ENGINEERING
TOMORROW

Technical Information

# Steering
## OSPB, OSPC, OSPD Open Center and OSPB Closed Center

powersolutions.danfoss.com

## Revision history

*Table of revisions*

| Date | Changed | Rev |
|---|---|---|
| April 2016 | Updated to Engineering Tomorrow design | 0602 |
| August 2014 | Port thread deleted= | FA |
| July 2014 | Changed to Danfoss layout | EA |
| August 2013 | | DA |
| November 2009 | Steering column deleted | CA |
| May 2008 | TAD deleted | BA |
| November 2002 | First version | AA |

## Contents

## A wide range of Steering Components


Danfoss is one of the largest producers in the world of steering components for hydrostatic steering systems on off-road vehicles. Danfoss offers steering solutions both at component and system levels. Our product range makes it possible to cover applications of all types - ranging from ordinary 2-wheel steering (also known as Ackermann steering) to articulated steering, automatic steering (e.g. by sensor) and remote controlled steering via satellite. We can offer more than 1,800 different steering units and 250 different priority valves categorized in types, variants and sizes.

**For hydrostatic steering systems Danfoss offers:**

- Mini steering units with displacements from 32 to 100 $cm^3$/rev [1.95 to 6.10 $in^3$/rev], flow up to 20 l/min [5.28 US gal/min], steering pressure up to 140 bar [2030 psi].
- Steering units with displacements from 40 to 1200 $cm^3$/rev [2.44 to 73.2 $in^3$/rev], flow up to 100 l/min [26.4 US gaL/min, steering pressure up to 240 bar [3481 psi].
- Priority valves for rated flows at 40, 80, 120, 160 and 320 l/min [10.6, 21.1, 31.7, 42.3 and 84.5 US gal/min], pressure up to 350 bar [5076 psi].
- Pilot operated flow-amplifiers with amplification factors of 4, 5, 8, 10 or 20 for rated oil flows of 240 and 400 l/min [63.4 and 105.7 US gal/min], steering pressure up to 210 bar [3045 psi].
- Pilot operated steering valve with steering flow up to 100 l/min [26.4 US gal/min], steering pressure up to 250 bar [3625 psi] and with integrated priority valve for pump flow up to 120 l/min [31.7 US gal/min].

**For electrohydraulic steering systems Danfoss offers:**

- Pilot operated steering valves (pilot operated by hydrostatic steering unit or by electrical signal) with steering flows up to 100 l/min [26.4 US gal/min], steering pressure up to 250 bar [3625 psi].
- Steering units with integrated electrical operated steering valve with steering flow up to 50 l/min [13.2 US gal/min], steering pressure up to 210 bar [3045 psi].

## A wide range of Steering Components

**Characteristic features for steering units:**

- Low steering torque: From 0.5 N•m to 3 N•m in normal steering situations
- Low noise level
- Low pressure drop
- Many types available: Open center Non-reaction, Open center Reaction, Power Beyond, Closed center Non-reaction, Load Sensing, Load Sensing Reaction
- One or more built-in valve functions: relief valve, shock valves, suction valves, non-return valve in P-line and in LS-line
- Optional port connections (according to ISO, SAE or DIN standards)

**Characteristic features for electrohydraulic steering systems with OSPE and EHPS:**

- Possibility of GPS, row sensor, variable steering ratio and joystick steering
- The possibility of manual steering even on very heavy vehicles
- EHPS: High steering pressure requiring smaller cylinders and flow
- EHPS: Low pilot pressure and flow giving extremely low noise in the cabin
- EHPS: Can be combined with Danfoss PVG 32 proportional valve

### Conversion factors

1 N•m = [8.851 lbf•in]

1 N = [0.2248 lbf]

1 mm = [0.0394 in]

1 $cm^3$ = [0.061 $in^3$]

1 l = [0.264 US gal]

1 bar = [14.5 psi]

°F = [1.8°C + 32]

### Survey of literature with technical data on Danfoss Steering Components

Detailed data on all Danfoss steering components and accessories can be found in our steering component catalogues, which is divided in to the following individual sub catalogues:

| General information | Steering components |
|---|---|
| Technical data on mini steering units | OSPM |
| Technical data on open center, and closed center steering units | OSPB, OSPC, and OSPD |
| Technical data on load sensing steering units, priority valves and flow amplifiers | OSPB, OSPC, OSPF, OSPD, OSPL, OSPBX, OSPLX, OVPL, OLS and OSQ |
| Technical data on hydraulic and electrohydraulic pilot operated steering valves, electrical actuation modules and appropriate steering units. | EHPS, EHPS w. OLS 320, PVE for EHPS and OSPCX |
| Technical data on combined steering unit/electrohydraulic steering valves and steering wheel sensors | OSPE |
| | SASA |
| Technical data on load sensing steering unit with amplification | OSPU |

For technical information on individual variants, please contact the Danfoss Sales Organization.

## Steering Units, OSPB, OSPC, OSPD Open Center

### Versions

Open center steering units have open connection between pump and tank in the neutral position. In open center steering systems, pumps with fixed displacement are used.

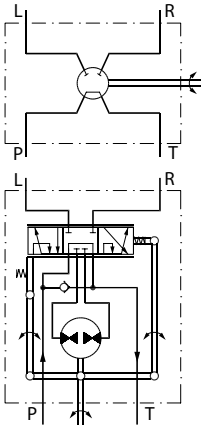
With reaction steering units any external forces acting on the steered wheels result in a corresponding movement of the steering wheel when the driver is not steering the vehicle.

