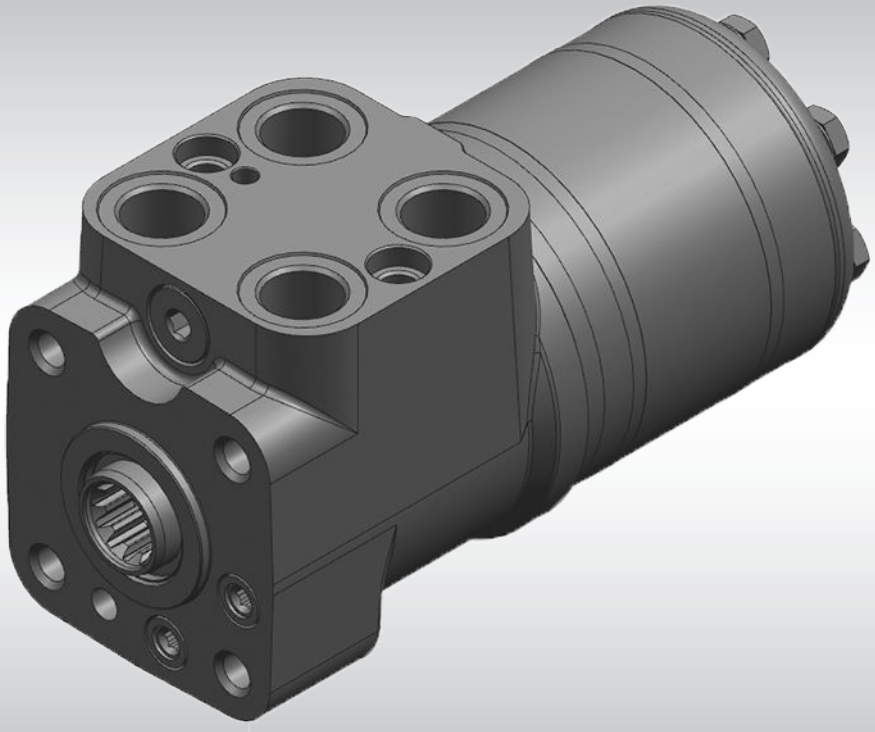
MAKING MODERN LIVING POSSIBLE

Service Manual

Steering Unit
Type OSPD V2



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Revision History

Table of Revisions

Date	Changed	Rev
Feb 2014	Torque value under assembly corrected	AB
Dec 2013	First version - DITA CMS	AA

Contents

Safety Precautions

Safety Precautions

Always consider safety precautions before beginning a service procedure. Protect yourself and others from injury. Take the following general precautions whenever servicing a hydraulic system.

Warning

Unintended Machine Movement

Unintended movement of the machine or mechanism may cause injury to the technican or bystanders. To prevent uintended movement, secure the machine or disable / disconnect the mechanism while servicing.

Warning

Flammable Cleaning Solvents

Some cleaning solvents are flammable. To eliminate the risk of fire, do not use cleaning solvents in an area where a source of ignition may be present.

Warning

Fluid under Pressure

Escaping hydraulic fluid under pressure can have sufficient force to penetrate your skin causing serious injury and/or infection. This fluid may also be hot enough to cause burns. Use caution when dealing with hydraulic fluid under pressure. Relieve pressure in the system before removing hoses, fittings, gauges, or components. Never use your hand or any other body part to check for leaks in a pressurized line. Seek medical attention immediately if you are cut by hydraulic fluid.

Warning

Personal Safety

Protect yourself from injury. Use proper safety equipment, including safety glasses, at all times.

Warning

Product Safety

Steering units are safety components and therefore it is extremely important that the greatest care is taken when servicing these products. There is not much wear on a steering unit and therefore they normally outlast the application they are built into. Therefore the only recommended service work on steering units is:

- Changing shaft seals and o-rings
- Disassemble, clean and assemble if contaminated
- Make hydraulic testing including valve setting.

Service Literature

Symbols Used in Danfoss Literature

Non removable part, use a new part	Note correct orientation
External hex head	Mark orientation for reinstallation
Internal hex head	Torque specification
Lubricate with hydraulic fluid	Press in - press fit
Inspect for wear or damage	Pull out with tool - press fit

OSPD Versions, Belonging Service Literature

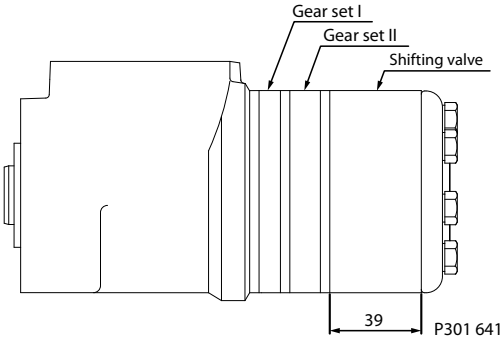
This service literature is valid for OSPD V2/OSPD in new design only.

