlip

NOTE :

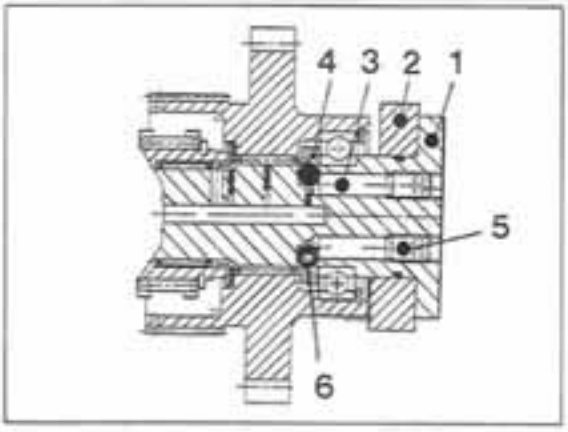
Make thrust washer adhere with grease. Pay attention to the installation position of the sleeve, Figure 190 !
Adjust ball bearing (6) free of play by means of disk !

Figure 191 shows the fixing of the spur gear after the installation of the clutch.

1 = Clutch shaft
2 = Housing
3 = Cylindrical roller
4 = Sleeve
5 = Set screw
6 = Ball



190



191



192

Install components according to Figure 188, 189, resp. 190.
Replace thrust plate (1) and thread up spur gear until all inner plates are received.



193

3.2.6.5 Install clutch KV/K1

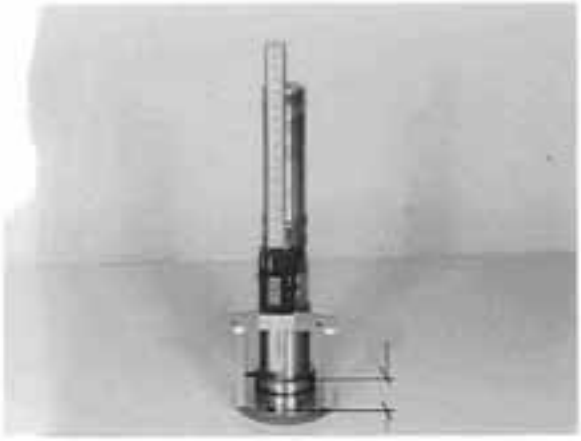
Adjust end play of clutch 0,1 ... 0,3 mm

Determine Dimension I from the flange-mounted surface/axle to the plane surface/ housing.

Dimension I e.g. 254,40 mm

NOTE :

In case of spur gear bearing KV, Version "B" (Figure 185), lay forked washer and thrust washer upon the plane surface of the housing and measure up to the thrust washer.



194

Measure Dimension II from the butting face /bearing rollers to the flange-mounted surface.

Dimension II e.g. 27,00 mm

Example "J", for the determination of the housing dimension

Dimension I e.g.	254,40 mm
Dimension II e.g.	- 27,00 mm
Difference = Housing dimension e.g.	227,40 mm

Place clutch on a suitable surface plate and determine Dimension III from the end face of the bearing inner race to the surface plate.

Dimension III e.g.	223,80 mm

Example "K", for the determination of the installation dimension

Dimension III e.g.	223,80 mm
End play e.g.	+ 0,20 mm
gives Installation dimension - Clutch	224,00 mm

Example "L", for the determination of the shim

Housing dimension e.g.	227,40 mm
Installation dimension - Clutch e.g.	- 224,00 mm
Difference = Shim e.g.	s = 3,40 mm



195

Insert clutch KV/K1 by means of lifting device in the housing and position it.

ATTENTION :

For different Transmission variants, the output gear of the lateral power take-off must be installed prior to the installation of the clutch axles KV/K1 and KR/K2 (narrow installation space).
If necessary, handle steps of Figure 216 ... 219 first.



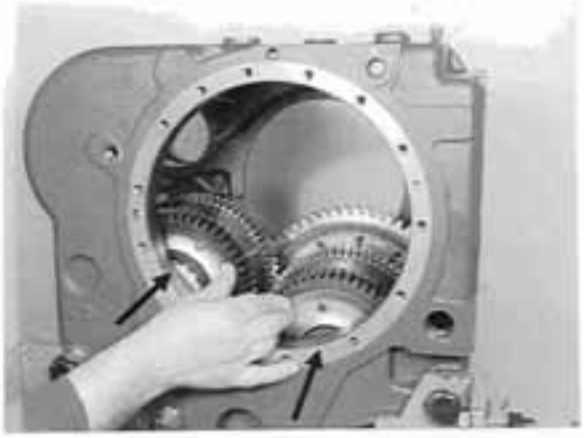
196

Align the two clutches (KV/K1 and KR/K2) by means of drift and fix them provisionally.

(S) Montagedorn 5870 345 025



197



198

Install thrust washer, forked washer and shim, resp. shim (according to the Version) (Figure 198 ... 201)

For the moment, tilt housing 90° and place the complete clutches in direction of Arrow against shoulder.
Now, tilt gear case forward in the horizontal position.



199

Pull drift downwards until the thrust washer, forked washer and shim (Figure 199), resp. the shim (Figure 200) can be installed.
Now, align the complete clutch as well as the shims again, using drift, and fix them.

NOTE :

Shim thickness for KV/K1 and KR/K2, see corresponding Examples !
Install thrust washer (plastic) facing the spur gear !
Pay attention to a correct fixing of the forked washer !



200



201

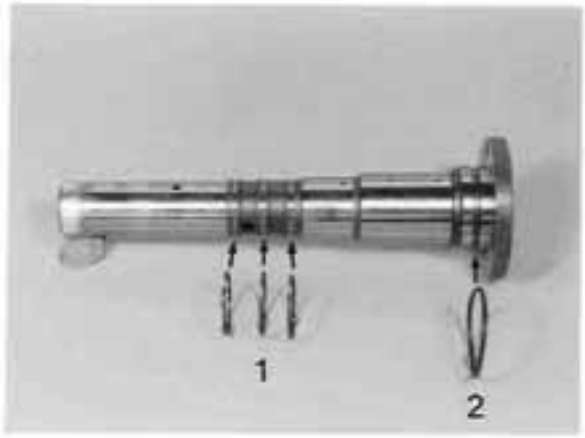
Tilt gear case in a vertical position (90°) and place the complete clutches in direction of Arrow against shoulder.
Now, tilt forward in the original position (Figure 197).

Install axle KR/K2 (Figure 202 ... 205)

Squeeze in rectangular rings (1) and engage them.
Install O-Ring (2).

NOTE :

Grease rectangular rings and align them centrically !



202

Heat housing bore (about 90° C).

(S)	Hot-air blower	220 V	5870 221 500
(S)	Hot-air blower	110 V	5870 221 501


203

Thread up axle (compl.) until contact is obtained.


204

Fasten axle by means of hex. nuts.

Torque limit (M8/ 8) 23 Nm


205



206

Check operation of clutches KR and K2 by means of compressed air.

NOTE :

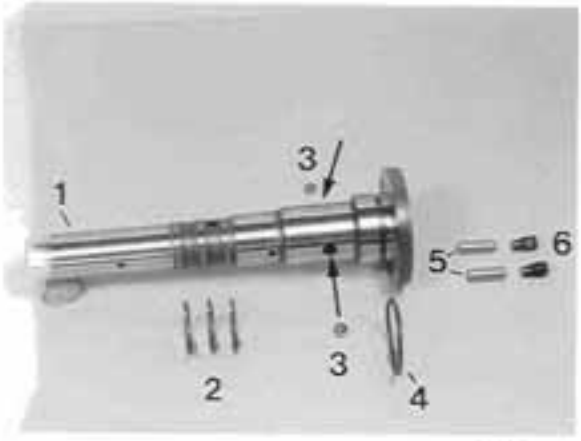
If the components are correctly installed, the closing, resp. opening of the clutches is clearly audible !

Install axle KV/K1 (Figure 207 ... 210)

NOTE :

The following steps (Figure 207 ... 210) are describing the installation of the clutch axle for the Version with internal Spur gear fixing K1 (see also Figure 190 and 191) !

In case of the Version without Spur gear fixing, install the clutch axle KV/K1 accordingly as KR/K2 (Figure 202 ... 206).



207

The Illustration on the left shows the components.

1 = Clutch axle
2 = Rectangular rings (3 pieces)
3 = Ball (2 pieces)
4 = O-Ring
5 = Cylindrical roller (2 pieces)
6 = Set screw (2 pieces)

Squeeze in and engage rectangular rings. Install O-Ring.
Insert the two balls with grease in the bores (Arrow).

NOTE :

Cylindrical rollers and set screws will be installed later !

Heat housing bore (about 90° C) and introduce the pre-assembled axle until contact is obtained.

NOTE :

Grease and align rectangular rings centrically prior to the introduction of the axle !



208

Fasten axle by means of hex. nuts (2 pieces).

Torque limit (M8/ 8) 23 Nm



209

Insert cylindrical rollers with the conical surface showing downwards in the bores (Arrows), and fix them by means of set screws.

Torque limit 10 Nm

NOTE :

To ensure the correct fixing of the spur gear, the spur gear K1 must be lifted, at the uniform tightening of the two set screws, in direction of the Arrow !

Insert set screws with Loctite (Type-No. 241)!



210

Check operation of the clutches K1 and KV by means of compressed air.

NOTE :

If the components are correctly installed, the closing, resp. opening of the clutches is clearly audible !



211

Check end play of the clutches 0,1 ... 0,3 mm again and correct if necessary !



212



213

3.2.7 Emergency steering pump

Squeeze in circlip (4), assemble spur gear (3) until contact is obtained and fix it free of play by means of disk (2) and circlip (1).
Introduce O-Ring into the annular groove (Arrow) and grease it.



214

Insert studs (4 pieces) with Loctite (Type-No. 241) and assemble emergency steering pump until contact is obtained.

NOTE :

Pay attention to the radial installation position !
A slight rotation on the final drive makes the threading up easier !



215

Fasten emergency steering pump by means of hex. nuts.

Torque limit (M8/ 8)	23 Nm

3.2.8 Lateral power take-off

Squeeze the two snap rings into the groove of the lower housing bore.



216

Lay expanding ring (S) upon the snap rings and mount ball bearing, with the recess showing upwards (Figure 217).
Now, tap and drive ball bearing in, until the upper snap ring engages in the ball bearing groove (Figure 218).

(S) Expanding ring 5870 345 038



217

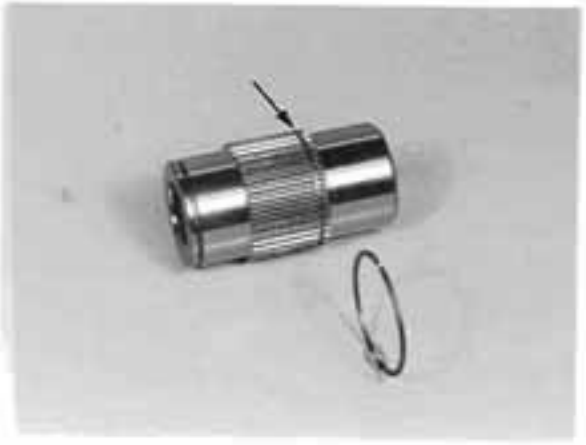


218

Position spur gear with the long hub side showing downwards.



219



220

Squeeze snap ring into the annular groove (Arrow) of the driving shaft.

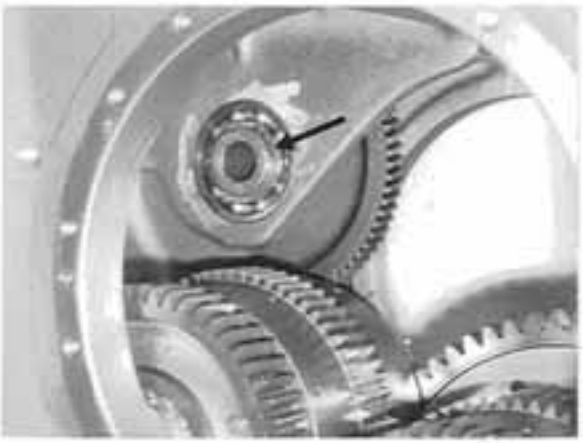


221

Heat ball bearing (Figure 221) and introduce driving shaft until contact is obtained (Figure 222).



222



223

Fix driving shaft by means of circlip (Arrow).

Press needle bush (Arrow) by means of drift into the pump flange until contact is obtained and fix it by engaging the snap ring.

NOTE :

The needle bush is marked on one end face. At the pressing in, the marking must be facing the drift (upwards).

(S) Drift 5870 506 060



224

Install two adjusting screws, mount flat gasket and place pump flange against shoulder.

(S) Adjusting screws (M8) 5870 204 011



225

Fasten pump flange by means of socket head screws.

Torque limit (M8/8.8, DIN 6912) 16 Nm



226

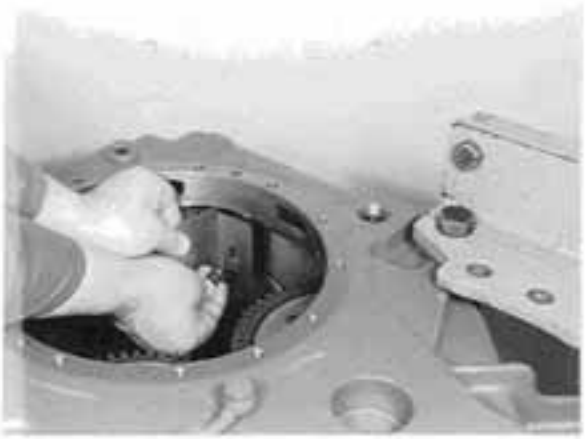
Install oil supply - power take-off.

NOTE :

Use new sealing rings !



227



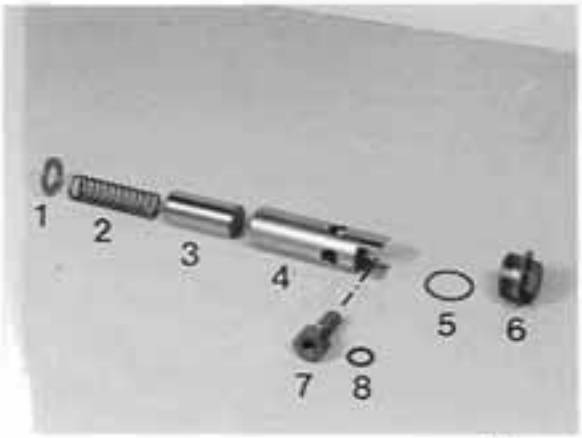
228

Fasten shield by means of hex. head screw (mount flat washer).

Torque limit (M8/8.8) 23 Nm

NOTE :

Secure hex. head screw with Loctite (Type-No. 241) !

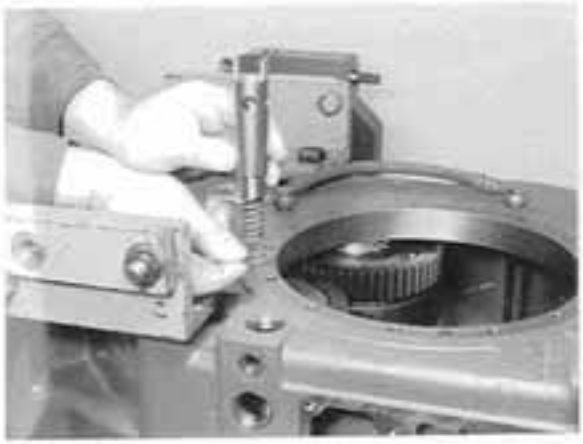


229

3.29 Converter control valve

Components :

1 = Disk
2 = Spring
3 = Spool
4 = Valve sleeve
5 = O-Ring
6 = Screw plug
7 = Connecting piece (temperature)
8 = O-Ring

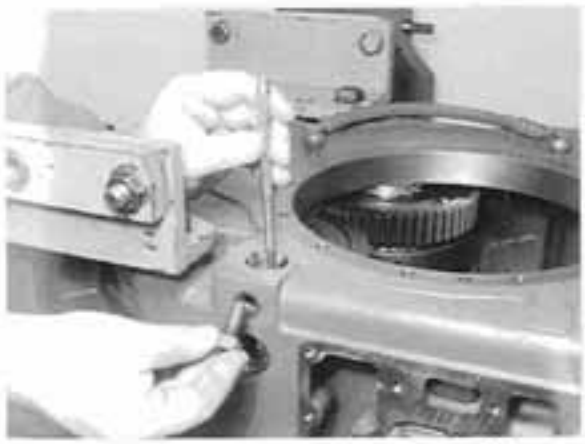


230

Thread up disk, spring, spool and the valve sleeve.

