



ZF Vane Pumps

Types 7681 - 7686

Repair Manual

**ZF-FRIEDRICHSHAFEN AG
GESCHÄFTSBEREICH LENKUNGSTECHNIK**

D- 73522 Schwäbisch Gmünd

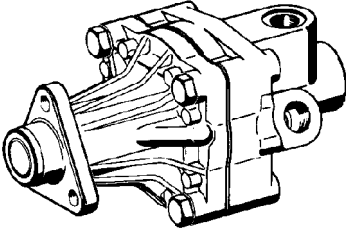
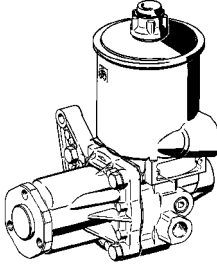
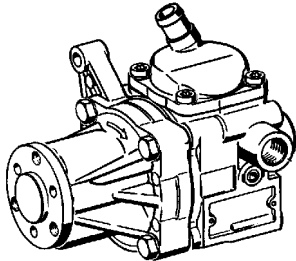
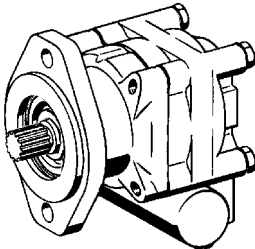
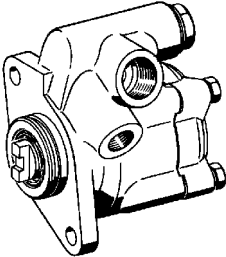
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This instruction refers to vane pumps types 7681 - 7686.

These pumps are produced in versions FP 3, FP 31, FP 32, FN 31 and FN 4.

As different dismantling and assembly instructions are required for the various types of pumps, it is important that it is established before commencing the repair work which type is to be repaired. Differentiation is possible by referring to the range of numbers, the final number or visually.

<p>Range of numbers: 7681 - 7682 (Optionally also versions with oil tanks)</p>		<p>Version: FP 3</p>
<p>Range of numbers: 7682</p>		<p>Version: FP 31</p>
<p>Range of numbers: 7681 - 7683 Final number: 500 . . . 699 (Optionally also versions with straight intake or oil tank)</p>		<p>Version: FP 32</p>
<p>Range of numbers: 7683 - 7686 Final number: 700 . . . 999</p>		<p>Version: FN 31</p>
<p>Range of numbers: 7683 - 7686 Final number: 100 . . . 399</p>		<p>Version: FN 4</p>



	Page
I. Dismantling	3
II. Checking the individual parts	8
III. Assembly	10
IV. Functional check	16
V. Troubleshooting	19
VI. Tightening torques	21
VII. Special tools	22
VIII. Key to numbers in figures and exploded views	24

I. Dismantling



Attention:

In order to ensure safe operation of the pump, close attention must be paid on cleanliness during dismantling and storage of the parts. Never apply force during the dismantling process which could, for instance, damage sealing faces, sealing surfaces etc. The resultant damage could lead to partial or total failure of the pump.

Note:

- ! The numbers featured in round brackets, e.g. (9), refer to the numbers used in chapter VIII and the list of spare parts.
- ! Numbers featured in square brackets, e.g. [1], refer to the special tools listed in chapter VII.

1 Removing the oil tank (1) and/or filter (4)

1.1 Unscrew the wing nut / screw cap (9) (Fig. 1).

Remove cover (8) together with seal (7).

1.2 Versions fitted with a locking disc (10)

Withdraw the locking disc (10) together with the compression spring (6). Remove filter cover (5) from the oil tank.

Remove the filter (4).

Loosen the fixing bolt (14) and remove the oil tank (1).

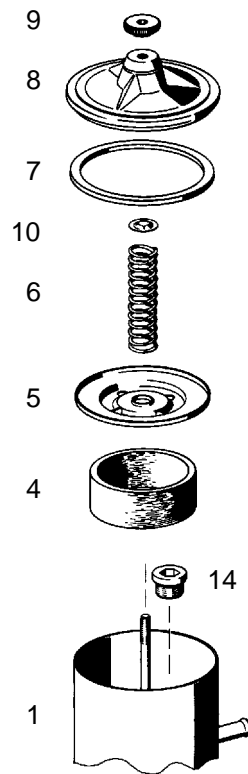


Fig. 1

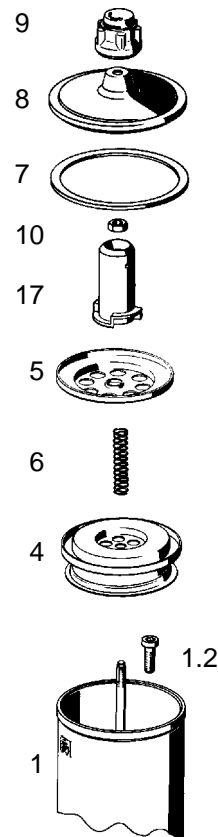


Fig. 2

1.3 Versions with hexagon nut (10)

Unscrew the hexagon nut (10). Remove the protecting tube (17) together with the filter cover (5) (Fig. 2).

Remove the compression spring (6) and filter (4) from the oil tank. Loosen the cap screw (1.2).

Remove the oil tank (1).

1.4 Versions with screen (16)

Loosen the cap screws (1.2) and remove the oil tank (1) (**Fig. 3**).

Unscrew the screen (16) from the oil tank and remove the sealing ring (16.1).

Dismantle the hose nipples (31 and 33) together with sealing ring (30) and O-ring (32).

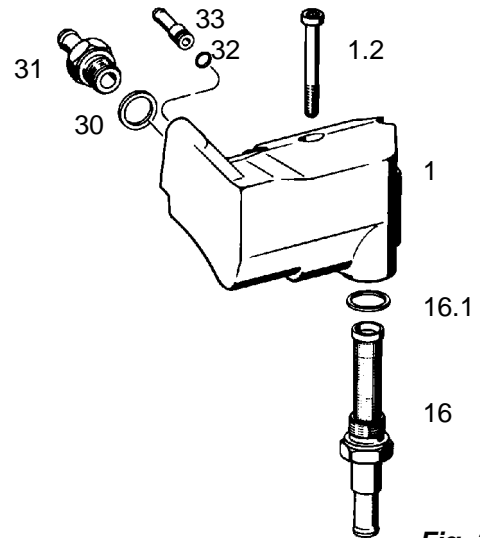


Fig. 3

2 Removing the cover (726)

Clamp pump into a vice (soft jaws) or in tool [1] and [2].

Note position of special screws, screw brackets and bracket / fixing devices (770 and 770.1) (**Fig. 4**).

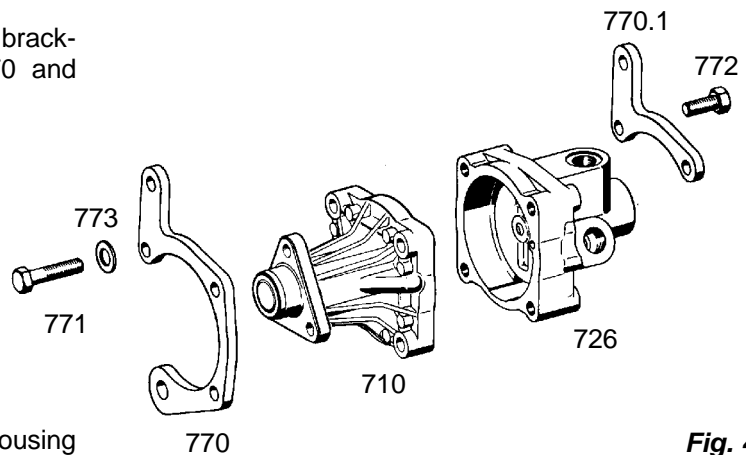


Fig. 4

Mark position of cover (726) and housing (710) in relation to each other.

Unscrew hexagon screws (771 and 772) together with washers (773).

Lift off cover (726).

3 Dismantling the cover (726)

Note:

Not applicable with version FN 4

3.1 Versions FP 3, FP 31, FP 32

3.1.1 Dismantle the intake connection (735) together with sealing ring (735.1) or O-ring (734) (**Fig. 5**).

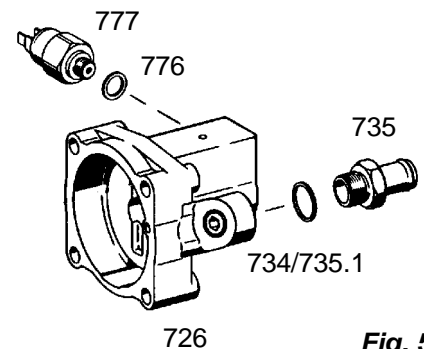


Fig. 5

Unscrew the oil pressure switch (777) together with sealing ring (776).

Remove the O-ring (736.1) (**Fig. 6**).

Remove O-ring (1.1) from cover (726) (**Fig. 7**).

Release the spring cap (724).

Remove valve spool (729) together with compression spring (730) from cover (726).

3.1.2 Versions with removable throttle insert (728)

Note:

Reusable throttle inserts (728) can be recognised in that they, like the valve spool (729), are held in their final position by the spring cap (724) (**Fig. 6**).

Remove throttle insert (728) together with compression spring (728.3) from the cover (726).

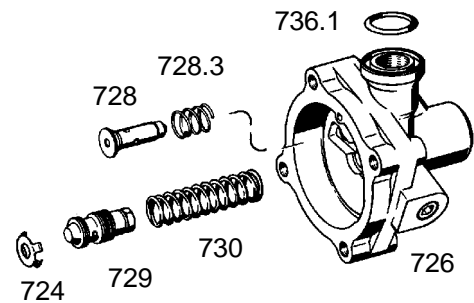


Fig. 6

3.1.3 Versions with firmly pressed in throttle insert (728)

Note:

These throttle inserts (728) are recognisable in that they are pressed into the cover (726) and are located without spring cap (724) in their final position (**Fig. 7**).

Do not dismantle the throttle insert (728), as a special fixture is required for correct installation.

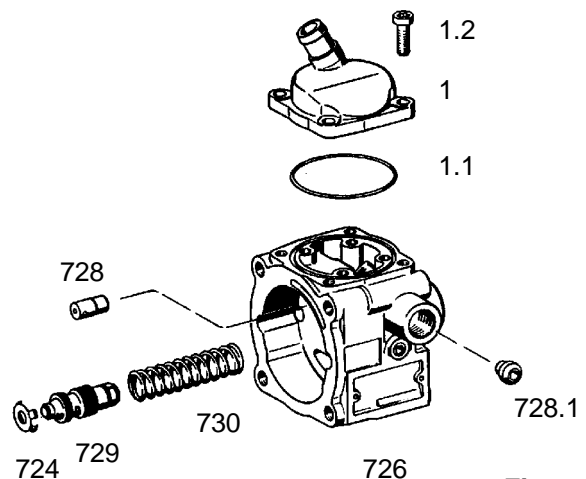


Fig. 7

3.1.4 Version with sealing cone (728.1)

If leaks are noticed remove the sealing cone (728.1).