If the OSPD in question is in “old” or “V2/new” design can be traced by the product code:

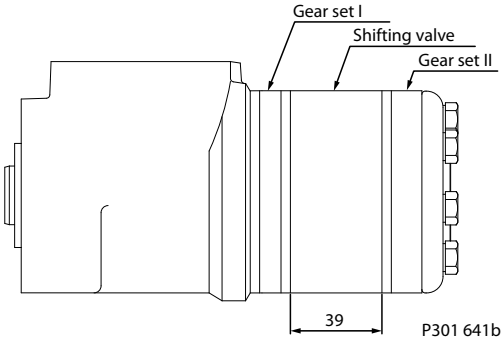
- OSPD’s with product code number higher than 11113069 are all in “new” design
- OSPD’s with product code number 150xxxxx (e.g. 150G4051) and with product code lower than 11113069 are all in “old” design

The outside shape differs between OSPD in “old” and “V2/new” design:

OSPD old design



OSPD V2 / New Design

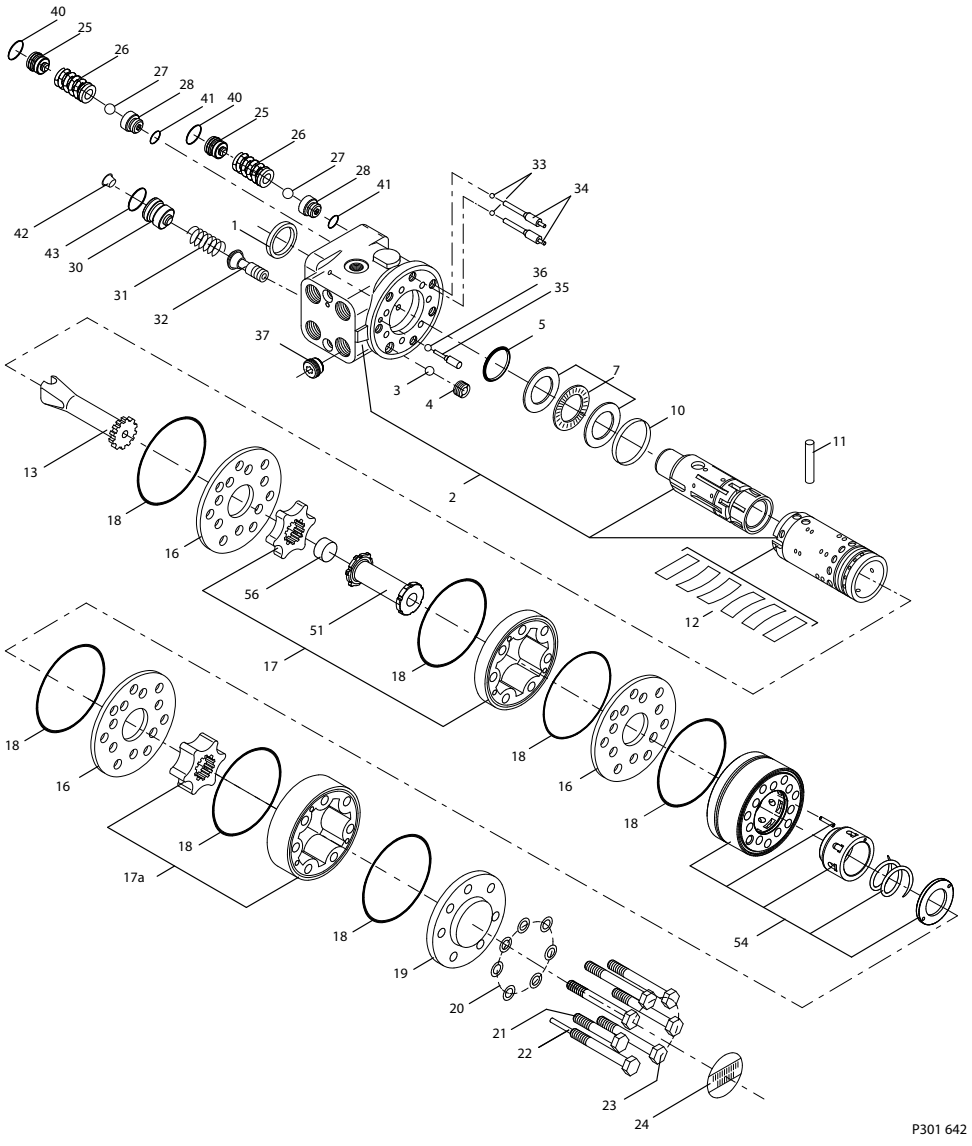


For further explanations between OSPD in “old” and “new” design, see Product Information Bulletin ST2013-068.

Service literature HN.21.ZA.52 is valid for OSPD in “old” version.

Exploded View and Seal Kit

Exploded View, OSPD V2/OSPD New Design



OSPD V2 Parts List

Parts list	Num. per unit	Item	Tightening torque
Dust seal ring	1	1	-
Housing & spool/sleeve	1	2	-
Ball Ø8.5 mm	1	3	-
Threaded bushing	1	4	Screw below surface of housing
Shaft seal	1	5	-
Bearing assembly	1	7	-
Ring	1	10	-
Cross pin	1	11	-
Set of springs	1	12	-

Exploded View and Seal Kit

OSPD V2 Parts List (continued)

Parts list	Num. per unit	Item	Tightening torque
Cardan shaft	1	13	-
Distributor plate	3	16	-
Gearwheel set (GWS1)	1	17	-
Gearwheel set (GWS2)	1	17a	-
O-ring ø79.4 x ø2.0 mm	7	18	-
End cover	1	19	-
Washer	7	20	-
Screw	1	21	30±6 Nm
Pin bolt screw	1	22	30±6 Nm
Screw	5	23	30±6 Nm
Model/Code label	1	24	-
Adjusting screw for shock valve	2	25	-
Spring with thrust pad for shock valve	2	26	-
Ball ø3/16 in for shock valve	2	27	-
Seat for shock valve	2	28	6+0/-1 Nm
Adjusting screw for relief valve	1	30	-
Spring for relief valve	1	31	-
Piston for relief valve	1	32	-
Ball Ø3/16 in for suction valve	2	33	-
Bushing with pin for suction valve	2	34	-
Ball stop, threaded for LS check	1	35	1±0.1 Nm
Ball Ø3.0 mm for LS check	1	36	-
Check valve	1	37	25±5 Nm
O-ring ø9.0 x ø1.5 mm	2	40	-
O-ring ø6.0 x ø1.5 mm	2	41	-
Plug	1	42	-
O-ring ø14.3 x ø2.4 mm	1	43	-
Cardan shaft	1	51	-
Valve housing assembly	1	54	Do not disassembly
Spacer (present if GWS1 >/= 100 cm^3)	1	56	-