With non-reaction steering units there is no corresponding movement of the steering wheel when the driver is not steering the vehicle.

#### OSPB

#### Steering unit with no valve functions

*OSPB ON Open center Non-reaction*




150-181.10

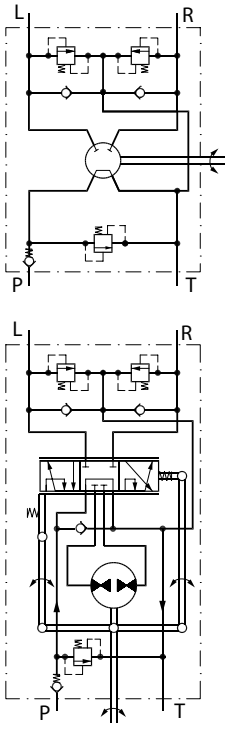
## Steering Units, OSPB, OSPC, OSPD Open Center

### OSPC

**Steering unit with integrated valve functions**

*OSPC ON*

*OSPC ON Open center Non-reaction*

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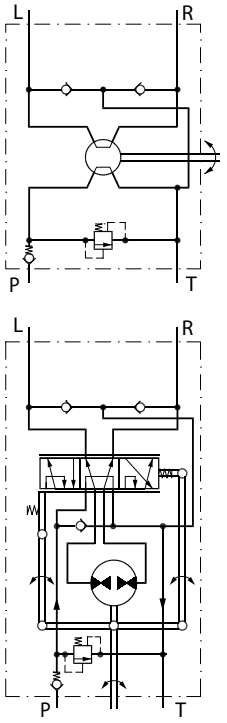
*OSPC OR Open center Reaction*

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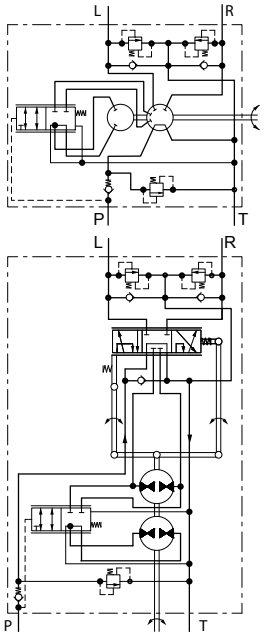
## Steering Units, OSPB, OSPC, OSPD Open Center

### OSPD

**Steering unit with 2 rotary meters and with integrated valve functions**

The OSPD has 2 rotary meters (gear wheel sets). In the case of no pump supply only one rotary meter is active for emergency steering. In normal steering situations both rotary meters are active.

*OSPD ON Open center Non-reaction*




150-581.11

## Code numbers and weights

### OSPB open center non-reaction steering units

OSPB has no valve functions.

| Steering unit | Code Numbers, connections | | Pump flow range | | Weight | |
|---|---|---|---|---|---|---|
| | European versionG 1/2 | US version3/4-16UNF O[1)] | l/min | [US gal/min] | kg | [lb] |
| OSPB 50 ON | 150N0039 | 150N0025 | 5-18 | [1.32-4.76] | 5.2 | [11.46] |
| OSPB 80 ON | 150N0040 | 150N0026 | 10-30 | [2.64-7.93] | 5.3 | [11.68] |
| OSPB 100 ON | 150N0041 | 150N0027 | | | 5.4 | [11.90] |
| OSPB 125 ON | 150N0042 | 150N0024 | 20-50 | [5.28-13.21] | 5.5 | [12.13] |
| OSPB 160 ON | 150N0043 | 150N0028 | | | 5.6 | [12.35] |
| OSPB 200 ON | 150N0044 | 150N0023 | | | 5.8 | [12.79] |
| OSPB 250 ON | 150N0052 | 150N0022 | | | 6.0 | [13.23] |
| OSPB 315 ON | 150N0045 | 150N0030 | 20-70 | [5.28-18.49] | 6.2 | [13.67] |
| OSPB 400 ON | 150N0046 | 150N0031 | | | 7.0 | [15.43] |
| OSPB 500 ON | 150N0047 | 150N0032 | | | 7.6 | [16.76] |

[1)] O-ring chamfer on port connections. Valve blocks OVP and OVR can be mounted on the all the OSPB steering units from the above table.

## Code numbers and weights

### OSPC open center non-reaction steering units

OSPC ON in the table below have all the following valve functions incorporated:

- check valve in P-port
- relief valve
- shock valves
- suction valves

| Steering unit | Code Numbers, connections | | Pump flow range | | Valve settings | | | | Weight | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Relief valve | | Shock valve | | | |
| | European version G 1/2 S[2] | US version 3/4-16 UNF O[1] | l/min | [US gal/min] | bar | [psi] | bar | [psi] | kg | [lb] |
| OSPC 40 ON | 150N2148 | - | 5-18 | [1.32-4.76] | 140 | [2030] | 200 | [2900] | 5.2 | [11.46] |
| OSPC 50 ON | 150N2149 | 150N2136 | | | | | | | 5.2 | [11.46] |
| OSPC 80 ON | 150N2150 | 150N2137 | 10-30 | [2.64-7.93] | 170 | [2465] | 225 | [3263] | 5.3 | [11.68] |
| OSPC 100 ON | 150N2151 | 150N2138 | | | | | | | 5.4 | [11.90] |
| OSPC 125 ON | 150N2152 | 150N2139 | 20-50 | [5.28-13.21] | | | | | 5.5 | [12.13] |
| OSPC 160 ON | 150N2153 | 150N2140 | | | | | | | 5.6 | [12.35] |
| OSPC 200 ON | 150N2154 | 150N2141 | | | | | | | 5.8 | [12.79] |
| OSPC 250 ON | 150N2155 | 150N2168 | | | | | | | 6.0 | [13.23] |
| OSPC 315 ON | 150N2156 | 150N2142 | 20-70 | [5.28-18.49] | | | | | 6.2 | [13.67] |
| OSPC 400 ON | 150N2157 | - | | | | | | | 7.0 | [15.43] |
| OSPC 500 ON | 150N2158 | - | | | | | | | 7.6 | [16.78] |