3.1.5 Version with intake connection (1)

Loosen the cap screws (1.2), lift off the intake connection (1) and O-ring (1.1).

3.2 Version FN 31

Unscrew protecting screw (732) and remove O-ring (731) (**Fig. 8**).

Remove valve spool (729) together with compression spring (730).

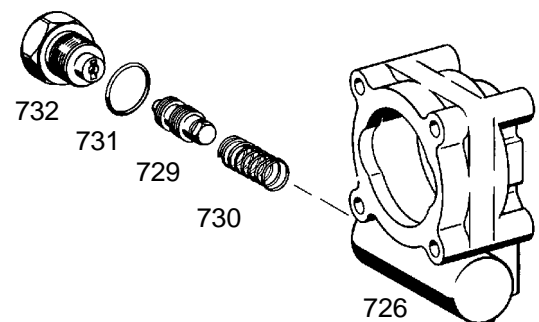


Fig. 8



Attention:

Care must be taken as spring will jump out.

4 Removing and dismantling the pressure plate (723 and 718)

Note:

Not applicable with version FN 4

4.1 Lift pressure plate (723) from housing (710) (Fig. 9).

Remove sealing ring (722) and back-up ring (722.1) from pressure plate (723).

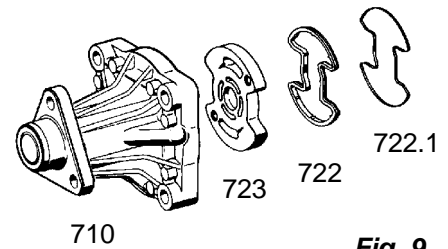


Fig. 9

4.2 Additional with version FN 31

Remove the complete rotor set (721) together with needle rollers (715.1) (Fig. 10).

Dismantle needle rollers and remove vanes from rotor.

Remove pressure plate (718).

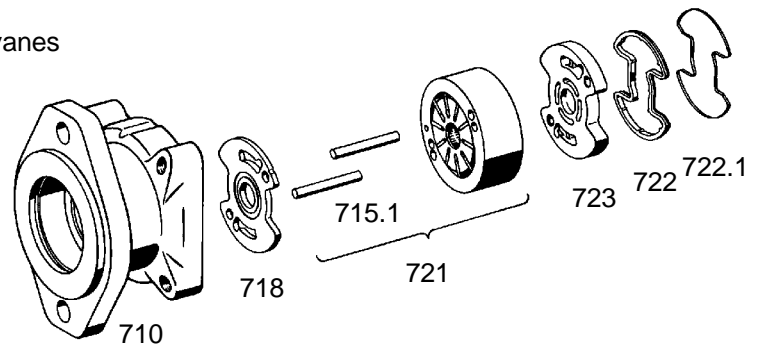


Fig. 10

5 Removing the shaft (703)

5.1 Versions FP 3, FP 31, FP 32

Release snap ring / retaining ring (707) (Fig. 11).

Note:

On versions fitted with a grooved pin (715.1) do not remove the pressed in grooved pin.

Remove cylindrical pins (715.1) and curved ring of rotor set (721).

Lift off rotor and vanes. Dismantle vanes from rotor. Pull shaft (703) out of the housing (710).

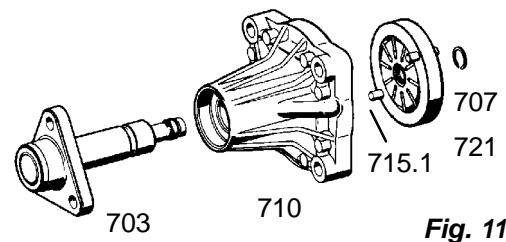


Fig. 11

5.2 Version FN 31

Snap out retaining ring (705) (Fig. 12).

Press out shaft (703) together with ball bearing (706) and snap ring / retaining ring (707).

Note:

Only press out ball bearing (706) if damaged. For this release the snap ring / retaining ring (707).

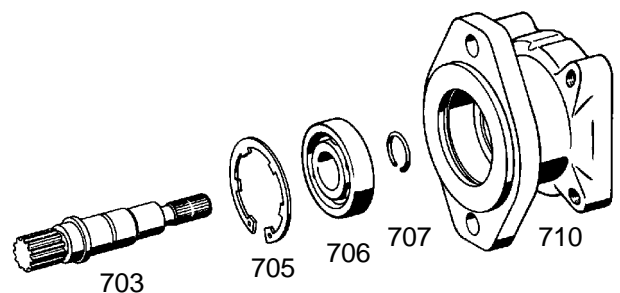


Fig. 12

5.3 Version FN 4

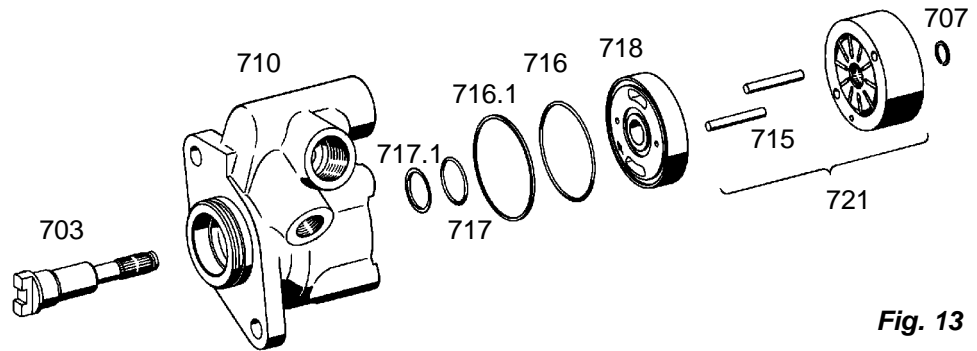


Fig. 13

Release retaining ring (707) (**Fig. 13**).

Remove rotor set (721) together with pressure plate (718).

Remove needle rollers (715) and vanes from rotor.

Remove seals (716, 716.1, 717 and 717.1) from pressure plate (718).

Pull shaft (703) out of the housing (710).

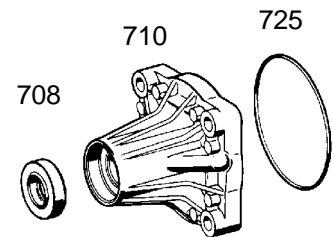


Fig. 14

6 Dismantling the housing (703)

6.1 Versions FP 3, FP 31, FP 32, FN 31

6.1.1 Pull out shaft seal (708) with tool [3] (**Fig. 14**).

Remove O-ring (725).

6.1.2 Additional with version FN 31

If the shaft (703) is damaged in the vicinity of the needle sleeve (709) bearing surface remove the needle sleeve (709) (**Fig. 15**).

Use tools [4] and [5] for the removal.

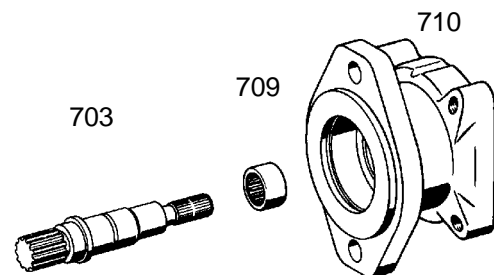


Fig. 15

6.2 Version FN 4

Remove shaft seal (708), O-ring (725 and 733) (**Fig. 16**).

Unscrew protecting screw (732) together with O-ring (731). Dismantle compression spring (730) and valve spool (729).

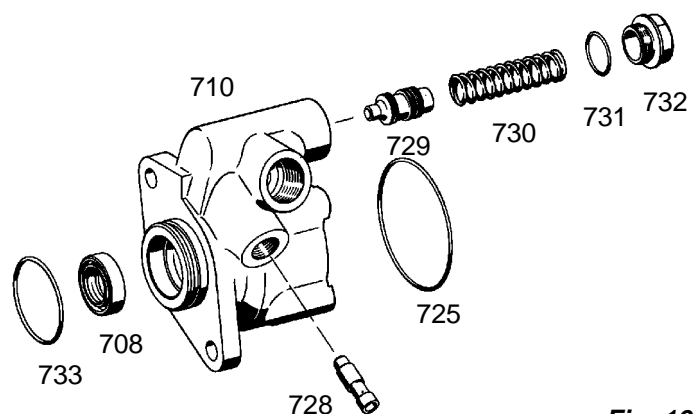


Fig. 16

If the throttle insert (728) is damaged or the required power output is not achieved, note depth of press fit and remove throttle insert (728).

II. Checking the individual parts

! Thoroughly clean all individual parts.

Note:

Due to the danger of swelling it is important that sealing rings and other rubber parts do not come into contact with chlorinated hydrocarbons.

! Check all parts for wear, corrosion, pressure damage or other faults and decide, whether or not parts are suitable for re-use.

! If necessary, re-polish or re-face flange and sealing surfaces (e.g. sealing ring bearing faces).



Attention:

This test requires specialist knowledge and conscientiousness. The fitter must be able to decide whether or not the parts need to be changed.

The following must be checked:

1 Shaft (703)

- ! Bearing surface of bearings
- ! Bearing surface of the shaft sealing ring
- ! Threads
- ! Serrations
- ! Groove for the retaining ring

2 Housing (710)

- ! Needle bearing and/or bushing/sleeve
- ! Holes for throttle insert and valve spool
- ! Threads
- ! Chamfered edges for O-rings
- ! Sealing face of the shaft sealing ring
- ! Holes for pipe connections (foreign matter)
- ! Dowel pin seats
- ! Front faces (signs of fretting and wear)
- ! Pipe connections (faces and walls for signs of impact, grooves)

3 Cover (726)

- ! Holes for throttle insert and valve spool (check hole diameter for restrictions)
- ! Threads
- ! Chamfered edges for O-rings
- ! Sealing face of the shaft sealing ring
- ! Holes for pipe connections (foreign matter)
- ! Front faces (signs of fretting and wear)
- ! Pipe connections (faces and walls for signs of impact, grooves)
- ! Sealing cones (surfaces and diameter for impact, grooves)



4 Rotor set (721)

Note:

If wear is noted on the curved rings, the rotor or the vanes it is essential that parts are only changed as a set.

- ! Curved ring (signs of fretting, wear)
- ! Rotor (signs of fretting, wear)
- ! Vanes (signs of fretting and wear, especially on the rounded bearing surface and side guide surfaces)
- ! Easy movement of the vanes in the armature

5 Pressure plates (718 and 723)

- ! Front faces (signs of fretting, wear and flatness)

6 Throttle insert (728)

- ! External diameter (grooves, wear, damage and jamming in the cover and/or housing aperture)
- ! Throttle port for cleanliness.
- ! Dismantling the throttle insert (728) is not possible.

7 Valve spool (729)

- ! External diameter (grooves, wear, damage and jamming in the cover and/or housing aperture)
- ! Only dismantle the valve spool (729) for cleaning purposes.

Note:

In cases of wear or variations in pressure replace the complete valve spool (729).

- ! Clamp the valve spool (729) into tool [6].

- ! Version without lock nut:
 - Completely dismantle the valve spool (729).
 - Clean all individual parts and re-assemble.
 - Re-centralize all washers.
 - Tighten valve screw to 5+2 Nm.