Seal Kit for OSPD

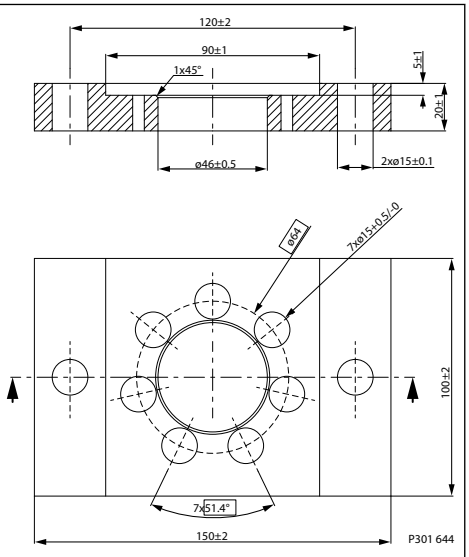
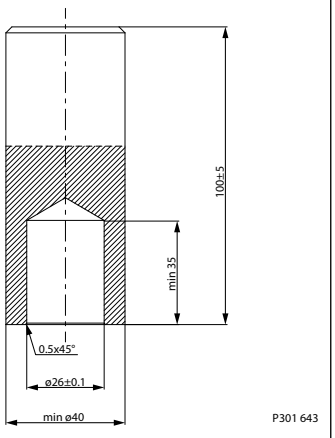
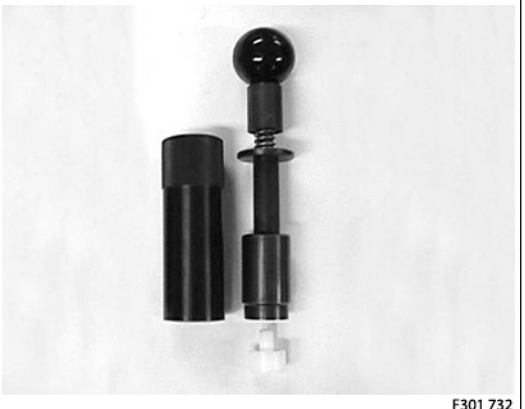
Seal kit, Danfoss code 150N4041 is valid for all OSPD's, both in "old" and in "new" design.

Parts list for 150N4041	Number per spare part kit	Item
Dust seal ring	1	1
Shaft seal	1	5
O-ring	7	18
Washer	7	20
O-ring	2	40
O-ring	2	41
Plug	1	42
O-ring	1	43

Tools

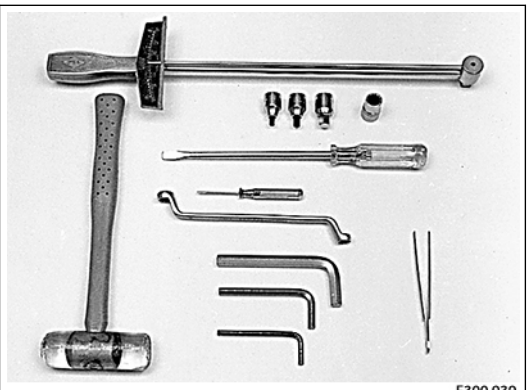
Tools

Tools

Holding tool for the entire steering unit. Material: Appropriate metal or hard plastic. This tool is not available from Danfoss.	
Assembly tool for dust seal. Material: Free cutting steel. This tool is not available from Danfoss.	
Assembly tool for shaft seal, O-ring/Roto Glyd type: Code number: 11092408.	

Tools

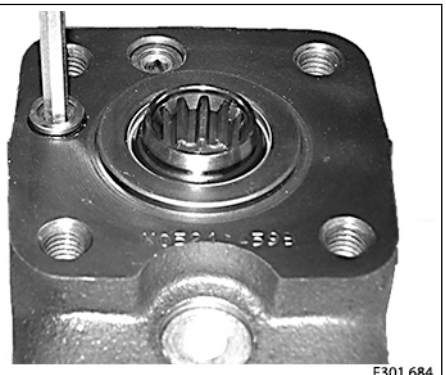
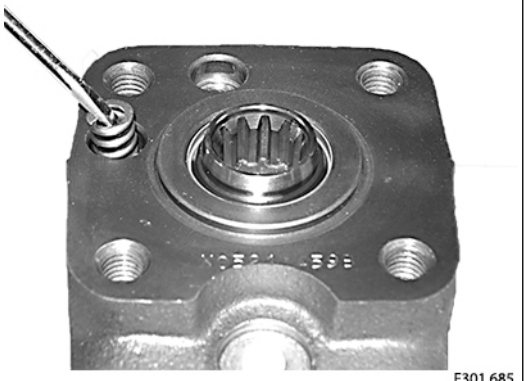
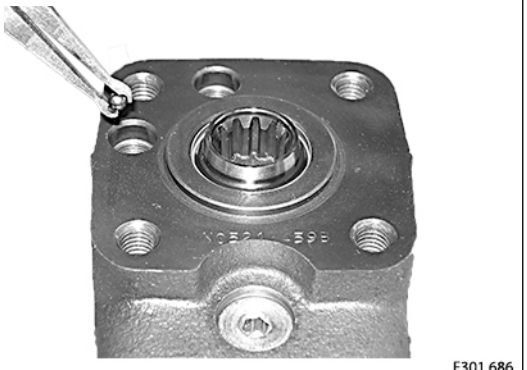
Tools (continued)

