## Revision history

<table>
<thead>
<tr>
<th>Date</th>
<th>Changed</th>
<th>Rev</th>
</tr>
</thead>
<tbody>
<tr>
<td>April 2017</td>
<td>Updated LS copy valve</td>
<td>0102</td>
</tr>
<tr>
<td>September 2014</td>
<td>First edition</td>
<td>AA</td>
</tr>
</tbody>
</table>
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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 vehicle or machine movement hazard.**

Unintended movement of the machine or mechanism may cause injury to the technician or bystanders. To prevent unintended 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.
Symbols used in Danfoss Literature

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

The symbols above appear in the illustrations and text of this manual. They are intended to communicate helpful information at the point where it is most useful to the reader. In most instances, the appearance of the symbol itself denotes its meaning. The legend above defines each symbol and explains its purpose.
Exploded view and seal kit

**OSPU exploded view**

![Exploded view of OSPU](image)

**OSPU parts list**

<table>
<thead>
<tr>
<th>Parts list</th>
<th>Num. per unit</th>
<th>Item</th>
<th>Tightening torque</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dust seal ring</td>
<td>1</td>
<td>1</td>
<td>-</td>
</tr>
<tr>
<td>Housing &amp; spool/sleeve set</td>
<td>1</td>
<td>2</td>
<td>-</td>
</tr>
<tr>
<td>Ball Ø8.5 mm</td>
<td>1</td>
<td>3</td>
<td>-</td>
</tr>
<tr>
<td>Threaded bushing (Screw below surface of housing)</td>
<td>1</td>
<td>4</td>
<td>-</td>
</tr>
<tr>
<td>Shaft seal</td>
<td>1</td>
<td>5</td>
<td>-</td>
</tr>
<tr>
<td>Bearing assembly</td>
<td>1</td>
<td>7</td>
<td>-</td>
</tr>
<tr>
<td>Ring</td>
<td>1</td>
<td>10</td>
<td>-</td>
</tr>
<tr>
<td>Cross pin</td>
<td>1</td>
<td>11</td>
<td>-</td>
</tr>
<tr>
<td>Set of springs</td>
<td>1</td>
<td>12</td>
<td>-</td>
</tr>
<tr>
<td>Cardan shaft</td>
<td>1</td>
<td>13</td>
<td>-</td>
</tr>
<tr>
<td>Distributor plate</td>
<td>1</td>
<td>16</td>
<td>-</td>
</tr>
<tr>
<td>Gearwheel set</td>
<td>1</td>
<td>17</td>
<td>-</td>
</tr>
<tr>
<td>O-ring ø79.4 x ø2.0 mm</td>
<td>3</td>
<td>18</td>
<td>-</td>
</tr>
<tr>
<td>End cover</td>
<td>1</td>
<td>19</td>
<td>-</td>
</tr>
<tr>
<td>Washer</td>
<td>7</td>
<td>20</td>
<td>-</td>
</tr>
</tbody>
</table>
Exploded view and seal kit

OSPU parts list (continued)

<table>
<thead>
<tr>
<th>Parts list</th>
<th>Num. per unit</th>
<th>Item</th>
<th>Tightening torque</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pin bolt screw</td>
<td>1</td>
<td>21</td>
<td>30±6 N•m</td>
</tr>
<tr>
<td>Screw</td>
<td>6</td>
<td>22</td>
<td>30±6 N•m</td>
</tr>
<tr>
<td>Model/Code label</td>
<td>1</td>
<td>24</td>
<td>-</td>
</tr>
<tr>
<td>Adjusting screw for shock valve</td>
<td>2</td>
<td>25</td>
<td>-</td>
</tr>
<tr>
<td>Spring with thrust pad for shock valve</td>
<td>2</td>
<td>26</td>
<td>-</td>
</tr>
<tr>
<td>Ball ø3/16 in for shock valve</td>
<td>2</td>
<td>27</td>
<td>-</td>
</tr>
<tr>
<td>Seat for shock valve</td>
<td>2</td>
<td>28</td>
<td>6+0/-1 N•m</td>
</tr>
<tr>
<td>Adjusting screw for relief valve</td>
<td>1</td>
<td>30</td>
<td>-</td>
</tr>
<tr>
<td>Spring for relief valve</td>
<td>1</td>
<td>31</td>
<td>-</td>
</tr>
<tr>
<td>Piston for relief valve</td>
<td>1</td>
<td>32</td>
<td>-</td>
</tr>
<tr>
<td>Ball Ø3/16 in for suction valve</td>
<td>2</td>
<td>33</td>
<td>-</td>
</tr>
<tr>
<td>Bushing with pin for suction valve</td>
<td>2</td>
<td>34</td>
<td>-</td>
</tr>
<tr>
<td>LS copy valve</td>
<td>1</td>
<td>35</td>
<td>-</td>
</tr>
<tr>
<td>Check valve</td>
<td>1</td>
<td>37</td>
<td>25±5 N•m</td>
</tr>
<tr>
<td>O-ring ø9.0 x ø1.5 mm</td>
<td>2</td>
<td>40</td>
<td>-</td>
</tr>
<tr>
<td>O-ring ø6.0 x ø1.5 mm</td>
<td>2</td>
<td>41</td>
<td>-</td>
</tr>
<tr>
<td>O-ring ø12.42 x ø1.78 mm</td>
<td>1</td>
<td>43</td>
<td>-</td>
</tr>
<tr>
<td>O-ring ø15.3 x ø2.2 mm</td>
<td>1</td>
<td>44</td>
<td>-</td>
</tr>
<tr>
<td>O-ring ø12.5 x ø1.8 mm</td>
<td>1</td>
<td>45</td>
<td>-</td>
</tr>
<tr>
<td>O-ring ø9.5 x ø1.0 mm</td>
<td>1</td>
<td>46</td>
<td>-</td>
</tr>
<tr>
<td>Torque compensator valve plug</td>
<td>1</td>
<td>50</td>
<td>-</td>
</tr>
<tr>
<td>Torque compensator valve spring</td>
<td>1</td>
<td>51</td>
<td>-</td>
</tr>
<tr>
<td>Torque compensator valve spool</td>
<td>1</td>
<td>52</td>
<td>-</td>
</tr>
<tr>
<td>Torque compensator valve ball, Ø13.0 mm</td>
<td>1</td>
<td>53</td>
<td>-</td>
</tr>
</tbody>
</table>