NOTE :

Pay attention to the radial installation position of the valve sleeve !



231

Install connecting piece.

NOTE :

Pay attention to the installation position, see Figure 229 !

Install screw plug.



232

Mount closing cover until it is flush.

NOTE :

Wet sealing surface with Loctite (Type-No.270).



233

3.2.10 Converter charge pump and control pressure pump

Squeeze rectangular rings into the annular grooves of the drive shaft and engage them. Insert the two roll pins (1,5x5 and 2,5x5 mm) flush-mounted in the bore (Arrow).



234

Press bearing outer race firmly against shoulder.



235



236

Thread up drive shaft.



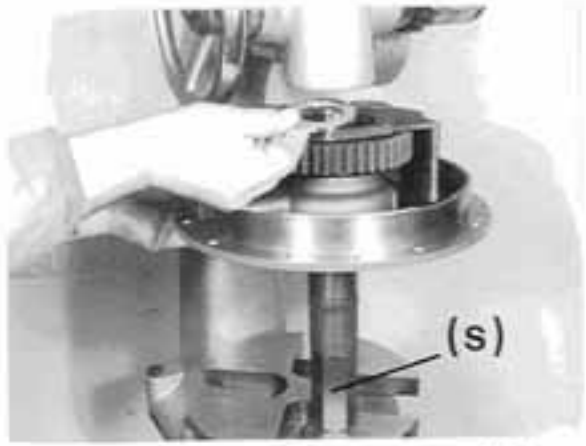
237

Install bearing inner race.



238

Position spur gear with the long hub side (Arrow) showing upwards (facing the ball bearing).



239

Back up drive shaft and oil supply flange by means of Assembly aid (S).
Assemble disk (according to the Version with or without).

NOTE :

The exact installation position of the drive shaft is determined by means of the Assembly aid !

(S) Assembly aid 5870 345 032

Press ball bearing against shoulder.



240

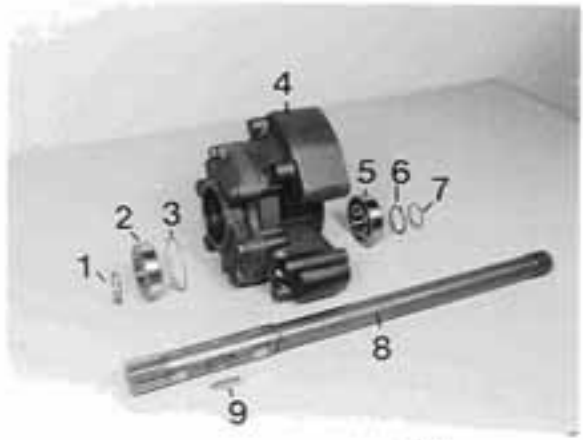
Squeeze circlip into the annular groove of the drive shaft.



241

The Illustration on the right shows the output shaft along with bearing as well as the pump.

1 = Circlip
2 = Ball bearing
3 = Shim (optional)
4 = Pump
5 = Ball bearing
6 = Circlip
7 = Rectangular ring
8 = Output shaft
9 = Adjusting spring

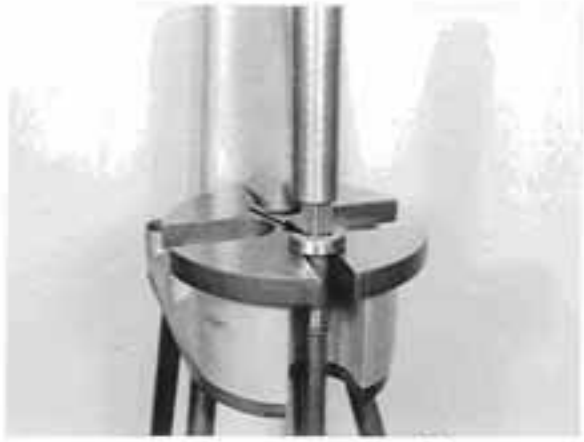


242

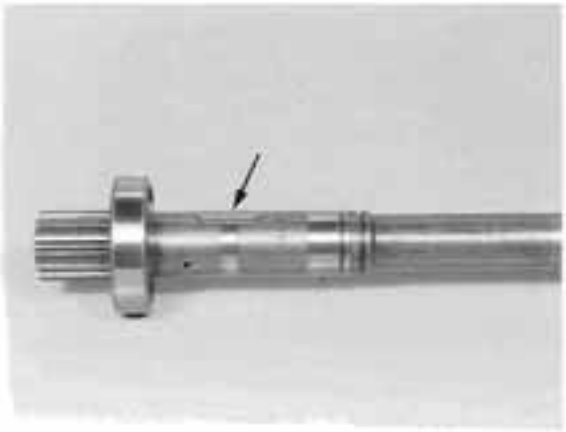
Squeeze in circlip (Arrow).
Press ball bearing against circlip until contact is obtained.

NOTE :

Pay attention to the installation position of the ball bearing, closed bearing side is facing the circlip (upwards) !



243



244

Install adjusting spring (Arrow).



245

Install shim s = 0,8 mm (empirical value) and press output shaft against shoulder.

NOTE :

The end play of the output shaft of 0,2 ... 0,4 mm is adjusted by means of shim (e.g. s = 0,8 mm) !



246

Press ball bearing against shoulder, with the closed side showing upwards.



247

Squeeze in circlip.
Check end play 0,2 ... 0,4 mm between circlip and bearing inner race, using feeler gauge.

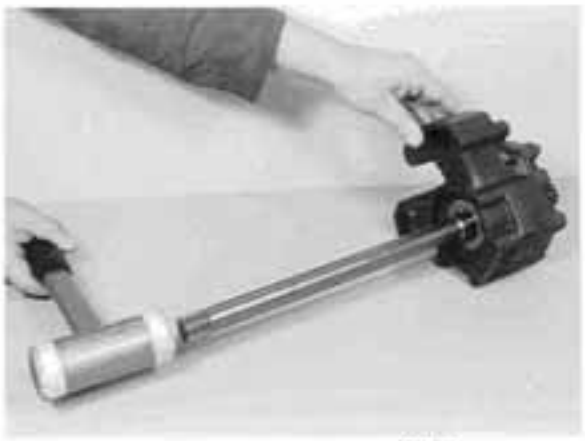
NOTE :

In case of deviations from the required end play, correct by means of shim (Figure 245).

Relax the output shaft bearing by tapping.

NOTE :

Use plastic hammer !



248

Squeeze in rectangular ring (Arrow) and engage it.
Now, grease rectangular ring and align it centrically.



249

Adjust the end play of the drive shaft bearing 0,2 ... 0,4 mm (Figure 250 ... Example "M")

Determine Dimension I from the flange-mounted surface to the contact area/ball bearing.

Dimension I e.g. 7,10 mm



250

Replace gasket and measure Dimension II from the end face/ball bearing to the gasket (flange-mounted surface).

Dimension II e.g. 6,05 mm



251

Example "M" :

Dimension I	7,10 mm
Dimension II	- 6,05 mm
Difference	1,05 mm
Required end play e.g.	- 0,30 mm
gives Shim e.g.	s = 0,75 mm



252

Make shim (e.g. s = 0,75 mm) adhere with grease.



253

Install two adjusting screws, mount flat gasket and install converter relief valve (ball and spring).

(S) Adjusting screws (M8) 5870 204 011



254

Place pre-assembled pump against oil supply flange and fasten it by means of hex. head screws.

Torque limit (M8/8.8) 23 Nm

Relax the output shaft bearing by tapping and check the free movement of the spur gear.



255

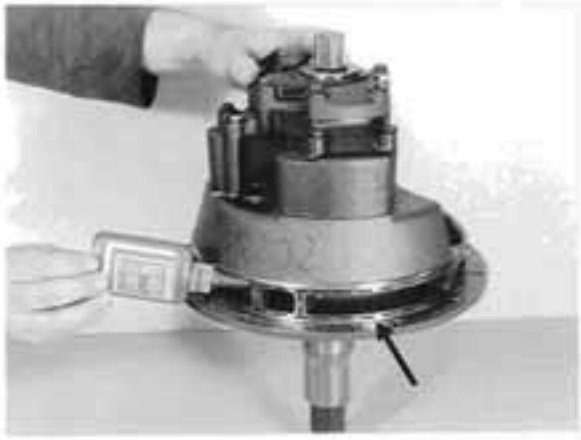
Heat housing bore.

(S)	Hot-air blower 220 V	5870 221 500
(S)	Hot-air blower 110 V	5870 221 501
(S)	Pre-heating sleeve	5870 801 003



256

Wet oil supply flange in the area of suction ports and pressure ports with Loctite (Type-No. 221).



257

Install two adjusting screws. Install flat gasket (Arrow) and thread up oil supply flange until contact is obtained.

(S)	Adjusting screws (M8)	5870 204 011

ATTENTION :

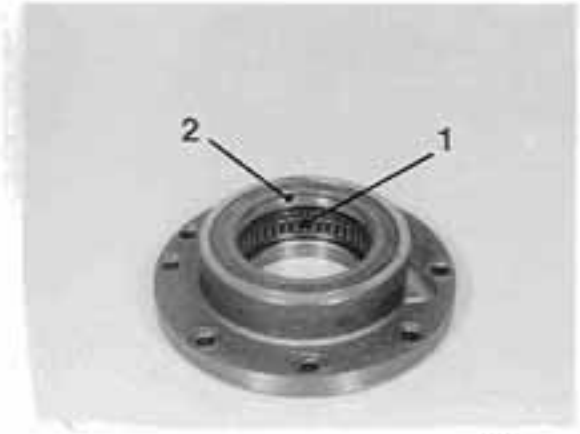
For different Transmission Versions, one O-Ring must be installed instead of the flat gasket !
Installation position of the O-Ring see Arrow/ Figure 257 !



258



259



260



261



262

NOTE :

To ensure an exact sealing of the suction ports and pressure ports, resp. to avoid the breaking away of the Loctite, fix oil supply flange by a provisional installation of the two outer roll pins (10x50 mm) as well as hex. head screws (3 pieces) radially and axially, see Figure 259 ! The inner roll pins (6x50 mm) are installed only after the attachment of the engine connecting case (Figure 262).
Hardening time of the Loctite about 10 ... 30 minutes.

3.2.11 Engine connection

Install needle bearing (1) and shaft seal (2).

NOTE :

The needle bush is marked on one end face. At the pressing in, the marking must be facing the drift (upwards) !
The exact installation position is obtained by application of the prescribed Special Tool. Wet shaft seal outer diameter with sealing compound !

(S) Driver	5870 058 058
(S) Driver	5870 055 022
(S) Handle	5870 260 002

Install two adjusting screws and mount flat gasket.
Assemble bearing cap and fasten it by means of hex. head screws.

Torque limit (M8/8.8) 23 Nm

NOTE :

Pay attention to the radial installation position !

(S) Adjusting screws (M8) 5870 204 011

Fasten engine connecting case by means of hex. head screws and mount the two inner roll pins (6x50 mm).

Torque limit (M10/10.9) 68 Nm

Mount oil line (Arrow).

NOTE :

Use new sealing rings !



263

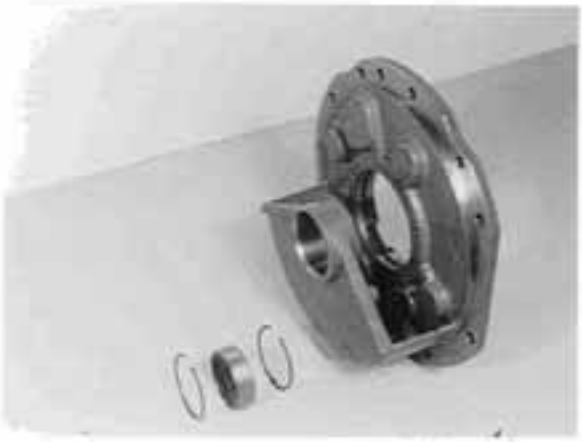
3.2.12 Coaxial power take-off (controllable)

Install snap rings and needle bush.

NOTE :

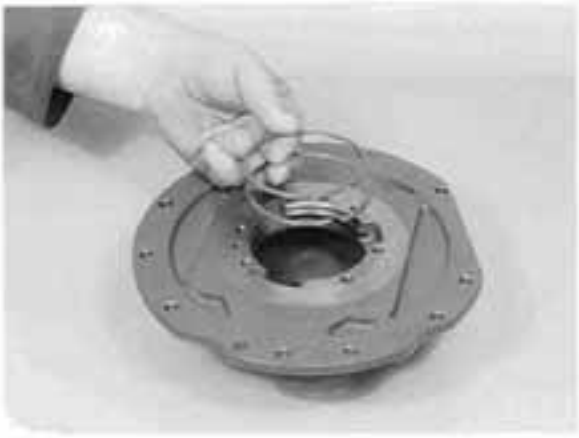
The needle bush is marked on one end face. At the pressing in, the marking must be facing the drift (S) !

(S) Drift 5870 506 060



264

Squeeze the two snap rings into the annular groove of the housing.

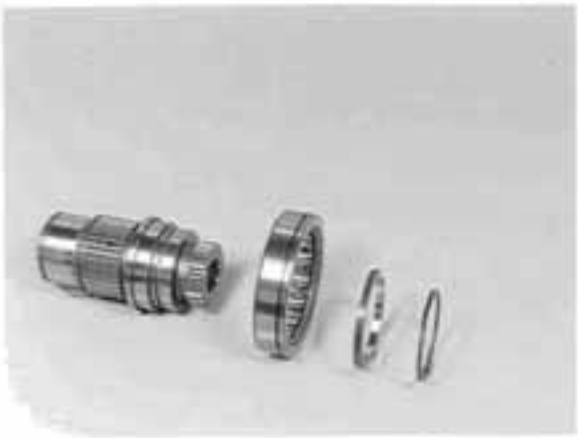


265

Assemble roller cage and collar shim, and fix them by means of circlip.

NOTE :

Pay attention to the installation position of the roller cage (annular groove) !



266



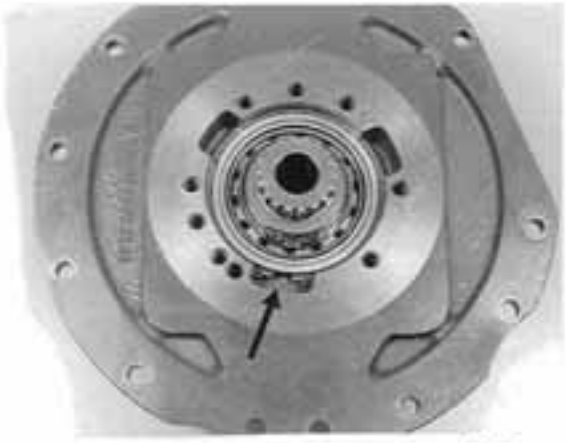
267

Position spur gear and thread up drive dog until the snap ring is located.