- ! Versions with lock nut:
 - Measure the total length of the valve spool (729).
 - Completely dismantle the valve spool (729).
 - Clean all individual parts and re-assemble.
 - Using the valve screw set the valve spool (729) to the correct length.
 - Tighten lock nut to 5+2 Nm.
 - Check the total length.

8 Needle and/or ball bearing

- ! If signs of indentation or wear are noted on the bearing surfaces of the pump parts, exchange the relevant bearings.

III. Assembly

Notes:

- ! So as to guarantee safe operation of the pump, ensure the utmost cleanliness during assembly. Do not use force when assembling components, as this could lead to damage to sealing ring seats, sealing surfaces etc. The resultant damage could lead to partial or complete failure of the pump.
- ! Before assembling the pump thoroughly clean all parts. Check all parts for wear or other faults (see chapter II) and lubricate them before installation.
- ! It is essential that seals, shaft sealing rings and O-rings are replaced with new items and that the front faces of the housings and covers are re-drawn to remove any damage and residues of paint/varnish.
- ! With shaft sealing rings fill the space between the sealing lip and dust lip with Spectron FO 20 or equivalent Calcium Complex grease of class 2 consistency.
- ! The measuring and setting tools used for the repair must be subjected to regular calibration checks.
- ! The tightening torque figures specified apply to tightening with a manually operated torque spanner.
- ! Before assembly check the list of spare parts for tightening torque figures and pressure depth or instructions relating to the installation position of special screws and brackets. Unless otherwise specified in the list, the following values and/or descriptions apply:

1 Pre-assembling the housing

1.1 Versions FP 3, FP 31, FP 32, FN 4

Press in the shaft sealing ring (708) up to the stop using tool [7] (**Fig. 17**).

Insert the O-ring (725).

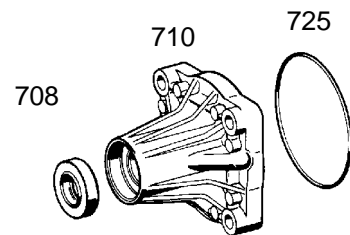


Fig. 17

1.2 Version FN 31

Press in needle sleeve (709) up to the stop using tool [8] (**Fig. 18**).

Press in shaft sealing ring up to the stop using tool [7].

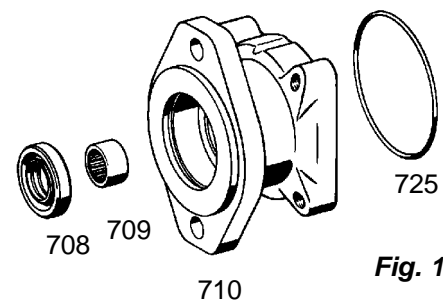


Fig. 18

1.3 Additional for version FN 4

Fit O-ring (733) (**Fig. 19**).

Insert valve spool (729) together with compression spring (730). Fit O-ring (731) on to protection screw (732). Screw in protection screw (732) (tightening torque 60+10 Nm).

Press throttle insert (728) to the pressure depth determined during dismantling using tool [9].

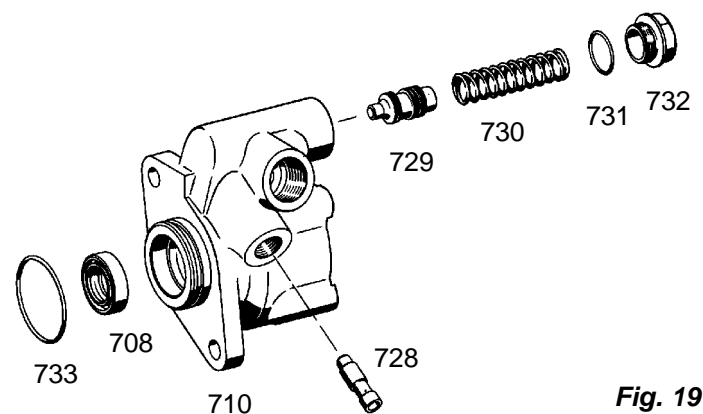


Fig. 19

2 Fitting the shaft (703)

2.1 Versions FP 3, FP 31, FP 32, FN 4

Insert shaft (703) into the housing (710) (**Fig. 20**).

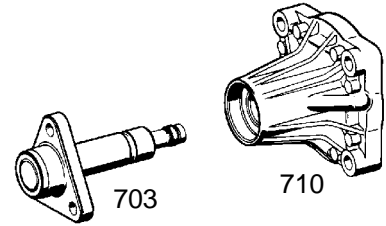


Fig. 20

2.2 Version FN 31

Press ball bearing (706) on to the shaft (703) up to the stop and secure with the snap ring/retaining ring (707) (**Fig. 21**).

Press the shaft (703) into the housing up to the stop and secure with retaining ring (705).

3 Pre-assembling and installing the rotor (721)

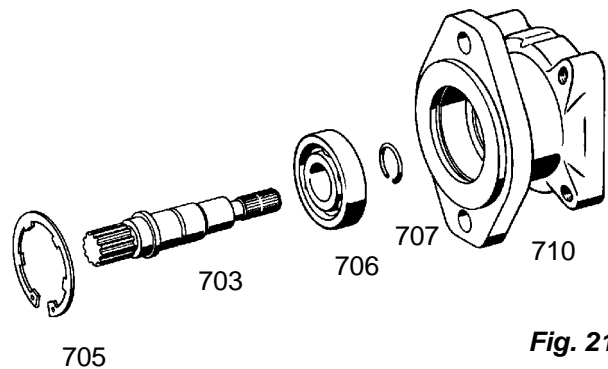


Fig. 21

Note:

The following description applies to pumps with clockwise rotation. Anti-clockwise rotating pumps must be assembled mirror-inverted.

3.1 Versions FP 3, FP 31, FP 32

Insert the 10 vanes, with rounded, polished sides and aligned to the curved ring, into the rotor.

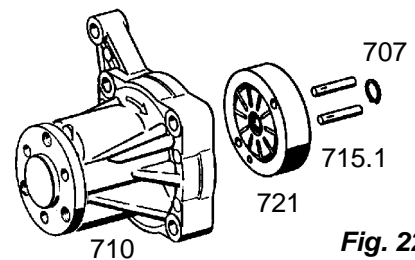


Fig. 22

Set the complete rotor, with internal chamfer towards the housing (710), on to the shaft (703) (**Fig. 22**).

Install the curved ring so that the direction of rotation arrows of the housing, curved ring and front face as well as assembly markings are aligned as illustrated in **Fig. 23** and **Fig. 24**.

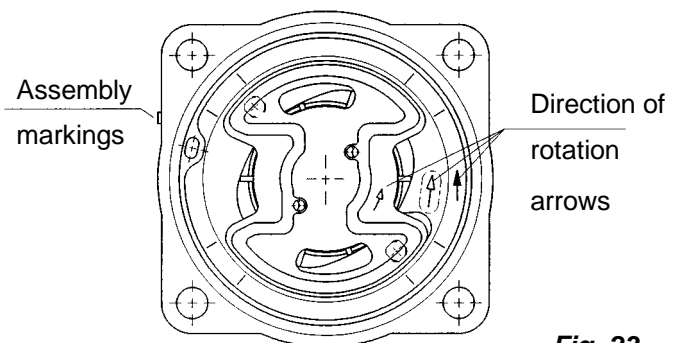


Fig. 23

Version FP 3: **Fig. 23**

Versions FP 31 and FP 32: **Fig. 24**

Insert the cylindrical pins (715.1) into the curved ring and housing (710).

Fit the snap ring / retaining ring (707) using tool [10].

Direction of rotation arrows of the housing, pressure plate and/or auxiliary assembly hole and direction of rotation arrow of the curved ring

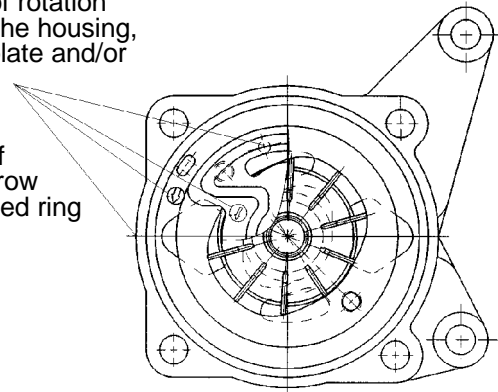


Fig. 24

3.2 Version FN 31

Fit the pressure plate (718) on to shaft (703) as illustrated in **Fig. 25**.

Insert the 10 vanes, with rounded, polished sides and aligned to the curved ring, into the rotor.

Set the complete rotor, with internal chamfer towards the housing (710), on to the shaft (703).

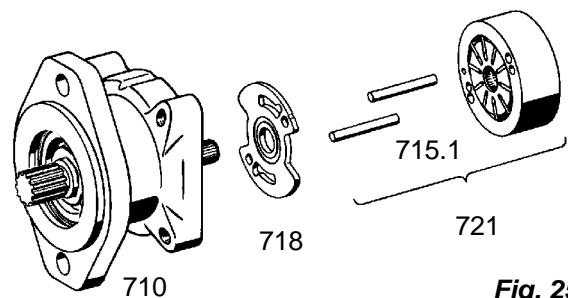


Fig. 25

Fit the curved ring so that the direction of rotation arrows and the assembly markings are aligned as illustrated in **Fig. 26**.

Fit needle rollers (715.1) in curved ring, pressure plate (718) and housing (710).

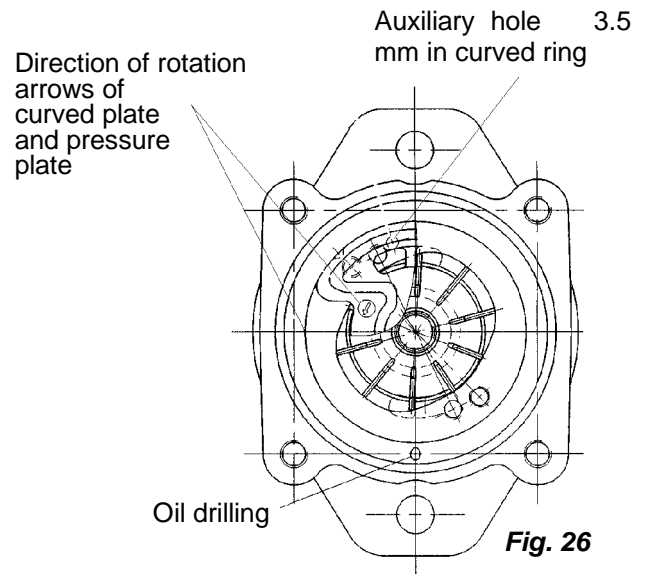


Fig. 26

3.3 Version FN 4

Fit sealing parts (716, 716.1, 717 and 717.1) in pressure plate (718) (**Fig. 27**).

Fit pressure plate (718) on to shaft (703).

