

REPAIR MANUAL



011356

ZF-ECOMAT 2

HP 502 C / HP 592 C / HP 602 C

EST 46 C / EST 47 C

Stages 1-2

4149 751 601e

Subject to alterations in design

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Printed in Germany

Edition: 2001 - 03

4149 751 601e

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This repair manual is intended for skilled personnel trained by ZF Friedrichshafen AG to carry out maintenance and repair work on ZF products.

This manual deals with the standard ZF product in accordance with the state of development on the date of issue.

However, due to continuing development of the product, repair work might require work practices and test or adjustment data not contained in this manual.

We recommend that work done on your ZF product is carried out only by skilled mechanics who have had their practical and theoretical knowledge updated on a regular basis at our After-Sales Service training centers.

Service points equipped by ZF Friedrichshafen AG all over the world offer you:

1. Continually trained personnel
2. Specified equipment, e.g. special tools
3. Genuine ZF spares, to our latest specifications

All work performed at these service points is carried out conscientiously and with utmost care.

Repair work carried out at ZF service points is subject to the contractual conditions prevailing in the individual case.

ZF FRIEDRICHSHAFEN AG
C.V./Special Transmissions
Service Plant 2
Tel.: (0 75 41) 77-0
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Damage resulting from work performed by non-ZF personnel in an improper and unprofessional manner and any consequential costs are excluded from the contractual liability agreement. Exclusion of liability also applies if genuine ZF spares are not used.

SAFETY NOTICE

Companies repairing ZF units are responsible for their own work safety.

To avoid injury to personnel and damage to products, all safety regulations and legal requirements which apply to repair and maintenance work must be adhered to.

Before starting work, mechanics must familiarize themselves with these regulations.

Personnel required to carry out repairs on ZF products must receive appropriate training in advance. It is the responsibility of each company to ensure that their repair staff is properly trained.

The following safety instructions appear in this manual:

NOTE

Refers to special processes, techniques, data, use of auxiliary equipment, etc.

CAUTION

This is used when incorrect, unprofessional working practices could damage the product.

DANGER

This is used when lack of care could lead to personal injury or death.

GENERAL INFORMATION

Read this manual carefully before starting any tests or repair work.

CAUTION

Pictures, drawings and components do not always represent the original object, but are used to illustrate working procedures.

Pictures, drawings and components are not to scale. Conclusions about size and weight should not be drawn (even within a complete illustration). Always follow the working steps as described in the text.

After completion of repair work and testing, skilled staff must satisfy themselves that the product is functioning correctly.

THREATS TO THE ENVIRONMENT !

Lubricants and cleaning agents must not be allowed to enter the soil, ground water or sewage system.

- **Ask your local environment agency for safety information on the relevant products and adhere to their requirements.**
 - **Collect used oil in a suitably large container.**
 - **Dispose of used oil, dirty filters, lubricants and cleaning agents in accordance with environmental protection guidelines.**
 - **When working with lubricants and cleaning agents always refer to the manufacturer's instructions.**
-

CAUTION

The transmission must NOT be hung by the input shaft NOR by the output flange.

In case of doubt always turn to the relevant department within ZF After-Sales Services for advice.

All work on transmissions is to be performed expertly and under clean conditions.

Use specified tools to dismantle and assemble transmissions.

After removing the transmission from the vehicle, clean thoroughly with a suitable cleaning agent before opening.

Pay particular attention to the projections and recesses of housings and covers when cleaning.

Parts joined with Loctite are easier to separate if warmed with a fan heater.

CLEANING PARTS

Remove remains of old gaskets on all seal-faces. Carefully remove burrs or similar patches of roughness using an oil-stone.

Lube bores and grooves must be free of anti-corrosion agents and foreign matter; check for perfect passage.

Carefully cover opened transmissions to prevent foreign matter from entering.

REUSING PARTS

Parts such as ball or roller bearings, multi-discs, thrust washers etc., must be inspected by a competent person, who should decide whether or not they can be re-used. Replace parts which are damaged or have suffered from excessive wear.

GASKETS, LOCKING PLATES

Parts which cannot be removed without being damaged must always be replaced with new parts (e.g. gaskets and locking plates).

SHAFT SEALS

Always change shaft seals with rough, ripped or hardened packing washers. Seal contact surfaces must be totally clean and in perfect condition.

REWORKING

Rework may be carried out on seal contact surfaces using plunge-cut grinding only, never use an emery cloth. Ensure that there are no traces of grinding or riffling.