268

Expand the two snap rings, align them centrically and tap drive dog into the housing until the first snap ring engages in the annular groove of the roller bearing.



269

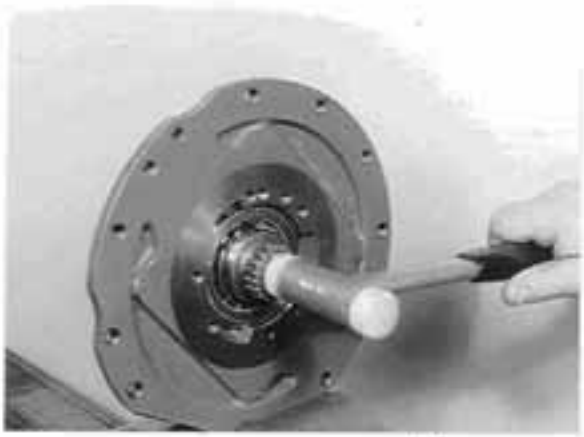
The Illustration on the left shows the installation position of the snap rings, see Arrow !



270

Locate snap ring finally, thus fixing the spur gear.

Relax the bearing by tapping.

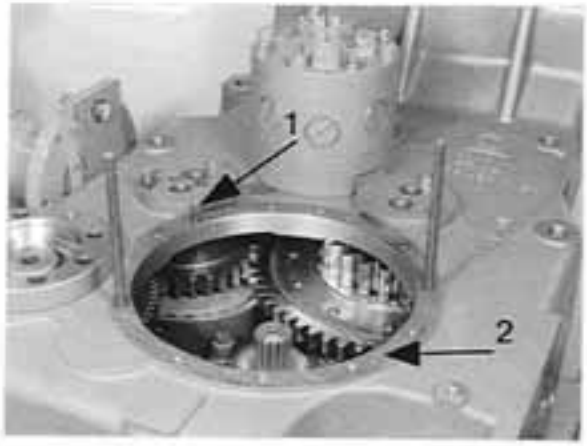


271

Insert stud (Arrow 1), install two adjusting screws and assemble flat gasket (Arrow 2).

NOTE :

Insert stud with Loctite (Type-No. 242) !



272

Thread up pre-assembled power take-off and fasten it by means of hex. head screws and hex. nuts.

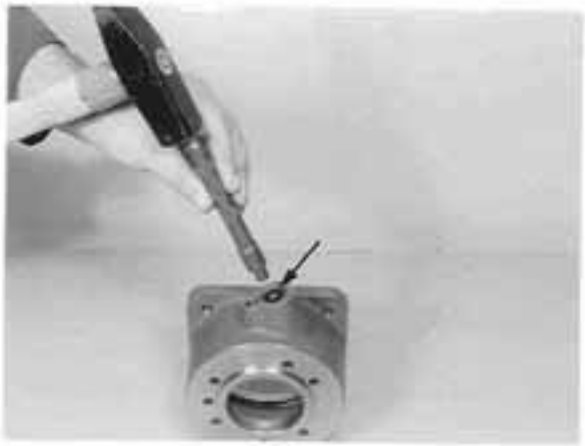
Torque limit (M8/8.8) 23 Nm



273

Install shaft seal (Arrow) flush-mounted with the sealing lip showing inwards.

(S) Driver 5870 048 074



274



275

Install two adjusting screws and assemble flat gasket.
Place housing against shoulder and fasten it by means of socket head screws.

Torque limit (M8/10.9) 34 Nm



276

Install shim (s = 3,0 mm), see Arrow and thread up shift fork.

NOTE :

Use installer (S) !

(S Installer 5870 651 018



277

Thread up locking device composed of pin and two compression springs, and fix it by means set screw.

NOTE :

Insert the set screw with Loctite (Type-No. 242) !



278

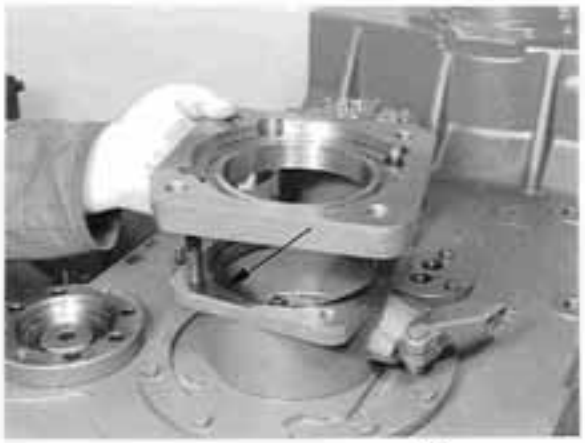
Assemble shim (s = 1,5 mm) and install adjusting spring.
Install shift lever free of pressure (a small end play is permitted), and fix it by means of hex. head screw.

Insert O-Ring (Arrow), assemble pump flange and fasten it by means of socket head screws.

Torque limit (M12/8.8 DIN 7984) 55 Nm

NOTE :

Pay attention to the radial installation position of the pump flange !
Install sliding collar and sliding block prior to the reassembly of the pump !



279

ATTENTION :

The following Description and Illustrations show the attachment and installation of different assemblies and components, in relation to a specific Transmission Variant.
Deviating steps of other possible Versions can be carried out without difficulty by trained personnel.
In this connection, see also the Perspective Illustration of the corresponding Spare Parts Lists.

Thread up torque converter by means of lifting device until contact is obtained.

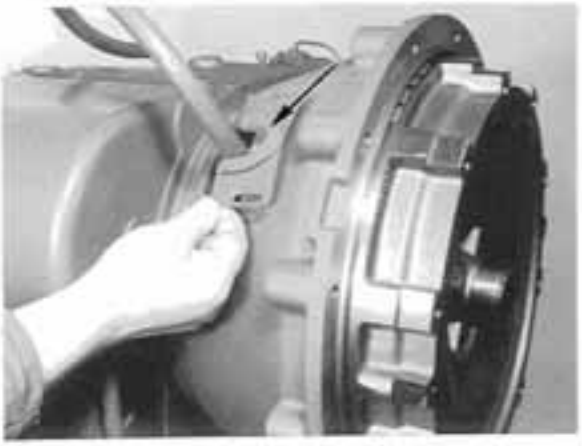
(S) Set of eye bolts 5870 204 002



280

Mount edge protection (Arrow) and fasten cover plate by means of hex. head screws (mount flat washers).

Torque limit (M6/8.8) 9,5 Nm



281



282

Install screw plug (Arrow 1) and breather (Arrow 2).



283

Mount suction pipe.

NOTE :

Install new gaskets.



284

Install oil level pipe.

NOTE :

Install new gaskets as well as baffle plate.



285

Install compl. cover plate.

NOTE :

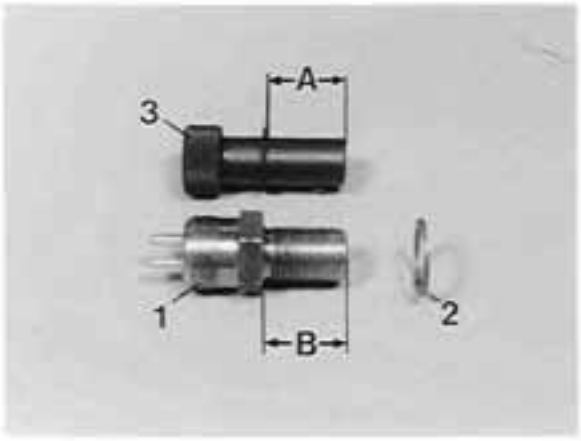
Install new gaskts.

3.2.1.3 Inductive transmitter

Adjust required gap $0,5^{+0,3}$ mm between the contact area/inductive transmitter and the spur gear (tooth tip).
Figure 286 to Example "N".

Ref. Figure 286 : 1 = Inductive transmitter
2 = Shim
3 = Measuring pin (S)

(S) Measuring pin 5870 200 040



286

Insert measuring pin until the end face has got contact on the tooth tip of the spur gear as well as the circlip is located on the screw-in surface of the housing.

NOTE :

The tooth tip must be centrically located to the housing bore, if necessary, align the spur gear accordingly !



287

Remove measuring pin and measure Dimension "A" from the end face/measuring pin to the circlip (see Figure 286).

Dimension "A" e.g. 26,00 mm

Determine Dimension "B" from the contact surface/inductive transmitter to the contact area (see Figure 286).

Dimension "B" e.g. 27,10 mm

Example "N" :

Dimension "A"	26,00 mm
required gap e.g.	- 0,60 mm
Difference = Adjustment dimension	25,40 mm

Dimension "B"	27,10 mm
Adjustment dimension	- 25,40 mm
Difference = Shim(s) e.g.	1,70 mm

Assemble corresponding shim and install the inductive transmitter.

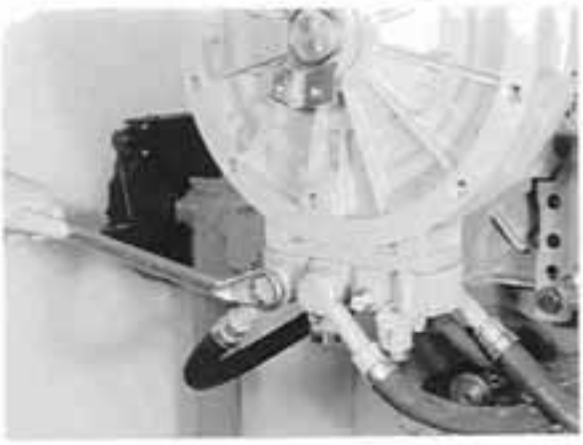
NOTE :

Wet thread of inductive transmitter with sealing compound !

4. RETARDER

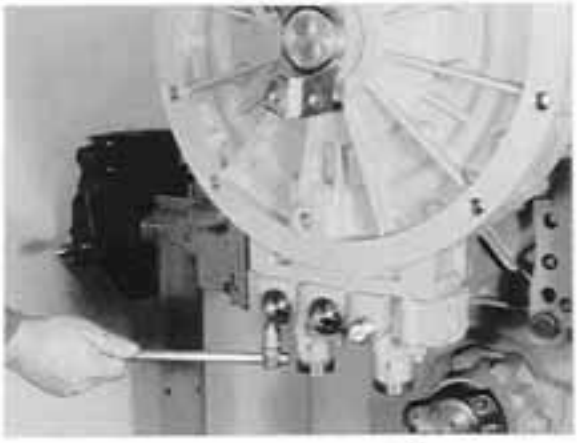
4.1 DISASSEMBLY

Loosen hose lines.



1

Loosen hex. head screws and remove retarder valve.



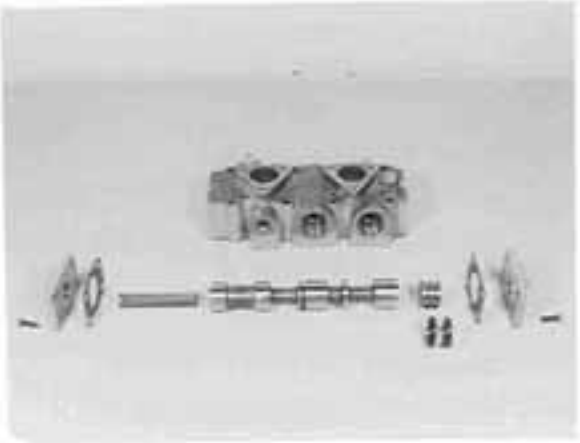
2

Demount temperature sensor and the two connecting pieces (see Arrows).



3

Loosen hex. head screws, remove the two covers and demount components.



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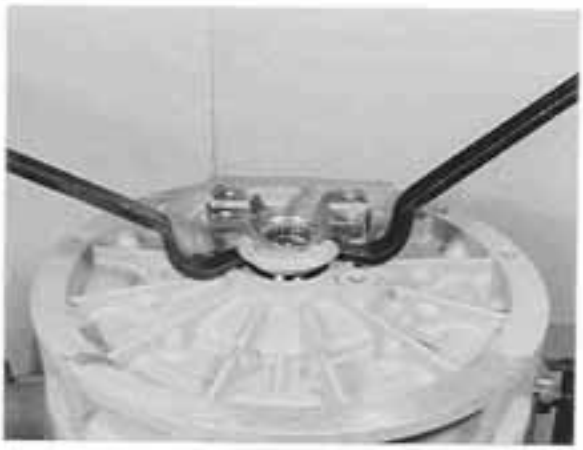


5

Tilt gear case 90°.

Remove lock plate.
Loosen hex. head screws and pull off output flange.

NOTE :

If only operations on the transmission are necessary, the complete retarder can be separated from the converter compartment by loosening the screwed connection (Figure 8)!



6

Loosen screw plug.



7

Loosen first hex. head screw and remove it by means of magnetic rod.

Remove the remaining hex. head screws accordingly.



8

Loosen screwed connection.

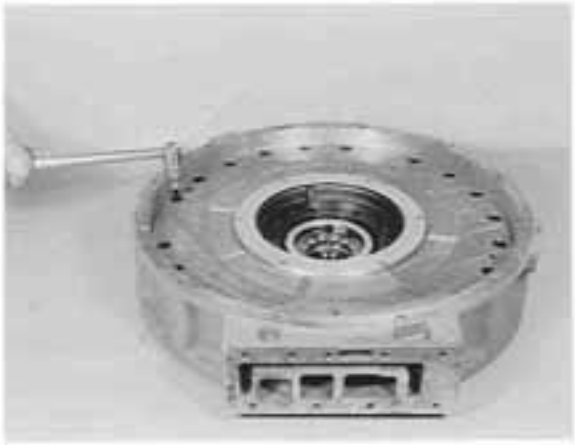
Separate the complete retarder from the converter compartment, using lifting device.

(S) Set of eye bolts 5870 204 002



9

Loosen socket head screws.



10

Separate cover from stator.

(S) Set of eye bolts 5870 204 002



11

Remove rectangular ring.



12



13

Remove rotor.



14

Loosen screwed connection and remove thrust ring.



15

Remove stator ring.

NOTE :

Pay attention to the released components !



16

Squeeze out circlip and remove shim.

Remove shaft seal.

(S) Pry bar 5870 345 065



17

Drive 4-point bearing out of the bore.



18



20

4.2 REASSEMBLY

4.2.1 Pre-assemble and attach Retarder

Heat bearing bore and insert 4-point bearing firmly against shoulder.



21

Adjust the 4-point bearing free of play by means of disk (optional) and circlip.

NOTE :

Pay attention that the two bearing inner races are present !



22

If necessary, insert upper bearing inner race and intall shaft seal.

NOTE :

The exact installtion position is obtained by application of the prescribed driver !

(S) Driver 5870 048 068



23

Install stator ring.

Fasten thrust ring by means of hex. head screws.

Torque limit (M8/8.8) 23 Nm

NOTE :

Secure hex. head screws with Loctite (Type-No. 241) !

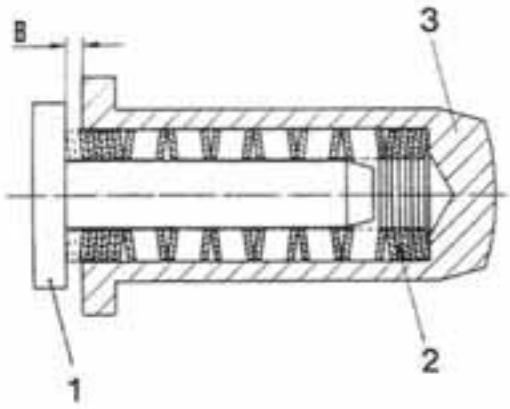


24

Pre-assemble dampers (3 pieces) according to Figure 25 and 26.