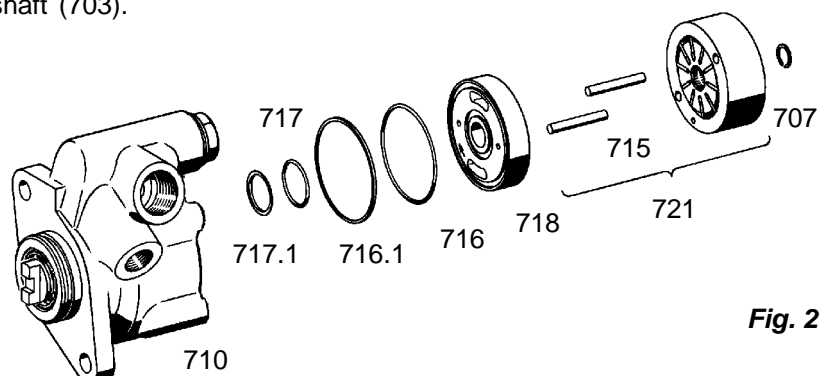


Fig. 27

Insert the 10 vanes, with rounded, polished sides and aligned to the curved ring, into the rotor.

Set the complete rotor, with internal chamfer towards the housing (710), on to the shaft (703).

Fit the curved ring so that the auxiliary holes in the curved ring as well as the direction of rotation on the pressure plate are aligned as illustrated in **Fig. 28**.

Fit needle rollers (715) in curved ring, pressure plate (718) and housing (710).

Fit retaining ring (707).

Auxiliary hole in curved ring to the right of the pin hole

Direction of rotation on the front plate

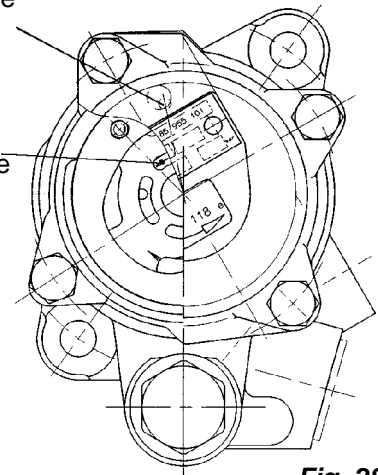


Fig. 28

4 Pre-assembling and installing the front plate (723)

Note:

Not applicable with version FN 4

Fit sealing ring (722) together with back-up ring (722.1) in the front plate (723) (**Fig. 29**).

Fit pressure plate (723) with the direction of rotation arrow aligned as illustrated in **Figs. 23, 24** and/or **Fig. 25**.

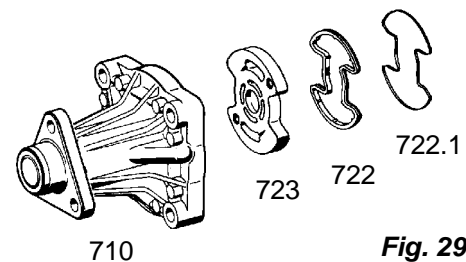


Fig. 29

5 Pre-assembling the cover (726)

5.1 Versions FP 3, FP 31, FP 32

Screw in the oil pressure switch (777) together with sealing ring (776) (tightening torque 13+2 Nm) (**Fig. 30**).

Fit the intake connection (735) together with sealing ring (735.1) or O-ring (734) (tightening torque 25+5 Nm).

Fit the removable throttle insert (728) together with compression spring (728.3) and valve spool (729) with compression spring (730) into the cover (726) (**Fig. 31**).

Fit the spring cap (724) with the tab facing the cover (726), ensuring a flush fit.

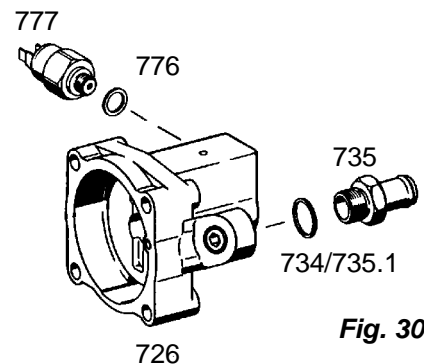


Fig. 30

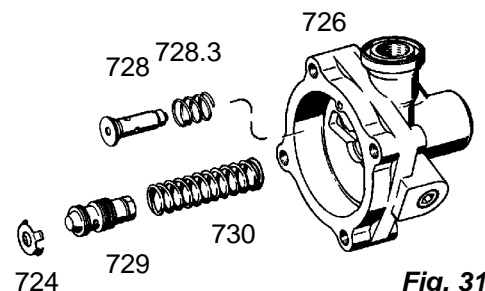


Fig. 31

5.2 Version FN 31

Fit compression spring (730) and valve spool (729) into the cover (726) (**Fig. 32**).

Screw in the protecting screw (732) with O-ring (731) (Tightening torque 60+10 Nm).

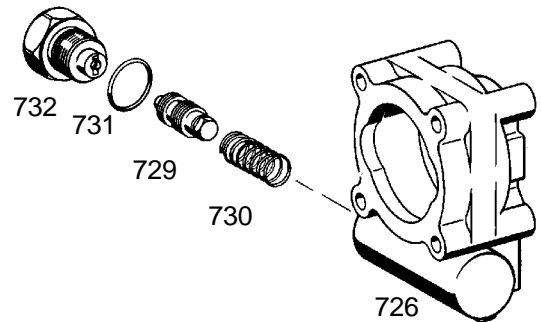


Fig. 32

6 Fitting the cover (726)

6.1 Position the cover (726) as marked during dismantling (**Fig. 33**).

6.2 Fit hexagon bolts (771) together with washers (773) and, depending on version, with bracket / fixing device (770 and 770.1).

Tightening torque:

FP 3: max. pressure up to 100+10 bar	:16±3 Nm
max. pressure above 100+10 bar	:19+3 Nm
FP 31/FP 32:	:24±2 Nm
FN 31:	:25±2 Nm
FN 4:	:19+3 Nm

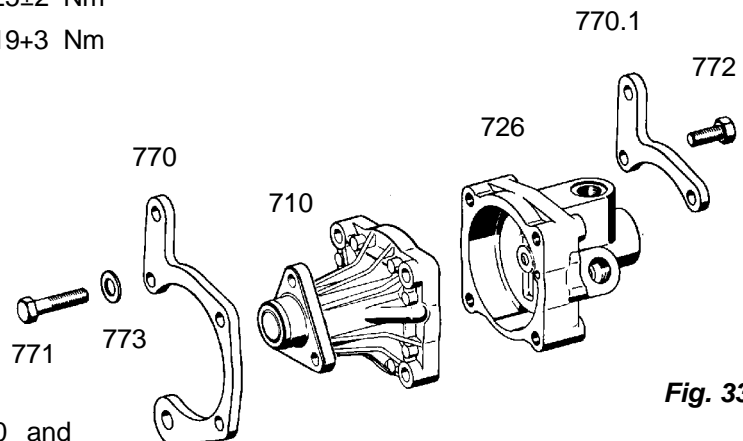


Fig. 33

6.3 Secure bracket / fixing device (770 and 770.1) with hexagon bolts (772) (Tightening torque 16+3 Nm).

Note:

Observe positions of special screws and bracket.

6.4 Versions with sealing cone (728.1)

Press in sealing cone (728.1) up to the stop (**Fig. 34**).

6.5 Version with intake connection (1)

Fit O-ring (11).

Fit intake connection (1) and secure with cap screws (1.2) (Tightening torque 9+2 Nm).

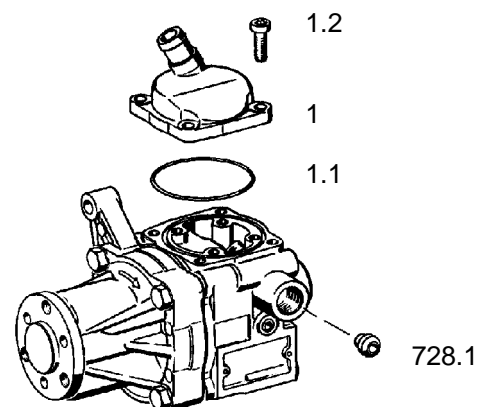


Fig. 34

7 Fitting oil tank (1) and/or filter (4)

7.1 Version with locking disk (10)

Fit O-ring (736.1) in cover (726) (**Fig. 35**).

Position oil tank (1) and secure with fixing bolt (14) (tightening torque 45+7 Nm).

Fit filter (4) and filter cover (5).

Fit compression spring (6) and secure with locking disk (10).

Position gasket (7) and cover (8) and secure with wing nut / screw cap (9).

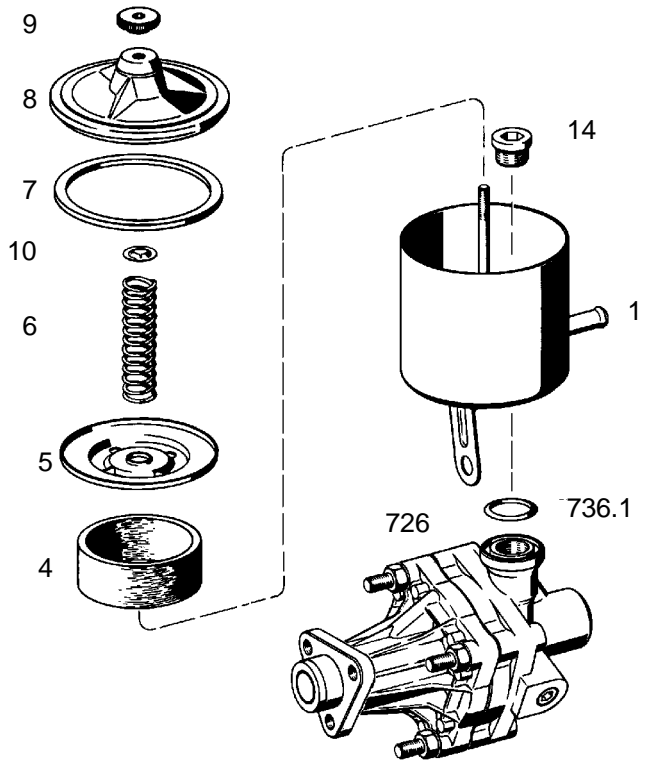


Fig. 35

7.2 Versions with hexagon nut (10)

Fit O-ring (1.1) to cover (726) (**Fig. 36**).

Secure oil tank (1) with cap screws (1.2) (tightening torque 9+2 Nm).

Fit filter (4) and compression spring (6).

Fit filter cover (5), protecting tube (17) and hexagon nut (10) (tightening torque 2+2 Nm).

Fit gasket (7) and secure cover (8) with wing nut / screw cap (9).