[2] Spot-face around port connections (can not be used in connection with OVR angular block).

[1] O-ring chamfer on port connections

If you wish other port connection displacements, combination of displacement and pump flow range, valve combinations and/or other valve settings, please fill in the *Order specification* on page 12 and contact the Danfoss Sales Organisation.

## Code numbers and weights

### OSPC open center reaction steering units

OSPC OR in the table below have all the following valve functions incorporated:

- check valve in P-port
- relief valve
- suction valves

| Steering unit | Code numbers | Pump flow range | | Valve settings | | Weight | |
|---|---|---|---|---|---|---|---|
| | Connections | | | Relief valve | | | |
| | European version G 1/2 | l/min | [US gal/min] | bar | [psi] | kg | [lb] |
| OSPC 80 OR | 150N2159 | 10-30 | [2.64-7.93] | 170 | [2465] | 5.3 | [11.68] |
| OSPC 200 OR | 150N2160 | 20-50 | [5.28-13.21] | | | 5.8 | [12.79] |

If you wish other displacements, port connections, pump flow range, valve combinations and/or other valve settings, please fill in the*Order specification* on page 12 and contact the Danfoss Sales Organisation.

### OSPD open center non-reaction steering units

OSPD ON in the table below has the following valve functions incorporated:

- check valve in P-port
- relief valve
- shock valves
- suction valves

| Steering unit | Code numbers | Pump flow range | | Valve settings | | | | Weight | |
|---|---|---|---|---|---|---|---|---|---|
| | Connections European version G1/2 S[2)] | l/min | [US gal/min] | Relief valve | | Shock valve | | | |
| | | | | bar | [psi] | bar | [psi] | kg | [lb] |
| OSPD 70/195 ON | 11113183 | 20-50 | [5.28-13.21] | 170 | [2465] | 225 | [3263] | 7.5 | [16.53] |

[2)] Spot-face around port connections (can not be used in connection with OVR angular block)

If you wish other displacements, reaction type, pump flow range and/or other valve settings, please fill in the *Order specification* on page 12 and contact the Danfoss Sales Organisation.

## Order specification

### Specification table for non catalogue numbers

Specification table for Danfoss open center steering units type OSPC and OSPD which are not available in the code number tables.

Fill in your company data and place x's in the table where appropriate then send to your Danfoss Sales Organisation.

| **Your company** | **Name** | **Vehicle** | **Potential pcs/year** | **Completed by** | **Date** |
|---|---|---|---|---|---|
| | | | | | |

| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Steering unit type | OSPC | | | | | | | | OSPD | | | | | | |
| | | | | | | | | | | | | | | | |
| Reaction type | ON (Open center Non-reaction) | | | | | | | | OR (Open center Reaction) | | | | | | |
| | | | | | | | | | | | | | | | |
| DP, $cm^3$/rev OSPC ON | 40 | 50 | 60 | 70 | 80 | 100 | 125 | 160 | 185 | 200 | 230 | 250 | 315 | 400 | 500 |
| | | | | | | | | | | | | | | | |
| DP, $cm^3$/rev OSPC OR | 40 | 50 | 60 | 70 | 80 | 100 | 125 | 160 | 185 | 200 | | | | | |
| | | | | | | | | | | | | | | | |
| DP, $cm^3$/rev OSPD ON | 60/185 | 60/220 | 60/260 | 70/195 | 70/230 | 70/270 | 100/260 | 100/300 | 125/285 | 125/325 | 125/440 | | | | |
| | | | | | | | | | | | | | | | |
| DP, $cm^3$/rev OSPD OR | 60/185 | | 60/220 | | 70/195 | | 70/230 | | | | | | | | |
| | | | | | | | | | | | | | | | |
| Pump flow range l/min | 5-18 | | 10-30 | | 20-50 | | 20-70 | | | | | | | | |
| | | | | | | | | | | | | | | | |
| Port threads | G1/2 | | G1/2 - S[2] | | M18 × 1.5 - O[1] S[2] | | M22 × 1.5/M18 × 1.5 - S[2] | | 3/4-16UNF - O[1] | | | | | | |
| | | | | | | | | | | | | | | | |
| Relief valve bar | 70 | 80 | 90 | 100 | 110 | 120 | 140 | 170 | 190 | 200 | 210 | no relief valve | | | |
| | | | | | | | | | | | | | | | |
| Shock valves bar | 150 | 180 | 200 | 225 | 240 | no shock valves | | | | | | | | | |
| | | | | | | | | | | | | | | | |
| Suction valves | Yes | | | | | No | | | | | | | | | |
| | | | | | | | | | | | | | | | |
| Neutral setting springs[4] | Soft:<br>0.5 - 1.8 N•m in normal steering situations | | | Standard:<br>0.8 - 3 N•m in normal steering situations | | | Strong:<br>1.5 - 4 N•m in normal steering situations | | | | | | | | |
| | | | | | | | | | | | | | | | |
| Unit black painted | Yes | | | | | No | | | | | | | | | |
| | | | | | | | | | | | | | | | |

[1] O-ring chamfer on port connections

[2] Spot-face around port connections (can not be used in connection with OVR angular block)

[4] Soft springs only allowed for pump flow up to 30 l/min

DP: Displacement

All OSPC and OSPD steering units specified by code numbers in this catalogue have check valve in P-connection.

