ZF-ECOSPLIT®

16 S 221
16 S 181
8 S 181

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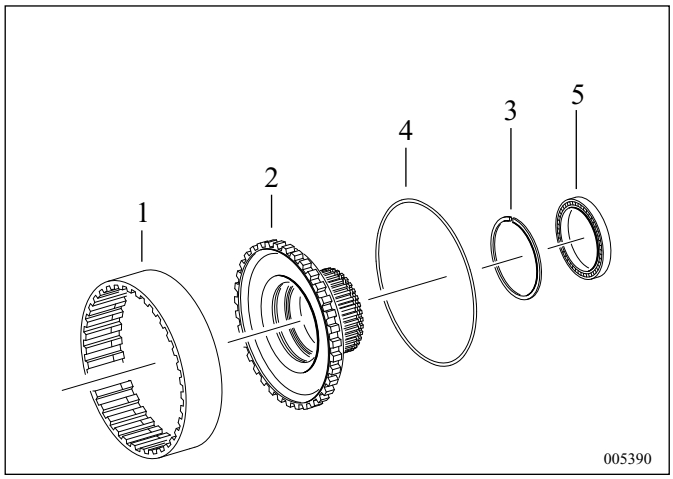
Description	Tolerance	Measuring device	Remarks
11. Permitted axial play on planet gears in planet carrier	0.4 to 1.30 mm	Feeler gauge	Tolerance includes permitted wear on thrust washers. If wear limit exceeded exchange thrust washers
12. Wear limit for synchronizer ring and clutch body, measured between flat surfaces of ring and body with cones firmly nested together. 4-gear section and splitter Range-change	 0.80 mm 1.20 mm	Feeler gauge	Exchange synchronizer ring and/or clutch body if dimension too small
13. Wear limit for 1st/2nd gear synchronizer parts, measured between outer ring and clutch disc, measured with cones nested firmly together) and force F = 50 N applied on the outer ring.	1.5 mm	Feeler gauge	Exchange intermediate ring and/or outer ring and inner ring if wear limit is excluded.
14. Max. permitted play on fulcrum pads in sliding sleeves	0.6 - 1.2 mm	Feeler gauge	Exchange if play is excessive
15. Adjustment dimension for splitter shift fork	107.9 mm	Depth gauge	Nominal dimension between piston and mid-housing sealing face without gasket. Fulcrum pads must have play of min. 0.10 mm upwards and downwards. Tightening torque for grub screw: 60Nm
16. Adjusting mainshaft and determining thickness of shim and ring (in straight-cut version)	19.20 - 0.5 mm	Depth gauge	Measured between upper edge of clutch body with ring inserted and mid-housing with gasket attached. Select appropriate ring to ensure nominal dimension (see table)

1.7.2 Ring gear

1 Attach circlip (7) from Section 1.7.1 onto ring gear carrier. Place adapter onto planet carrier and fit using 2- or 3-leg puller underneath circlip.



Straight-cut version:

2 Pull off ring gear (1), ring gear carrier (2) and ball bearing (5) together.

3 Detach safety wire (4) from annular groove in ring gear.

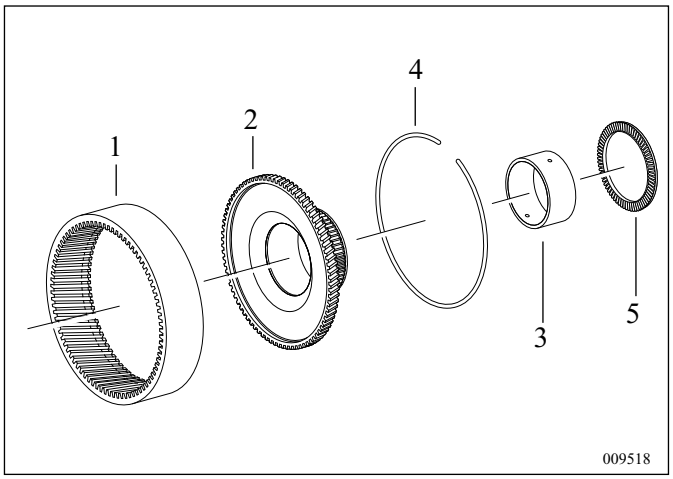
4 Using plastic hammer, drive out ring gear carrier (2) from ring gear (1).