NOTE :

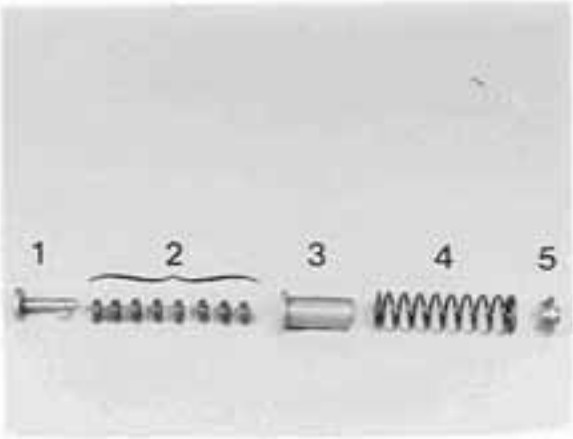
Pay attention to the installation dimension B = $1{,}6^{+0{,}5}$ mm !



25

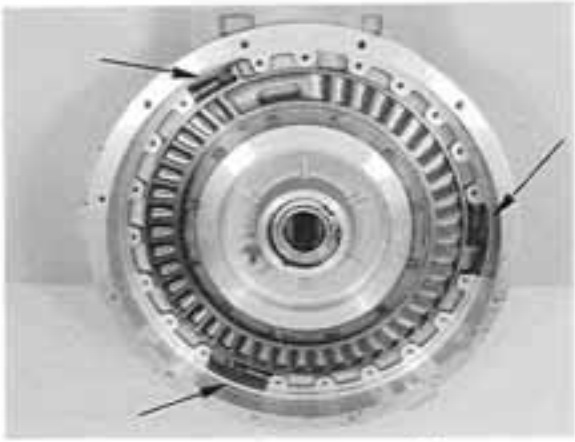
Ref. Figure 25 and 26 :

1 = Guide pin
2 = Cup spring packs (8 packs with 6 cup springs each)
3 = Spring guide
4 = Compression spring
5 = Spring guide



26

Install pre-assembled dampers, see Arrows !



27



28

Slide rectangular ring into the recess of the rotor and preload it by means of 3 straight pins ø 6 mm (Assembly aid) (Figure 28 and 29).

(3x) Straight pin 0631 306 178



29



30

Oil rectangular ring, slide rotor into the stator case until contact is obtained and remove straight pins again.

Slide second rectangular ring into the recess (Figure 31).

Make the bore of the rectangular ring as well as of the rotor overlap and fix rectangular ring by means of suitable pin (ø 1 mm) (Figure 32).



31



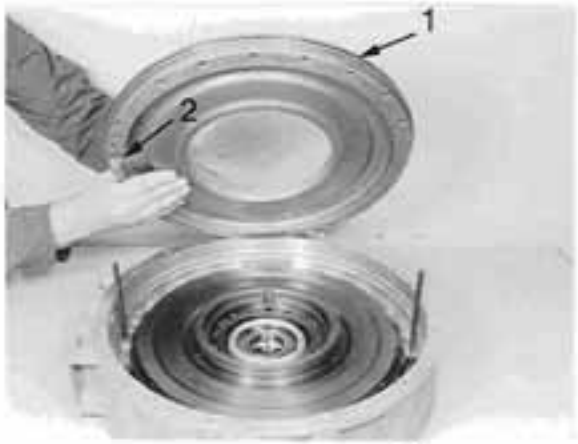
32

Insert O-Ring in the annular groove of the cover (Arrow 1) and grease it.
Install two adjusting screws and insert cover until contact is obtained.

NOTE :

Pay attention to the radial installation position (oil duct, see Arrow 2) !

(S) Adjusting screws (M8) 5870 204 011



33

Now, remove guide pin (Assembly aid) again and fasten cover by means of socket head screws (mount flat washers).

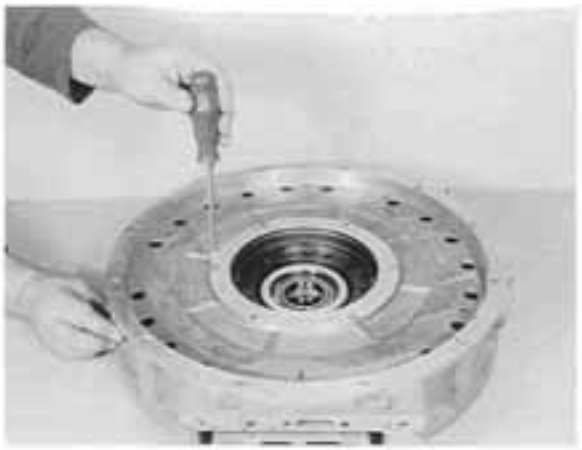
NOTE :

Secure socket head screws with Loctite (Type-No. 640) !

Torque limit (M8/10.9) 34 Nm



34



35

Fasten oil slinger by means of countersunk screws.

NOTE :

Wet thread of countersunk screws with Loctite (Type-No. 640) !

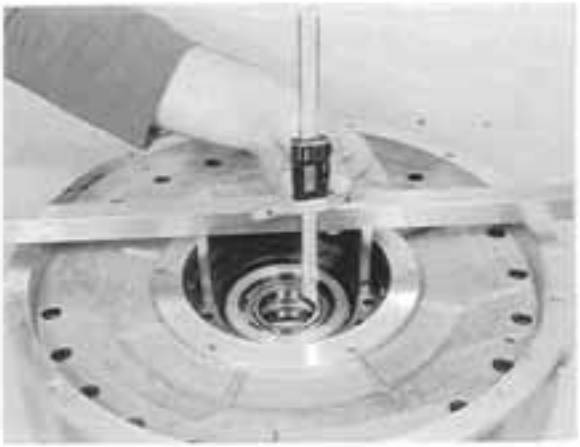


36

Adjust gap between Rotor and Stator ring = 0,8 ... 1,6 mm (Figure 36 ... 38) :

Measure Dimension I from the contact surface (4-point bearing) to the flange-mounted surface.

Dimension I e.g.	12,00 mm
(S) Straightedge	5870 200 022
(S) Gauge blocks	5870 200 066
(S) Digital depth gauge	5870 200 072



37

Determine Dimension II from the flange-mounted surface (drive flange) to the bearing inner race.

Dimension II e.g.	10,65 mm

EXAMPLE "A" :

Dimension I	12,00 mm
Dimension II	- 10,65 mm
Difference	1,35 mm
Required gap Rotor-Stator ring e.g.	- 1,20 mm
gives Shim	s = 0,15 mm



38

Assemble shim (e.g. s = 0,15 mm).

Heat bearing inner race and place it against shoulder.

NOTE :

Pay attention to the installation position, ball running surface is showing upwards !



39

Mount flat gasket, assemble the retarder until contact is obtained and fasten it by means of hex. head screws.

Torque limit (M10/8.8) 46 Nm



40

Fasten rotor at the drive flange.

NOTE :

Tighten hex. head screws uniformly (180° displaced) and secure them with Loctite (Type-No. 241) !

Torque limit (M10/8.8) 46 Nm



41

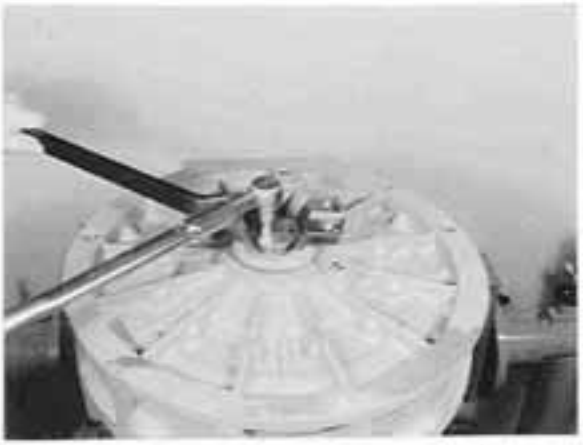
Install the two screw plugs, see Arrows !

NOTE :

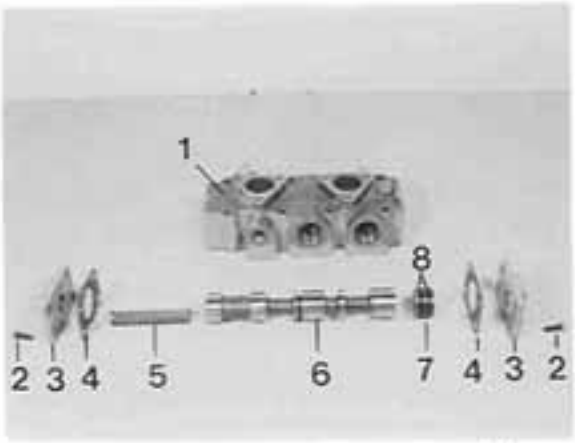
Install new O-Rings !



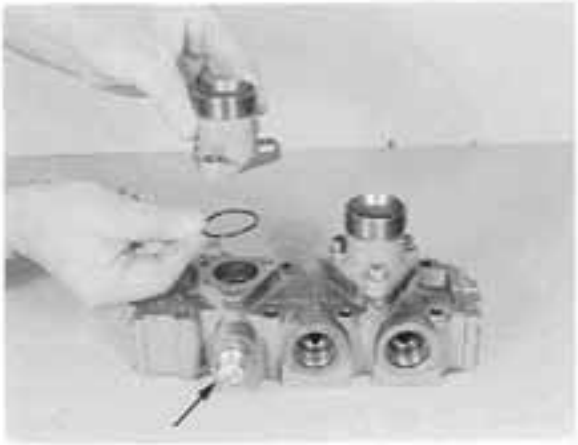
42



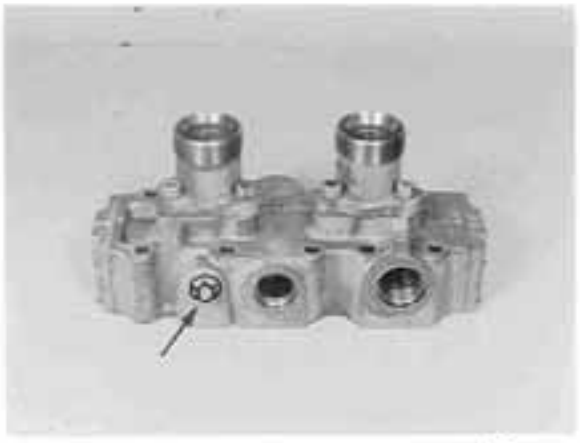
43



44



45



46

Assemble drive flange and fasten it by means of disk and hex. head screws.

NOTE :

Wet contact area of disk with sealing compound !

Torque limit (M8/10.9) 34 Nm

Now, fix hex. head screws by means of lock plate.

(S)	Driver	5870 057 010
(S)	Handle	5870 260 002

4.2.2 Pre-assemble and attach Retarder valve

Install components according to the Figure on the left.

1 = Case
2 = Hex. head screw
3 = Cover
4 = Gasket
5 = Compression spring
6 = Spool
7 = Spool
8 = Grooved rings

NOTE :

Install grooved rings (8) with the sealing lip facing the pressure chamber !

Fasten the two connecting pieces by means of socket head screws.
Install temperature sensor (Arrow).

NOTE :

Install new O-Rings !

Torque limit (M8/8.8) 23 Nm

Install screw plug (Arrow).

NOTE :

Install new O-Ring !

Install two adjusting screws.

Assemble first gasket, intermediate plate and second gasket.

(S) Adjusting screws (M8) 5870 204 011



47

Place retarder valve against shoulder and fasten it by means of hex. head screws.

Torque limit (M8/8.8) 23 Nm



48

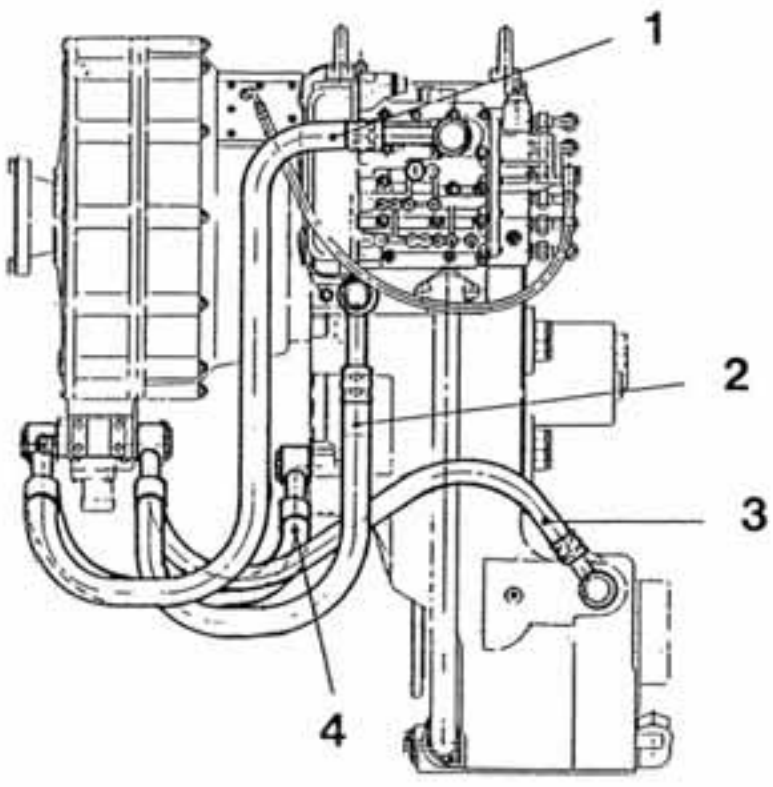
4.2.3 Install delivery lines

Install delivery lines according to the Draft on the right.

1 = To the Retarder
2 = Converter exit
3 = Return to Sump
4 = To the Lubrication

NOTE :

Install new O-Rings.



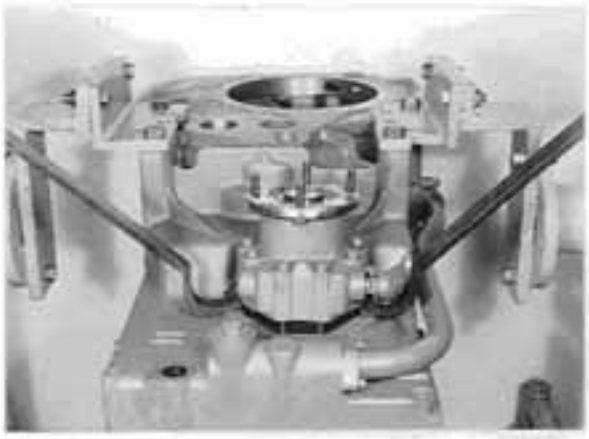
49

5. AXLE DECLUTCH

5.1 DISASSEMBLY

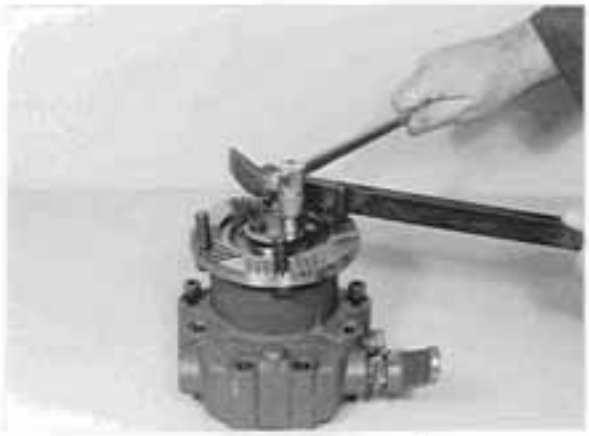
Loosen socket head screws and separate axle declutch from gear case.

(S) Pry bar 5870 345 065



1

Remove lock plate, loosen hex. head screws and remove disk.



2

Pull flange from output shaft.

