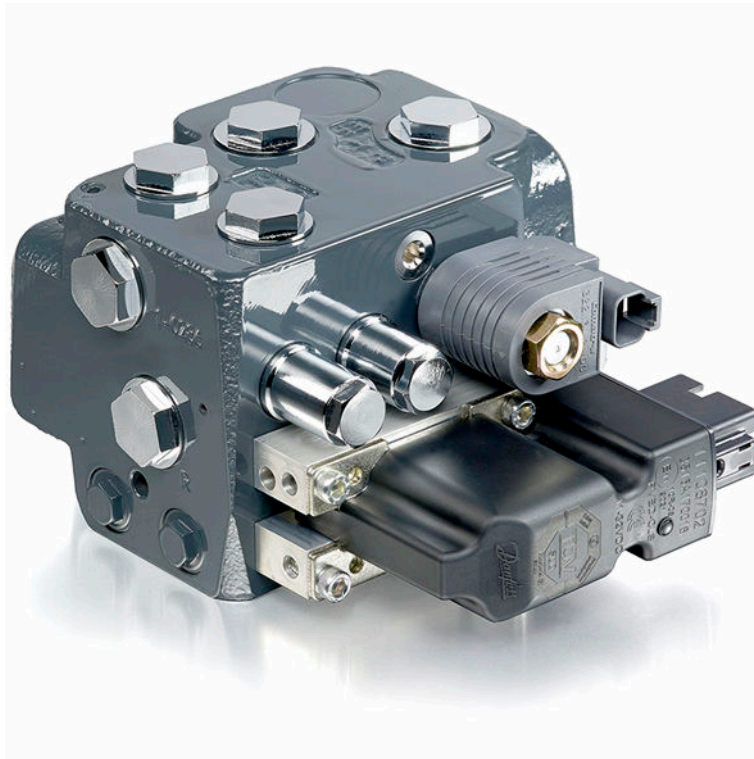


Service Manual

Steering

EHi Steering Valve



Revision history

Table of revisions

Date	Changed	Rev
Sep 2017	First edition	0101

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Safety precautions

⚠ 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 valves 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 valve and therefore they normally outlast the application they are built into. Therefore the only recommended service work on steering valve is:

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

EHi Steering Valve versions

EHi versions

This service literature is valid for any version of EHi, the exploded view is universal.

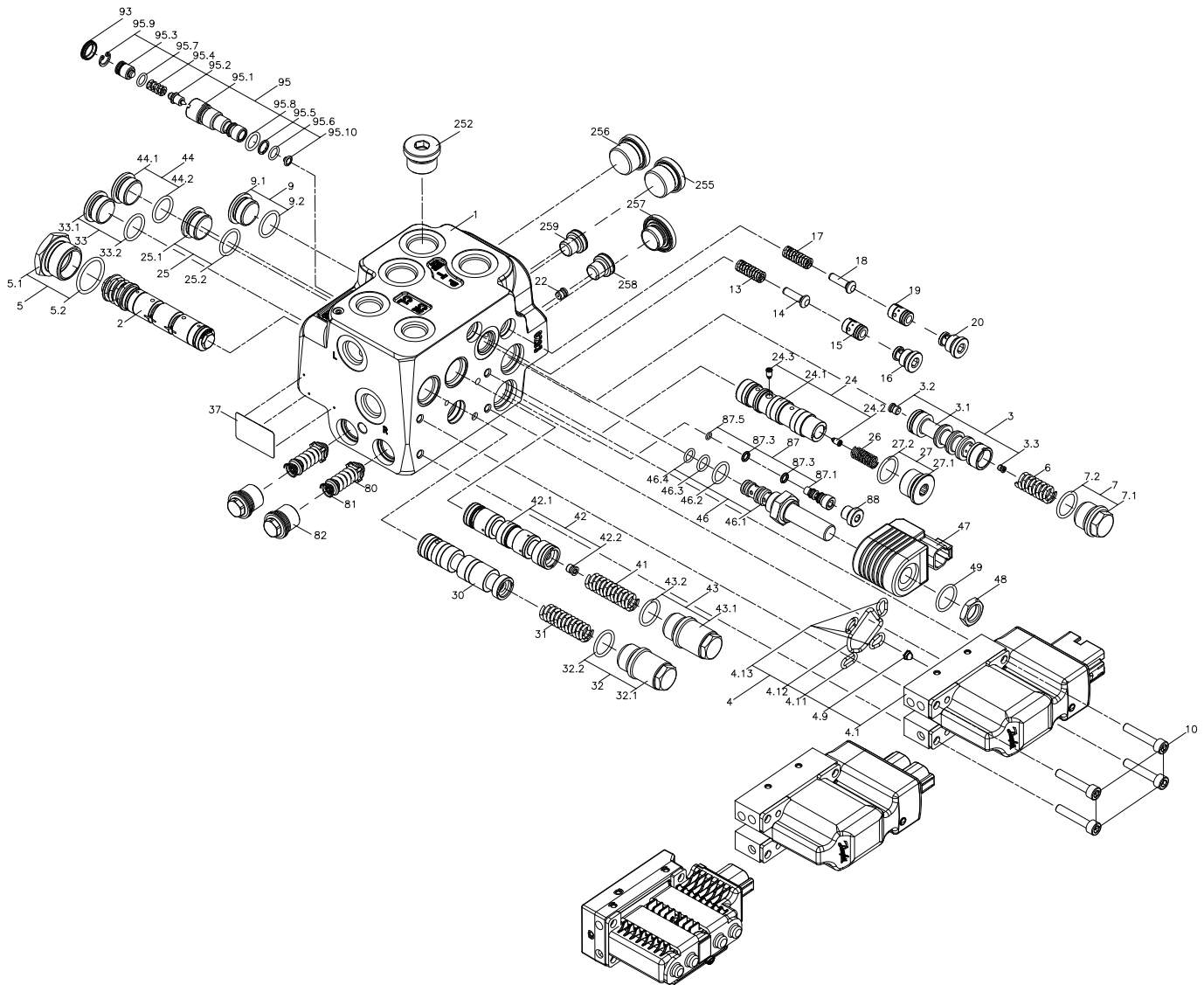
These modules/valve functions are present only in some versions of EHi:

- Reaction Switch Valve, RSV.
- Pilot reduction valves, PRV; in versions with RSV: 2 PRV's. In any other versions: 1 PRV.
- Priority Valve
- PVFC valve/LS resolver or LS shuttle valve, or none.
- Shock and suction valves.