5 Detach snapring (3) from ring gear carrier and remove ball ball bearing (5).

Helical-cut version:

2 Pull off ring gear (1), ring gear carrier (2), intermediate ring (3) and axial needle bearing (5) together.

3 Detach safety wire (4) from annular groove in ring gear.



1.7.3 Planet carrier

1 Drive dowels (1) fully into planet pin (2).

2 Using plastic drift, drive out planet gear pin from planet carrier (3) towards “input”.

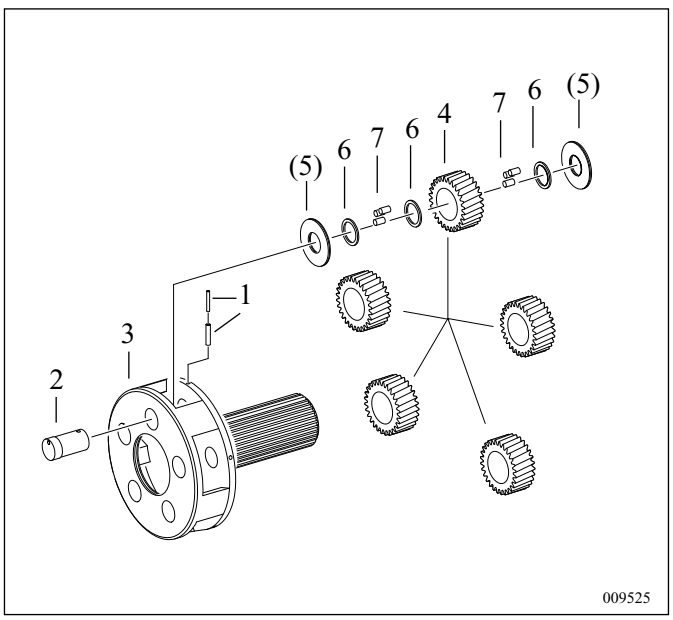
3 Remove planet gear (4) from planet carrier together with thrust washers (5).

NOTE: Thrust washers (5) in straight-cut version only.

4 Remove shims (6) and cylinder rollers (7) from planet gear.

5 Drive out dowels (1) from planet pin.

Repeat steps 1) to 5) for remaining planet gears.



2.3 Removing and dismantling friction-optimized shift housing (illustrations show superimposed "H" shift pattern)

1 Loosen hex bolts (1) and remove shift turret together with gasket (2).

2 Loosen shift lever (3) (depending on parts list) and remove together with protective cap.

3 Remove detent plunger (4) and screw plug or switch (5).

4 Take out cutoff valve and remove together with O-ring (7).

NOTE: Cutoff valve is a complete component and is not dismantled. In the version with double "H" shift pattern, there are 2 ball rollers (8) in the cutoff valve.

5 Remove screw plug (9) together with seal ring, spring (10) and bolt (11).

6 Remove screw plugs (12 and 13) together with seal rings.

7 Unscrew cover (14) together with piston and remove together with gasket.

NOTE: In the version with double "H" shift pattern, a cover and switch are installed here.

8 Loosen housing (15) and remove together with gasket.

9 Remove detent plate (16) and detent (17) from housing.

10 Unscrew hex bolts from shift cover (18) and remove together with gasket.

11 Drive out shaft seal (19), bearing bush (20), shaft seal (21) and wiper (22) from shift cover.

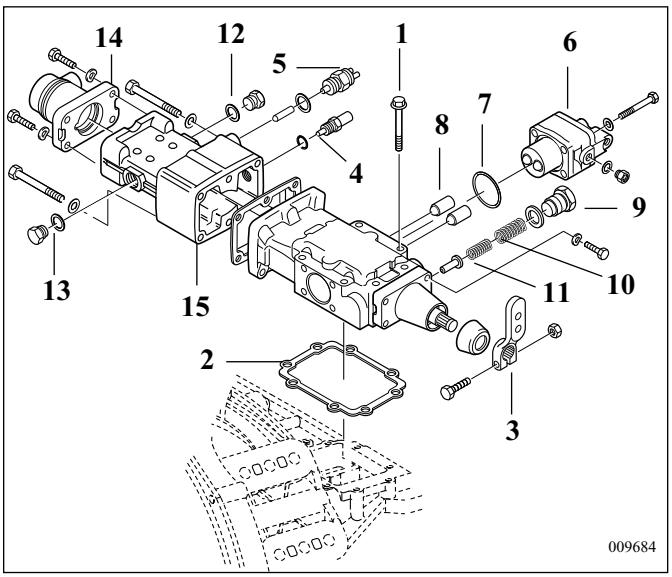
12 Detach split ring (23) and remove detent (24) from housing together with O-ring.