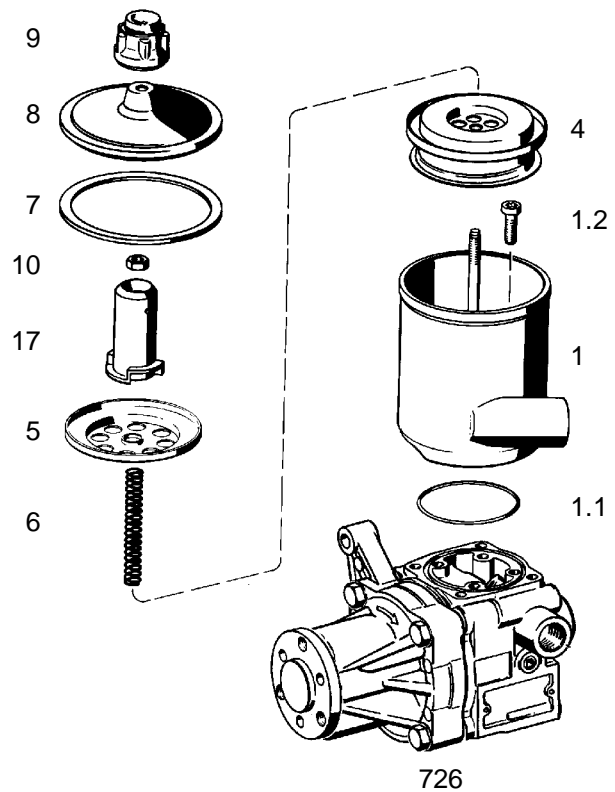


Fig. 36

7.3 Version with screen (16)

Fit hose nipples (31 and 33) with sealing ring (30) and O-ring (32) (tightening torque 35 ± 10 Nm) (**Fig. 37**).

Screw screen (16) with sealing ring (16.1) into the oil tank (1) (tightening torque $45 + 7$ Nm).

Fit O-ring (1.1).

Secure oil tank (1) with cap screws (1.2) (tightening torque $9 + 2$ Nm).

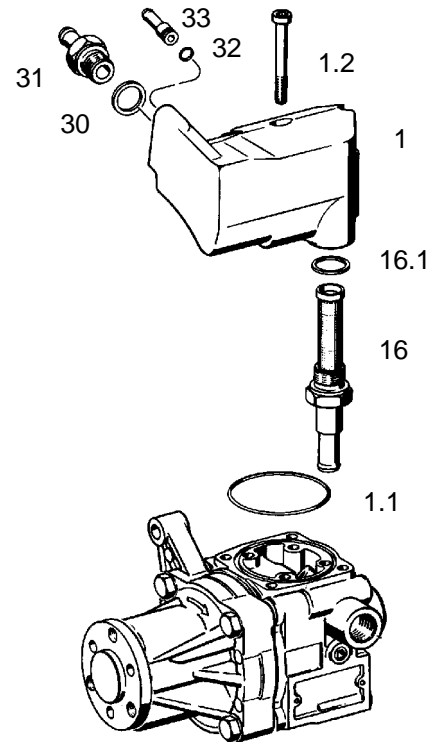


Fig. 37

IV. Functional check

Note:

All required specific values, tolerances etc. are to be taken from those listed in the list of spare parts. If nothing is listed in the list of spare parts, the following specific values will apply. If the required specified values cannot be achieved rework the pump or replace it with a new one.

1 Preparing the pump for the functional check

! Install completely assembled pump in the test rig.

! Connect pressure and suction pipe.



Attention:

Use only connections and pipes which are authorized for the resultant max. pressure.

! Required oil temperature 50_C (+10_)

2 Checking for leaks

Check for external leaks on the pump during the subsequent functional check.

3 Noise level check

Check for increased noise level during the whole of the test run.



4 Running in the pump

- ! Allow the pump to run at 10 bar and n= 500 RPM for one minute.
- ! Allow the pump to run at 10 bar and n=1000 RPM for one minute.

5 Max. pressure



Attention:

Do not close the stop cock after max pressure has been obtained, otherwise the pump will be destroyed.

Duration of max. pressure no longer than 5 seconds.

- Versions without pressure relief valve
- ! Note max. pressure from list of spare parts.
- ! Set test rig to max. pressure.
- ! Set speed control to n=1300 RPM.
- ! Slowly close the stop cock until max. pressure has been obtained.
- ! Carry out the test 3 times.
- Versions without pressure relief valve
- ! Read off max. pressure from type plate.
- ! Set test rig control 20 bar higher than the max. pressure.
- ! Set speed control to n=1300 RPM.
- ! Slowly close the stop cock until max. pressure has been obtained (tolerance +10/-5 bar).
- ! Carry out the test 3 times.

6 Checking the regulated delivery

- ! Note delivery details from list of spare parts

- ! Set speed.

Versions FP 3, FP 31, FP 32:	1300 RPM
Versions FN 31, FN 4:	1700 RPM

- ! Set pressure to 10 bar.

- ! Read-off test figures.

Tolerance:	Versions:	FP 3, FP 31, FP 32:	±10%
		FN 31:	+20%/-10%
		FN 4:	+30%

- ! Repeat test with max. permissible pump speed.

Permissible speed:	Versions:	FP 3, FP 31, FP 32:	500 - 6000 U/min
		FN 31, FN 4:	500 - 3500 U/min

Note:

On test rigs, where the required speed is not achieved, the max. achievable speed of the test rig must reach the same test figures (tolerance, see above) as those reached with test runs at 1300 RPM or 1700 RPM.



Additional for versions with decreasing delivery:

- ! Run through permissible speed range of the vane pump and check decreasing delivery
- ! Read off test figures. Tolerance: $\pm 20\%$
- For test rigs with max. speed of 3500 RPM
- ! Calculate test figures:

Calculate average value from max. and min. delivery (contained in list of spare parts).

Example of calculation:

max. delivery:	9 l/min
min. delivery:	5 l/min

Sum total:	14 l/min : 2 =
Average value:	7 l/min

- ! Set pressure to 10 bar.
- ! Set speed to 3500 RPM.
- ! Read of test figures. Tolerance: $\pm 20\%$
- For test rigs with max speed of 1800 RPM
- ! The tendency of decreasing delivery must be recognisable at the max. speed of the test rig.

7 Checking the min. delivery

- ! Set test rig to specified pressure or speed and check min. delivery.
- ! On pumps with a regulated min. delivery of less than 4.5 l/min, 6 l/min etc (see values in bracket) the min. delivery must be checked at n=350 RPM. The figures in brackets apply for min. delivery.
- ! Specified values:

Type of pump (min. regul. delivery smaller)	Nominal pressure [bar]	Regulated pressure [bar]	Speed [RPM]	Min. delivery [l/min]
7681 (< 4.5 l/min)	to 100 to 120 above 120	50 80 100	500 (350) 500 500	3.1 (1.8) 2.7 2.5
7682 (< 6 l/min)	to 100 to 120 above 120	50 80 100	500 (350) 500 500	4.3 (2.3) 4.0 3.7
7683 (PKW) (< 7.5 l/min)	to 100 to 120 above 120	50 80 100	500 (350) 500 500	4.8 (2.8) 4.5 4.2
7683 (NKW) (< 7 l/min)		50	500 (350)	5.0 (2.9)
7684 (< 8 l/min)		50	500 (350)	5.9 (3.4)
7685 (< 10 l/min)		50	500 (350)	7.0 (4.0)
7686		50	500	9.4



8 Checking the starting torque

- ! Remove the connecting pipes from the pump.
- ! Axially load the pump shaft and turn by hand. It is essential that no restriction or resistance is felt during this test.

9 Checking the axial play of the shaft

Note:

This test is only required if a special comment regarding the axial play is given in the list of spare parts.

- ! Axially load the pump shaft and measure the play. This figure must not exceed the value given in the list of spare parts.

V. Troubleshooting

Notes:

- ! The ZF vane pump has been developed for high loads. A feature of its design is that with perfect maintenance and operation there will be no problems.
- ! However, should this not be the case, the following notes will help to find and solve the problem.
- ! Before the individual faults on the pump are investigated, check the oil level with the motor running.
- ! At the same time we would point out that, with use of strongly foaming oil, it is possible that faults occur, as such oils release any air, which may have entered the steering system, only very slowly.



Fault	Cause	Remedy
Noise	→ Oil level too low	→ Rectify leaks Top up oil
	→ Pump sucks in air	→ Rectify leaks Top up oil Vent steering system
No pressure	→ Valve spool (729) jammed	→ Remove Clean Ensure movement Centralize washers → Renew
	→ Sealing parts (716, 717, 722 and 725) defective	→ Renew
	→ Foreign bodies between pressure plate (723) and rotor set (721)	→ Remove foreign bodies
Max. or min. delivery not achieved	→ Drive belt has too little tension	→ Re-tension drive belt ^j
	→ Valve spool (729) dirty or defective	→ Clean → Renew
	→ Throttle set (728) dirty or defective	→ Renew → Renew
	→ Vanes in rotor set (721) worn	→ Renew rotor set (721)

^j See manufacturer's instructions



Fault	Cause	Remedy
Delivery too high	→ Valve spool (729) jammed	→ Remove Clean Ensure movement Centralize washers → Renew
Max. pressure too high	→ Valve spool (729) defective	→ Renew

VI. Tightening torques

(Listed progressively with illustration numbers)

! Cap screw (1.2):	9+2 Nm
! Hexagon nut (10):	2+2 Nm
! Fixing bolt (14):	45+7 Nm
! Screen (16):	45+7 Nm
! Hose nipple (31):	35±10 Nm
! Protecting screw (732):	60+10 Nm
! Intake connection (735):	25+5 Nm
! Hexagon bolt/screw (771) for version FP 3: FP 31/32: FN 31: FN 4:	max. pressure at 100+10 bar: max. pressure above 100+10 bar: 16±3 Nm 19+3 Nm 24±2 Nm 25±2 Nm 19+3 Nm
! Hexagon bolt/screw (772):	16+3 Nm
! Oil pressure switch (777):	13+2 Nm

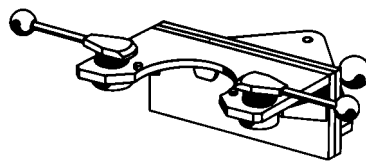
VII. Special tools

Notes:

The special tools listed refer to mass production versions and type of design of the vane pumps, upon which also the repair instructions have been based. It is therefore possible that other tools may be required for the repair of the vane pumps.