Torque wrench 0 - 70 Nm. 13 mm socket spanner. 2.75 - 5 and 6 mm Allan key. 12 mm screwdriver. 2 mm screwdriver. 13 mm ring spanner. Plastic hammer. Tweezers. These tools are not available from Danfoss.	 F300 939

Disassembly

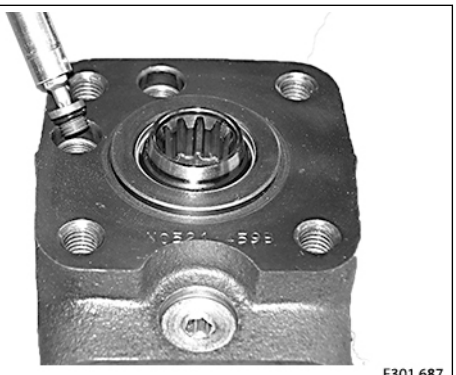
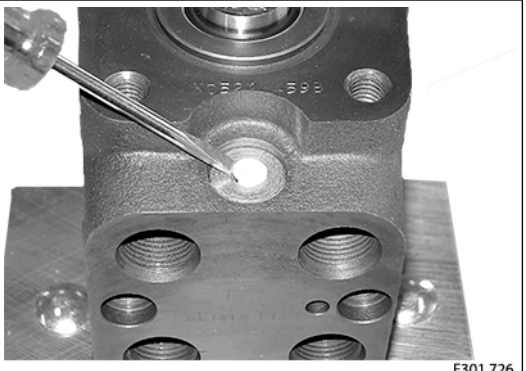
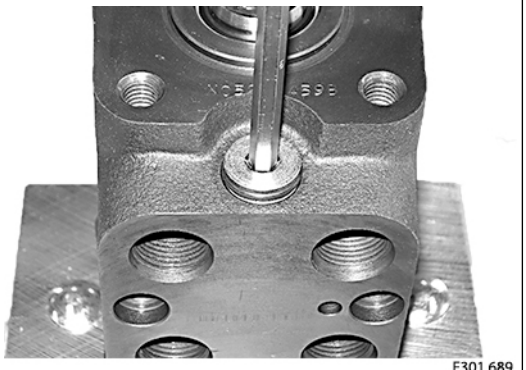
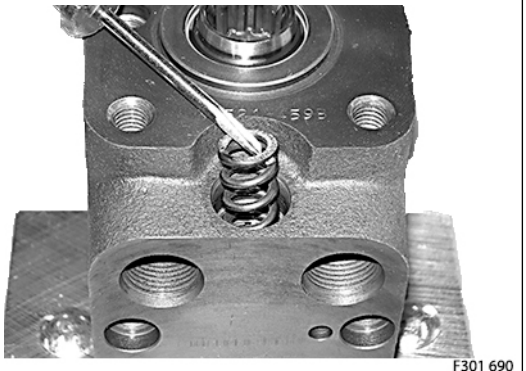
Disassembling OSPD V2

Disassembly

Place the unit in the holding tool on gear set end. Screw out the adjusting screws for shock valves (25). O-ring (40) is fitted on adjusting screw (25).	 F301 684
Remove the springs with trust pads for shock valves (26).	 F301 685
Remove the balls for shock valves (27).	 F301 686

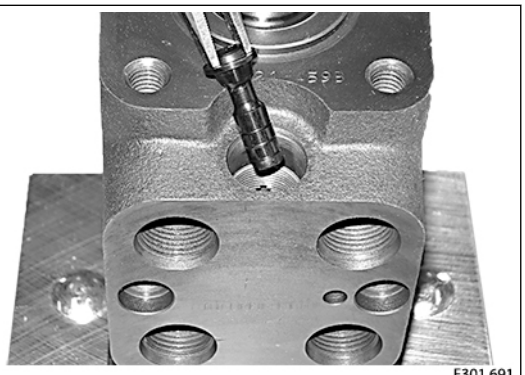
Disassembly

Disassembly (continued)

Screw out the seats for shock valves (28). O-ring (41) is fitted on seat (28).	 F301 687
Remove the plastic plug (42).	 F301 726
Screw out the adjusting screw for relief valve (30). O-ring (43) is fitted on adjusting screw (30).	 F301 689
Remove the spring for relief valve (31).	 F301 690

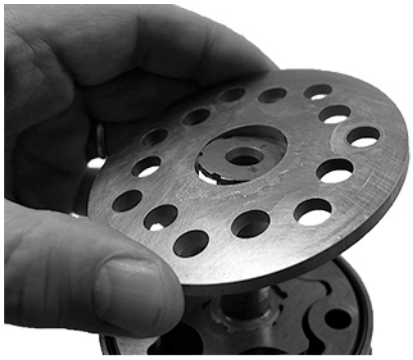
Disassembly

Disassembly (continued)

Remove the piston for relief valve (32).	 F301 691
Replace the unit in the holding tool on steering column end. Remove the screws (21, 22 and 23) with washers (20). Some versions have pin bolt screw (22), threaded bushing (4) and 5 pieces standard screws (23) as shown on exploded view page 5. Other versions (like this taken apart) has threaded bushing with ball stop (4) and 6 pieces standard screws (23). All versions have one piece short standard screw (21). Screw (21) is threaded in valve housing (54).	 F301 792
Remove the end cover (19), sideways.	 F301 793
Lift the gearwheel set (17a) off the unit. Remove the two O-rings (18).	 F301 794

