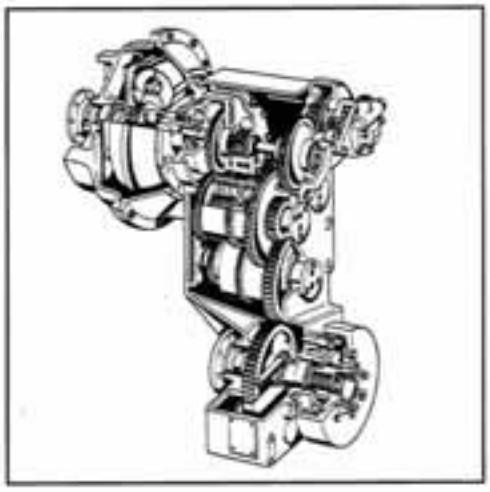
Order No. 5871 162 002 E

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

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.

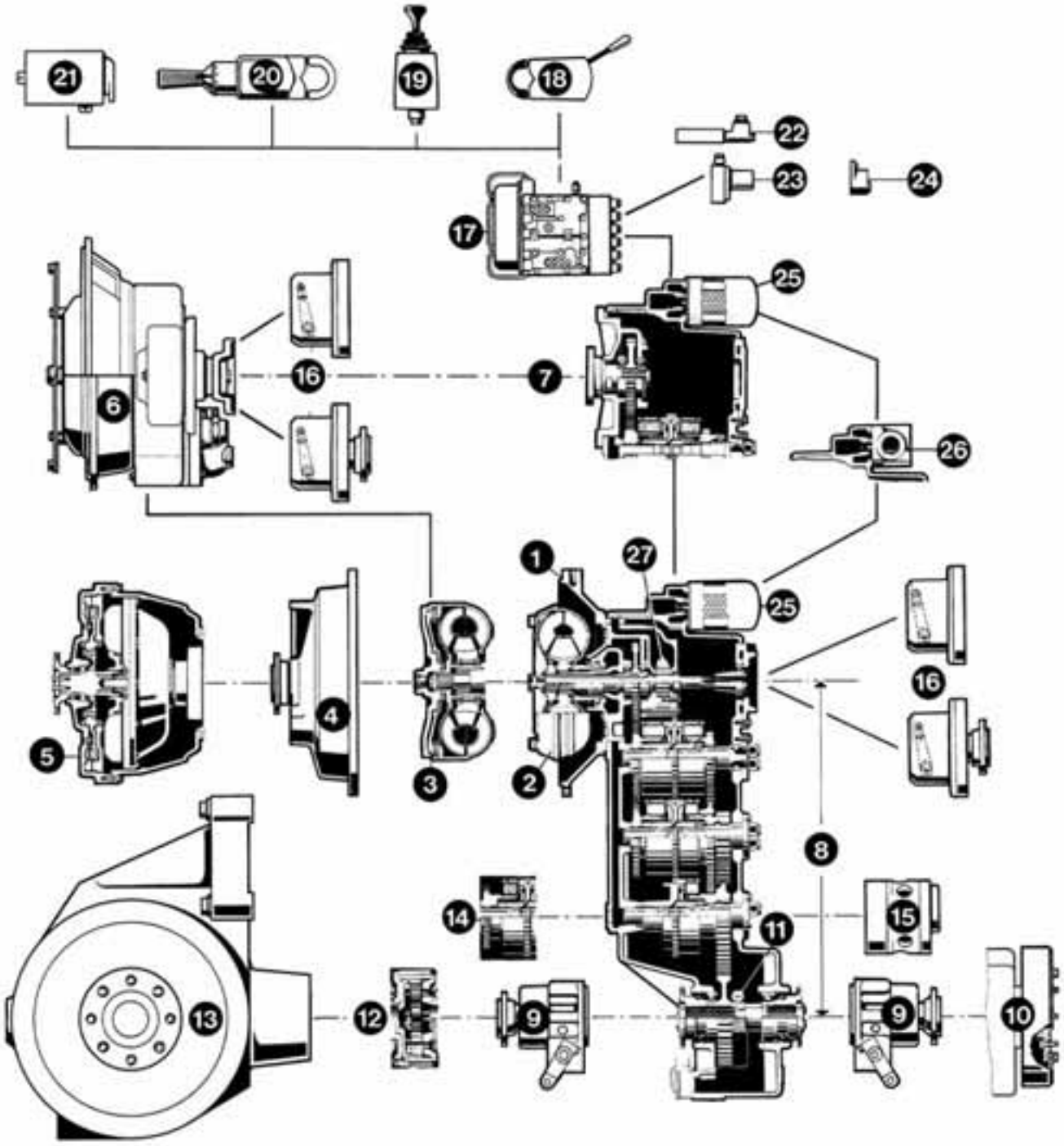
} **See Model Identification Plate!**

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 3C
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 SXC
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
LEPRINOXOL SUPER
LEPRINOXOL 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