Tool [1]

Assembly vice



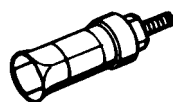
Tool [2]

Clamping plate for the assembly vice



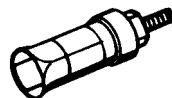
Tool [3]

Extractor for the shaft seal (708)



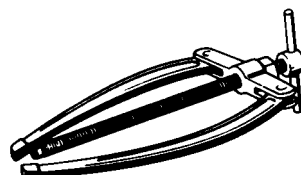
Tool [4]

Extractor for needle sleeve (709)



Tool [5]

Counter support for extractor device 7868 798 201 and 7421 798 201

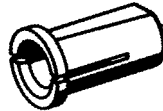


FP 3	FP 31 FP 32	FN 31	FN 4
7633 798 651			
7682 798 651		7685 798 651	7672 798 651
7868 798 201			
		7421 798 201	
7421 798 351			



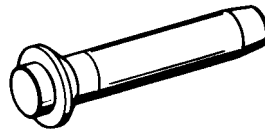
Tool [6]

Adapter sleeve for unscrewing the valve seat screw from the valve spool (729)



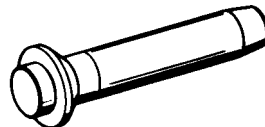
Tool [7]

Mandril for pressing in the shaft sealing ring (708)



Tool [8]

Mandril for pressing in the needle sleeve (709)



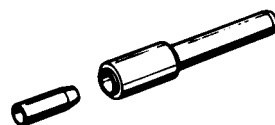
Tool [9]

Mandril for pressing in the throttle insert (728)



Tool [10]

Device for fitting the snap ring / retaining ring (707)



FP 3	FP 31 FP 32	FN 31	FN 4
Ø 14 7681 798 652 Ø 17 7671 798 651	7671 798 651		
7682 798 051		7685 798 053	7672 798 056
		7685 798 052	
			7685 798 051
7671 798 001		7685 798 001	7671 798 001

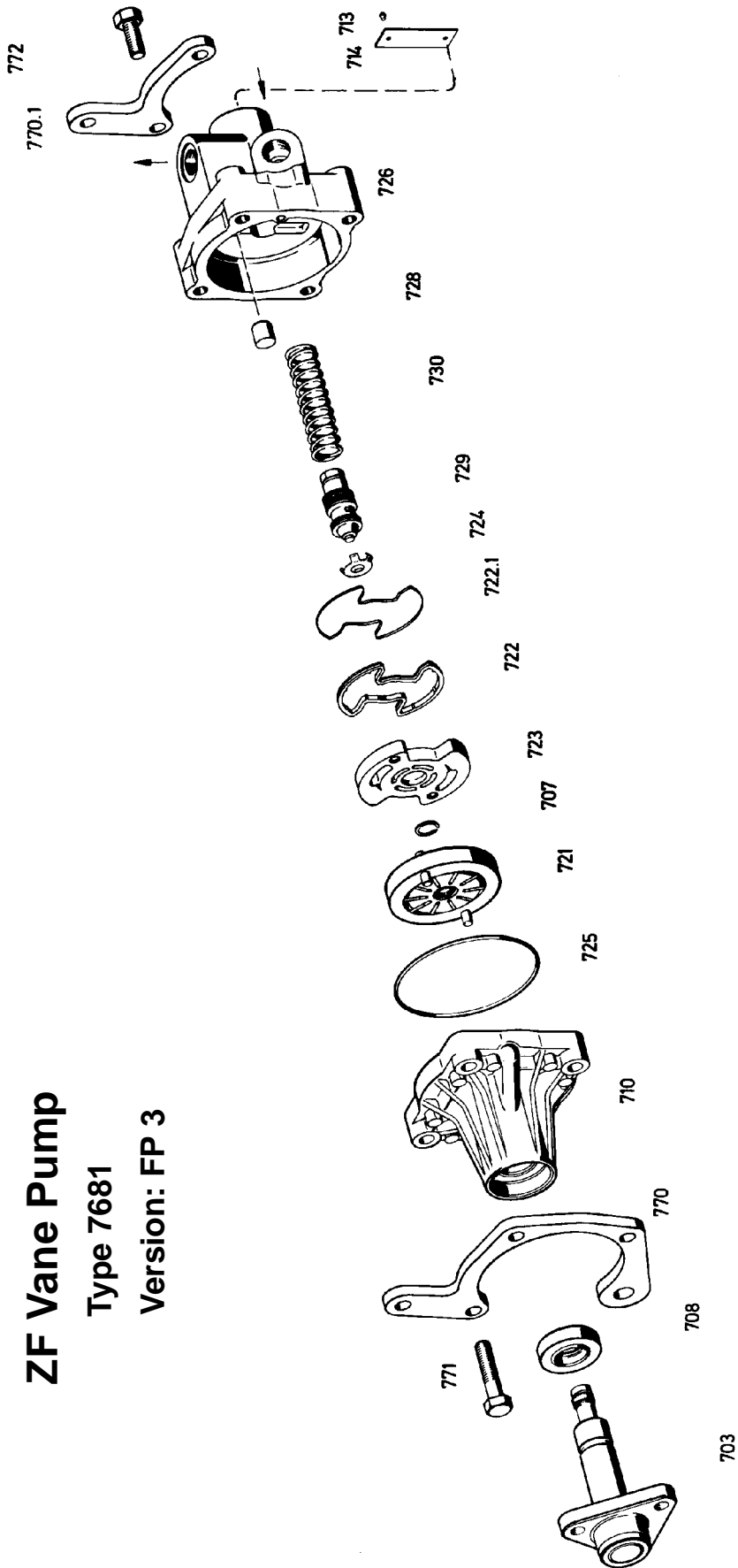


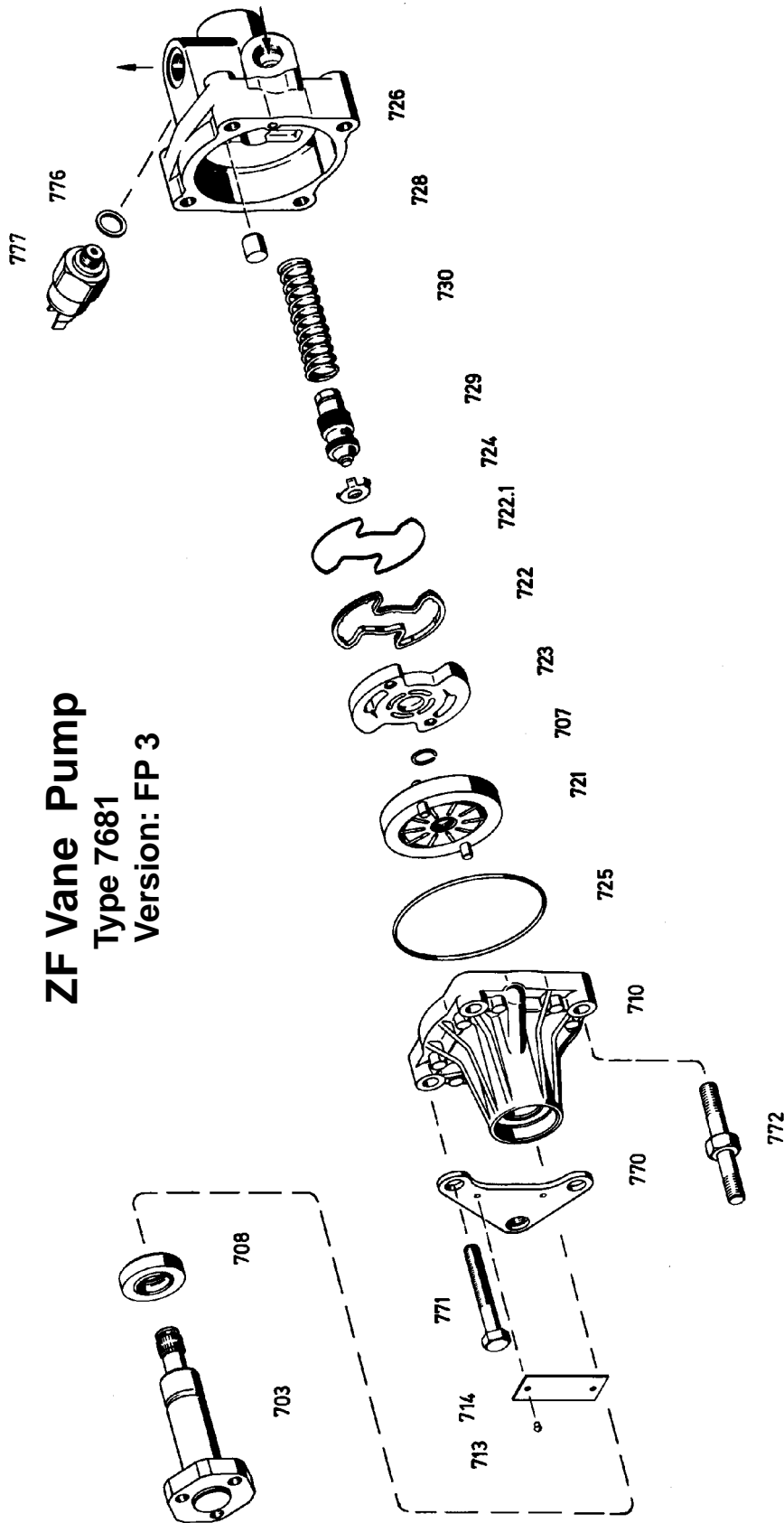
VIII. Key to number in figures and exploded views

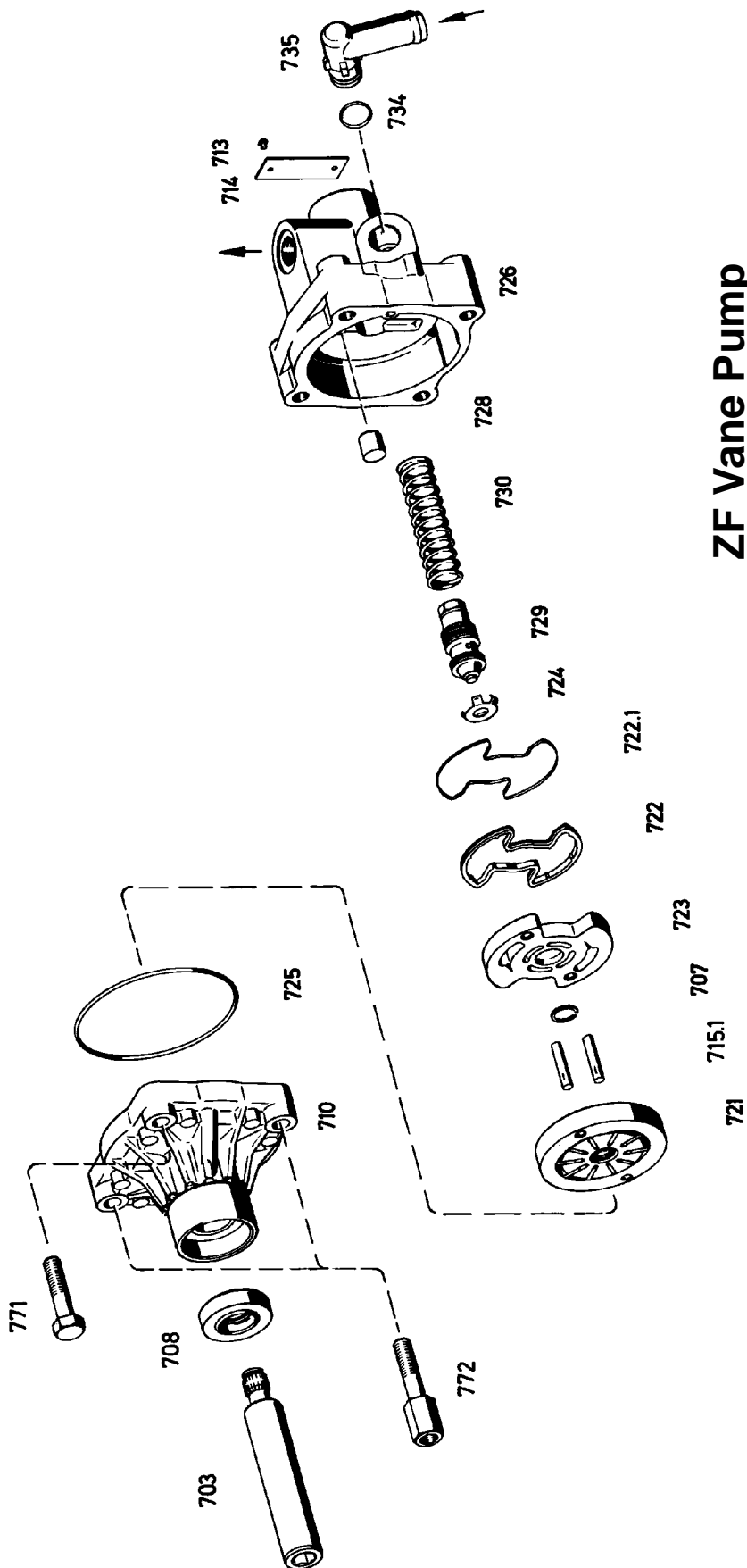
1.0	Oil Tank / Intake	716.1	Support Ring
1.1	O-Ring	717.0	O-Ring
1.2	Cap Screw	717.1	Support Ring
4.0	Filter	718.0	Pressure Plate
5.0	Filter Cover	721.0	Rotor Set
6.0	Compr. Spring	722.0	Sealing Ring
7.0	Gasket	722.1	Backup Ring
8.0	Cover	723.0	Pressure Plate
9.0	Wing nut/Screw Cap	724.0	Spring Cap
10.0	Locking Disk / Hexagon Nut	725.0	O-Ring
14.0	Fixing bolt	726.0	Cover
16.0	Screen	728.0	Throttle Insert
16.1	Sealing Ring	728.1	Sealing Cone
17.0	Protecting Tube	728.3	Compr. Spring
19.0	Sealing Cone	729.0	Valve Spool
30.0	Sealing Ring	730.0	Compr. Spring
31.0	Hose nipple	731.0	O-Ring
32.0	O-Ring	732.0	Protecting Screw
33.0	Hose nipple	733.0	O-Ring
703.0	Shaft	734.0	O-Ring
705.0	Retaining Ring	735.0	Intake Connect.
706.0	Ball bearing	735.1	Sealing Ring
707.0	Snap Ring / Retaining Ring	736.1	O-Ring
708.0	Shaft Seal	770.0	Bracket / Fixing Device
709.0	Needle Sleeve	770.1	Fixing Device
710.0	Housing	771.0	Hexagon Screw
713.0	Grooved Stud	772.0	Hexagon Screw
714.0	Type Plate	773.0	Washer
715.0	Needle Roller	774.0	Hexagon Screw
715.1	Cylindrical Pin / Needle Roller / Grooved Pin	775.0	Hexagon Nut
		776.0	Sealing Ring
716.0	O-Ring	777.0	Oil Pr. Switch