All steering units specified by code numbers in this catalogue have standard neutral setting springs.

An alternative way to specify a variant is to state an existing code number and add the modifications, you would like to have implemented in the basic steering unit.

Code number of basic steering unit:_____

## Order specification

Requested modifications:_____

## Steering units, OSPB Closed center

### Version and code numbers - OSPB

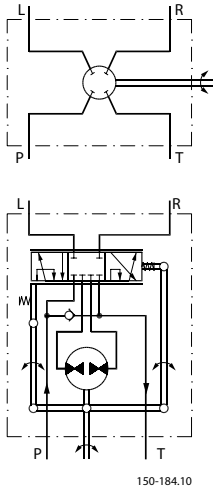
#### Closed center

Closed center steering units are blocked on their P port in the neutral position. In closed center steering systems, variable oil flow is required.

#### Non-reaction

With non-reaction steering units there is no corresponding movement of the steering wheel when the driver is not steering the vehicle

*OSPB CN Closed center Non-reaction*



## Code numbers and weights

### OSPB code numbers and weights

OSPB has no valve functions.

*OSPB closed center non-reaction steering units*

| Steering unit | Code numbers | Weight | |
|---|---|---|---|
| | Connections US version 3/4-16UNF O[1)] | kg | [lb] |
| OSPB 50 CN | 150-0125 | 5.2 | [11.46] |
| OSPB 80 CN | 150-0126 | 5.3 | [11.68] |
| OSPB 100 CN | 150-0127 | 5.4 | [11.90] |
| OSPB 125 CN | 150-0129 | 5.5 | [12.13] |
| OSPB 160 CN | 150-0128 | 5.6 | [12.35] |
| OSPB 200 CN | 150-0146 | 5.8 | [12.79] |
| OSPB 315 CN | 150G4104 | 6.2 | [13.23] |
| OSPB 400 CN | 150G4105 | 7.0 | [15.43] |

[1)] O-ring chamfer on port connections

Valve blocks OVP and OVR can be mounted on the all the OSPB steering units from the above table

## Steering units open center and closed center

### Technical data

#### Displacement, flow and pressure

Common data:

Look in sub catalogue: “General, Steering Components “ page 28.

*OSPB / OSPC ON / OR*

| Steering unit | Displacement | | Recommended[1] oil flow | | Max. pressure on connections | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | T | | L, R | |
| | $cm^3$/rev | [$in^3$/rev] | l/min | [US gal/min] | bar | [psi] | bar | [psi |
| OSPC 40 ON | 40 | [2.44] | 4-18 | [1.05-4.76] | 40 | [580] | 280 | [4061] |
| OSPB/OSPC 50 ON | 50 | [3.05] | 5-18 | [1.32-4.76] | | | | |
| OSPC 60 ON | 60 | [3.66] | 6-18 | [1.59-4.76] | | | | |
| OSPC 70 ON | 70 | [4.27] | 7-18 | [1.85-4.76] | | | | |
| OSPB/OSPC 80 ON | 80 | [4.88] | 8-30 | [2.11-7.93] | | | | |
| OSPB/OSPC 100 ON | 100 | [6.10] | 10-30 | [2.64-7.93] | | | | |
| OSPB/OSPC 125 ON | 125 | [7.63] | 13-50 | [3.43-13.21] | | | | |
| OSPB/OSPC 160 ON | 160 | [9.76] | 16-50 | [4.23-13.21] | | | | |
| OSPB/OSPC 185 ON | 185 | [11.29] | 19-50 | [5.02-13.21] | | | | |
| OSPB/OSPC 200 ON | 200 | [12.20] | 20-50 | [4.23-13.21] | | | | |
| OSPB/OSPC 230 ON | 230 | [14.04] | 23-50 | [6.08-13.21] | | | | |
| OSPB/OSPC 250 ON | 250 | [15.26] | 25-50 | [6.60-13.21] | | | | |
| OSPB/OSPC 315 ON | 315 | [19.22] | 32-70 | [8.45-18.49] | | | | |
| OSPB/OSPC 400 ON | 400 | [24.41] | 40-70 | [10.57-18.49] | | | | |
| OSPB/OSPC 500 ON | 500 | [30.51] | 50-70 | [13.21-18.49] | | | | |
| OSPC 40 OR | 40 | [2.44] | 4-18 | [1.05-4.76] | 40 | [580] | 280 | [4061] |
| OSPC 50 OR | 50 | [3.05] | 5-18 | [1.32-4.76] | | | | |
| OSPC 60 OR | 60 | [3.66] | 6-18 | [1.59-4.76] | | | | |
| OSPC 70 OR | 70 | [4.27] | 7-18 | [1.85-4.76] | | | | |
| OSPC 80 OR | 80 | [4.88] | 8-30 | [2.11-7.93] | | | | |
| OSPC 100 OR | 100 | [6.10] | 10-30 | [2.64-7.93] | | | | |
| OSPC 125 OR | 125 | [7.63] | 13-50 | [3.43-13.21] | | | | |
| OSPC 160 OR | 160 | [9.76] | 16-50 | [4.23-13.21] | | | | |
| OSPC 185 OR | 185 | [11.29] | 19-50 | [5.02-13.21] | | | | |
| OSPC 200 OR | 200 | [12.20] | 20-50 | [4.23-13.21] | | | | |
| OSPB 50 CN | 50 | [3.05] | 5 | [1.32] | 40 | [580] | 280 | [4061] |
| OSPB 80 CN | 80 | [4.88] | 8 | [2.11] | | | | |
| OSPB 100 CN | 100 | [6.10] | 10 | [2.64] | | | | |
| OSPB 125 CN | 125 | [7.63] | 13 | [3.43] | | | | |
| OSPB 160 CN | 160 | [9.76] | 16 | [4.23] | | | | |
| OSPB 200 CN | 200 | [12.20] | 20 | [5.28] | | | | |
| OSPB 315 CN | 315 | [19.22] | 32 | [8.45] | | | | |
| OSPB 400 CN | 400 | [24.41] | 40 | [10.57] | | | | |