Seal kit for OSPU

Seal kit, Danfoss code 11140740 is valid for all codes of OSPU's.

Spare part kit for OSPU, code no. 11140740

<table>
<thead>
<tr>
<th>Parts list</th>
<th>Number per spare part kit</th>
<th>Item</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dust seal ring</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Shaft seal</td>
<td>1</td>
<td>5</td>
</tr>
<tr>
<td>O-ring</td>
<td>3</td>
<td>18</td>
</tr>
<tr>
<td>Washer</td>
<td>7</td>
<td>20</td>
</tr>
<tr>
<td>O-ring</td>
<td>2</td>
<td>40</td>
</tr>
<tr>
<td>O-ring</td>
<td>2</td>
<td>41</td>
</tr>
<tr>
<td>O-ring</td>
<td>1</td>
<td>43</td>
</tr>
<tr>
<td>O-ring</td>
<td>1</td>
<td>44</td>
</tr>
<tr>
<td>O-ring</td>
<td>1</td>
<td>45</td>
</tr>
<tr>
<td>O-ring</td>
<td>1</td>
<td>46</td>
</tr>
</tbody>
</table>
Tools

Tools for OSPU

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.
Tools (continued)

- Assembly tool for shaft seal, O-ring/Roto Glyd type:
  - Code number: 11092408.

- Torque wrench 0 - 70 N•m.
- 13 mm socket spanner.
- 2.75 - 5 and 8 mm Allan key.
- 12 mm screwdriver.
- 2 mm screwdriver.
- 13 mm ring spanner.
- Plastic hammer.
- Tweezers.
- These tools are not available from Danfoss.
Dismantling

**Dismantling OSPU**

**Dismantling OSPU**

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).

Remove the springs with trust pads for shock valves (26).

Remove the balls for shock valves (27).

Screw out the seats for shock valves (28). O-ring (41) is fitted on seat (28).
Dismantling OSPU (continued)

Screw out the adjusting screw for relief valve (30). O-ring (43) is fitted on adjusting screw (30).

Remove the spring for relief valve (31).

Remove the piston for relief valve (32).
Dismantling OSPU (continued)

- Screw out the plug for the torque compensator valve (50). Spring (51), spool (52) and O-rings (44, 45 and 46) is fitted to the plug (50).

- Remove the spool (52) and spring (51) from the plug (50).

- Remove the ball (53) from housing.

- Replace the unit in the holding tool on steering column end.
Dismantling OSPU (continued)

<table>
<thead>
<tr>
<th>Step</th>
<th>Image</th>
</tr>
</thead>
<tbody>
<tr>
<td>Remove the screws (21 and 22) with washers (20).</td>
<td>![Image](F301 048)</td>
</tr>
<tr>
<td>Remove the end cover (19), sideways.</td>
<td>![Image](F301 049)</td>
</tr>
<tr>
<td>Lift the gearwheel set (17) off the unit. Remove the two O-rings (18).</td>
<td>![Image](F301 850)</td>
</tr>
<tr>
<td>Remove the cardan shaft (13).</td>
<td>![Image](F301 851)</td>
</tr>
</tbody>
</table>
Dismantling

**Dismantling OSPU (continued)**

Remove the distributor plate (16).

Remove the threaded bushing (4) from housing.

Remove the O-ring (18) from housing.

Shake out the check valve ball (3), suction valve pins (34), balls (33) and LS copy valve (35).
**Dismantling OSPU (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.

Take 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.

Press out the cross pin (11).

Remove the ring (10).
Dismantling

**Dismantling OSPU (continued)**

Carefully press the spool out of the sleeve.

Press the neutral position springs (12) out of the slot of the spool.

Remove dust seal (1) and shaft seal (Roto Glyd) (5) carefully with a screw driver or similar tool.