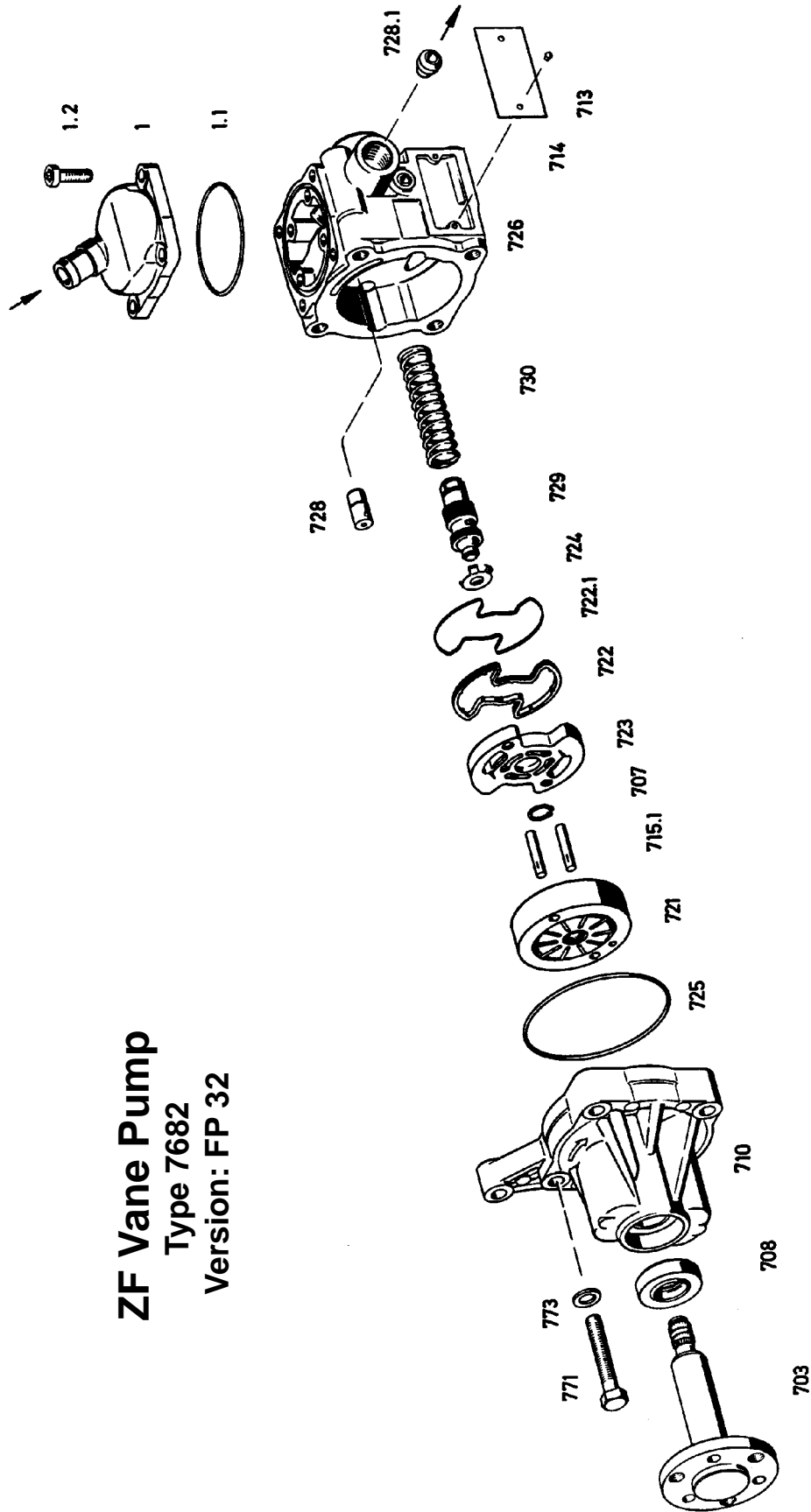
ZF Vane Pump
Type 7681
Version: FP 3







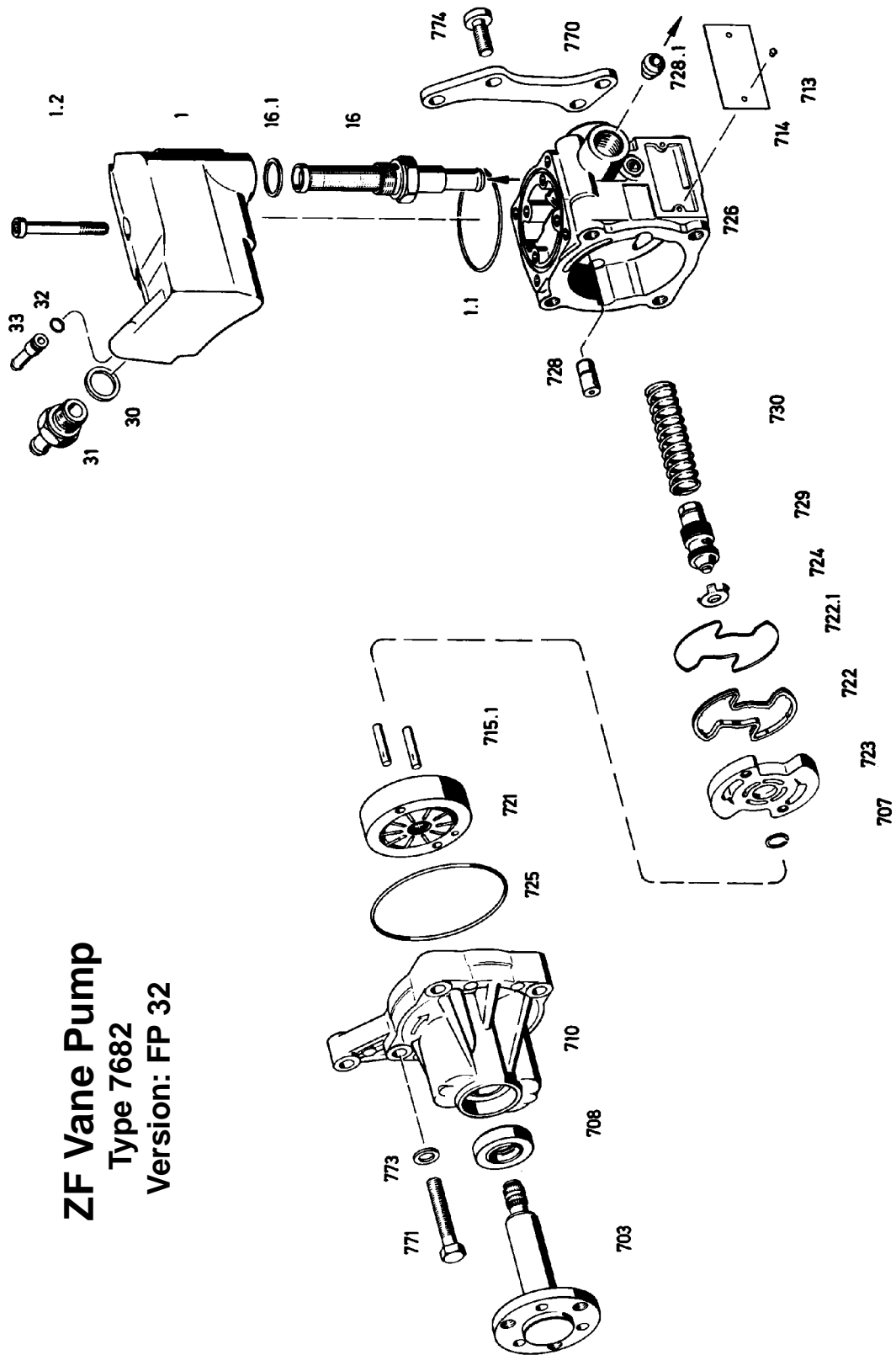
ZF Vane Pump
Type 7682
Version: FP 3

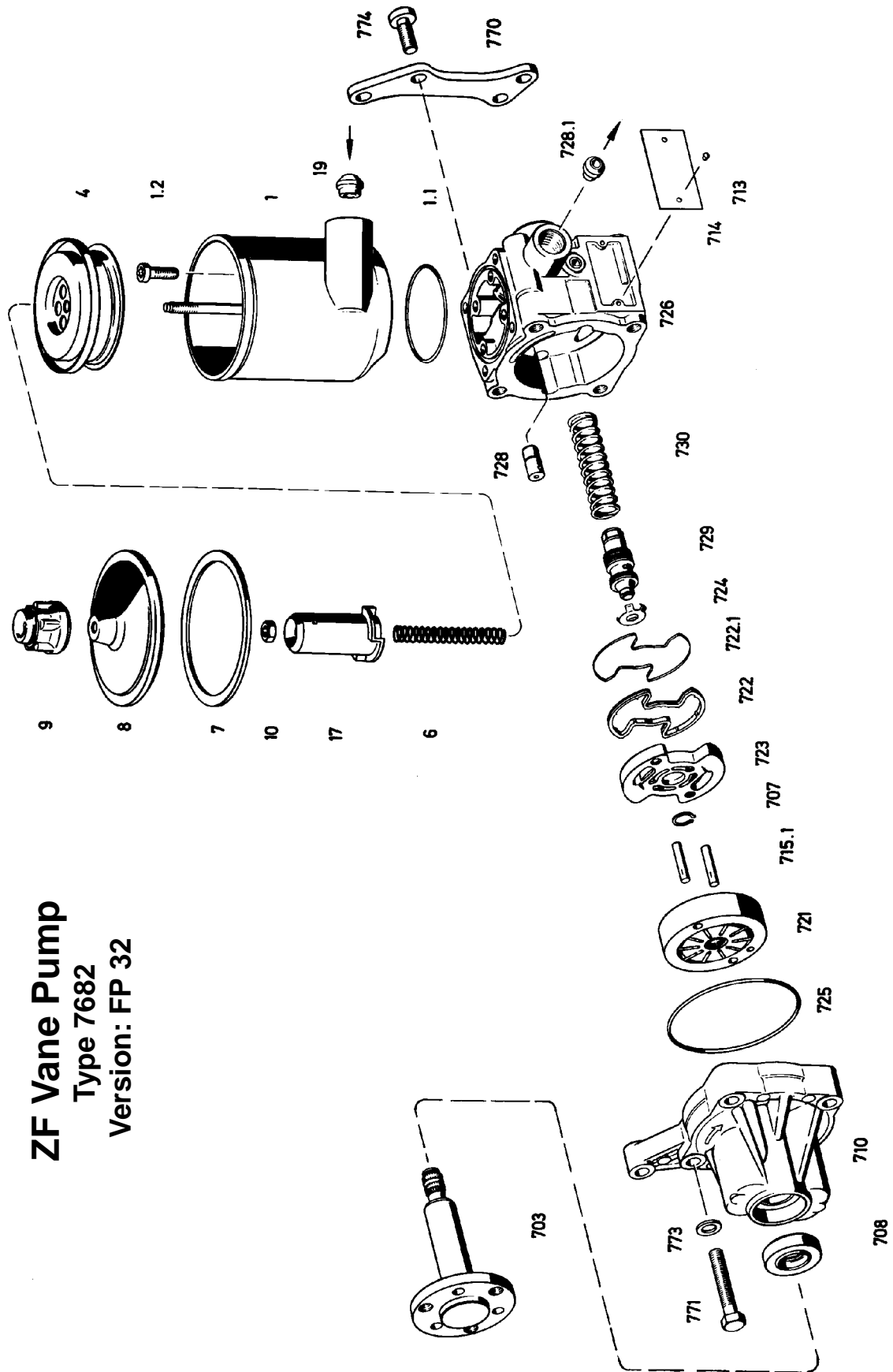


ZF Vane Pump
Type 7682
Version: FP 32