[1] Criteria for determining the recommended oil flow:

- As a minimum the oil flow it takes to ensure sufficient steering speed at engine idle speed
- Ensures the least possible pressure loss at full engine speed

Common data:

## Steering units open center and closed center

Look in sub catalogue: “General, steering components“

*OSPD ON / OR*

| Steering unit | Displacement manual steer mode | | Displacement normal steer mode | | Recommended[1] oil flow | | Max. pressure on connections | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | P | | T | | L, R | |
| | $cm^3$/rev | [$in^3$/rev] | $cm^3$/rev | [$in^3$/rev] | l/min | [US gal/min] | bar | [psi] | bar | [psi] | bar | [psi] |
| OSPD 60/185 ON | 60 | [3.66] | 185 | [11.29] | 20-50 | [5.28-13.21] | 210 | [3045] | 40 | [580] | 280 | [4060] |
| OSPD 60/220 ON | 60] | [3.66] | 220 | [13.43] | 22-50 | [5.81-13.21] | | | | | | |
| OSPD 60/260 ON | 60 | [3.66] | 260 | [15.87] | 26-50 | [6.87-13.21] | | | | | | |
| OSPD 70/195 ON | 70 | [4.27] | 195 | [11.90] | 20-50 | [5.28-13.21] | | | | | | |
| OSPD 70/230 ON | 70] | [4.27 | 230 | [14.04] | 23-50 | [6.08-13.21] | | | | | | |
| OSPD 100/260 ON | 100 | [6.10] | 260 | [15.87] | 26-50 | [6.87-13.21] | | | | | | |
| OSPD 100/300 ON | 100 | [6.10] | 300 | [18.31] | 30-50 | [7.93-13.21] | | | | | | |
| OSPD 125/285 ON | 125 | [7.63] | 285 | [17.39] | 30-50 | [7.93-13.21] | | | | | | |
| OSPD 125/325 ON | 125 | [7.63] | 325 | [19.83] | 33-70 | [8.72-18.49] | | | | | | |
| OSPD 125/440 ON | 125 | [7.63] | 440 | [26.85] | 44-70 | [11.62-18.49] | | | | | | |
| OSPD 60/185 OR | 60 | [3.66] | 185 | [11.29] | 20-50 | [5.28-13.21] | 210 | [3045] | 40 | [580] | 280 | [4060] |
| OSPD 60/220 OR | 60 | [3.66] | 220 | [13.43] | 22-50 | [5.81-13.21] | | | | | | |
| OSPD 70/195 OR | 70 | [4.27] | 195 | [11.90] | 20-50 | [5.28-13.21] | | | | | | |
| OSPD 70/230 ON | 70 | [4.27] | 230 | [14.04] | 23-50 | [6.08-13-21] | | | | | | |

[1] Criteria for determining the recommended oil flow:

- As a minimum the oil flow it takes to ensure sufficient steering speed at idle engine speed
- Ensures the least possible pressure loss at full engine speed

Please contact the Danfoss Sales Organisation regarding steering units with code numbers not mentioned in this catalogue. They may have different technical data.

### Valve functions in OSPC and OSPD steering units

The data below comes from measurements on a representative sample of steering units from production. Oil with a viscosity of 21 $mm^2/s$ [100 SUS] at 50°C [122°F] was used during measuring.