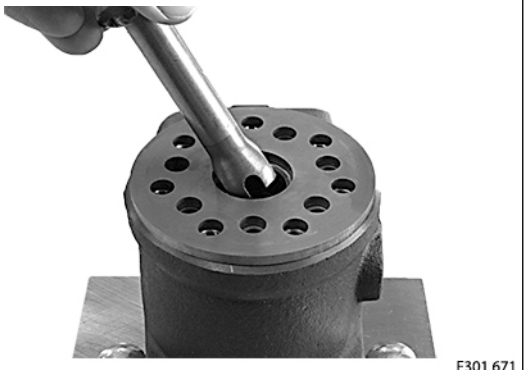
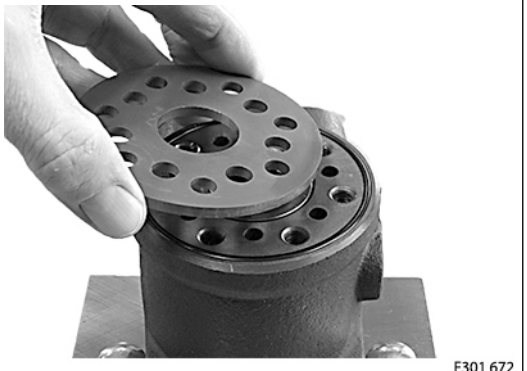
Disassembly

Disassembly (continued)

Remove the rear distributor plate (16).	 F301 795
Remove valve housing assembly (54). Remove the two O-rings (18). Do not dismantle the entire valve (54)	 F301 796
Remove the middle distributor plate (16).	 F301 797
Remove the cardan shaft (51).	 F301 798

Disassembly

Disassembly (continued)

Remove spacer (56) if present. Spacer is only present in OSPD with GSW1 (17) equal to 100 cm^3/rev or larger/height 13.0 mm or larger.	 F301 799
Lift the gearwheel set (17) off the unit. Remove the two O-rings (18).	 F301 670
Remove the cardan shaft (13).	 F301 671
Remove the distributor plate (16) from the housing.	 F301 672

Disassembly

Disassembly (continued)

Remove the threaded bushing/ball stop (4) from housing.	 F301 800
Remove the ball stop (35) from housing. Ball stop (35), and belonging ball (36) is only present in OSPD LS with check valve in LS line.	 F301 801
Remove the O-ring (18) from housing.	 F301 802
Shake out the check valve ball (3), suction valve pins (34), balls (33) and ball (36).	 F301 803

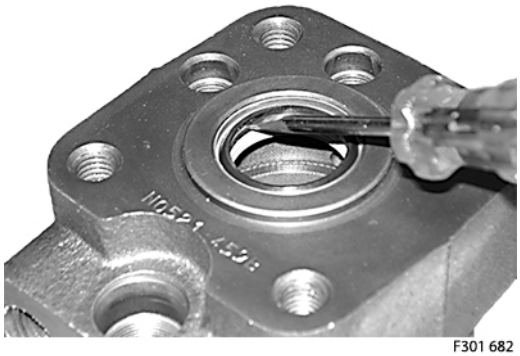
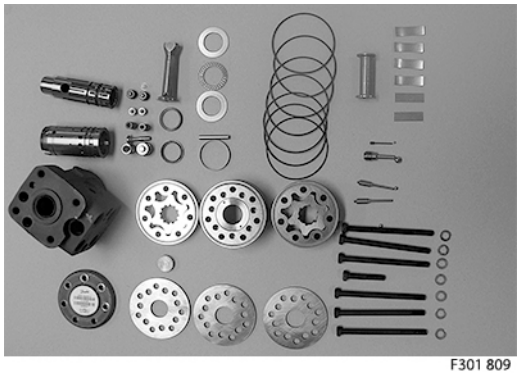
Disassembly

Disassembly (continued)

Place the housing with the ports facing down on the work bench. Ensure that the cross pin (11) in the spool and sleeve set (2) is in the horizontal position. The pin (11) can be observed through the open end of the spool. Press the spool (2) inwards (from the housing mounting face end) and the sleeve (2), ring (7) and bearing assembly (6) will be pushed out of the housing together.	 F301 804
Take the ring (10), bearing races and needle bearing (7) from the spool and sleeve set (2). The outer bearing (7) race can sometimes “stick” in the housing, therefore check that it has come out.	 F301 805
Press out the cross pin (11).	 F301 806
Carefully press the spool out of the sleeve.	 F301 807

Disassembly

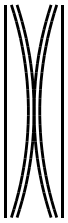
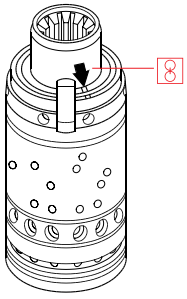
Disassembly (continued)

Press the neutral position springs (12) out of the slot of the spool.	 F301 808
Remove dust seal (1) and shaft seal (Roto Glyd) (5) carefully with a screw driver or similar tool.	 F301 682
The steering unit OSPD is now completely dismantled	 F301 809
Cleaning Clean all parts carefully in Shellsol K or similar cleaner fluid.	
Inspection and Replacement Replace all seals and washers. Check all parts carefully and make any replacements as is necessary.	

Assembly

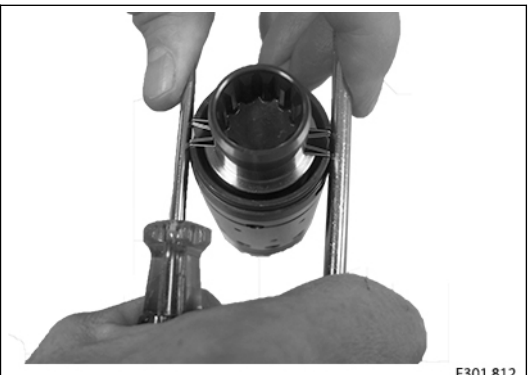
Assembling OSPD V2

Assembling OSPD V2

Place the two flat neutral position springs in the slot. Place the curved springs between the flat ones and press them into place.	 F301 810
Configuration of spring set (12). There can be different numbers of curved springs depending on configuration of spring set. There can be 2, 4 or 6 curved springs.	 150-386.10
OSPD LSR Spool and sleeve must be positioned correctly relatively to each other. Small marks are present on both spool and sleeve close to one of the slots for the spring set.	 150-412.10
Guide the spool into the sleeve (2). If the spool and sleeve has marks as shown above, these must be placed on same side. Make sure the centering springs (12) are placed into the slot.	 F301 811