Exploded View and Parts List

EHi Full Exploded View

EHi exploded view



EHi Steering Valve Parts List

EHi parts list

Item	Description	Number per unit	Tightening torque
1	Housing	1	-
2	Spool, EH steering	1	-
3	Priority valve spool	1	-
3.1	Spool	1	-
3.2	Orifice, PP	1	3.5 ± 0.5 N•m [31 ± 4.4 lbf•in]
3.3	Orifice, dynamic	1	1 ± 0.1 N•m [8.9 ± 0.9 lbf•in]

Exploded View and Parts List

EHi parts list (continued)

Item	Description	Number per unit	Tightening torque
4	PVE	1	-
4.1	PVE actuator	1	-
4.9	Filter	1	-
4.11	O-ring Ø8x2	1	-
4.12	O-ring Ø30x2.5	1	-
4.13	O-ring Ø10x2	3	-
5	Plug with O-ring	1	45 ± 5 N•m [398.3 ± 44.3 lbf•in]
5.1	Plug	1	-
5.2	O-ring Ø23.3x2.40	1	-
6	Compression spring	1	-
7	Plug with O-ring	1	45 ± 5 N•m [398.3 ± 44.3 lbf•in]
7.1	Plug	1	-
7.2	O-ring Ø17.40x2.10	1	-
9	Plug with O-ring	1	45 ± 5 N•m [398.3 ± 44.3 lbf•in]
9.1	Plug	1	-
9.2	O-ring Ø17.4x2.1	1	-
10	Screw	4	8 ± 1 N•m [70.8 ± 8.9 lbf•in]
13	Compression spring	2	-
14	Cone, pilot supply	1	-
15	Spool, pilot supply	1	-
16	Plug with O-ring	1	30 ± 3 N•m [265.5 ± 26.6 lbf•in]
17	Compression Spring	1	-
18	Cone, pilot supply	1	-
19	Spool, pilot supply	1	-
20	Plug with O-ring	1	30 ± 3 N•m [265.5 ± 26.6 lbf•in]
22	Orifice, LS	1	3.5 ± 0.5 N•m [31 ± 4.4 lbf•in]
24	Spool PVFC/LS resolver	1	-
24.1	Spool	1	-
24.2	Check valve	1	1.4 ± 0.2 N•m [12.4 ± 1.8 lbf•in]
24.3	Check valve	1	1.4 ± 0.2 N•m [12.4 ± 1.8 lbf•in]
25	Plug with O-ring	1	45 ± 5 N•m [398.3 ± 44.3 lbf•in]
25.1	Plug	1	-
26	Compression spring	1	-
27	Plug with O-ring	1	45 ± 5 N•m [398.3 ± 44.3 lbf•in]
27.1	Plug	1	-
27.2	O-ring Ø17.4x2.10	1	-
30	Spool, RSV	1	-
31	Compression spring	1	-
32	Plug with O-ring	1	45 ± 5 N•m [398.3 ± 44.3 lbf•in]
32.1	Plug	1	-
32.2	O-ring Ø17.40x2.10	1	-
33	Plug with O-ring	1	45 ± 5 N•m [398.3 ± 44.3 lbf•in]
33.1	Plug	1	-
33.2	O-ring Ø17.4x2.1	1	-

Exploded View and Parts List

EHi parts list (continued)

Item	Description	Number per unit	Tightening torque
37	Label with cover	1	-
41	Compression spring	1	-
42	Spool, Cut off	1	-
42.1	Spool	1	-
42.2	Plug	1	3.5 ± 0.5 N·m [31 ± 4.4 lbf·in]
43	Plug with O-ring	1	45 ± 5 N·m [398.3 ± 44.3 lbf·in]
43.1	Plug	1	-
43.2	O-ring Ø17.40x2.10	1	-
44	Plug with O-ring	1	45 ± 5 N·m [398.3 ± 44.3 lbf·in]
44.1	Plug	1	-
44.2	O-ring Ø17.4x2.1	1	-
46	Spool kit	1	-
46.1	Spool, pilot dump	1	15 ± 2 N·m [132.8 ± 17.7 lbf·in]
46.2	O-ring Ø9.25x1.78	1	-
46.3	O-ring Ø7.65x1.78	1	-
46.4	O-ring Ø13.5x2.08	1	-
47	Coil	1	-
48	Nut	1	5 ± 1 N·m [44.3 ± 8.9 lbf·in]
49	O-ring Ø10x2	1	-
80	Shock valve	2	-
81	Spring	2	-
82	Plug with O-ring	2	35 ± 3 N·m [309.8 ± 26.6 lbf·in]
87	LS shuttle valve	1	10 ± 1 N·m [88.5 ± 8.9 lbf·in]
87.1	Cartridge housing with ball	1	-
87.3	O-ring Ø5x1.5	2	-
87.5	O-ring Ø4.0x1.0	1	-
88	Plug	1	12.6 ± 0.6 N·m [111.5 ± 5.3 lbf·in]
93	Plug	1	-
95	PV valve	1	20 ± 3 N·m [177 ± 26.6 lbf·in]
95.1	Cartridge	1	-
95.2	Cone	1	-
95.3	Adjusting screw	1	-
95.4	Compression spring	1	-
95.5	Backup ring	1	-
95.6	O-ring Ø8x1.5	1	-
95.7	O-ring Ø7.5x1.5	1	-
95.8	O-ring Ø11x2	1	-
95.9	Lock ring	1	-
95.10	Filter	1	-
252	Plug	1	45 ± 5 N·m [398.3 ± 44.3 lbf·in]
255	Plug	1	45 ± 5 N·m [398.3 ± 44.3 lbf·in]
256	Plug	1	45 ± 5 N·m [398.3 ± 44.3 lbf·in]
257	Plug with O-ring	1	45 ± 5 N·m [398.3 ± 44.3 lbf·in]