(S) Three-leg puller 5870 971 003



3



4

Pry shaft seal out of the bore.

(S) Crow bar 5870 345 071



5

Squeeze out circlip.



6

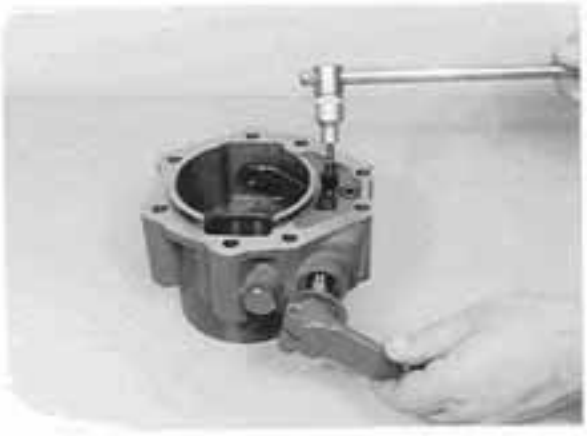
Press output shaft out of the housing.

Remove sliding collar.



7

Loosen the two set screws and remove gear-shift shaft.
If necessary, separate shift lever from gear-shift shaft - mark radial installation position !



8

Demount locking device and remove shift fork.



9

Squeeze out circlip and remove shim(s).



10



11

Demount sleeve and disk.



12

Remove needle bearing.

5.2 REASSEMBLY

Press ball bearing in until contact is obtained.



15

Adjust ball bearing free of play by means of disk and circlip.



16

Install shaft seal (Arrow) with the sealing lip facing the oil chamber.

NOTE :

The exact installation position is obtained by application of the prescribed driver (S) !
If the outer diameter of the shaft seal is rubberized, wet the sealing surface with spirit !
If not, use sealing compound (Curilt T) !
Grease sealing lip !

(S) Driver 5870 048 057



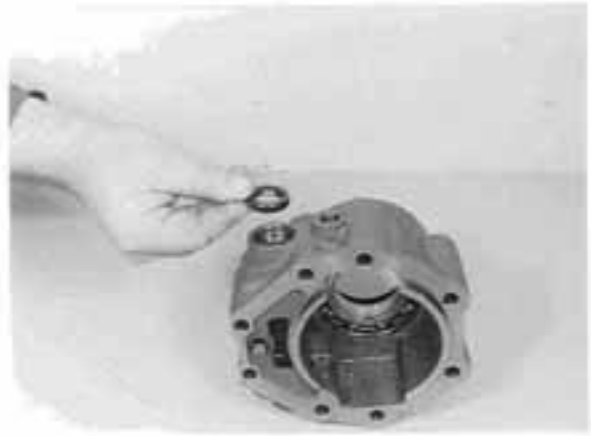
17

Insert shaft seal until contact is obtained.

NOTE :

Wet rubberized outer diameter with spirit !
Grease sealing lip !

(S) Driver 5870 048 031



18

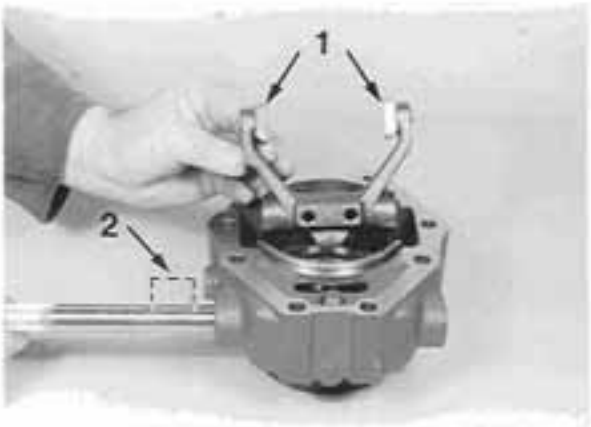


19

Insert shim (1) and straight pin (2) in the housing bore (Arrow).

NOTE :

The overlapping of the locating bore to the countersinking-shift fork is determined by means of shim(s), e.g. s = 0,50 mm (empirical value) !
However, a later check (Figure 27) is absolutely essential !



20

Install sliding blocks (Arrow 1), position shift fork and fix by means of gearshift shaft.

NOTE :

Pay attention to the installation position of the sliding blocks, see Figure !



21

Realize the overlapping of the gearshift shaft countersinkings (Arrow 2, Figure 20) and the tapped holes of the shift fork, and install the two set screws.

NOTE :

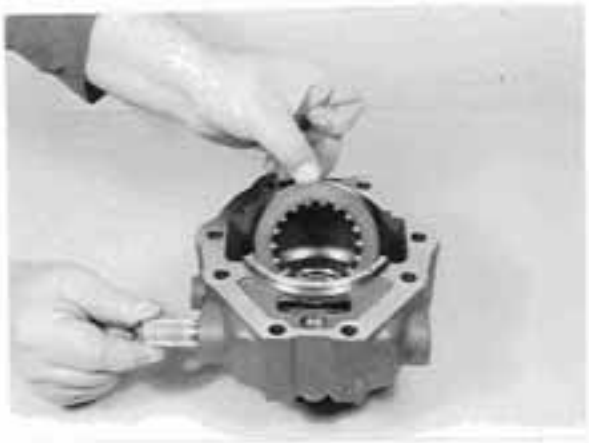
Secure set screws with Loctite (Type-No.242)!



22

Insert disk.

Thread up sliding collar.



23

Thread up output shaft and press it against shoulder.



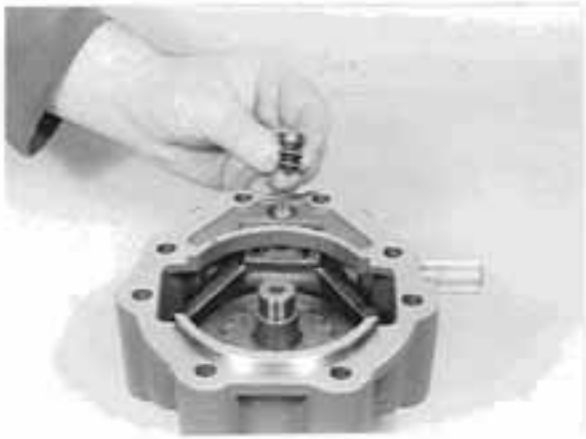
24

Assemble shim(s), e.g. s = 2,00 mm and mount socket head screws.

Torque limit (M10/8.8, DIN 7984) 32 Nm

NOTE :

By means of shim, e.g. s = 2,00 mm (empirical value), the sliding collar will be adjusted free of pressure (Figure 26) !
Secure socket head screw with Loctite (Type-No. 242) !



25

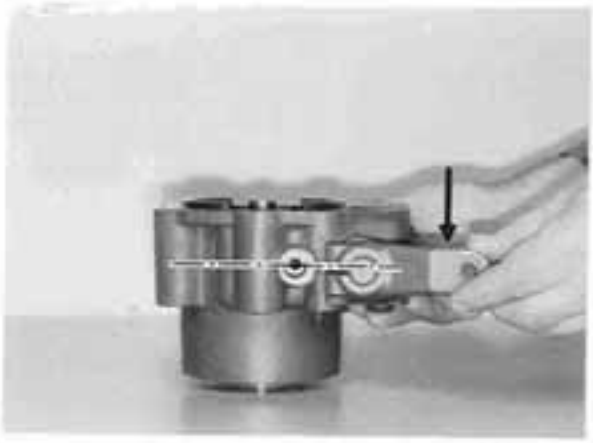
Check the pressureless condition of the sliding collar !

NOTE :

In a pressureless condition, a small tilting play on the sliding collar can be noted !
If necessary, correct by means of shim (Figure 25) !

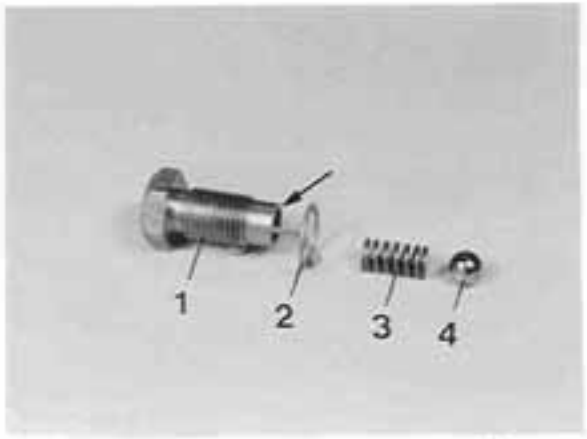


26



27

Bring shift fork, in direction of Arrow, to the upper stop position (final drive is engaged).
In this position, the countersinking of the shift fork must be centric to the tapped hole of the housing.
If necessary, correct by means of corresponding shims (Figure 19) !



28

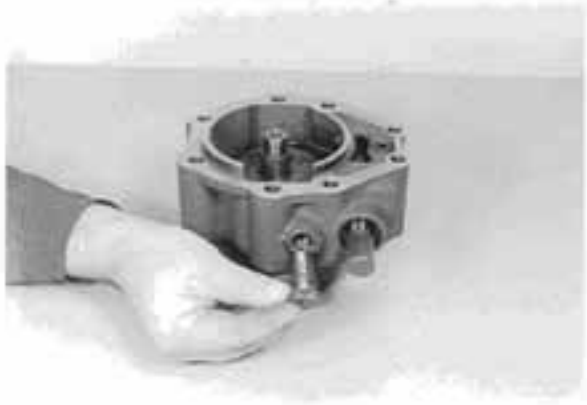
The Illustration on the left shows the components of the locking screw.

1 = Spring bush
2 = Sealing ring
3 = Compression spring
4 = Ball



29

Fix the ball by indents (3 x 120°) on the end face of the spring bush (see Arrow, Figure 28).
Insert compression spring and ball in the spring bush and preload them in a vise.



30

Assemble new sealing ring and install locking screw.

Assemble shift lever flush-mounted to the end face of the shaft and fix it by means of clamping screw.

NOTE :

Radial installation position of the shift lever according to the Indications of the Manufacturer of the vehicle, resp. according to the markings !

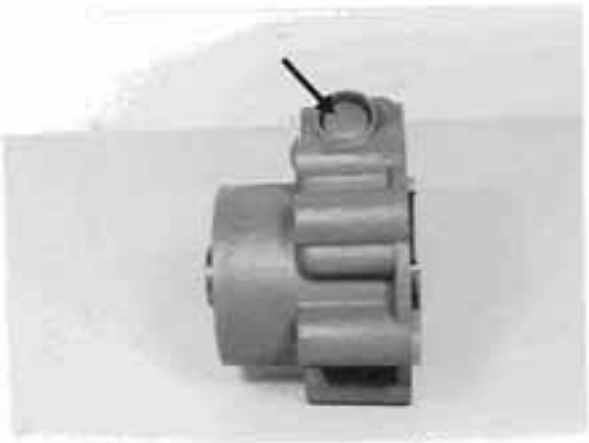


31

Insert closing cover (Arrow) until contact is obtained and fix it by slight central tapping.

NOTE :

Wet sealing surfaces with Loctite (Type-No. 270) !

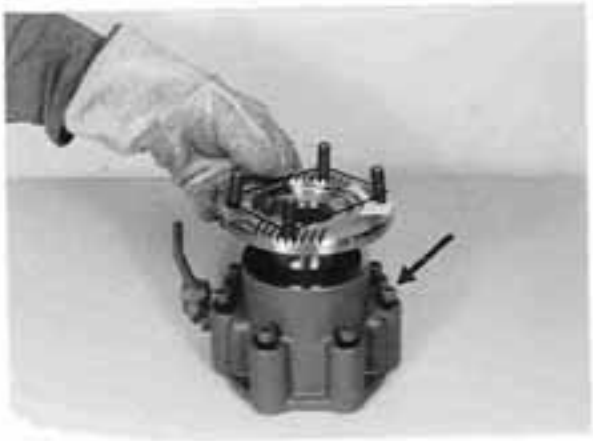


32

Insert socket head screws (Arrow) in the housing bores.
Insert hex. head screws in the bores of the output flange, heat output flange and assemble it until contact is obtained.

NOTE :

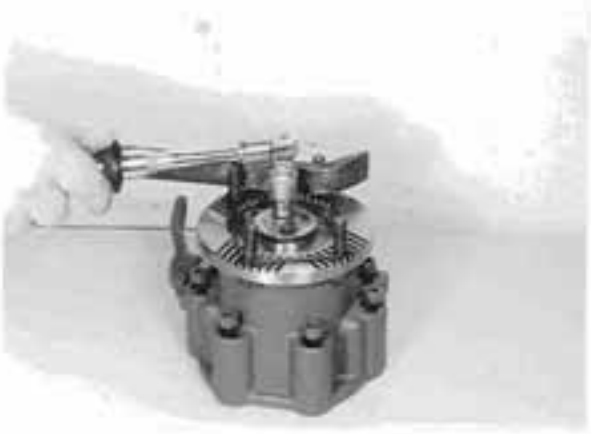
Pay attention to a correct contact !
If necessary, press it against shoulder, see Figure 34 !



33



34



35

Fasten output flange by means of disk and hex. head screws.

NOTE :

Wet contact area of the disk and the screw heads with sealing compound !

Torque limit (M8/10.9) 34 Nm



36

Fix hex. head screws by means of lock plate.

(S) Driver	5870 057 011
(S) Handle	5870 260 002



37

Install disk and assemble driving bush.

NOTE :

Pay attention to the installation position of the driving bush, see Figure !



38

Fix driving bush free of play by means of shim(s) and circlip.

Insert needle ring (Arrow) in the output shaft bore.
Install two adjusting screws and assemble flat gasket.

(S) Adjusting screws (M10) 5870 204 021



39

Place axle declutch assembly against housing until contact is obtained, and fasten it by means of socket head screws.

Torque limit (M10/8.8) 46 Nm



40

6. AXLE DIFFERENTIAL

6.1 SHIFT-CONTROL HOUSING

6.1.1 DISASSEMBLY

Pull off output flange.



1

Loosen socket head screws and separate axle declutch unit from gear case by means of pry bar.

(S) Pry bar 5870 345 065



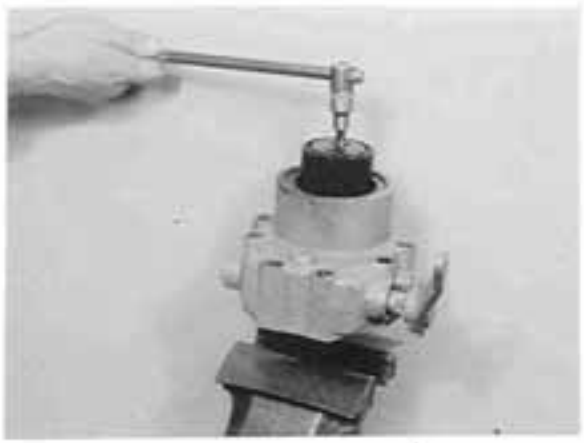
2

Remove hollow shaft.



3

Loosen the two socket head screws and remove them along with disk.