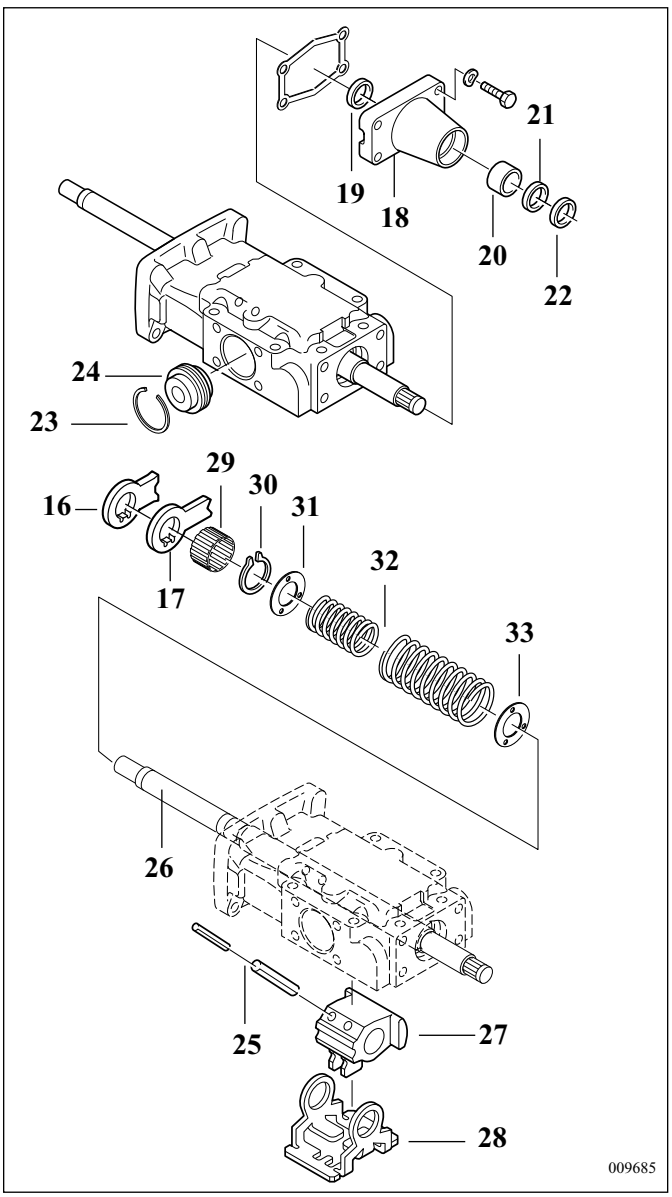
13 Drive out dowels (25) from driver.

14 Remove selector shaft (26), driver (27) and locking piece (28).

15 Remove needle sleeve (29) from housing.

16 Detach split ring (30) and remove disc (31), spring (32) and disc (33) from selector shaft.





4.3 Removing shafts

For Steps 1 - 6, see Section 4.4

1 Unscrew cover (9) together with gasket.

2 Using drift, drive out reverse pin (3) from centre housing in direction of output. In older versions, loosen and remove fixing screw (3a) and fixing-washer.

CAUTION
Reverse idler gear may fall out.

3 Remove reverse idler gear (4) together with needle cage (5).

4 Remove screw plug (6) together with seal ring.

5 Screw in fixture **1X56 137 287**. Interlock locking pin (7) is pushed against spring pressure.

6 Bolt lifting device (17) **1X56 137 122** to centring bush **1X56 137 921** and place over input shaft (18) and shift rails (19) so that it lies on the layshaft (21). Place disc **1X56 137 933** between lifting device and layshaft. Place holder (20) **1X56 137 918** onto lifting device and insert into shift rail driver.

7 Bolt layshaft (21) to lifting device; tightening torque = 85 Nm.

8 Pull out shafts and shift rails from centre housing without tilting and place into device **1X56 137 675**.

9 Remove lifting device (17) and accessories. Take out shift rails, forks and fulcrum pads.

10 Remove fulcrum pads from shift forks.

NOTE: Do not dismantle shift rails any further. In this condition, they form a complete unit.