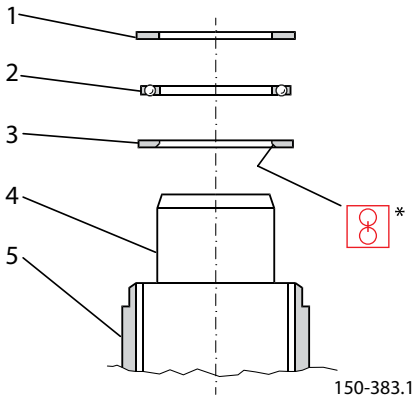
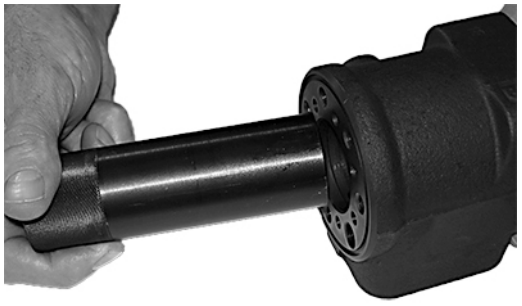
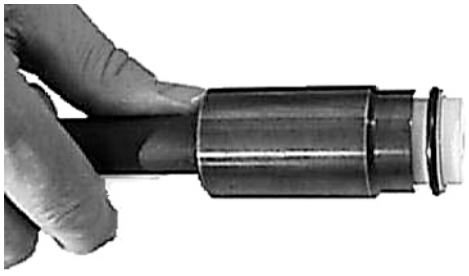
Assembly

Assembling OSPD V2 (continued)

Line up the spring set (12).	 F301 812
Guide the ring (10) down over the sleeve. The ring should be able to move free of the springs.	 F301 813
Fit the cross pin (11) into the spool/sleeve.	 F301 814
Fit bearing races and needle bearing (7) as shown on the next drawing.	 F301 815

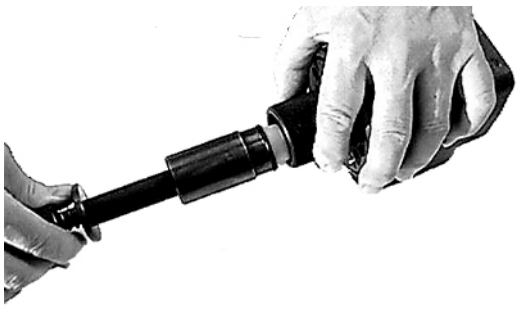
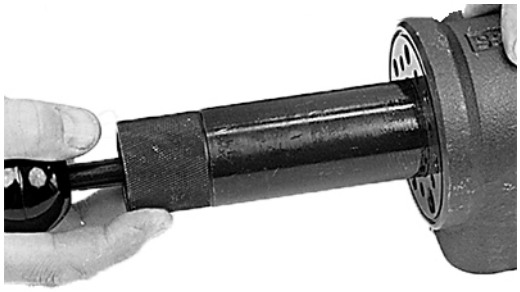
Assembly

Assembling OSPD V2 (continued)

Caution Assembly pattern for standard bearing 1. Outer bearing race 2. Needle bearing 3. Inner bearing race 4. Spool 5. Sleeve *The inside chamfer on the inner bearing race must face the chest of the inner spool.	 150-383.10
Place the steering unit housing with the port face down on the work bench. Guide the outer part of the assembly tool into the bore for the spool/sleeve set (2).	 F301 703
Grease the shaft seal (Roto Glyd, 5) with hydraulic oil and place them on the tool. Ensure that the Roto Glyd seal is placed on the insertion tool as per the photograph.	 F300 985

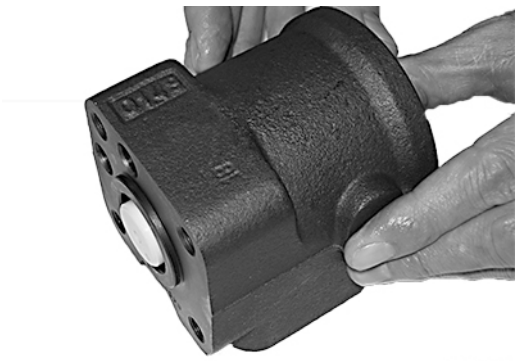
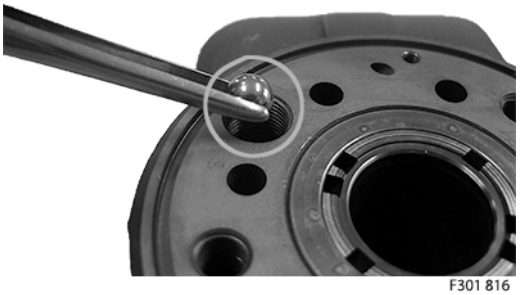
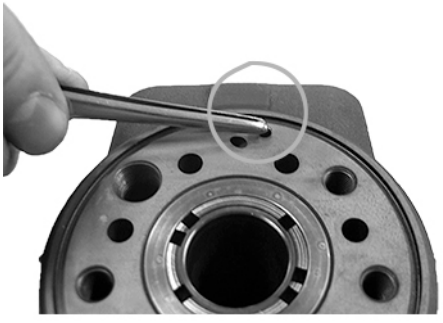
Assembly

Assembling OSPD V2 (continued)