The steering unit OSPU is now completely dismantled.

**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.
Assembling OSPU

Place the two flat neutral position springs in the slot. Place the curved springs between the flat ones and press them into place.

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.

OSPU

Spool and sleeve can be positioned relatively to each other in 2 positions. Both positions possible are valid due to symmetry of the OSPU spool/sleeve sets.

Guide the spool into the sleeve (2). Make sure the centering springs (12) are placed into the slot.

Line up the spring set (12).
Assembling (continued)

Guide the ring (10) down over the sleeve. The ring should be able to move free of the springs.

Fit the cross pin (11) into the spool/sleeve.

Fit bearing races and needle bearing (7) as shown on the drawing below.

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.
Assembling (continued)

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).

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.

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.

Press and turn the shaft seal (5) into position in the housing.
### Assembling (continued)

<table>
<thead>
<tr>
<th>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.</th>
</tr>
</thead>
<tbody>
<tr>
<td>With a light turning movement, guide the spool and sleeve into the bore.</td>
</tr>
<tr>
<td><strong>Fit the spool set holding the cross pin (11) horizontal.</strong></td>
</tr>
<tr>
<td>The spool set will push out the assembly tool guide. The shaft seal (5) are now installed.</td>
</tr>
<tr>
<td>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.</td>
</tr>
</tbody>
</table>
Assembling (continued)

Screw the threaded bushing (4) lightly into the check valve bore. The top of the bush must lie just below the surface of the housing.

Place a ball (33) in the two bolt holes indicated by the circles.

Place the pins (34) in the same two bolt holes.

Place the LS copy valve (35) into the hole indicated by the circle. The conical end must point downwards.
Assembling (continued)

Insert the o-ring (18) in the groove on the housing.

Place the distributor plate (16) so that the channel holes match the holes in the housing.

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).

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 OSPU has timing securing; splines of gear wheel and cardan shaft can only be assembled with correct timing.
Assembling (continued)

Place the end cover (19) in position. Ensure that the bar codes and writing are parallel with port face.

Fit the pin bolt screw (21) with washer (20) and place it in the hole shown.

Fit the six screws (22) with new washers (20) and insert them. Cross-tighten all the screws (22 and 23) with a torque of 30 ± 6 N•m [265.5 ± 53 lbf•in].

Replace the unit in the holding tool on gear set end.

The OSPU can now be function tested manually: it must be possible to rotate input shaft with torque < 3.5 N•m [31 lbf•in].

Assemble the torque compensator valve: new O-rings (46) in spool (52), (44 and 45) on plug (50), spring (51) and spool (52) to be pressed into plug (50).
Assembling (continued)

Install the ball (53) in the housing.

Screw in the entire torque compensator plug w. parts (50) with an 8 mm Allan key into the cavity indicated by the arrow. Torque 30 +10/-0 N•m [265 +88/-0 lbf•in].

Install the piston (32) to housing.

Install the spring (31) on top of the piston (32).
Assembling (continued)

Place o-ring (43) on adjusting screw (30). Screw in the adjustment screw (30) with an 5 mm Allan key. Make the pressure setting on a test panel according to valve setting specification.

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 $6 \pm 1$ N•m [53 ±9 lbf•in].

Place one ball (27) in each of the shock valve cavities.

Place springs with trust pads (26) over the two balls.
Assembling (continued)

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.

Place the dust seal ring (1) in the housing.

Fit the dust seal ring in the housing using special tool for dust seal assembly (see page 7) and a plastic hammer.

Screw in the plastic plugs into the connection ports to keep the ports clean during storage and transportation.
Tightening torques for connections

Tightening torques

<table>
<thead>
<tr>
<th>Connections</th>
<th>Recommended tightening torque N•m [lbf•in]</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>With cutting edge</td>
</tr>
<tr>
<td>G 1/4</td>
<td>35 [309]</td>
</tr>
<tr>
<td>G 3/8</td>
<td>70 [619]</td>
</tr>
<tr>
<td>G 1/2</td>
<td>100 [885]</td>
</tr>
<tr>
<td>G 3/4</td>
<td>180 [1593]</td>
</tr>
<tr>
<td>7/16-20 UNF</td>
<td>-</td>
</tr>
<tr>
<td>3/4-16 UNF</td>
<td>-</td>
</tr>
<tr>
<td>7/8-14 UNF</td>
<td>-</td>
</tr>
<tr>
<td>1 1/16-12 UN</td>
<td>-</td>
</tr>
<tr>
<td>M12 • 1.5</td>
<td>30 [265]</td>
</tr>
<tr>
<td>M18 • 1.5</td>
<td>80 [708]</td>
</tr>
<tr>
<td>M22 • 1.5</td>
<td>100 [885]</td>
</tr>
<tr>
<td>9/16 - 18 UNF, ORFS</td>
<td>-</td>
</tr>
<tr>
<td>11/16 - 16 UN, ORFS</td>
<td>-</td>
</tr>
</tbody>
</table>

Danfoss Steering Components can withstand the tightening torques stated. However it is recommended to use torque levels stated by supplier of fittings.
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- Steering
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