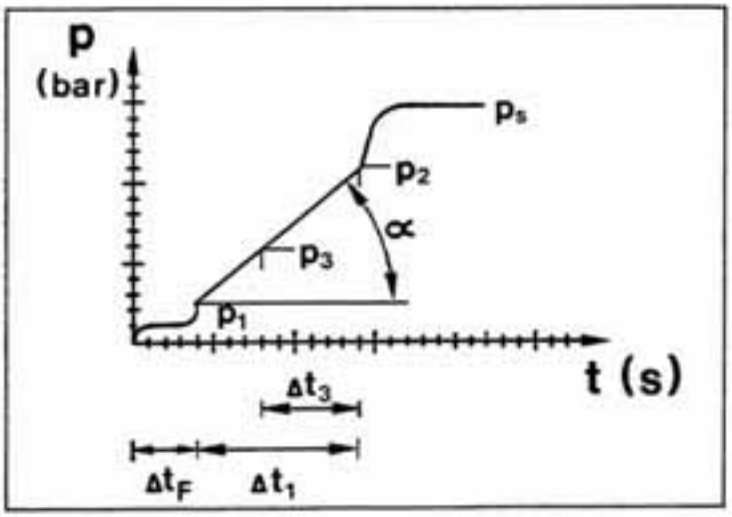
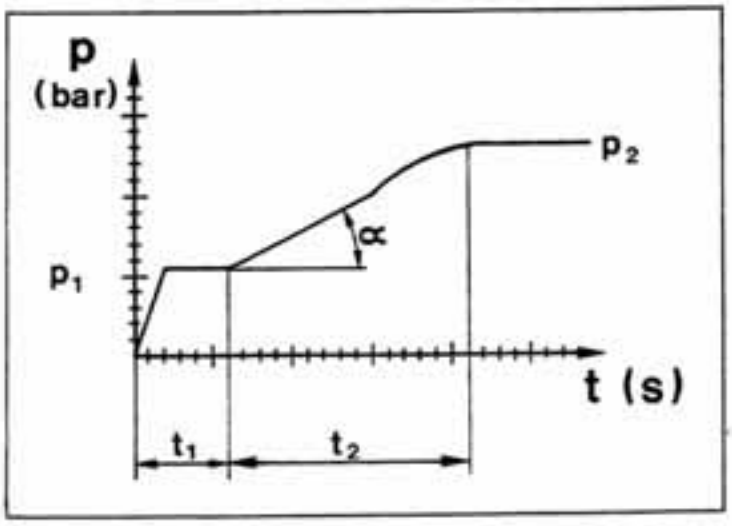


Diagram 2 (Basic diagram)

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)!

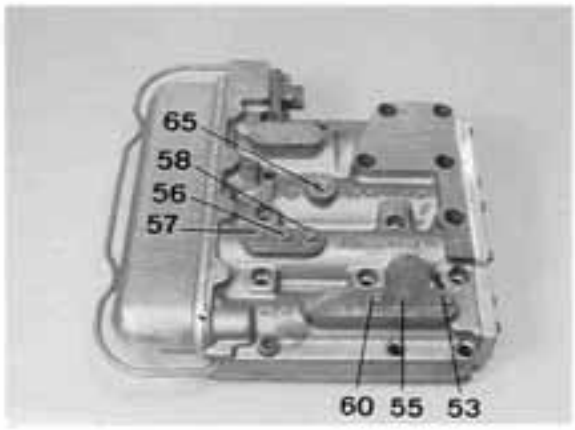
Note:

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!

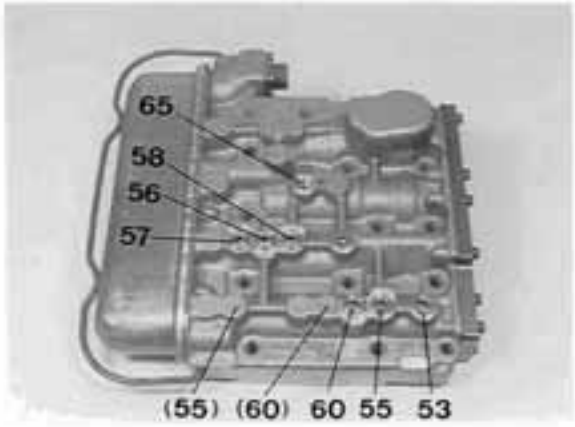
1.1 Cast-iron gearbox control



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**

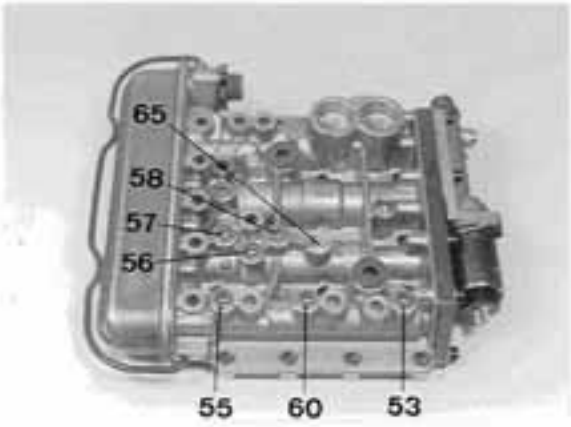
1.2 Aluminium sand-casting gearbox control (e.g. 4 magnets)



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

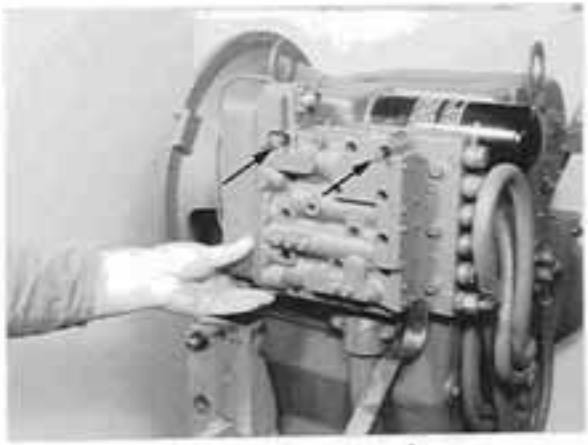
Separate shift-control housing and channel plate from gear case (Figure 1 ... 3).

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

Now, remove gaskets and intermediate plate.

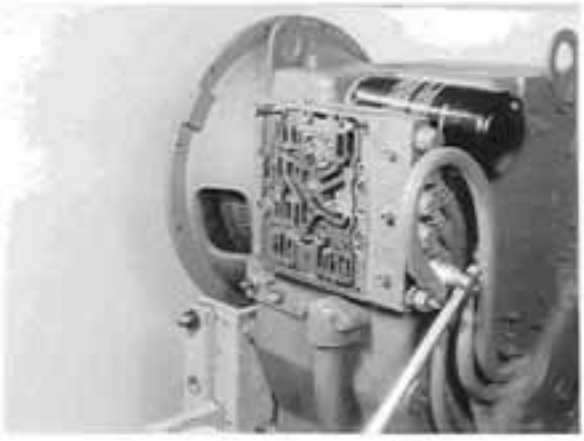
(S) Adjusting screws (M8) 5870 204 011

Now, remove gaskets and intermediate plate.