#### *Pressure relief valve*

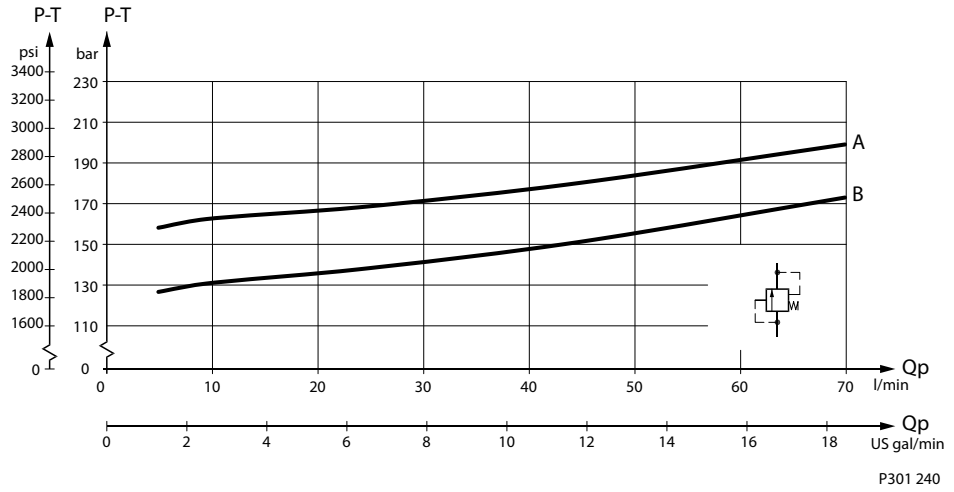
The pressure relief valve protects pump and steering unit against excessive pressure and limits the system pressure while steering. The pressure relief valve is set at 25 l/min [6.60 US gal/min] flow.

Setting tolerances:

170 bar [2466 psi]: rated value +5 bar [+73 psi]

> 170 bar [2466 psi]: rated value +10 bar [+145 psi]

## Steering units open center and closed center




**A:** 170 +5/-0 bar [2465 +73/-0 psi]

**B:** 140 +5/-0 bar [2030 +73/-0 psi]

**Q:** 25 l/min [6.60 US gal/min]

### *Shock valves*

The shock valves protect the steering unit and limit maximum external forces on the steering cylinder. The shock valves in the steering unit limit the maximum pressure drop from L to T and from R to T. The shock valves are set at 3 l/min [0.792 US gal/min].

The shock valves are of the direct acting type, so they react very quickly.

Settings: rated value +20 bar [290 psi], ex: 200 +20 bar [2900 +290 psi].

### *Suction valves*

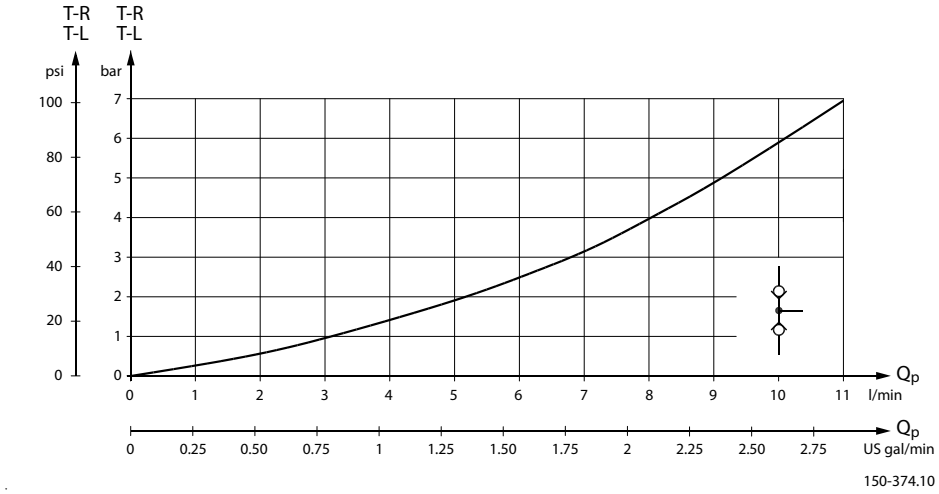
The suction valves ensure oil suction to avoid cavitation in the steering cylinder. To provide correct suction, a back pressure valve must be fitted in the tank line from the steering unit.

Generally we recommended a back pressure of 2 bar [29 psi], but on vehicles with strong selfstraightening tendencies, we recommend 5-10 bar [72-145 psi].

For further advice, please contact the Danfoss Sales Organisation.

A connection which incorporates a check valve must be established to allow oil flow to by-pass the back pressure valve (and filter) from the tank to steering unit.

## Steering units open center and closed center




### *Check valve*

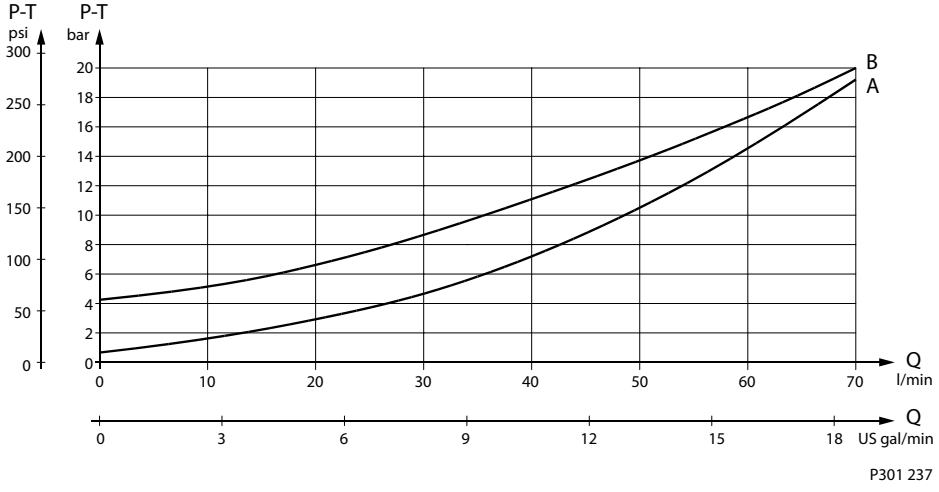
The check valve protects the driver against steering wheel jerks. The check valve prevents oil from flowing backwards into the pump line when steering against a high pressure on the cylinder side. The check valve is built into the steering unit P connection. The pressure drop across the check valve depends on the use of port adoptors with 11 mm [0.43 in] minimum bore and is indicated on the graph in *Pressure drop in neutral* on page 19.