Exploded View and Parts List

EHi parts list (continued)

Item	Description	Number per unit	Tightening torque
258	Plug	1	20 ± 3 N·m [177 ± 26.6 lbf·in]
259	Plug	1	20 ± 3 N·m [177 ± 26.6 lbf·in]

Seal kits and spare parts for EHi

Seal kits and spare parts for EHi

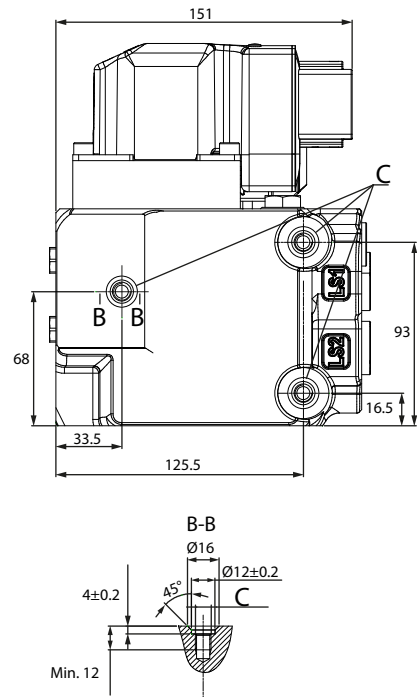
Part	Code number	Item
Seal kit for EHi	11191725	5.2, 7.2, 9.2, 16, 20, 25.2, 27.2, 32.2, 33.2, 43.2, 44.2, 49, 2x 87.3, 87.5, 88, 93
Coil, DEUTSCH: D08 12V DE 322113	11084688	47
Coil, DEUTSCH: D08 24V DE 322115	11192696	47
Spare part bag containing: 1 plug. O-ring for shock valve For replacement shock valves please refer to <i>PVG 32 Technical information</i> , document number 520L0344	157B2002	82
Spare part bag containing: Cartridge spool for pilot dump, Nut and O-ring	11085713	46, 48, 49
Seal kit for Cartridge spool for pilot dump	120433	46.2, 46.3, 46.4
Seal kit for Pilot relief valve	155L6870	95.5, 95.6, 95.7, 95.8, 95.9, 95.10
Seal kit for PVE	157B4997	4.9, 4.11, 4.12, 4.13

Tools

EHi Steering Valve holding tool

It is recommended to use appropriate steel plate with mounting holes 3x \varnothing 10 mm matching mounting thread holes, C, on mounting side of EHi.

Mounting dimensions for EHi holding tool



C parameters

M8 x 1.25
 12 mm deep

Tools

Other required tools for EHi Steering Valve maintenance

A list of tools required for disassembly and reassembly of EHi Steering Valve for inspection and maintenance.

Tool for removing/assembling pilot relief valve cartridge:

Code Number: 155L6494

These tools are not available from Danfoss:



- Torque wrench 0 - 70 Nm
- 13, 18, 19, and 32 mm socket spanner
- 2, 3, 4, 5, 6, 8, and 10 mm Hex keys
- 2mm screwdriver
- 13, 18, 19 mm, and 7/8 inch ring spanner.
- Inside circlip pliers
- Magnet, max outer diameter: 9 mm
- Tweezers (not pictured)

Disassembly

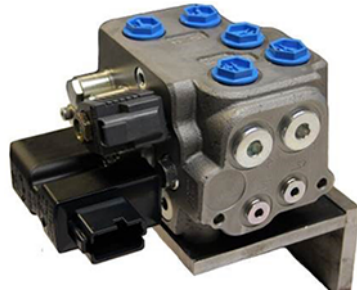
This section will show you how to fully disassemble the EHi Steering Valve for inspection, cleaning, and maintenance.

To disassemble EHi Steering Valve follow these steps.

Place the unit on the holding tool.

Use 3 pcs M8 x 1.25, length: 10 mm, plus thickness of console plate.

EHi Steering Valve mounted on holding tool.

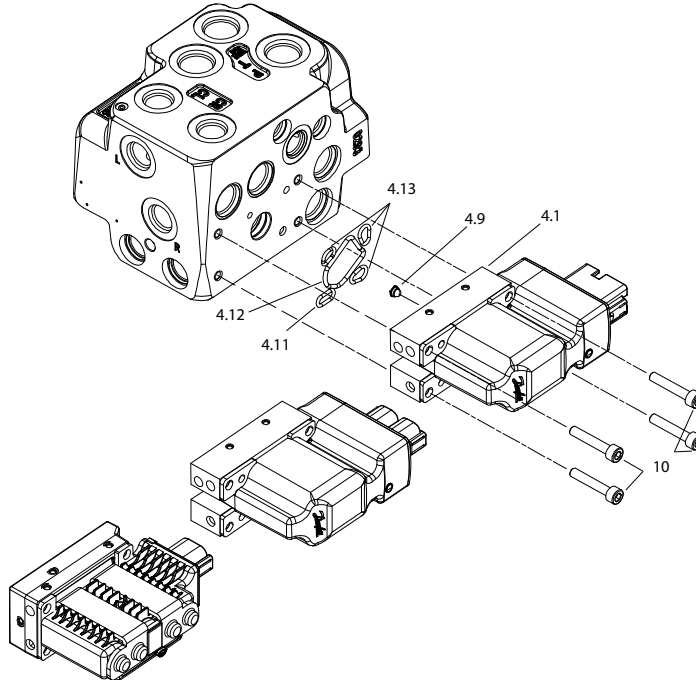


Remove PVE from housing

To remove the PVE from the EHi Steering Valve housing, follow these steps.