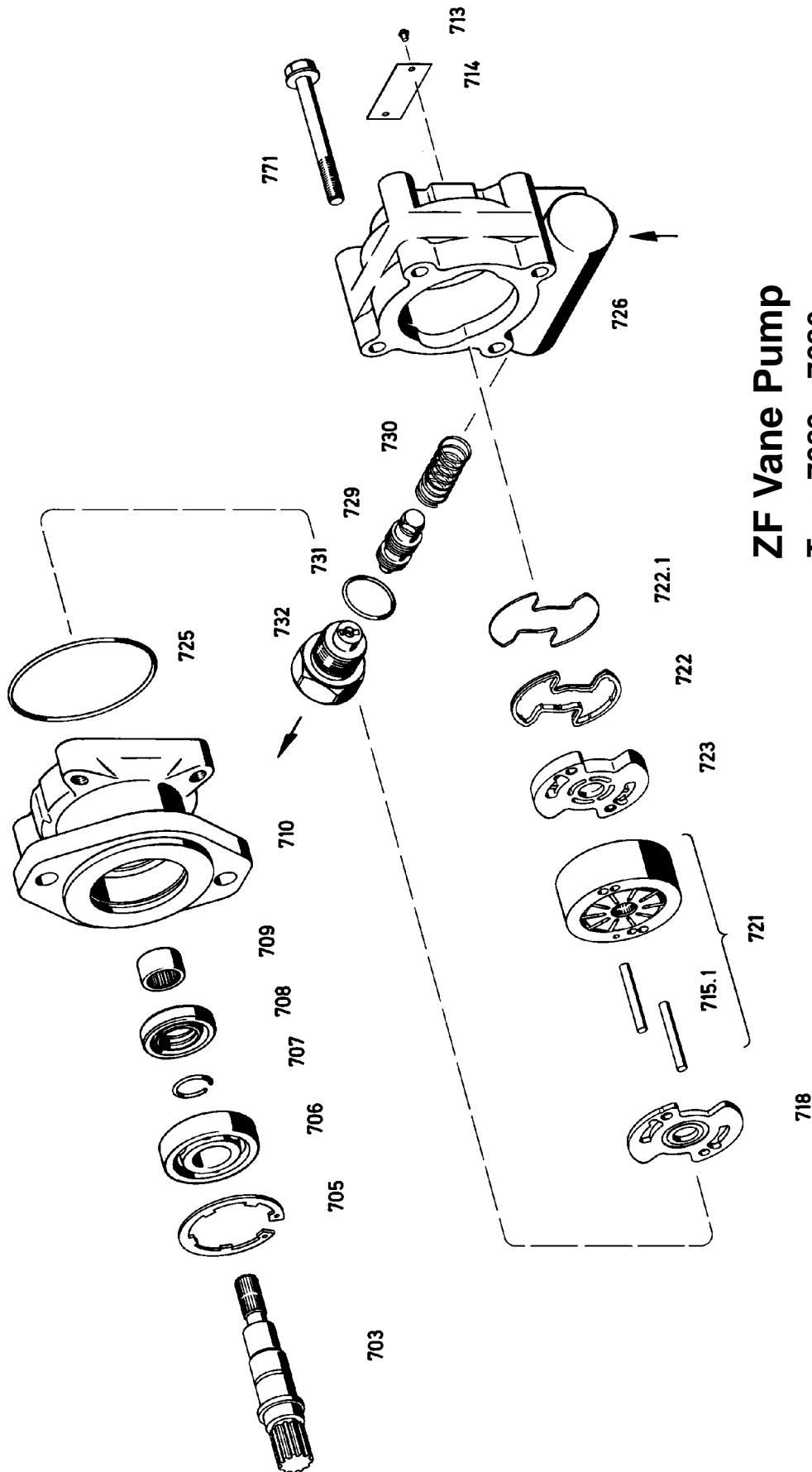


ZF Vane Pump
 Type 7682
 Version: FP 32

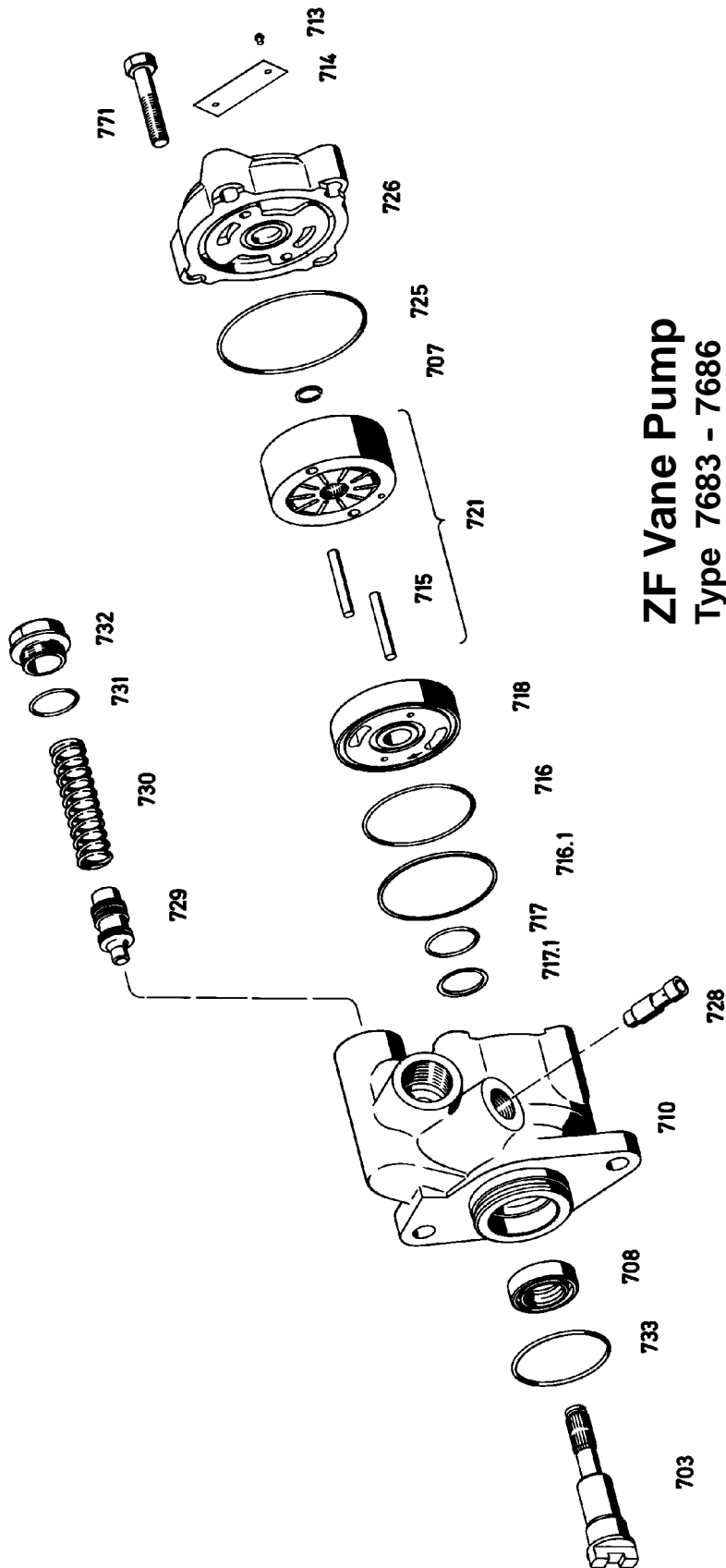




ZF Vane Pump
 Type 7682
 Version: FP 32



ZF Vane Pump
Type 7683 - 7686
Version: FN 31



ZF Vane Pump
Type 7683 - 7686
Version: FN 4