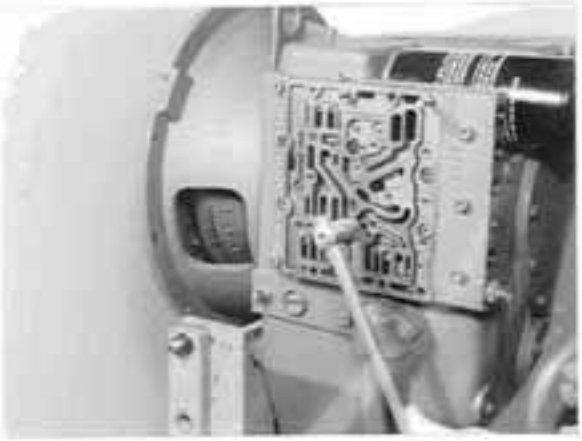
1

Remove delivery lines.

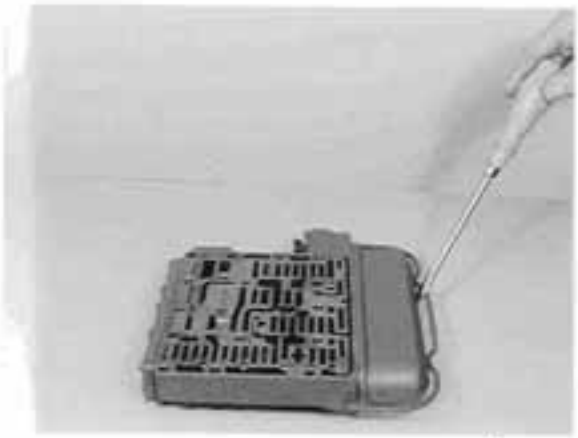


2

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

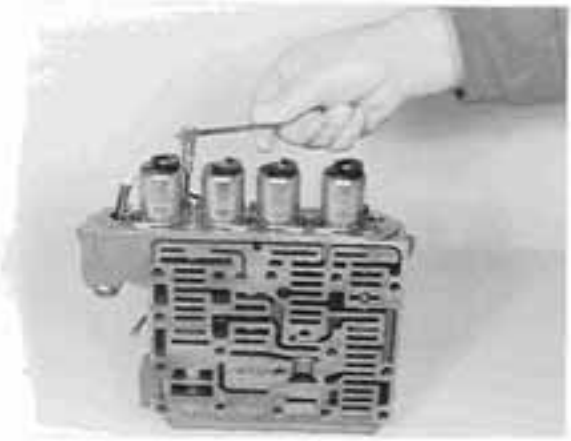


3



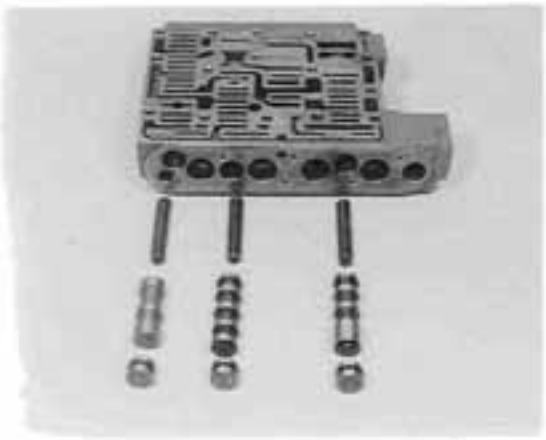
4

Relax spring clip and remove cover.



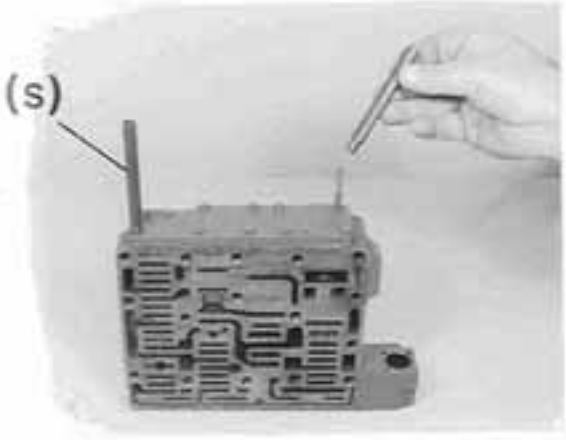
5

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

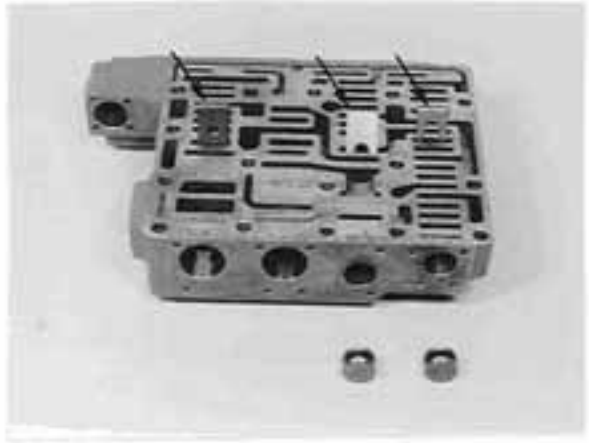
Remove components, see Figure on the right !

8

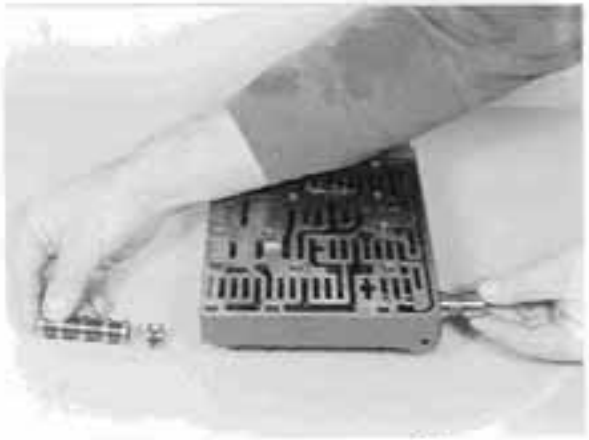
Remove stop plates (Arrows) and demount detent blocks.