The PVE is attached to the housing with four screws. Five O-rings seal the unit in place, and a filter is also found between the unit and the housing itself.

PVE parts and housing



Wrench size and torque

Item	Description	Wrench Size	Torque
10 (x4)	Screw	5 mm internal hex	8 ± 1 N·m [70.8 ± 8.9 lbf·in]

1. Screw out the four screws (10) for PVE (4) using a 5 mm Hex key .

2. Remove the PVE (4).

O-rings (4.11, 4.12, and 4.13), and filter (4.9) are fitted to the mounting surface of the PVE.

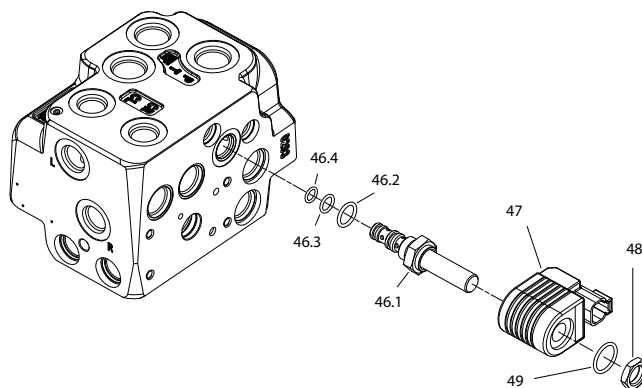
Disassembly

One or more O-rings may stick to the EHi housing. Remove before proceeding.

Remove Coil from housing

To remove the Coil from the EHi Steering Valve housing, follow these steps.

Coil parts and housing



Wrench size and torque

Item	Description	Wrench size	Torque
48	Nut	19 mm external hex	$5 \pm 1 \text{ N}\cdot\text{m}$ [$44.3 \pm 8.9 \text{ lbf}\cdot\text{in}$]
46.1	Spool, pilot dump	7/8 inch external hex	$15 \pm 2 \text{ N}\cdot\text{m}$ [$132.8 \pm 17.7 \text{ lbf}\cdot\text{in}$]

1. Screw off the nut (48) using a 19 mm socket or ring spanner.
2. Remove the O-ring (49) using a 2 mm flat head screwdriver.
3. Lift off the Coil (47).
4. Screw out the cartridge spool (46) using a 7/8 inch ring spanner.
 O-rings (46.2, 46.3, and 46.4) are fitted on cartridge spool (46).

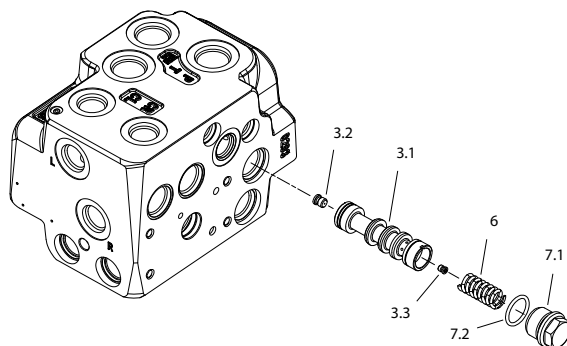
Remove Priority Valve from housing

To remove Priority Valve from the EHi Steering Valve housing, follow these steps.

The valve is removed in a three-step sequence, involving the plug, spring, and the spool.

Remove the Priority Valve

Priority Valve parts and housing



Disassembly

Wrench size and torque

Item	Description	Wrench size	Torque
7	Plug with O-ring	18 mm external hex	45 ± 5 N•m [398.3 ± 44.3 lbf•in]
3.2	Orifice, PP	3 mm internal hex	3.5 ± 0.5 N•m [31 ± 4.4 lbf•in]
3.3	Orifice, dynamic	2 mm internal hex	1 ± 0.1 N•m [8.9 ± 0.9 lbf•in]

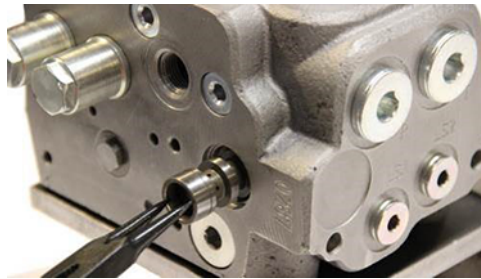
1. Screw out the plug (7) using an 18 mm socket or ring spanner.

On EHi versions without priority valve, only plug (7) with hex key profile is present. Screw out this plug using an 8 mm Hex key.

O-ring (7.2) is fitted to the plug.

2. Remove the spring (6).
3. Remove the priority valve spool (3).

Remove priority valve spool with circlip pliers.



Orifices (3.2 and 3.3) are screwed into spool (3.1)

Orifice (3.3) is not present in the "Static" type priority valve spool.

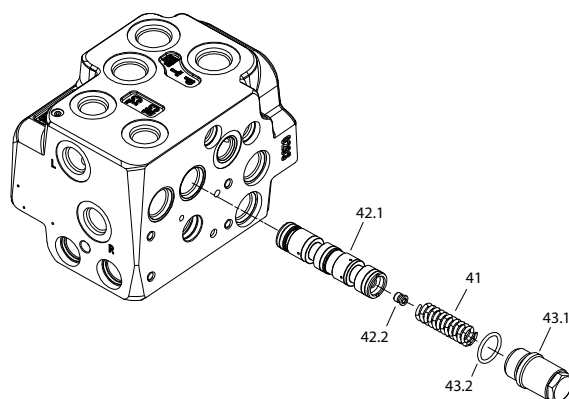
- a) Before removing orifices (3.2 and 3.3): fix the spool in a vice with aluminum jaws.
- b) Screw out PP orifice (3.2) using a 3 mm Hex key.
- c) Screw out dynamic orifice (3.3) using a 2 mm Hex key.