4.4 Removing components/ centre housing

1 Unscrew device **1X56 137 287** and remove locking pin (7) and compression spring (8).

2 Remove all screw plugs, seal rings, pressure switches, pins, filler necks and gasket.

3 If necessary, remove injection pipe (10), type plate (22) and roll pins (11).

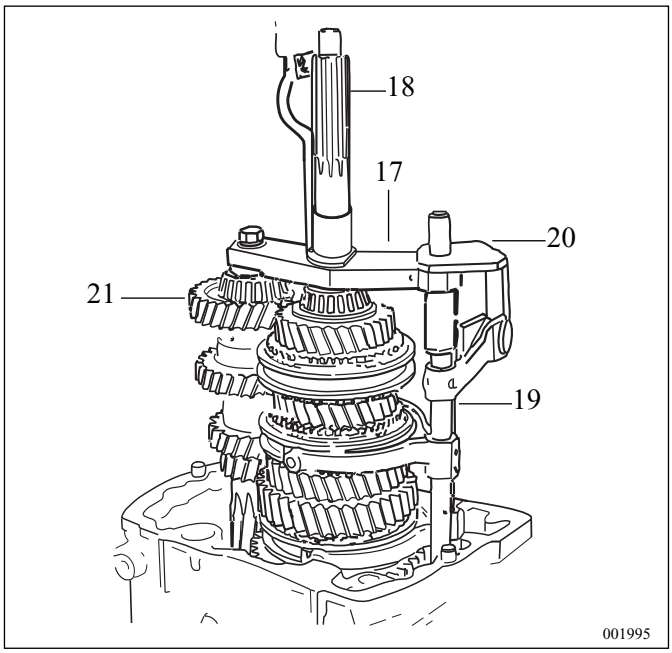
4 Remove packing (12), circlip (13) and bearing bush (14).

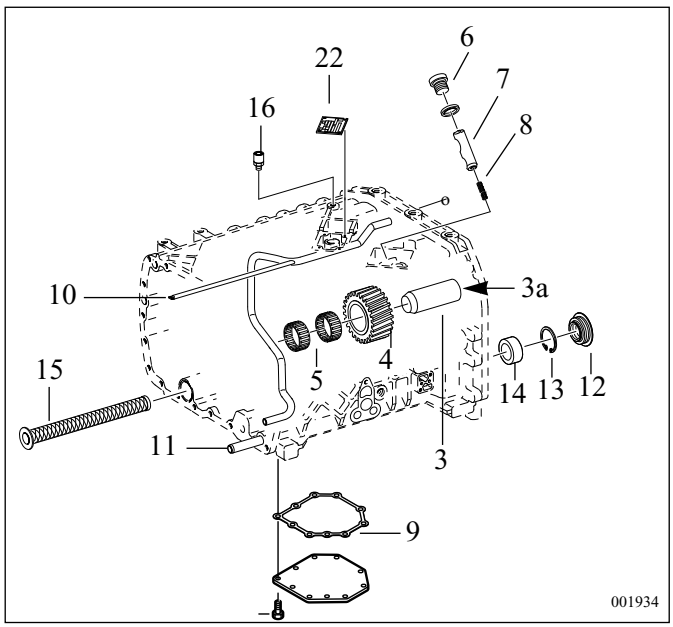
5 Remove roller bearing outer races for mainshaft and layshaft from centre housing. Drive out towards inside of housing.

6 Renew filter (15).

7 Remove breather (16).

⚠ DANGER
Ensure mounting brackets and rope are firmly connected.





4.7.2 Version ZF-D

1 Assembly procedure basically similar to version ZF-BK.

2 Teeth of sliding sleeve (6) have 3 recesses covering 3 teeth each. Align middle tooth with narrow recess in synchronizer hub (3) (pressure piece groove). Renew compression springs.