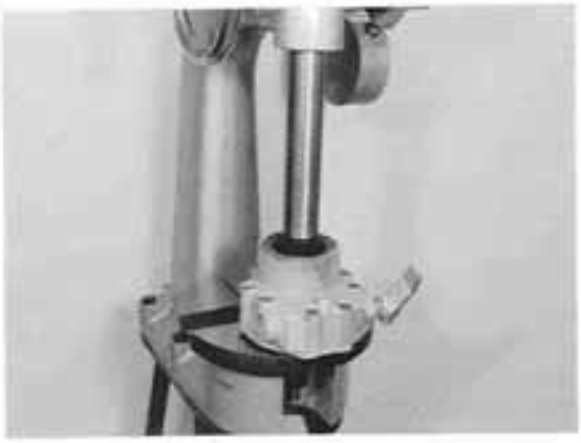


4



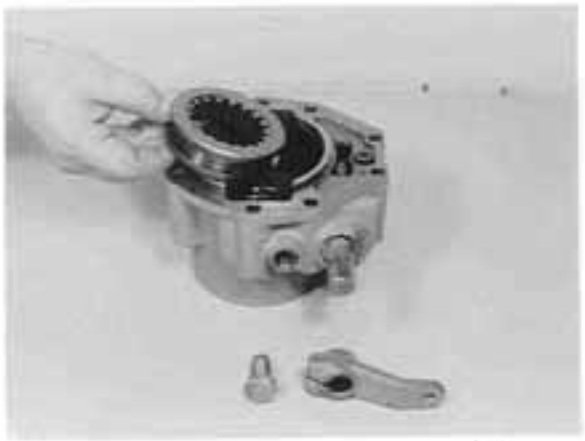
5

Pull sleeve from the output shaft.



6

Press output shaft out of the housing.

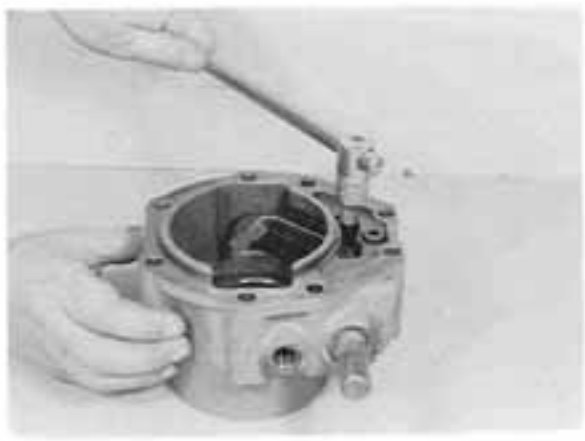


7

Demount locking screw and shift lever, and remove sliding collar.

NOTE :

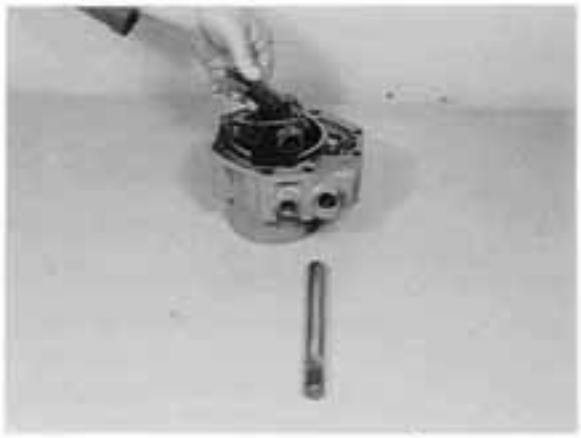
Mark the radial installation position of the shift lever !



8

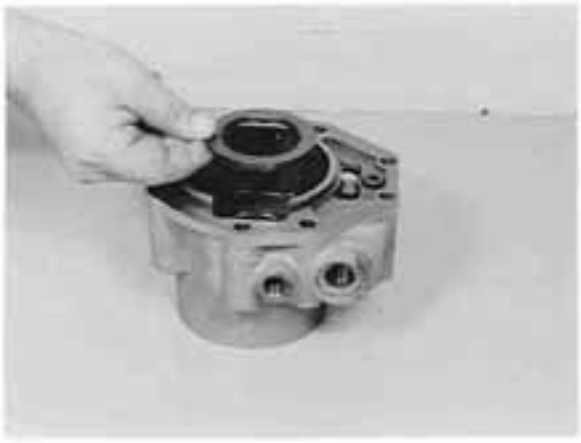
Loosen the two set screws.

Demount gearshift shaft and remove the shift fork.



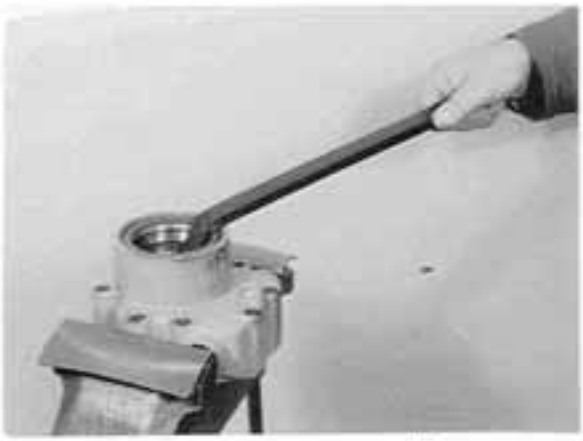
9

Remove disk.



10

Fasten housing in a vise - use protecting jaws - and pry shaft seal out of the housing bore.

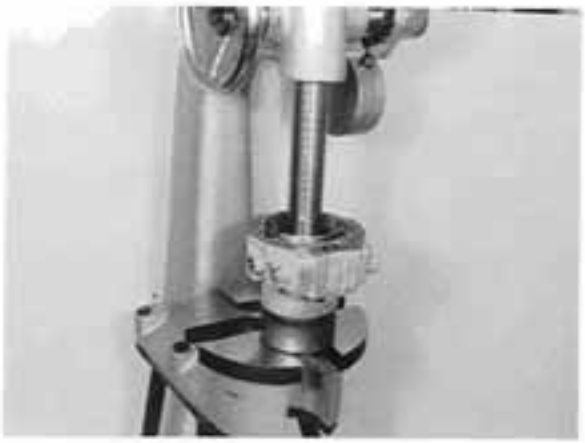


11

Remove sleeve and squeeze circlip out.



12



13

Press ball bearing out of the housing bore.

6.1.2 REASSEMBLY



15

Press ball bearing against shoulder until contact is obtained.



16

Fix ball bearing by means of circlip and lay sleeve upon it.



17

Install shaft seal with the sealing lip facing the oil chamber.

NOTE :

By application of the prescribed driver, the exact installation position is obtained !
If the outer diameter of the shaft seal is rubberized, wet the sealing surface with spirit !
If not, use a sealing compound !
Grease sealing lip !

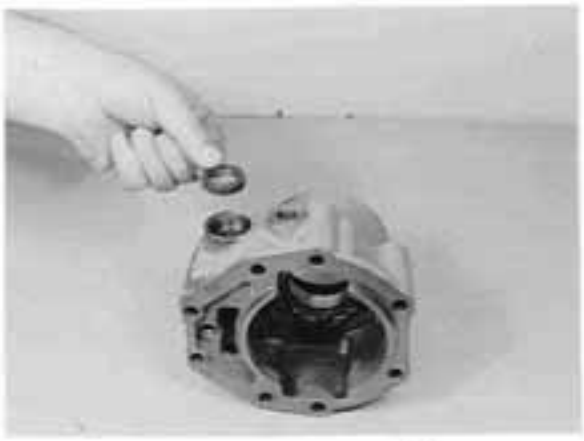
(S) Driver 5870 048 134

Insert shaft seal until contact is obtained.

NOTE :

Wet rubberized outer diameter with spirit !
Grease sealing lip !

(S) Driver 5870 048 031



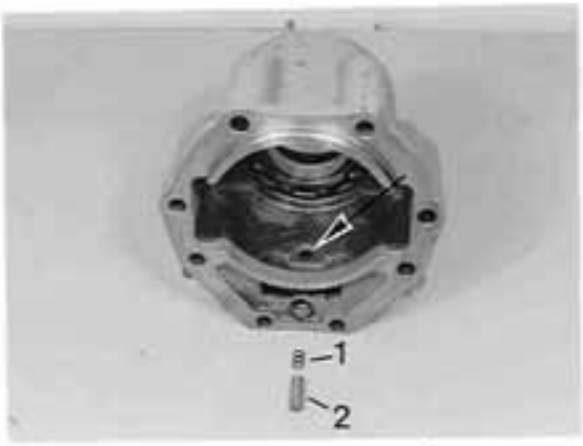
18

Insert shims (1) and straight pin (2) in the housing bore (Arrow).

NOTE :

The shifting travel is adjusted with the shims, total thickness s = 0,6 mm (empirical value) !

However, a later check is absolutely essential (see Figure 25) !

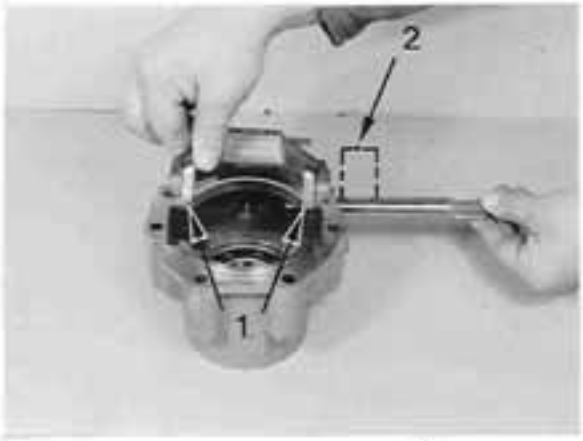


19

Install sliding blocks (Arrows 1), position shift fork and fix it by means of gearshift shaft.

NOTE :

Pay attention to the installation position of the sliding blocks - chamfered end face is showing to the rear !

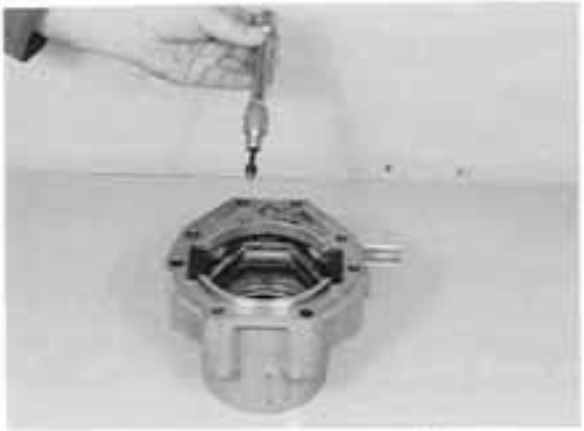


20

Realize the overlapaping of the gearshift shaft countersinkings (Arrow, Figure 20), and the tapped holes of the shift fork, and install the two set screws.

NOTE :

Secure set screws with Loctite (Type-No.242)!



21



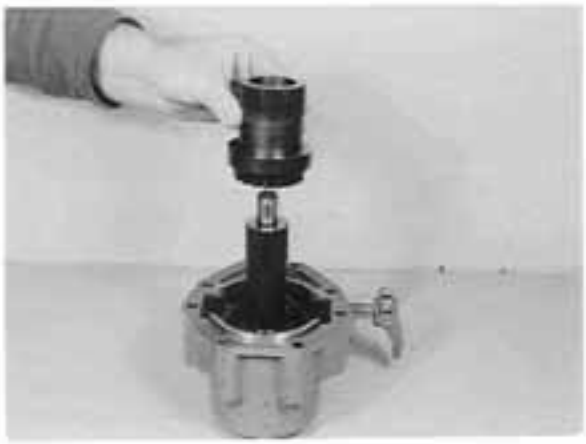
22

Insert disk and assemble sliding collar.



23

Introduce output shaft and press it against shoulder until contact is obtained.



24

Assemble the hollow shaft in order to check the shifting travel.



25

Place sliding collar by means of gearshift lever into the upper stop position (direction of Arrow) and determine the play between sliding collar and plane surface-hollow shaft.

NOTE :

If the required end play = 0,1 ... 0,2 mm is not obtained, correct with corresponding shims (see Figure 19) !

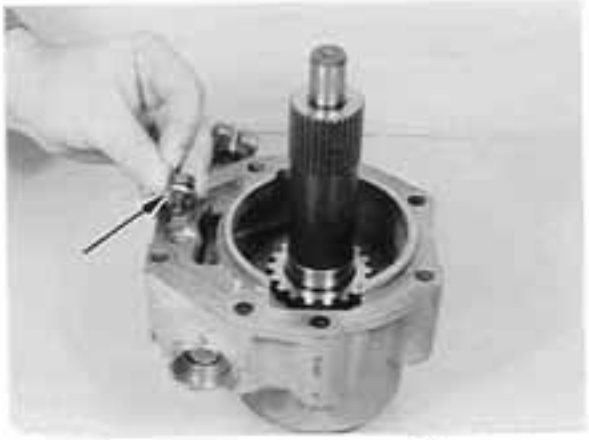
Now, remove hollow shaft again.

Assemble shim(s) e.g. s = 2,00 mm and install socket head screw.

Torque limit (M10/8.8 DIN 7984) 32 Nm

NOTE :

The sliding collar is adjusted free of pressure by the shim s = 2,00 mm (empirical value) (Figure 27) !
Secure socket head screw with Loctite (Type-No. 242) !

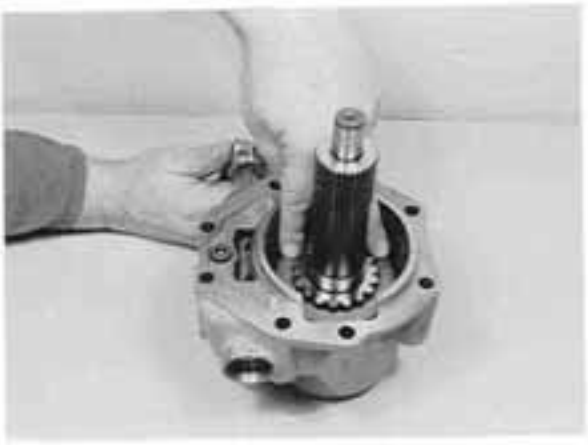


26

Place sliding collar by means of gearshift lever into the lower stop position and check the pressureless condition.

NOTE :

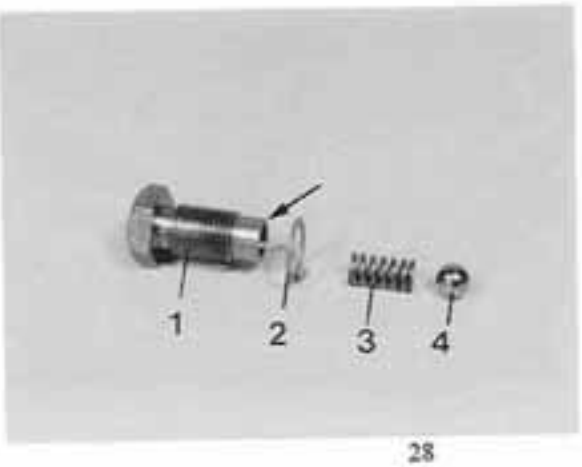
In case of a correct adjustment, a sligth tilting play on the sliding collar can be noted !
If necessary, correct it by means of shim (Arrow/Figure 26) !



27

The Illustration on the right shows the components of the locking screw.

1 = Spring bush
2 = Sealing ring
3 = Compression spring
4 = Ball



28

Insert compression spring and ball in the spring bush and preload them in a vise.
Fix the ball by indents (3 x 120°) on the end face of the spring bush (see Arrow Figure 28).



29

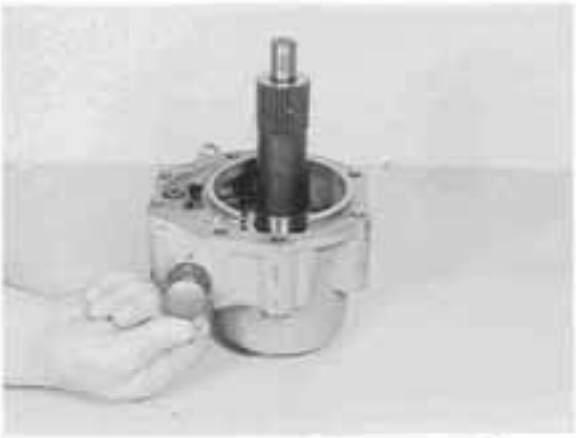


30

Assemble new sealing ring and install locking screw (Arrow 1).
Assemble gearshift lever (Arrow 2) flush-mounted and fix it by means of hex. head screw.