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



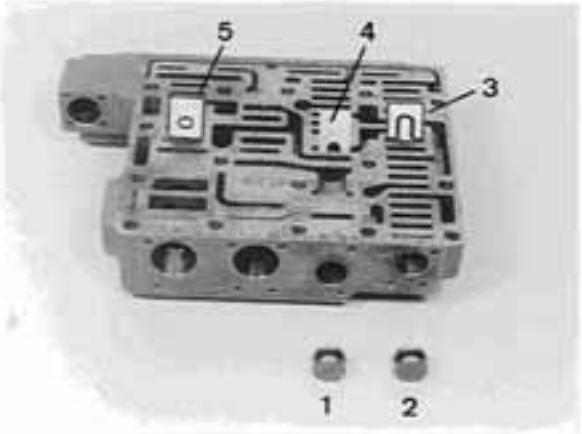
10

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

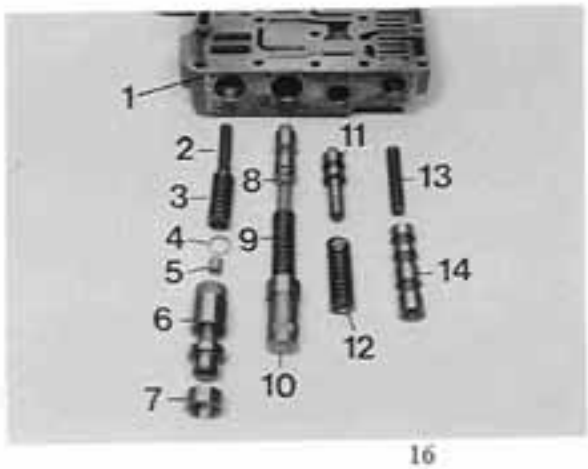
Introduce detent blocks (1 and 2) into the bores and fix them by means of stop plates (3 and 4).
Install stop plate (5).

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)



16

NOTE :

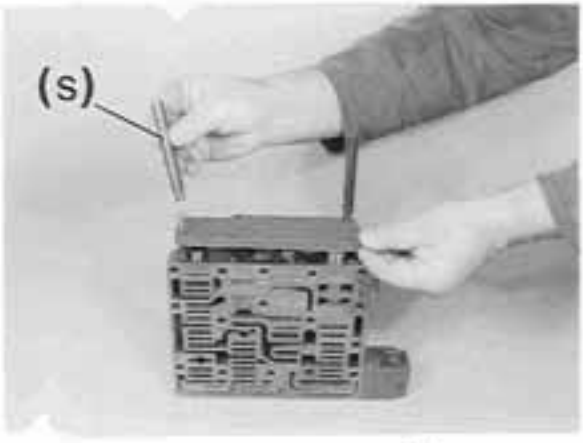
L_o = Length of the unloaded spring !

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

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

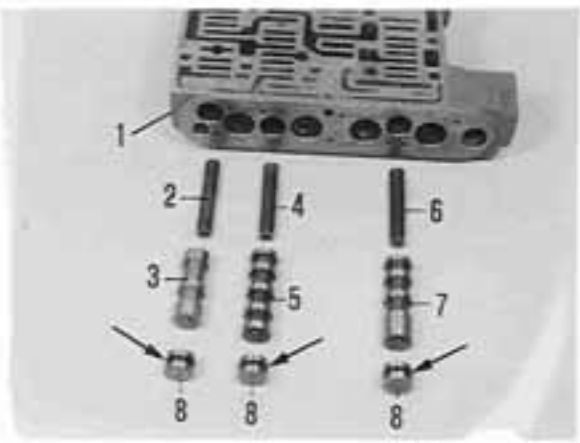
(S)	Adjusting screws (M5) with nut	5870 204 036
(S)	Adjusting screws (M6) with nut	5870 204 049



17

Install components :

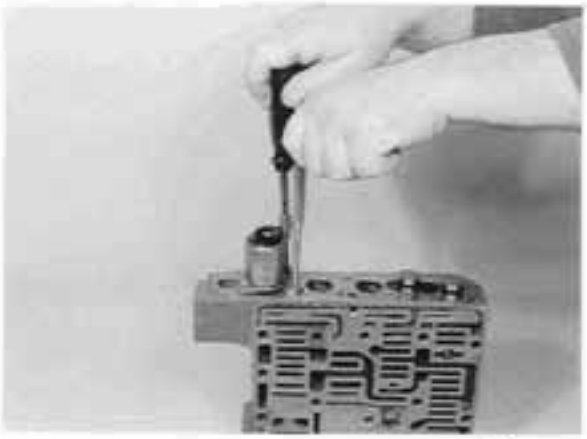
1 =	Valve body	
2 =	Spring	(L_o = 72,5 mm)
3 =	Spool	(3 control surfaces)
4 =	Spring	(L_o = 72,5 mm)
5 =	Spool	(5 control surfaces)
6 =	Spring	(L_o = 72,5 mm)
7 =	Spool	(total length 72,0 mm)
8 =	Detent block	(3 pieces)



18

NOTE :

Install new O-Rings, see Arrows !