Hold the outer part of the assembly tool in the bottom of the steering unit housing and guide the inner part of the tool right to the bottom.	 F300 986
Press and turn the shaft seal (5) into position in the housing.	 F301 987
Draw the inner and outer parts of the assembly tool out of the steering unit bore, leaving the guide from the inner part in the bore.	 F301 988
With a light turning movement, guide the spool and sleeve into the bore. Fit the spool set holding the cross pin (11) horizontal.	 F301 708

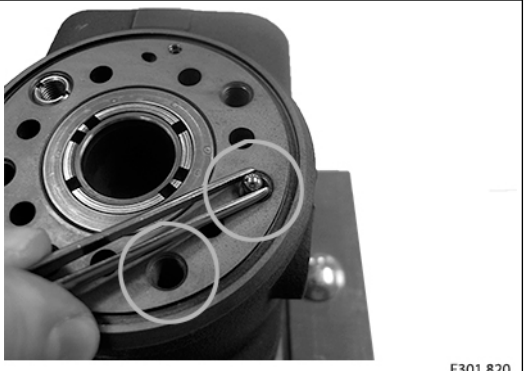
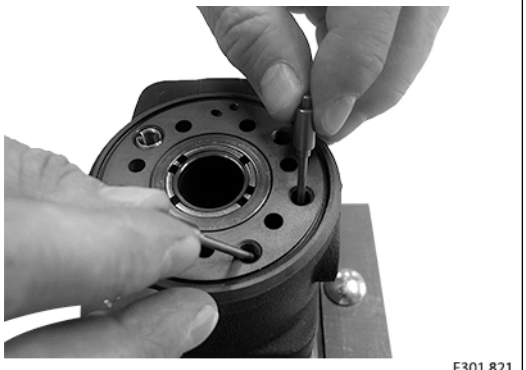
Assembly

Assembling OSPD V2 (continued)

The spool set will push out the assembly tool guide. The shaft seal (5) is now installed.	 F301 709
Place the steering unit housing on the holding tool on the steering column end. Put the check valve ball (3) into the hole indicated by the circle.	 F301 816
Screw the threaded bushing/ball stop (4) lightly into the check valve bore. The top of the bush must lie just below the surface of the housing.	 F301 817
Put the check valve ball (36) into the hole indicated by the circle. Ball (36) is only present in OSPD LS with check valve in LS line.	 F301 818

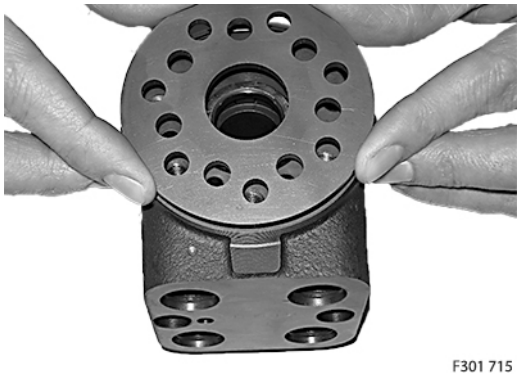
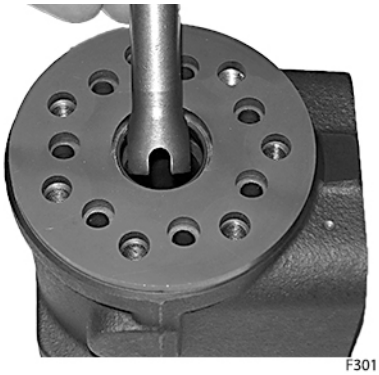
Assembly

Assembling OSPD V2 (continued)

Screw the ball stop (35) into the LS check valve bore. 1 +/-0.1 Nm [8.85 + /- 0.885 lbf.in].	 F301 819
Place a ball (33) in the two bolt holes indicated by the circles.	 F301 820
Place the pins (34) in the same two bolt holes.	 F301 821
Insert the o-ring (18) in the grove on the housing.	 F301 822

Assembly

Assembling OSPD V2 (continued)

Place the distributor plate (16) so that the channel holes match the holes in the housing.	 F301 715
Guide the cardan shaft (13) down into the bore so that the slot is parallel with the connection flange ports and lines up with the cross pin (11).	 F301 716
Place the 2 o-rings (18) in the two groves in the gear rim. Fit the gearwheel and rim (17) on the cardan shaft (13). Place the gear wheel side with all the deeper splines facing downwards. Only this side will fit on the cardan shaft due to all gear sets used in OSPD V2 has timing securing: splines of gear wheel and cardan shaft can only be assembled with correct timing.	 F301 717
Place the spacer (56) if present. Spacer is only present in OSPD with GSW1 (17) equal to or larger than 100 cm^3.	 F301 823

Assembly

Assembling OSPD V2 (continued)

Place and rotate the cardan shaft (51) with the big diameter end until it moves in gear with gear wheel of gear set (17).	 F301 824
Place the middle distributor plate (16) so that the channel holes match the holes in the gear set.	 F301 825
Place the 2 o-rings (18) in the two groves in the valve housing assembly (54). Place the valve housing assembly so that the one and only M8 thread whole points upwards and direction port face. Make sure that channel holes match the holes in the distributor plate (16).	 F301 826  F301 827