NOTE :

Radial installation position of the gearshift lever according to the Indications of the Manufacturer of the vehicle, resp. according to the markings !



31

Insert closing cover (Arrow) until contact is obtained and fix it by slight central tapping.

NOTE :

Wet sealing surfaces with Loctite (Type-No. 270) !

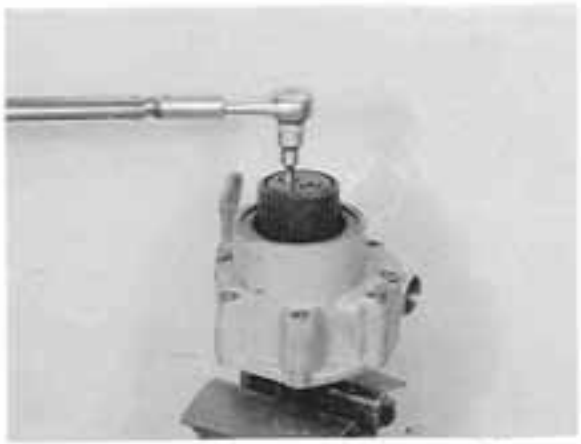


32

Insert disk and assemble sleeve.

NOTE :

Pay attention to the installation position of the sleeve !



33

Fix sleeve by means of disk and socket head screws.

Torque limit (M10/8.8 DIN 6912) 32 Nm

NOTE :

Secure socket head screws with Loctite (Type-No. 270) !

6.2 DIFFERENTIAL

6.2.1 Remove and dismantle differential

Pull roller bearing by means of puller device out of the housing bore.

(S) Internal puller 5870 300 010



35

Tilt gear case 180°.

Loosen hex. head screws and pull output flange from the shaft.

(S) Clamping yoke 5870 240 025



36

Pry shaft seal out of the housing bore.

(S) Pry bar 5870 345 071



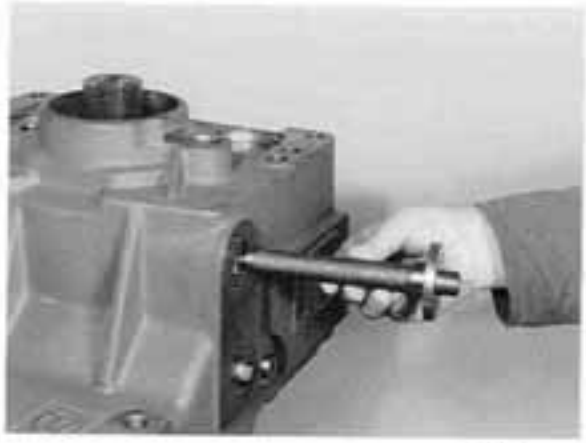
37

Remove circlip and shim.

(S) Clamping pliers 5870 900 021



38



39

Loosen hex. head screws and pull complete speedometer drive out of the housing bore.



40

Drive output shaft by means of striker out of the housing bore.

(S) Striker 5870 650 001



41

Squeeze circlip out and remove shim.



42

Pull roller bearing out of the housing bore.

(S) Puller 5870 300 010

Loosen closing cover by central tapping and remove it.



43

Loosen hex. head screws and remove them along with flat washers (Figure 44).
Now, take cover plate out of the gear case (Figure 45).



44



45

Loosen socket head screws and remove supporting tube.

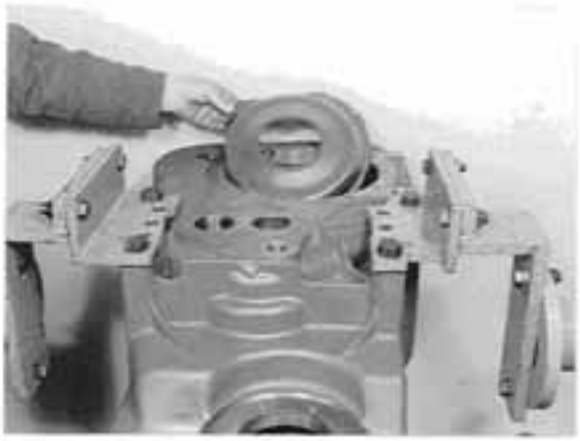
NOTE :

Socket head screws are secured with Loctite !

(S) Allen screw A/F-8 5870 290 001



46



47

Tilt gear case 180°.

Take cover plate out of the housing.



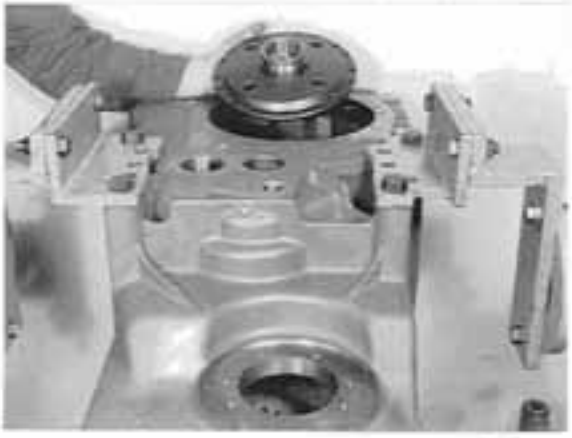
48

Loosen the screw connection (Figure 48) and separate the supporting plate by means of back-off screw (M8) from the output gear (Figure 49).

(S) Back-off screws (M8) 5870 204 008



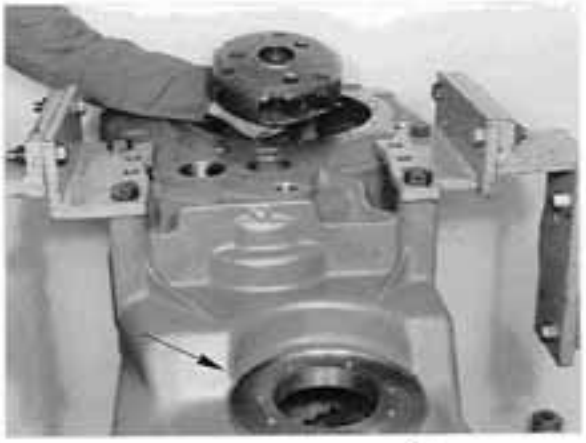
49



50

Take supporting plate out of the gear case.

Displace output gear in direction of arrow until the removal of the planetary carrier is ensured.



51

Take the output gear out of the gear case.



52

Drive roll pins carefully in until contact is obtained.

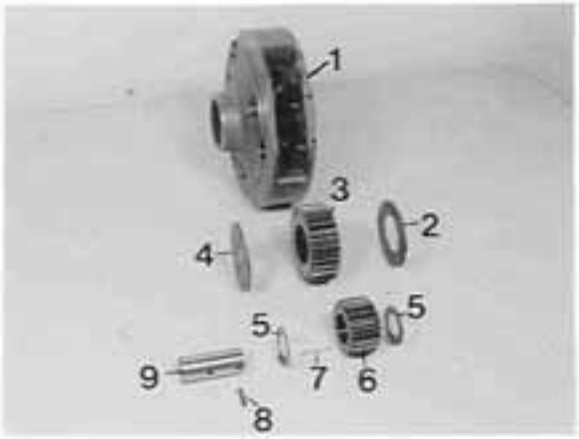


53

Press planetary shafts out of the bores and remove released components.



54



55



56



57



58

6.2.2 Pre-assemble and install differential

The Illustration on the left shows the components of the planetary carrier.

1 = Planetary carrier
2 = Thrust washer
3 = Sun gear
4 = Thrust washer (small inner diameter)
5 = Thrust washer
6 = Planetary gear
7 = Needle rollers (replace in sets only)
8 = Roll pin
9 = Planetary shafts

Install sun gear and thrust washers (Figure 56).

NOTE :

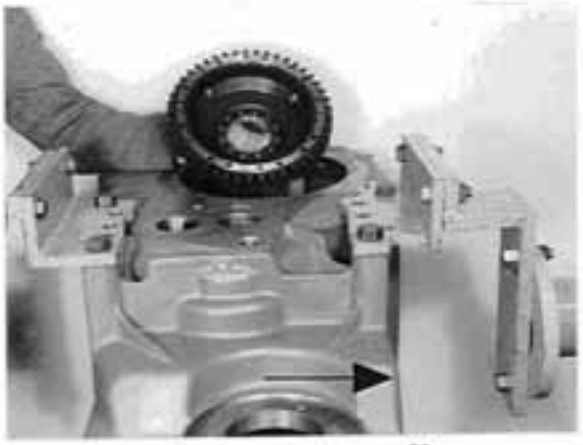
Pay attention to the installation position of the thrust washer 4 (smaller inner diameter) see Arrow !

Insert needle rollers 7 with grease in the planetary gear.
Position planetary gear as well as thrust washers and align them centrically.
Undercool planetary shafts, introduce and fix them by means of roll pin.
Install the remaining planetary gears accordingly.

NOTE :

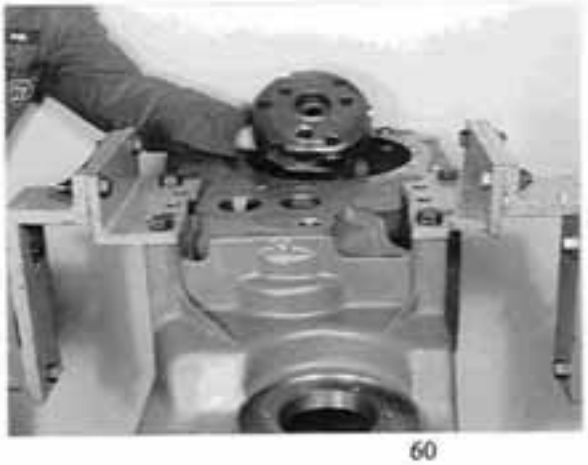
Pay attention to the installation position of the planetary shafts (lubricating hole) !
Figure 58 shows the installation position of the roll pins !

Insert output gear in the housing and displace it in direction of Arrow, to make the later reassembly of the planetary carrier possible.



59

Introduce planetary carrier with the long hub side showing downwards, into the internal gear.



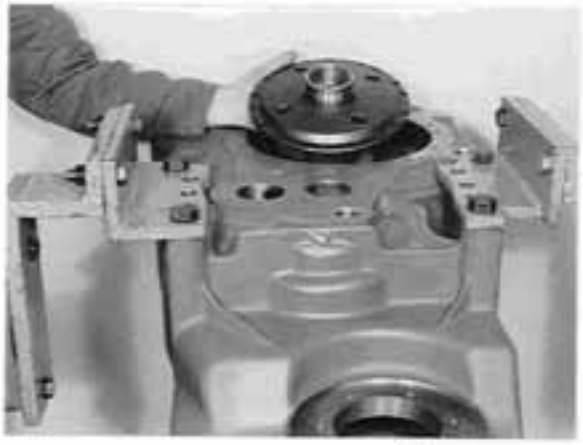
60

Lay supporting plate upon the output gear (Figure 61) and fix it by uniform tightening of the socket head screws (Figure 62).

Torque limit (M10/10.9) 68 Nm

NOTE :

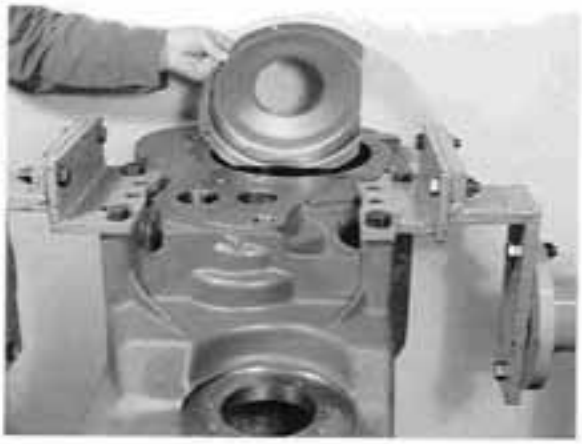
Secure socket head screws with Loctite (Type No. 241) !



61



62



63

Lay cover plate upon the supporting plate (Figure 63).

Now, tilt gear case 180°.

ATTENTION :

Differential is not fixed !



64

Squeeze in the first snap ring, press needle bearing against shoulder and fix it by means of second snap ring.

NOTE :

Install the needle bearing with the reinforced shell facing the pressing tool !

(S) Pressure piece 5870 100 035



65

Introduce supporting tube and fasten it by means of socket head screws.

Torque limit (M10/10.9) 68 Nm

NOTE :

Secure socket head screws with Loctite (Type-No. 241) !

(S) Allen screw A/F-8 5870 290 001



66

Insert roller bearing until the supporting tube is received.

NOTE :

In order to ensure a possible disassembly, the roller bearing must be installed with the open cage side showing outwards (on top) ! The exact fixing is carried out later !

Insert cover plate in the gear case.



67

Position the two cover plates and fasten them by means of hex. head screws (install flat washers).

Torque limit (M8/8.8) 23 Nm

NOTE :

Secure hex. head screws with Loctite (Type-No. 241) !



68

Tilt gear case 180°.

Insert roller bearing until contact is obtained.

NOTE :

Pay attention to the installation position, open cage side of roller bearing is showing outwards (on top) !



69

Insert sleeve (Arrow) flush-mounted in the hollow shaft.

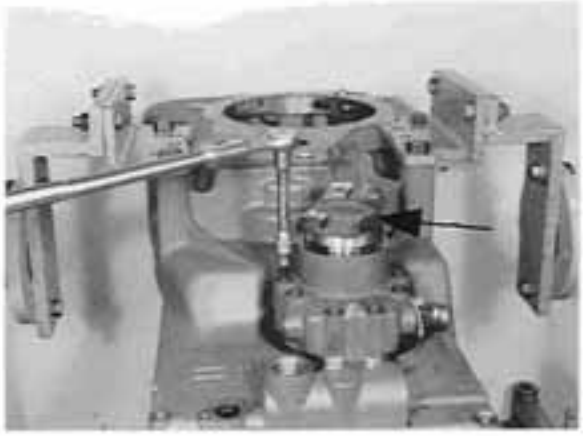


70



71

Introduce hollow shaft until contact is obtained.



72

Install two adjusting screws, replace flat gasket and place compl. shift-control housing against gear case until contact is obtained.
Fasten shift-control housing by means of socket head screws and install output flange (Arrow).

Torque limit (M10/8.8 DIN 7984) 32 Nm

(S) Adjusting screws (M10) 5870 204 007



73

Tilt gear case 180°.

Drive differential assembly by careful tapping upon the roller bearing downwards, until the exact contact of the lower roller bearing (Figure 69) on the shift-control housing (Figure 72) is ensured.



74

Adjust end play of the differential 0,4 ... 0,6 mm (Figure 74 ... 76)

Squeeze in circlip.

(S) Clamping pliers 5870 900 021

Push circlip in direction of Arrow against shoulder and determine play between circlip and end face/bearing outer race, using feeler gauge.

Dimension I e.g. 1,50 mm



75

EXAMPLE "A" :

Dimension I e.g. 1,50 mm
required end play (0,4 ... 0,6 mm)
e.g. - 0,50 mm

Difference ≙ Shim e.g. s = 1,00 mm

Install shim e.g. 1,00 mm (see Example "A") and squeeze circlip in.