### Pressure drop in neutral

The pressure drop is measured on Open Center steering units, and with the steering unit in neutral position.

The pressure drop is measured from P to T.

The values are valid at an oil temperature of 50°C [122°F] and a viscosity of 21 $mm^2/s$ (100 SUS).




**A:** OSPB ON and OSPC ON/OR

**B:** OSPD ON/OR

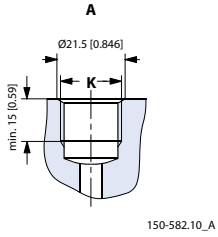
The pressure drop curves are solely valid for selected spool sets within the recommended flow range.

E.g. OSPC 50 ON with a spool set for 5-18 l/min [1.32-4.76 US gal/min], pressure drop curve A solely applies within the interval from 0-18 l/min [0-4.76 US gal/min]. A higher flow supply to the steering unit

## Steering units open center and closed center

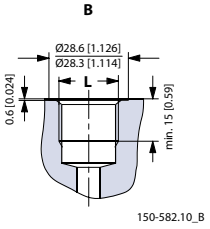
(e.g. 30 l/min [7.93 US gal/min]) will make the pressure drop exceed the value, which curve **A** shows at 30 l/min [7.93 US gal/min].

### Port thread versions



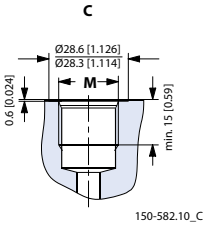

**A:** G main ports

**K:** DIN 3852-2 - G



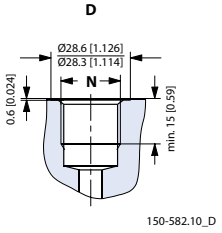

**B:** G main ports w.spot-face

**L:** DIN 3852-2 - G



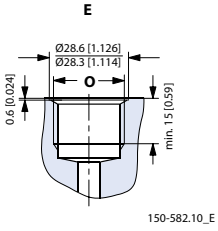

**C:** Metric main ports w.spot-face and O-ring chamfer

**M:** ISO 6149-1 – M18×1.5



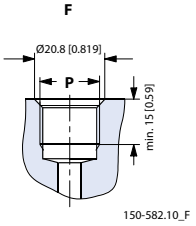

**D:** Metric main ports w. spot-face

**N:** DIN 3852-1 – M18×1.5




**E:** Metric main ports w. spot-face

**O:** DIN 3852-1 - M22×1.5




**F:** UNF main ports w. O-ring chamfer

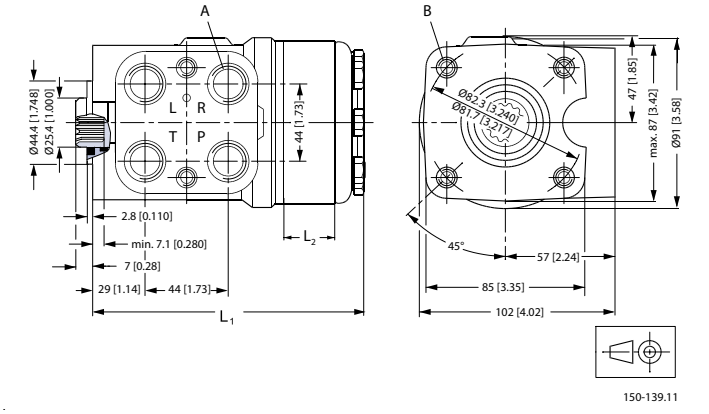
**P:** ISO 11926-1 ¾-16UNF
O-ring boss port

## Steering units open center and closed center

### Dimensions

#### OSPB ON and OSPB CN

*OSPB ON and OSPB CN*




*OSPB ON and OSPB CN version*

| | A | B |
|---|---|---|
| **European version** | G 1/2; 15 mm [0.59 in] deep | M10 × 1.5, 16 mm [0.63 in] deep |
| **US version** | 3/4 - 16 UNF O-ring boss; 15 mm [0.59 in] deep | 3/8 - 16 UNC, 16 mm [0.63 in] deep |

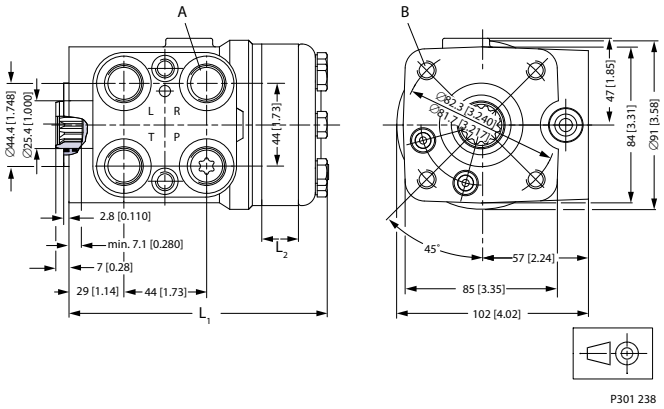
*OSPB ON and OSPB CN dimensions*

| Type | $L_1$ | | $L_2$ | |
|---|---|---|---|---|
| | mm | [in] | mm | [in] |
| OSPB 50 | 126 | [4.96] | 6.5 | [0.26] |
| OSPB 80 | 129 | [5.08] | 10.4 | [0.41] |
| OSPB 100 | 132 | [5.20] | 13.0 | [0.51] |
| OSPB 125 | 135 | [5.31] | 16.2 | [0.64] |
| OSPB 160 | 140 | [5.51] | 20.8 | [0.82] |
| OSPB 200 | 145 | [5.71] | 26.0 | [1.02] |
| OSPB 250 | 151 | [5.94] | 32.5 | [1.28] |
| OSPB 315 | 160 | [6.30] | 40.9 | [1.61] |
| OSPB 400 | 171 | [6.73] | 52.0 | [2.05] |
| OSPB 500 | 184 | [7.24] | 65.0 | [2.56] |