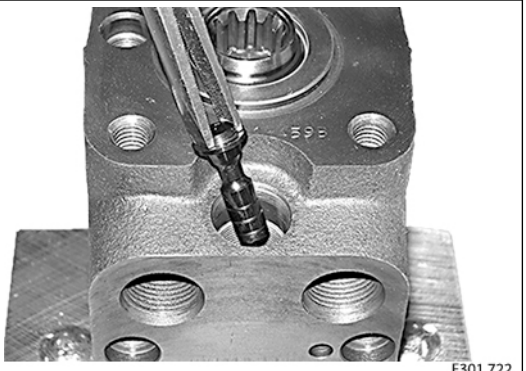
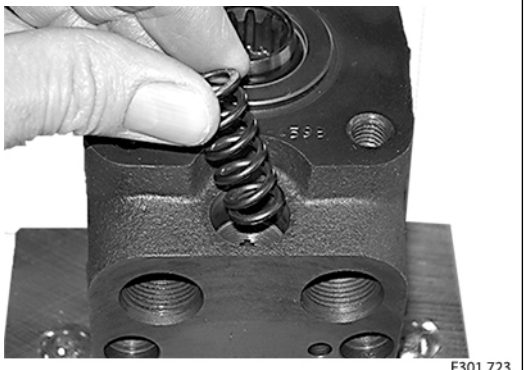
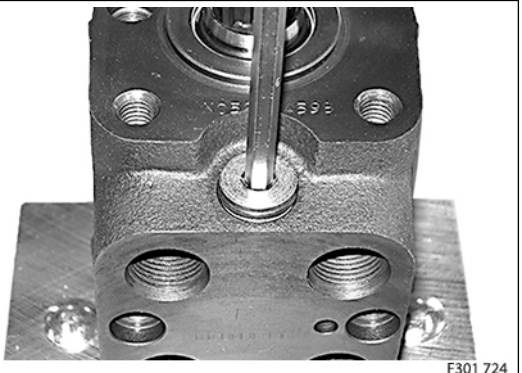
Assembly

Assembling OSPD V2 (continued)

Place the rear distributor plate (16) so that the channel holes match the holes in valve housing assembly (54).	 F301 828
Place the 2 o-rings (18) in the two groves in the gear rim. Fit the gearwheel and rim (17a) on the cardan shaft (51). Place the gear wheel side with all the deeper splines facing downwards. Only this side will fit on the cardan shaft due to all gear sets used in OSPD V2 has timing securing: splines of gear wheel and cardan shaft can only be assembled with correct timing.	 F301 829
Place the end cover (19) in position. Ensure that the bar codes and writing are parallel with port face.	 F301 830
Fit the short screw (22) with new washer (20) and place it in the hole shown.	 F301 831

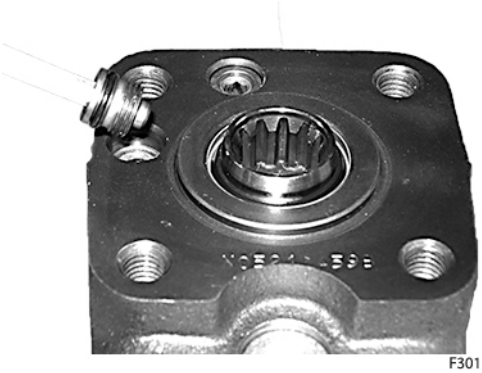
Assembly

Assembling OSPD V2 (continued)

Fit the six screws (23) with new washers (20) and insert them. In case the unit has pin bolt screw, this must be inserted where the circle is marked: Cross-tighten all the screws (22 and 23) with a torque of 30 +/-6 Nm [265.5 +/- 53 lbf•in]. Replace the unit in the holding tool on gear set end. The OSPD V2 can now be function tested manually: it must be possible to rotate input shaft with torque < 3.5 Nm [31.0 lbf•in].	 F301 832
Install the piston (32) to housing.	 F301 722
Install the spring (31) on top of the piston (32).	 F301 723
Place o-ring (43) on adjusting screw (30). Screw in the adjustment screw (30) with a 6 mm Allan key. Make the pressure setting on a test panel according to valve setting specification. Insert plastic protection plug (42) to the adjustment screw (30).	 F301 724

Assembly

Assembling OSPD V2 (continued)

Place o-ring (41) on the shock valve seats (28). Screw in the seats (28) with a 2.75 mm Allan key into the cavities indicated by the circles. Torque 6 +/-1 Nm [53.1 +/- 8.85 lbf•in].	 F301 734
Place one ball (27) in each of the shock valve cavities.	 F301 725
Place springs with trust pads (26) over the two balls.	 F301 766
Place o-rings (40) on adjusting screws (25). Screw in the two adjusting screws (25) using a 5 mm Allan key. Make the pressure setting on a test panel according to valve setting specification.	 F301 727
Make test for external leakage:	

Assembly

Assembling OSPD V2 (continued)

Plug all ports, established 35 bar, hydraulic pressure on T and check the unit is completely leak free.	
Place the dust seal ring (1) in the housing.	 F301 729
Fit the dust seal ring in the housing using *special tool for dust seal assembly* and a plastic hammer.	 F301 730
Screw in the plastic plugs into the connection ports to keep the ports clean during storage and transportation.	 F301 833

Tightening Torques

Tightening Torques for Connections OSDP V2

Tightening Torques for Connections OSPD V2

Connections	Max. tightening torque Nm [lbf.in]			
	With cutting edge	With copper washer	With alum. Washer	O-ring
G 1/4	35 [309]	35 [309]	35 [309]	-
G 3/8	70 [619]	45 [398]	50 [442]	-
G 1/2	100 [885]	55 [486]	80 [708]	-
G 3/4	180 [1593]	90 [796]	130 [1150]	-
7/16-20 UNF	-	-	-	20 [177]
3/4-16 UNF	-	-	-	60 [531]
7/8-14 UNF	-	-	-	90 [796]
1 1/16-12 UNF	-	-	-	120 [1062]
M12 • 1.5	30 [265]	20 [177]	30 [265]	25 [221]
M18 • 1.5	80 [708]	55 [486]	70 [619]	50 [442]
M22 • 1.5	100 [885]	65 [575]	80 [708]	60 [531]
9/16 - 18 UNF, ORFS	-	-	-	25 [221]
1 1/16 - 16 UN, ORFS	-	-	-	27 [239]

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