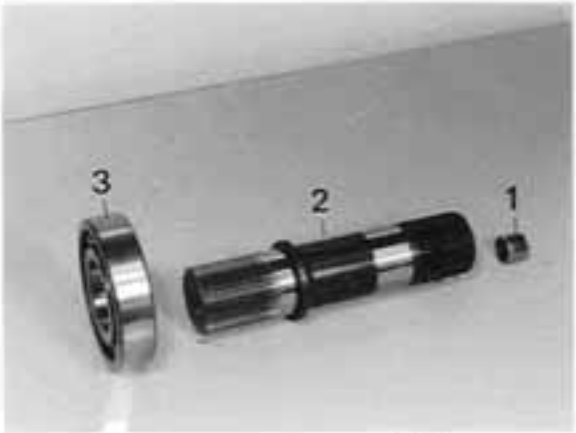
76

Insert needle bush 1 flush-mounted in the bore of the output shaft 2.
Press ball bearing 3 against shoulder until contact is obtained.

NOTE :

Install needle bush with the reinforced shell facing the pressing tool !

(S) Driver 5870 058 023
(S) Handle 5870 260 002



77



78

Introduce pre-assembled output shaft until contact is obtained.

NOTE :

Pay attention to the exact contact of the ball bearing !



79

Fix ball bearing free of play by means of shim and circlip.



80

Install shaft seal with the sealing lip facing the oil chamber.

NOTE :

By application of the prescribed driver, the exact installation position is obtained !
If the outer diameter of the shaft seal is rubberized, wet the sealing surface with spirit !
If not, use a sealing compound !
Grease sealing lip !

(S) Driver 5870 048 150

Assemble up output flange and fasten it by means of disk and hex. head screws.

NOTE :

Wet contact surface of disk and screw heads with sealing compound !

Torque limit (M10/8.8) 46 Nm

Now, fix hex. head screws with lock plate.

(S) Clamping yoke 5870 240 025
(S) Driver 5870 057 009
(S) Handle 5870 260 002



81

Install the two closing covers.

NOTE :

Wet sealing surfaces with Loctite (Type-No. 270) !

(S) Driver	5870 057 015
(S) Handle	5870 260 002



82

Fasten closing covers by means of hex. head screws and mount screw plug (Arrow).

NOTE :

Intall new flat gasket as well as O-Ring !

Torque limit (Hex. head screws M8/8.8)	23 Nm
Torque limit (Screw plug M22x1,5)	60 Nm



83

Assemble flat gasket and fasten speedometer (compl.) by means of hex. head screws on the gear case.

Torque limit (M8/8.8)	23 Nm

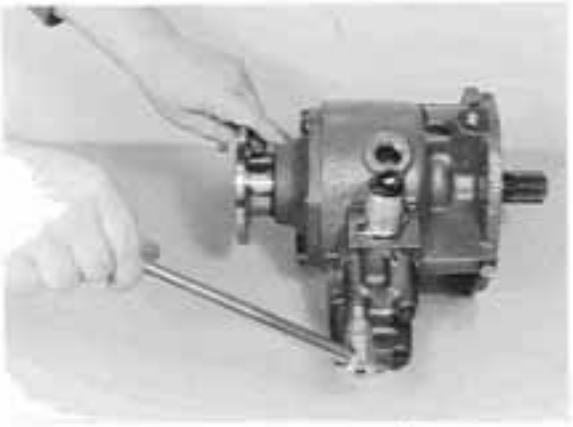


84

7. POWER TAKE-OFF CONTROLLABLE UNDER LOAD

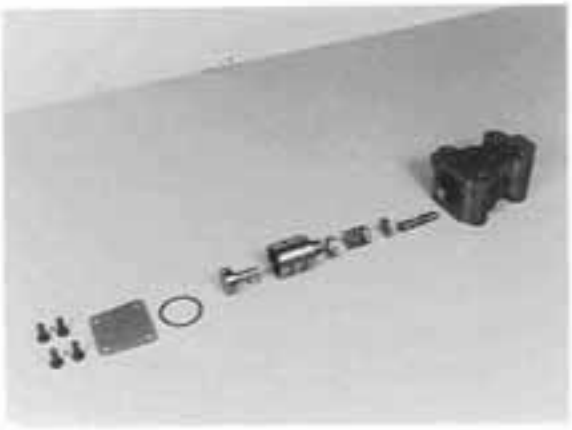
7.1 DISASSEMBLY

Loosen hex. head screws and remove shift-control housing.



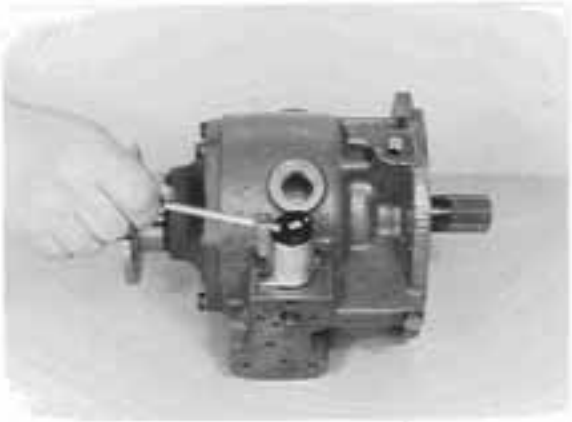
1

Remove components according to the Illustration on the right.



2

Loosen socket head screws and remove solenoid valve.



3

Loosen hex. head screws and pull the output flange from the output shaft, using puller.

(S) Clamping yoke 5870 240 025



4



5

Pry shaft seal out of the housing bore.



6

Loosen hex. head screws and pull complete clutch out of the housing.



7

Squeeze circlip out and remove backing plate as well as plate pack.

(S) Clamping pliers 5870 900 021



8

Remove rectangular ring.

Preload compression spring, squeeze circlip out and remove released components.

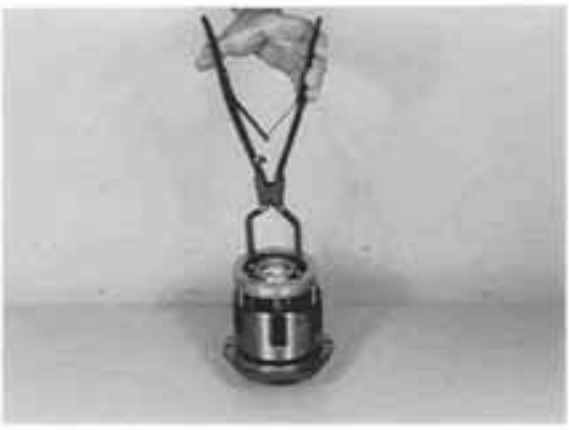
(S) Assembly jig 5870 345 028



9

Remove piston.

(S) Clamping pliers 5870 900 007



10

Squeeze out circlip.



11

Press output shaft (compl.) out of the ball bearing.



12



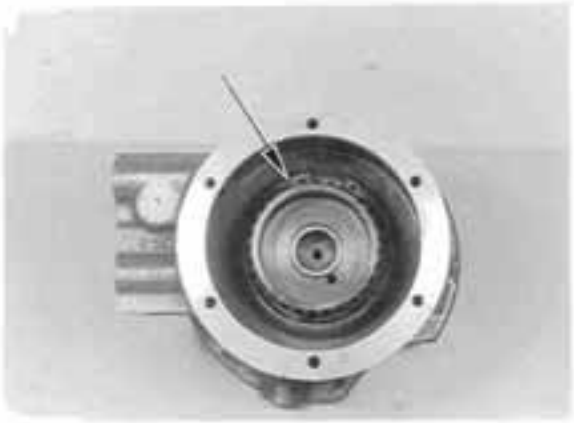
13

Squeeze circlip out.



14

Press ball bearing out of the cover.



15

Preload circlip (Arrow), align it centrically and squeeze it out.



16

Press drive shaft out of the housing bore.

Squeeze out snap rings (3 pieces).



17

Squeeze circlip out.



18

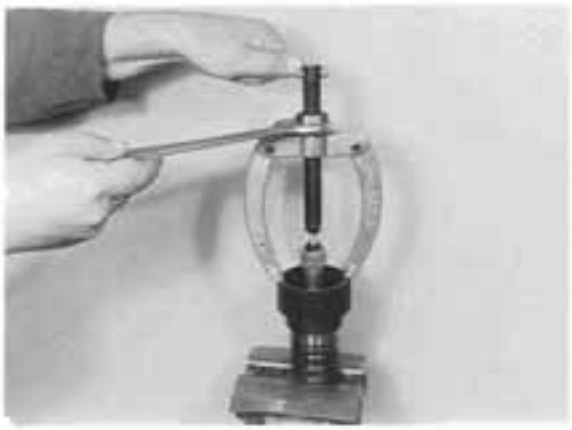
Press ball bearing from the drive shaft.



19

Pull needle bush out of the drive shaft bore.

(S)	Internal puller	5870 300 004
(S)	Back-up tool	5870 300 003



20



21

7.2 REASSEMBLY

Close the two bores by means of set screws see Arrows !

NOTE :

Insert set screws with Loctite (Type-No.270).



22

Mount circlip and press ball bearing against shoulder until contact is obtained.



23

Insert needle bush in the drive shaft bore until contact is obtained.

NOTE :

Install needle bush with the reinforced shell facing the pressing tool.

(S) Driver	5870 058 013
(S) Handle	5870 260 002



24

Fix ball bearing by means of circlip.

Squeeze in and engage snap rings (3 pieces).

Now, grease snap rings and align them centrically.



25

Press drive shaft into the housing bore until contact is obtained.

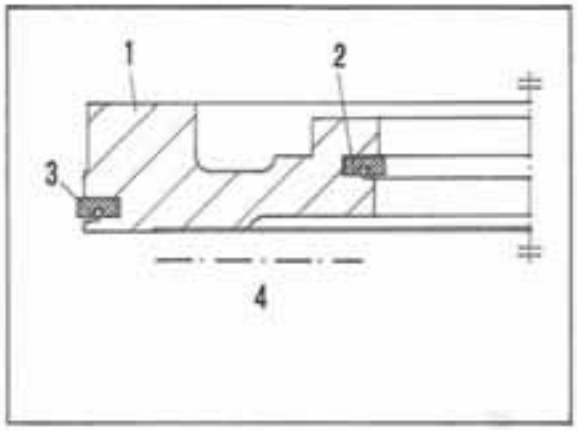


26

Preload circlip, align centrically and squeeze it into the annular groove of the housing.



27



28

Install radial lip-type sealing rings according to the Figure on the left.

1 = Piston
2 = Radial lip-type sealing ring (internal)
3 = Radial lip-type sealing ring (external)
4 = Pressure side

NOTE :

Sealing lip facing the pressure side !



29

Oil radial lip-type sealing rings and insert piston carefully until contact is obtained.

(S) Clamping pliers 5870 900 007



30

Install compression spring and disk.

NOTE :

Install disk with the reduced plane surface facing the compression spring !



31

Preload compression spring by means of assembly jig (S) and fix it by means of circlip (Arrow).

(S) Assembly jig 5870 345 028

Assemble outer and inner plates alternately, starting with one outer plate.

NOTE :

Quantity of outer and inner plates, see corresponding Spare Parts List !
Oil plate pack prior to the installation !



32

Mount backing plate and fix plate pack by means of circlip.

(S) Clamping pliers 5870 900 021



33

Check operation of the clutch by means of compressed air.



34

Squeeze rectangular ring into the annular groove (Arrow) and engage it.



35



36

Press ball bearing against shoulder until contact is obtained.



37

Fix ball bearing by means of circlip.



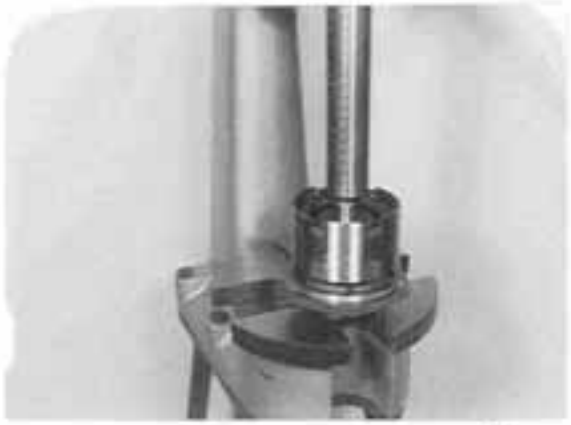
38

Install shaft seal with the sealing lip facing the oil chamber (downwards).

NOTE :

By appliation of the prescribed driver, the exact installation position is obtained !
If the outer diameter of the shaft seal is rubberized, wet the sealing surface with spirit !
If not, use a sealing compound !
Grease sealing lip !

(S) Driver	5870 055 054
(S) Handle	5870 260 002



39

Support the bearing inner race of the ball bearing and press cover against shoulder until contact is obtained.

Heat output flange and press it against shoulder until contact is obtained.



40

Fix output flange by means of disk and hex. head screws.

Torque limit (M8/8.8) 23 Nm

NOTE :

Wet contact surface of disk as well as of the screw heads with sealing compound !
Insert hex. head screws with Loctite (Type-No. 241) !

(S) Clamping yoke 5870 240 025



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Install two adjusting screws and replace flat gasket.
Grease rectangular ring (Figure 35), align it centrically and introduce the complete clutch until contact is obtained.

(S) Adjusting screws (M8) 5870 204 011



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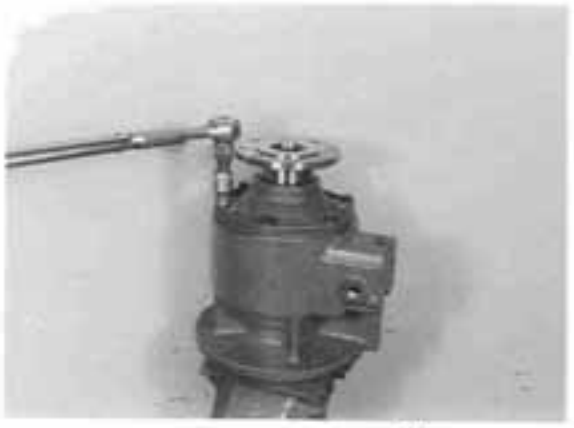
Fasten clutch by means of hex. head screws.

Torque limit (M8/8.8) 23 Nm



43



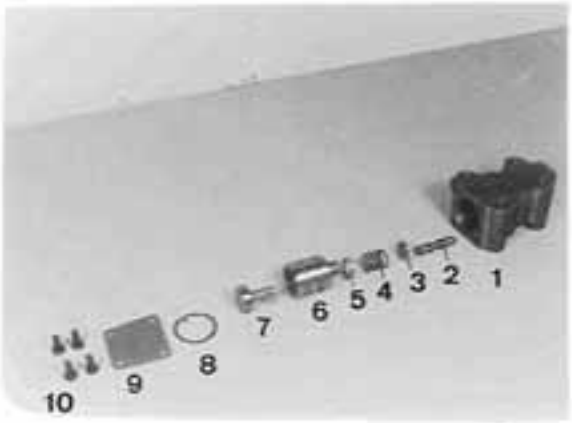
44

Make O-Ring (26 x 3 mm, see Arrow) adhere with grease in the countersinking of the housing.
Introduce solenoid valve until contact is obtained and fasten it by means of socket head screws.

Torque limit (M5/8.8) 5,5 Nm

NOTE :

Employ new O-Rings for the solenoid valve !



45

Install components according to the Illustration on the left.

1 = Housing
2 = Spool
3 = Disk
4 = Spring
5 = Disk
6 = Sleeve
7 = Spool
8 = O-Ring
9 = Cover
10 = Hex. head screw

Torque limit (M6/8.8) 9,5 Nm

NOTE :

Pay attention to the installation position of the spool (2) !
Install disk (5) with the chamfering facing the sleeve !



46

Install two adjusting screws and assemble flat gasket as well as shift-control housing.

Now, fasten shift-control housing by means of hex. head screws (use flat washers).

Torque limit (M8/8.8) 23 Nm

(S) Adjusting screws (M8) 5870 204 011

Install screw plug (Arrow).

NOTE :

Install new sealing ring !



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