## Steering units open center and closed center

### OSPC ON and OSPC OR

*OSPC ON and OSPC OR*




*OSPC ON and OSPC OR versions*

| | A | B |
|---|---|---|
| **European version:** | G 1/2 w. spot-face<br>or M18 × 1.5 ISO 6149<br>or M22 × 1.5 (P and T) + M18 × 1.5 (L and R) DIN 3852; 15 mm [0.59 in] deep | M10 × 1.5, 16 mm [0.63 in] deep |
| **US version:** | 3/4 - 16 UNF O-ring boss; 15 mm [0.59 in] deep | 3/8 - 16 UNC, 16 mm [0.63 in] deep |

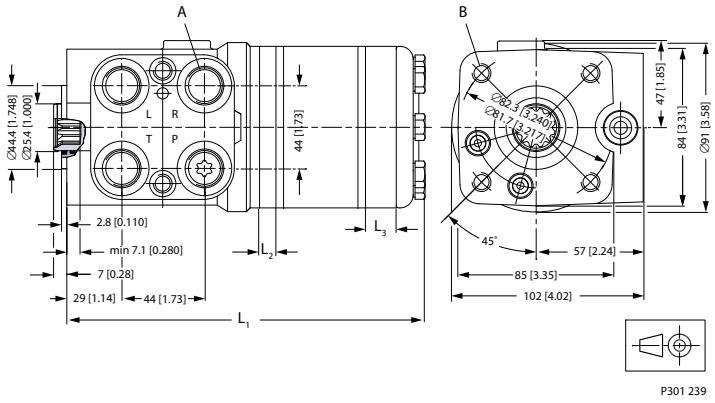
*OSPC ON and OSPC OR dimensions*

| **Type** | **$L_1$** | | **$L_2$** | |
|---|---|---|---|---|
| | **mm** | **[in]** | **mm** | **[in]** |
| OSPC 40 | 126 | [4.96] | 6.5 | [0.26] |
| OSPC 50 | 126 | [4.96] | 6.5 | [0.26] |
| OSPC 60 | 128 | [5.04] | 9.1 | [0.36] |
| OSPC 70 | 128 | [5.04] | 9.1 | [0.36] |
| OSPC 80 | 129 | [5.08] | 10.4 | [0.41] |
| OSPC 100 | 132 | [5.20] | 13.0 | [0.51] |
| OSPC 125 | 135 | [5.31] | 16.2 | [0.64] |
| OSPC 160 | 140 | [5.51] | 20.8 | [0.82] |
| OSPC 185 | 143 | [5.63] | 24.0 | [0.94] |
| OSPC 200 | 145 | [5.71] | 26.0 | [1.02] |
| OSPC 230 | 149 | [5.87] | 29.9 | [1.18] |
| OSPC 250 | 151 | [5.94] | 32.5 | [1.28] |
| OSPC 315 | 160 | [6.30] | 40.9 | [1.61] |
| OSPC 400 | 171 | [6.73] | 52.0 | [2.05] |
| OSPC 500 | 184 | [7.24] | 65.0 | [2.56] |

## Steering units open center and closed center

### OSPD ON and OSPD OR

*OSPD ON and OSPD OR*




*OSPD ON and OSPD OR versions*

| | A: | B: |
|---|---|---|
| **European version** | G 1/2; 15 mm [0.59 in] deep w. spot-face; | M10 × 1.5, 16 mm [0.63 in] deep |

*OSPD ON and OSPD OR dimensions*

| Type | $L_1$ | | $L_2$ | | $L_3$ | |
|---|---|---|---|---|---|---|
| | mm | [in] | mm | [in] | mm | [in] |
| OSPD 60/185 | 191 | [7.52] | 9.1 | [0.36] | 16.2 | [0.64] |
| OSPD 60/220 | 195 | [7.68] | 9.1 | [0.36] | 20.8 | [0.82] |
| OSPD 70/195 | 190 | [7.48] | 9.1 | [0.36] | 16.2 | [0.64] |
| OSPD 70/230 | 195 | [7.68] | 9.1 | [0.36] | 20.8 | [0.82] |
| OSPD 100/260 | 199 | [7.83] | 13.0 | [0.51] | 20.8 | [0.82] |
| OSPD 100/300 | 204 | [8.03] | 13.0 | [0.51] | 26.0 | [1.02] |
| OSPD 125/285 | 202 | [7.95] | 16.2 | [0.64] | 20.8 | [0.82] |
| OSPD 125/325 | 207 | [8.15] | 16.2 | [0.64] | 26.0 | [1.02] |
| OSPD 125/440 | 222 | [8.74] | 16.2 | [0.64] | 40.9 | [1.61] |

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