Disassembly

Remove Cut Off Valve from housing

Remove the cut off valve.

Cut Off Spool parts and housing



Wrench size and torque

Item	Description	Wrench size	Torque
43	Plug with O-ring	18 mm external hex	45 ± 5 N·m [398.3 ± 44.3 lbf·in]
42.2	Plug	3 mm internal hex	3.5 ± 0.5 N·m [31 ± 4.4 lbf·in]

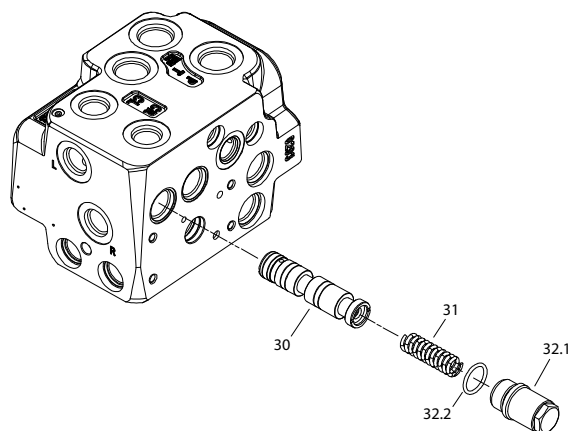
1. Screw out the plug (43) for the cut off spool using an 18 mm socket or ring spanner.
O-ring (43.2) is fitted to the plug.
2. Remove the spring (41) for the cut off spool.
3. Remove the cut off spool (42).
Plug (42.2) is present in some cut off spools (42.1).

Remove Reaction Switch Valve (RSV) from housing

To remove the Reaction Switch Valve (RSV) from the EHi housing, follow these steps.

If RSV (Reaction Switch Valve) is present:

RSV parts and housing



Disassembly

Wrench size and torque

Item	Description	Wrench size	Torque
32	Plug with O-ring	18 mm external hex	45 ± 5 N•m [398.3 ± 44.3 lbf•in]

1. Screw out the plug (32) using an 18 mm socket or ring spanner.
O-ring (32.2) is fitted to the plug.
2. Remove the spring (31).
3. Remove the RSV spool (30).

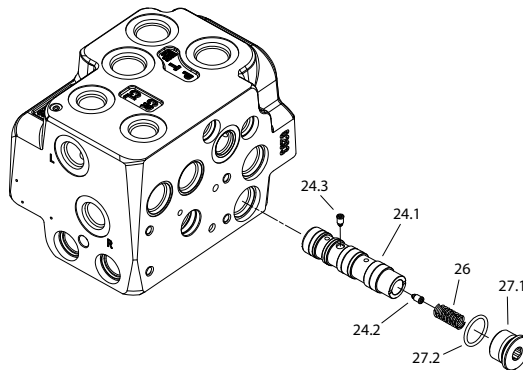
Remove PVFC/LS copy or LS shuttle valve from housing

To remove PVFC/LS copy or LS shuttle valve from EHi Steering Valve housing, follow these steps.

- If PVFC/LS copy valve is present, perform steps 1-3, below.
- Alternative is LS shuttle valve (parts 88 and 87), in that case, follow steps 4 and 5, below.
- If there is no valve at all, only plug (88) will be present. Screw out this plug as described in step 4, below.

Remove the PVFC valve:

PVFC valve parts and housing



Wrench size and torque

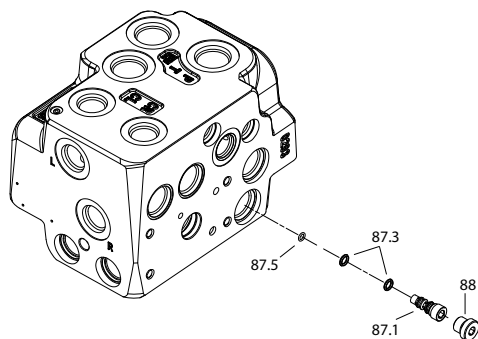
Item	Description	Wrench size	Torque
27	Plug with O-ring	8 mm internal hex	45 ± 5 N•m [398.3 ± 44.3 lbf•in]
24.2	Check Valve	-	1.4 ± 0.2 N•m [12.4 ± 1.8 lbf•in]
24.3	Check Valve	-	1.4 ± 0.2 N•m [12.4 ± 1.8 lbf•in]

1. Screw out the plug (27) using an 8mm Hex key.
O-ring (27.2) is fitted to the plug.
2. Remove the spring (26).
3. Remove the PVFC spool (24).
Some PVFC spools have check valves (24.2 and 24.3), which are screwed into spool (24.1).

If the PVFC/LS copy valve is absent, and the LS shuttle valve (88 and 87) is present instead, perform the following steps:

Disassembly

LS Shuttle valve/plug and housing



Wrench size and torque

Item	Description	Wrench size	Torque
88	Plug	5 mm internal hex	12.6 ± 0.6 N·m [111.5 ± 5.3 lbf·in]
87	LS Shuttle valve	5 mm internal hex	10 ± 1 N·m [88.5 ± 8.9 lbf·in]

- Screw out the plug (88) using a 5 mm Hex key.
O-ring (27.2) is fitted to the plug.
- Screw out the shuttle valve (87) using a 5 mm Hex key.
O-rings (2x 87.3 and 87.5) are fitted to the valve.