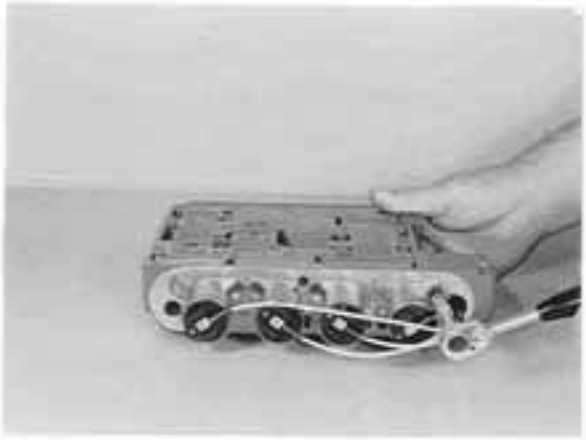


19

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)

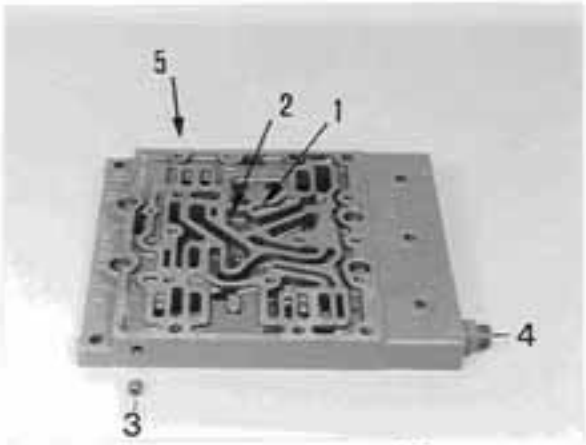
NOTE :

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.

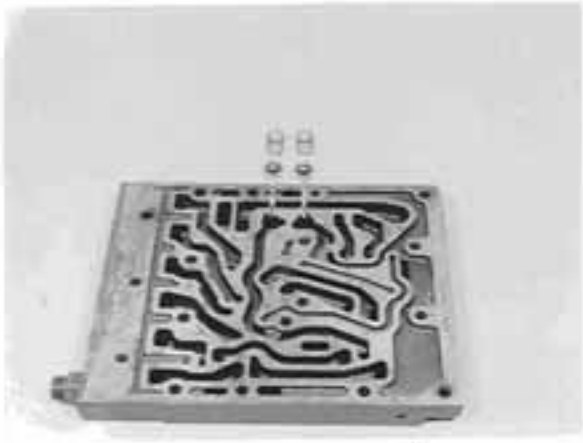
Install diaphragm for the backfeed (Position, see Arrow 2) accordingly.

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)

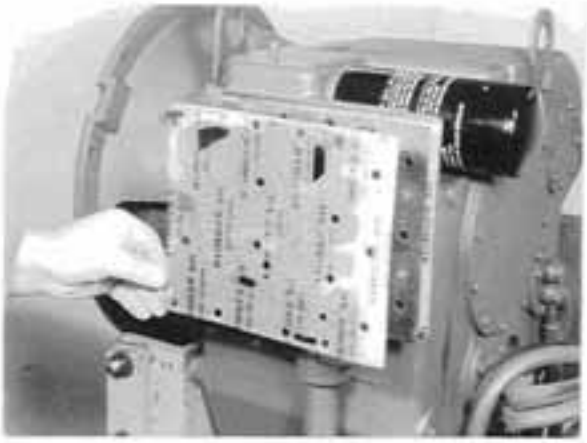
Install housing gasket.

NOTE :

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

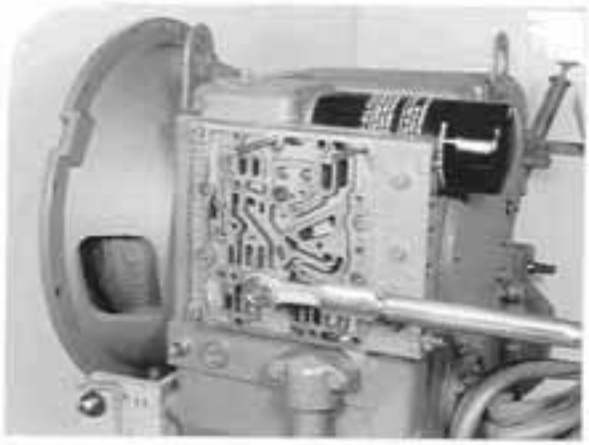
(S) Adjusting screws (M8) 5870 204 011


25



26

Install intermediate plate and 2nd gasket.



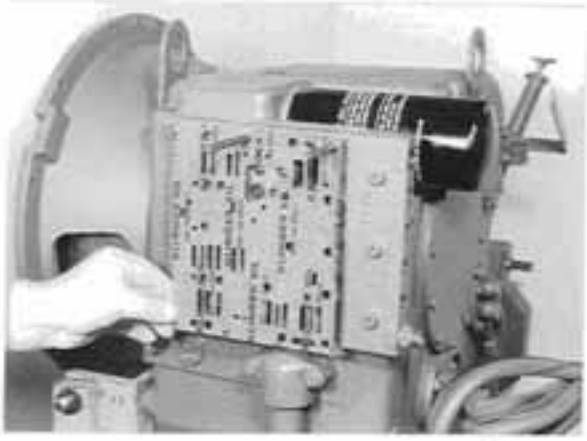
27

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 !

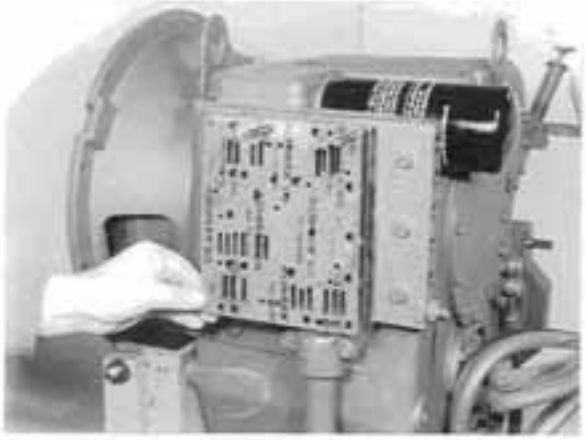


28

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.