If rework is needed on distance washers, shims etc. because of clearance settings, ensure that the reworked areas contain no face runout and have the same surface quality.

TRANSMISSION ASSEMBLY

Find a clean site to assemble the transmission. Gaskets are installed without the use of sealing compound or grease. When measuring silicon-coated gaskets, take care **not to include the silicon layer in the measurement.**

During assembly, comply with all adjustment data, checking data and tightening torques in the Repair Manual.

BEARINGS

If bearings are mounted in heated condition, they are to be heated evenly (e.g. heating cabinet). Temperature should be at ca. 85 °C and must not exceed 120 °C. Each mounted bearing must be oiled with operating oil.

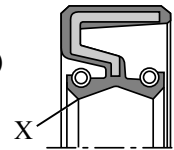
SEALING

If a specific sealing agent* is to be used for sealing, comply with the manufacturer's directions for use. Apply a thin layer of sealing agent to the surfaces and spread evenly. Do not allow sealing to enter oil ducts and bores. On oil-carrying ducts and bores, wipe off the sealing agent on the surfaces to be sealed near apertures to ensure that no sealing agent enters the oil feeds when the surfaces are sealed.

SHAFT SEALS

- a) Apply a light coat of sealing agent* on outer edge of shaft seals with "steel surround".
- b) **Never apply sealing agent** to shaft seals with "rubber surround", but apply a thin coat of Vaseline 8420 to the outer edge or wet with a lubricant, e.g. a water-soluble, concentrated washing-up liquid (e.g. Pril, Coin, Palmolive).
- c) Shaft seals with steel and rubber surrounds should be treated on the outer edge of the rubber surround as described above in section b).

- d) Dual shaft seals have two sealing lips. The dust-proof sealing lip (X) must face outwards.



- e) Fill the gap between the sealing lips so it is 60% filled with grease (e.g. produced by Aral such as Aralub HL2 or by DEA such as Spectron FO 20).
- f) If possible, heat shaft seal bores to between 40 and 50 °C (makes fitting easier). Press the seal shaft with mounting or faceplate onto the relevant installation depth plan.

RETAINING AGENTS

Retaining agents* may only be used in places as specified in the parts list. Always comply with manufacturer's directions for use when using retaining agents (e.g. Loctite). During assembly, comply with all adjustment data, checking data and tightening torques.

TRANSMISSION OIL

After completing repairs, fill transmissions with transmission oil. For the procedure and approved oils, refer to the transmission operating manual and List of Lubricants TE-ML (refer to identification plate) which are available from any ZF After-Sales Service Point. After filling the transmission with oil, tighten the screw plugs at the oil filling point and the oil overflow to the specified torques.

* refer to expendable material

HP 502 C / HP 592 C / HP 602 C**Tightening torques****Tightening torques for nuts and bolts, extract from ZFN 148**

This standard applies to bolts acc. to DIN 912, DIN 931, DIN 933, DIN 960, DIN 961 and to nuts acc. to DIN 934. This Standard contains data on tightening torques (M_A) for bolts and nuts in strength categories 8.8, 10.9 and 12.9 and nuts in strength categories 8, 10 and 12.

Surface condition of bolts: thermally blackened and oiled or galvanized and oiled or galvanized, chrome-plated and oiled.

Tighten screws with a calibrated torque spanner.

NOTE

Irregular tightening torques are listed separately in the Repair Manual.

Regular screw thread			
Size	Tightening torque M_A (Nm) for		
	8.8	10.9	12.9
Bolt	8.8	10.9	12.9
Nut	8	10	12
M 4	2.8	4.1	4.8
M 5	5.5	8.1	9.5
M 6	9.5	14	16.5
M 7	15	23	28
M 8	23	34	40
M 10	46	68	79
M 12	79	115	135
M 14	125	185	215
M 16	195	280	330
M 18	280	390	460
M 20	390	560	650
M 22	530	750	880
M 24	670	960	1100
M 27	1000	1400	1650
M 30	1350	1900	2250

Fine screw thread			
Size	Tightening torque M_A (Nm) for		
	8.8	10.9	12.9
Bolt	8.8	10.9	12.9
Nut	8	10	12
M 8 x 1	24	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	1100	1250
M 24 x 2	730	1050	1200
M 27 x 1.5	1100	1600	1850
M 27 x 2	1050	1500	1800
M 30 x 1.5	1550	2200	2550
M 30 x 2	1500	2100	2500

Edition: August 1991 / checked 1997