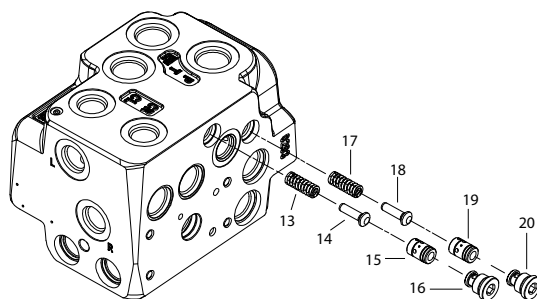
Remove Pilot reduction valve(s) from housing

To remove Pilot reduction valve(s) from EHi Steering Valve housing, follow these steps.

These steps will explain how to remove the pilot valve or valves from the EHi Steering Valve housing. If there is a second valve (17, 18, 19, and 20 are present), repeat these three steps for each valve.

Remove the Pilot reduction Valve(s)

Pilot reduction valve(s) parts and housing



Wrench size and torque

Item	Description	Wrench size	Torque
16	Plug with O-ring	6 mm internal hex	30 ± 3 N·m [265.5 ± 26.6 lbf·in]
20	Plug with O-ring	6 mm internal hex	30 ± 3 N·m [265.5 ± 26.6 lbf·in]

- Screw out the plug (16, and if present, 20) using a 6 mm Hex key .
O-ring (16.2) is fitted on plug.
- Remove the spool (15, and if present, 19).
- Remove the cone (14, and if present, 18) and spring (13, and if present, 17), eventually with magnet.

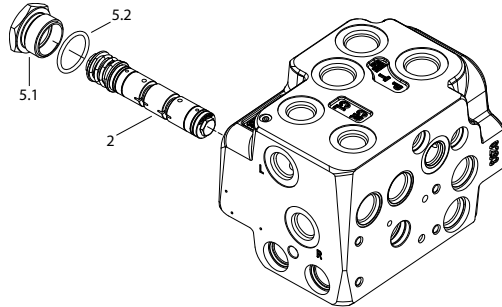
Disassembly

Remove Directional Valve from housing

To remove the Directional Valve from the housing, follow these steps.

Remove the directional spool.

Directional spool parts and housing



Wrench size and torque

Item	Description	Wrench size	Torque
5	Plug with O-ring	32 mm external hex	45 ± 5 N•m [398.3 ± 44.3 lbf•in]

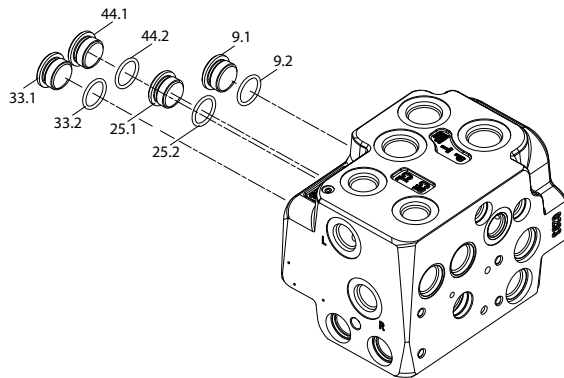
1. Screw out the plug (5) using a 32 mm socket spanner.
 O-ring (5.2) is fitted to the plug.
2. Remove the directional spool (2).

Remove four remaining plugs near Pilot Relief Valve from housing

To remove the four remaining plugs in this area, follow these steps.

Remove the four remaining plugs from this side of the housing.

Four plugs remain on this side



Wrench size and torque

Item	Description	Wrench size	Torque
9	Plug with O-ring	8 mm internal hex	45 ± 5 N•m [398.3 ± 44.3 lbf•in]
25	Plug with O-ring	8 mm internal hex	45 ± 5 N•m [398.3 ± 44.3 lbf•in]

Disassembly

Wrench size and torque (continued)

Item	Description	Wrench size	Torque
33	Plug with O-ring	8 mm internal hex	45 ± 5 N·m [398.3 ± 44.3 lbf·in]
44	Plug with O-ring	8 mm internal hex	45 ± 5 N·m [398.3 ± 44.3 lbf·in]

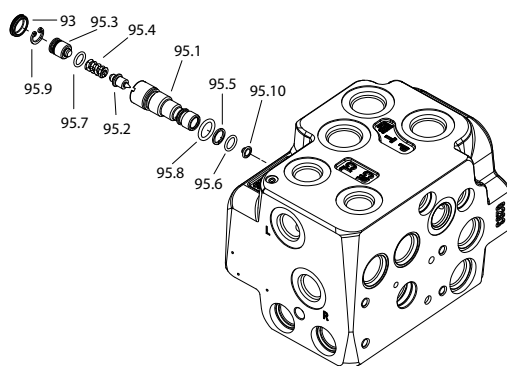
1. Screw out the plug (9) using an 8 mm Hex key.
O-ring (9.2) is fitted to the plug
2. Screw out the plug (25) using an 8 mm Hex key.
O-ring (25.2) is fitted to the plug.
3. Screw out the plug (33) using an 8 mm Hex key.
O-ring (33.2) is fitted to the plug.
4. Screw out the plug (44) using an 8 mm Hex key.
O-ring (44.2) is fitted to the plug.

Remove Pilot Relief Valve from housing

To remove the Pilot Relief Valve from the EHi Steering Valve housing, follow these steps.

Remove the Pilot Relief Valve

Pilot Relief Valve parts and housing.