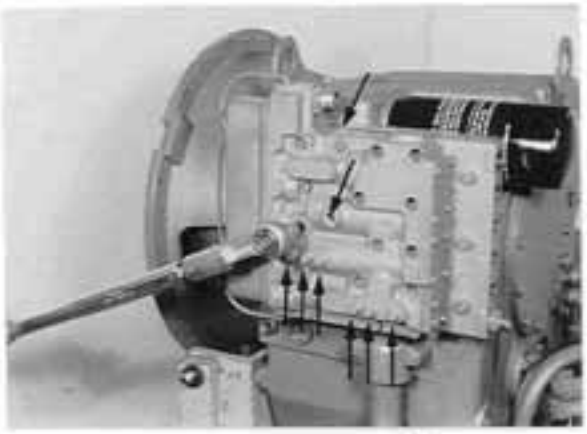
Torque limit (M8/8.8) 23 Nm

NOTE :

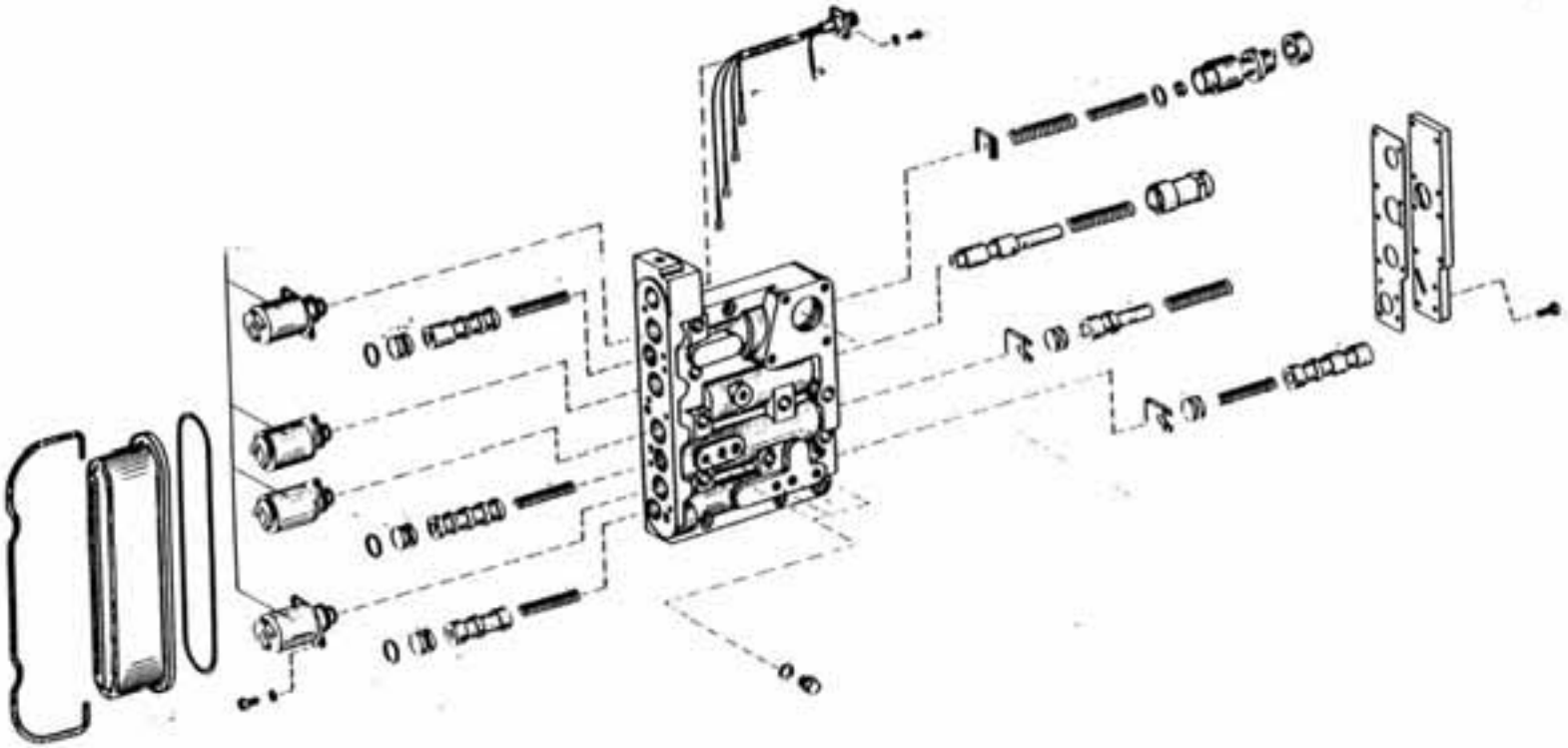
Pay attention to the position of the different screws (lengths) !