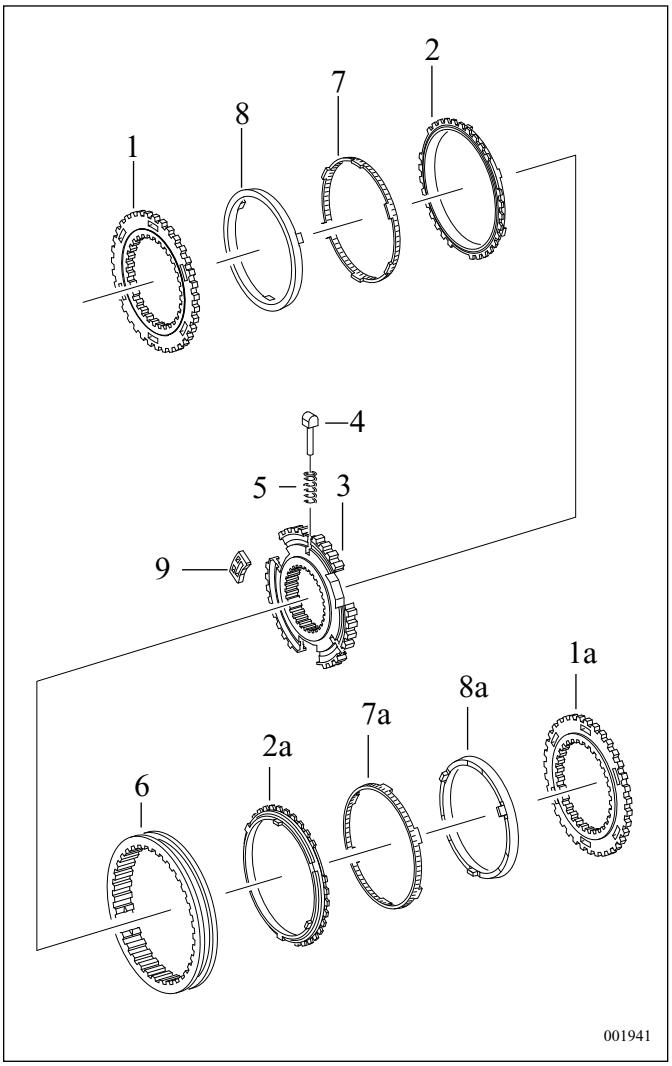
3 Insert new compression springs (5) and pressure pieces (4) into synchronizer hub. Fit pressure pieces so round head of pressure piece juts into recess in sliding sleeve teeth.

4 Insert couplings (9).

5 Insert outer ring (2), intermediate ring (7) and inner ring (8).

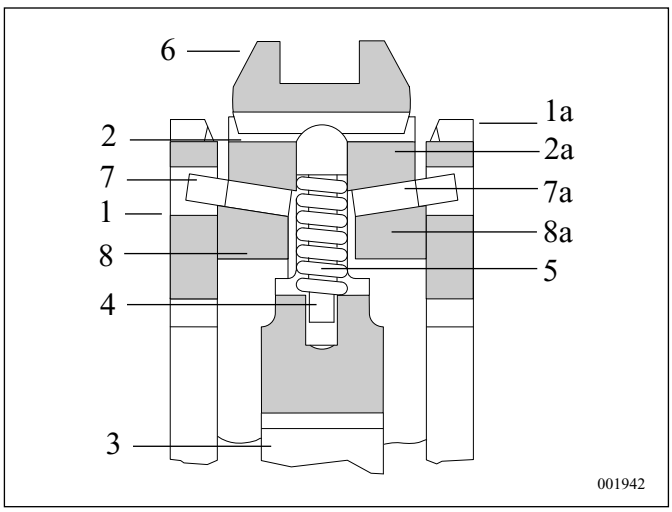
6 Place clutch disc (1) in position.

NOTE: Ensure correct position of pressure pieces.



4.7.2.1 Sectional view of synchronizer/ZF-D

1 Clutch disc
2 Outer ring
3 Synchronizer hub
4 Pressure piece
5 Compression spring
6 Sliding sleeve
7 Intermediate ring
8 Inner ring



11 Adjusting shafts

11.1 Input shaft and connection plate

1 To achieve correct setting, the input shaft roller-bearing must be play-free when measured. To ensure this, the outer race (1) must touch the bearing rollers (2). Use plastic drift to push taper roller bearing outer race towards output end. Rotate input bearing several times to centre bearing rollers.

NOTE: Bearing rollers should not move and should not be prestressed.

2 Measure distance between face of bearing outer race (1) and sealing face (3) using depth gauge. Note down dimension “a”.

NOTE: Measure at two opposite points and calculate the average value.

3 Measure distance between sealing face (4) and locating face (5) for shim in connecting plate using depth gauge. Note down dimension “b”. Measure gasket (6) and note down dimension.

NOTE: Measure at two opposite points and calculate the average value.

4 Calculate the difference “c” and note it down:
c = (b + gasket) – a

NOTE: Axial play on roller bearing: 0.0 to 0.1 mm.

5 Select a shim of the same thickness as dimension “c” (max. 0 - 0.1 mm).

6 Place shim in the connection plate. Shims are available in 0.05 mm thicknesses.

NOTE: The same procedure is used for measuring split connection plates.