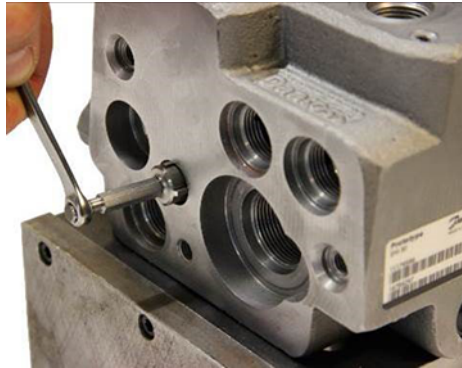
Wrench sizes and torque

Item	Description	Wrench size	Torque
93	Plug	2 mm Screwdriver	-
95	PV valve cartridge	Danfoss key (see below)	20 ± 3 N·m [177 ± 26.6 lbf·in]

1. Remove the plug (93) for the pilot relief valve (95) using a screwdriver.
2. Screw out the PV valve cartridge (95) using special key.
Danfoss code 155L6494.

Disassembly

Remove valve cartridge with Danfoss key.



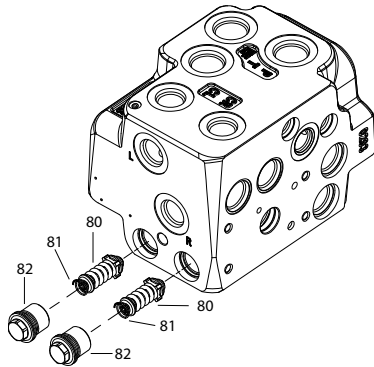
Remove Shock valves from housing

To remove shock valves from EHi Steering Valve housing, follow these steps.

If the EHi does have shock valves, remove them by following steps one and two below for each shock valve.

Remove Shock Valve(s) from housing.

Shock Valves and housing



Wrench size and torque

Item	Description	Wrench size	Torque
82 (x2)	Plug with O-ring	13 mm external hex	35 ± 3 N•m [309.8 ± 26.6 lbf•in]

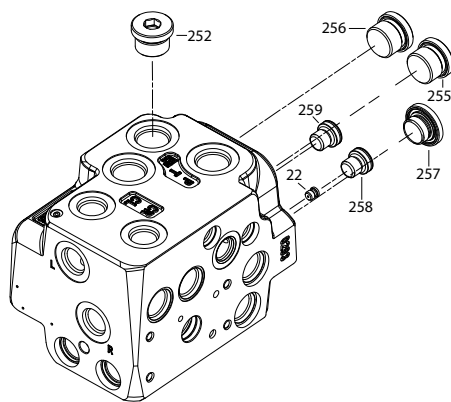
1. Screw out the plugs (82) using a 13 mm socket or ring spanner .
2. Remove the shock valves (80) with conical springs (81).

Disassembly

Remove steel plugs from ports

If the EHi has steel plugs in ports, perform the following steps:

Steel plugs, parts, and housing



Wrench size and torque

Item	Description	Wrench size	Torque
252	Plug	10 mm internal hex	45 ± 5 N•m [398.3 ± 44.3 lbf•in]
255	Plug	10 mm internal hex	45 ± 5 N•m [398.3 ± 44.3 lbf•in]
256	Plug	10 mm internal hex	45 ± 5 N•m [398.3 ± 44.3 lbf•in]
257	Plug with O-ring	8 mm internal hex	45 ± 5 N•m [398.3 ± 44.3 lbf•in]
258	Plug	6 mm internal hex	20 ± 3 N•m [177 ± 26.6 lbf•in]
22	Orifice, LS	3 mm internal hex	3.5 ± 0.5 N•m [31 ± 4.4 lbf•in]
259	Plug	6 mm internal hex	20 ± 3 N•m [177 ± 26.6 lbf•in]

1. In EF, P, and T-side-ports: screw out the plug (252, 255, and 256) using a 10 mm Hex key.
Seal ring is fitted to the plug.
2. In CF-side-port: screw out the plug (257) using an 8 mm Hex key.
Seal ring is fitted to the plug.
3. In LS1 and LS2-ports: screw out the plug (258 and 259) using a 6 mm Hex key.
Seal ring is fitted to the plug.
4. Screw out the orifice (22) using a 3 mm Hex key.
If the EHi has LS-orifice, it is placed behind the LS1-port (258).

Disassembly

Fully disassembled EHi

To properly maintain and clean the now fully dismantled EHi Steering Valve, follow these steps. This task illustrates the basic procedures for examining, cleaning, and maintaining EHi Steering Valve.

1. Check your own parts against those pictured below.

All parts except housing are illustrated



Cleaning:

2. Clean all parts carefully in Shellsol K or similar cleaner fluid.

Inspection and replacement:

3. Replace all O-rings. Check all parts carefully for damage.

In case any part appears damaged, or in case disassembly of any part was difficult or impossible, consider the EHi housing as damaged and replace the entire EHi valve.

Assembly

To assemble EHi Steering Valve, follow these steps.

Place EHi housing on holding tool.

Use 3 pcs M8 x 1.25, length: 10 mm + thickness of console plate.

EHi housing on holding tool



Address seal kit

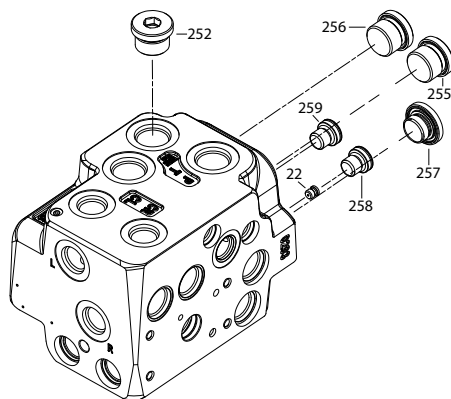
Place new O-rings from seal kit on plugs except on port plugs for which there are no seal rings/O-rings available.

The seal kit contains plugs with O-rings, (16 and 20), so these plugs shall be replaced.

Plugs (2x82) with O-rings are present in dedicated spare part bag only, see [Seal kits and spare parts for EHi](#) on page 9.