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

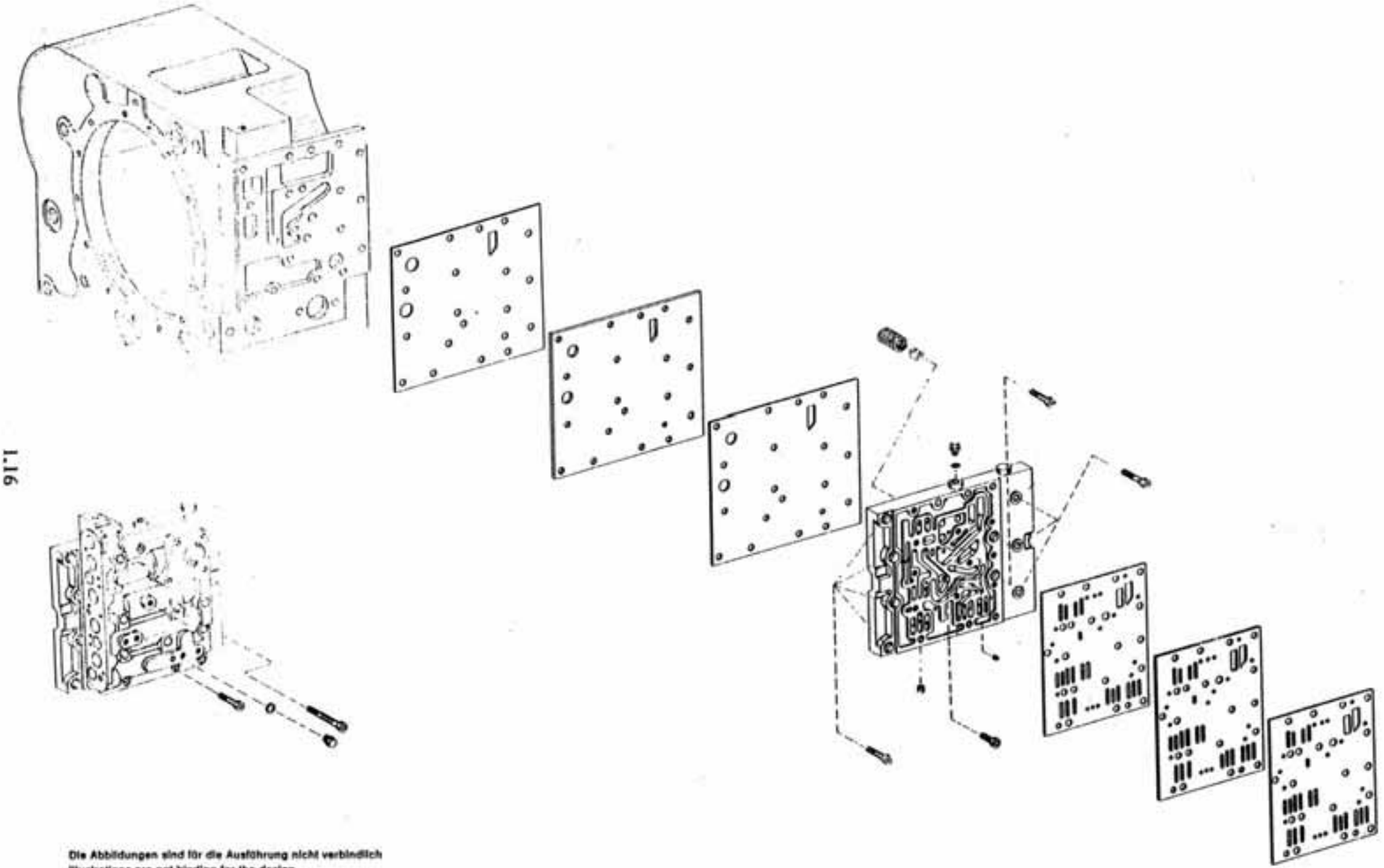
Now, install delivery lines, see Perspective Illustrations in the corresponding Spare Parts List !



30



Die Abbildungen sind für die Ausführung nicht verbindlich
Illustrations are not binding for the design
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

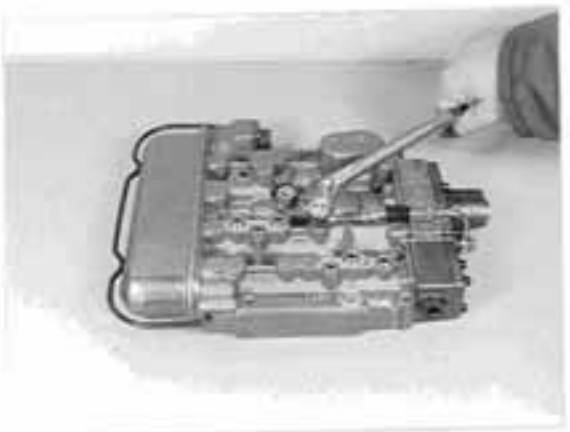
1.2 ALUMINIUM SAND-CASTING GEARBOX CONTROL

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

1.2.1.1 DISASSEMBLY

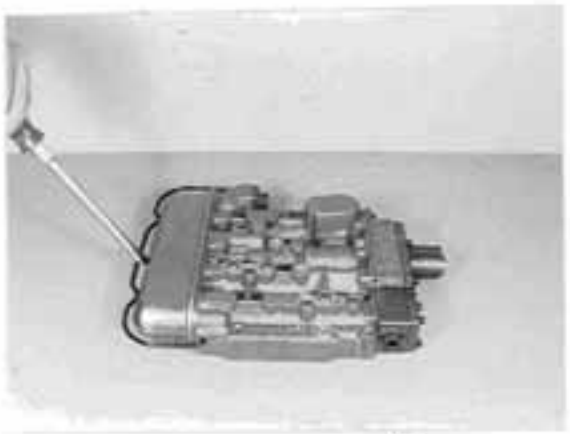
Remove delivery line.

(S) Adjusting screws (M8) 5870 204 011



35

Relax spring clip and remove cover.



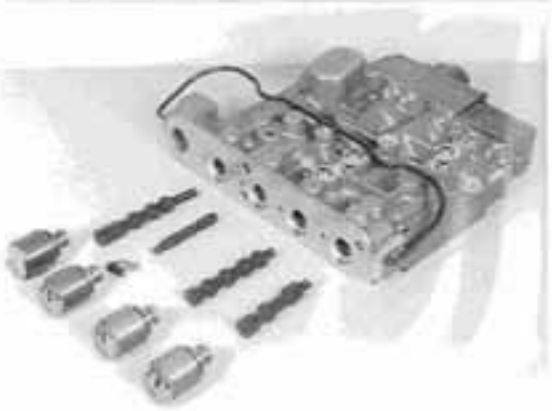
36

Pull off cable shoes and remove cable harness.

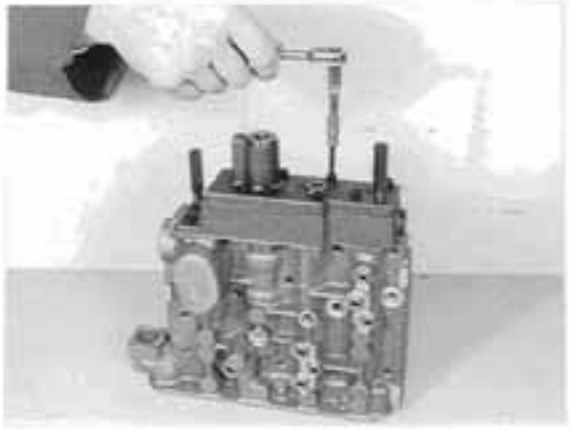
Loosen socket head screws and remove solenoid valves.

37

Remove components, see Figure on the right !



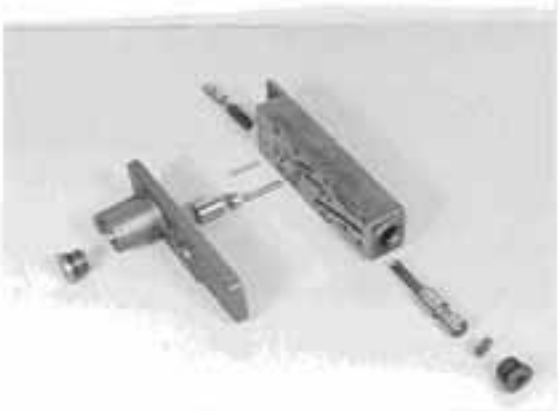
38



39

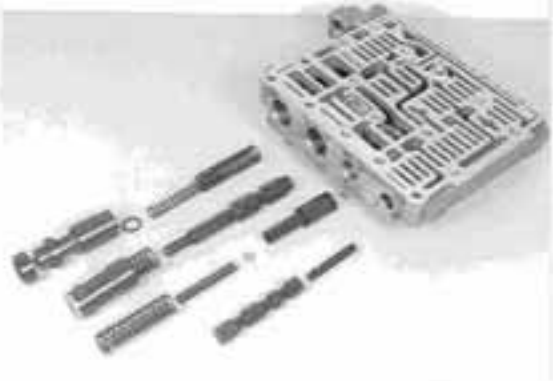
Loosen two socket head screws and fix shift-control housing provisionally, using a Special Tool (S).
Now, loosen the remaining socket head screws and separate shift-control housing (is spring-loaded) from the valve body by uniform loosening of the nuts (S).

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



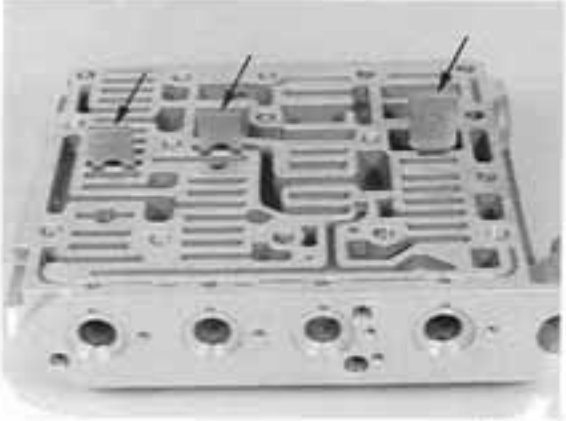
40

Dismantle pressure control valve.



41

Remove components.



42

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

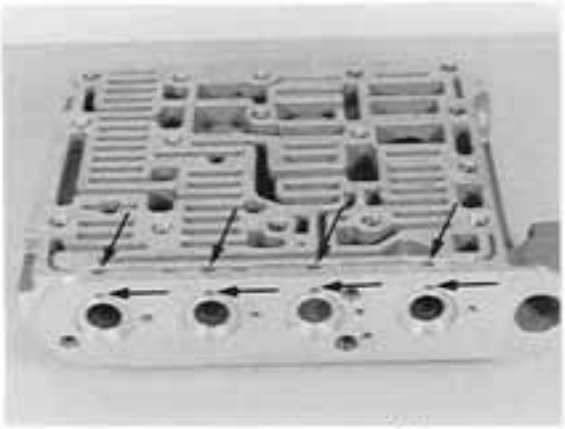
1.2.1.2 REASSEMBLY

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).



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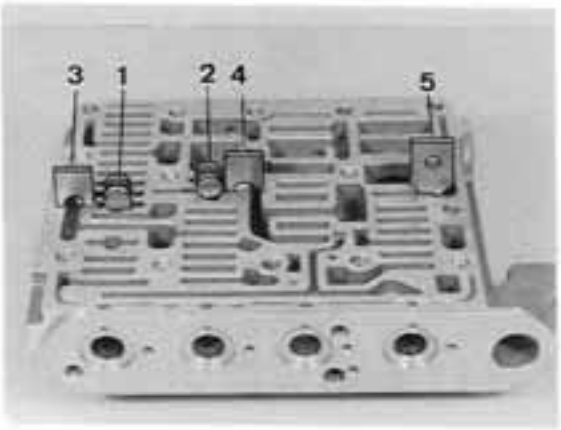
Introduce detent blocks (1 and 2) into the bores and fix them by means of stop plates (3 and 4).

Install detent block (5).

NOTE :

Pay attention to the installation position !



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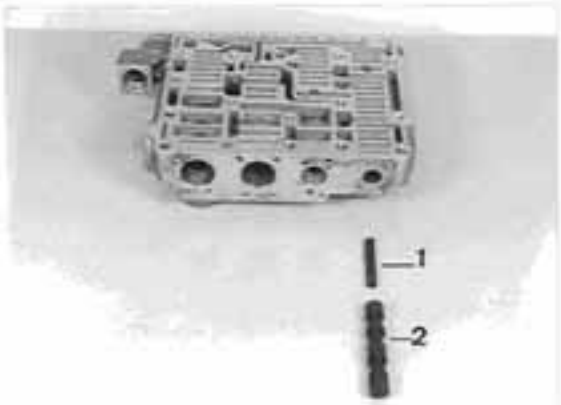
Install components :

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

NOTE :

L_o = Length of the unloaded spring !



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