Insert steel plugs into ports

Steel plugs, parts, and housing



Wrench size and torque

Item	Description	Wrench size	Torque
252	Plug	10 mm internal hex	45 ± 5 N·m [398.3 ± 44.3 lbf·in]
255	Plug	10 mm internal hex	45 ± 5 N·m [398.3 ± 44.3 lbf·in]
256	Plug	10 mm internal hex	45 ± 5 N·m [398.3 ± 44.3 lbf·in]
257	Plug with O-ring	8 mm internal hex	45 ± 5 N·m [398.3 ± 44.3 lbf·in]
258	Plug	6 mm internal hex	20 ± 3 N·m [177 ± 26.6 lbf·in]

Assembly

Wrench size and torque (continued)

Item	Description	Wrench size	Torque
22	Orifice, LS	3 mm internal hex	3.5 ± 0.5 N•m [31 ± 4.4 lbf•in]
259	Plug	6 mm internal hex	20 ± 3 N•m [177 ± 26.6 lbf•in]

1. Screw in the orifice (22) using a 3 mm Hex key.

Torque: 3.5 ± 0.5 N•m [31 ± 4.4 lbf•in]

If the EHi has steel plugs in ports:

2. In LS1-port: Screw in the plug (258) using a 6 mm Hex key.

Seal-ring is fitted to the plug.

Torque: 20 ± 3 N•m [177 ± 26.6 lbf•in]

3. In LS2-port: Screw in the plug (259) using a 6 mm Hex key.

Seal-ring is fitted to the plug.

Torque: 20 ± 3 N•m [177 ± 26.6 lbf•in]

4. In CF-side-port: Screw in the plug (257) using an 8 mm Hex key.

Seal-ring is fitted to the plug.

Torque: 45 ± 5 N•m [398.3 ± 44.3 lbf•in]

5. In T-side-port: Screw in the plug (256) using a 10 mm Hex key.

Seal-ring is fitted to the plug.

Torque: 45 ± 5 N•m [398.3 ± 44.3 lbf•in]

6. In P-side-port: Screw in the plug (255) using a 10 mm Hex key.

Seal-ring is fitted to the plug.

Torque: 45 ± 5 N•m [398.3 ± 44.3 lbf•in]

7. In EF-port: Screw in the plug (252) using a 10 mm Hex key.

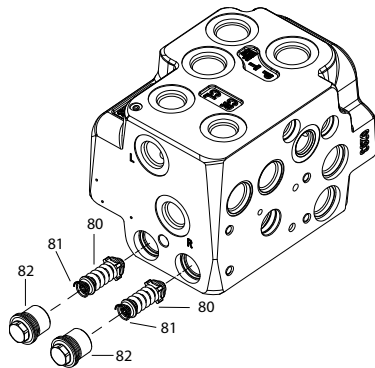
Seal-ring is fitted to the plug.

Torque: 45 ± 5 N•m [398.3 ± 44.3 lbf•in]

Insert shock valves into housing

If EHi has shock valves:

EHi housing and shock valve components



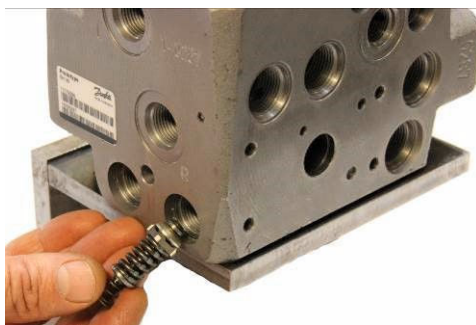
Assembly

Wrench size and torque

Item	Description	Wrench size	Torque
82 (x2)	Plug with O-ring	13 mm external hex	35 ± 3 N·m [309.8 ± 26.6 lbf·in]

1. Place the shock valves (80) with conical springs (81).

Conical springs affixed to shock valves for re-insertion.

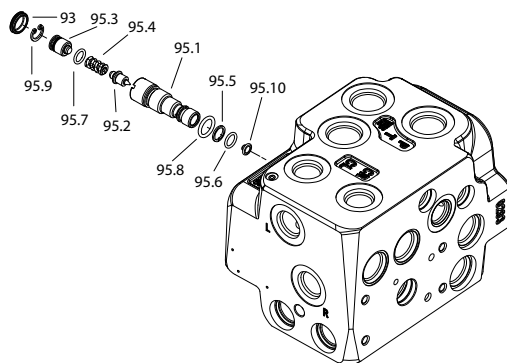


2. Screw in the plugs (82) using a 13 mm socket spanner.

Torque: 35 ± 3 N·m [309.8 ± 26.6 lbf·in]

Insert pilot relief valve into housing

Pilot relief valve parts and housing



Wrench sizes and torque

Item	Description	Wrench size	Torque
93	Plug	2 mm Screwdriver	-
95	PV valve cartridge	Danfoss key (see below)	20 ± 3 N·m [14.8 ± 2.2 lbf·ft]

1. Place back up ring (95.5), O-rings (95.6, 95.7, 95.8), filter (95.10) and locking ring (95.9) in/on cartridge (95.1).
2. Screw in cartridge (95) using special key.

Danfoss code 155L6494

20 ± 3 N·m [14.8 ± 2.2 lbf·ft]

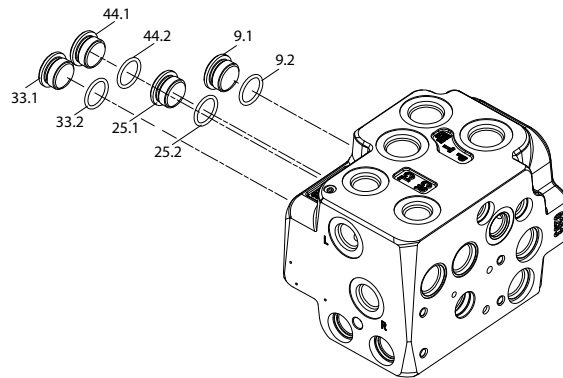
After entire assembly of the steering valve, make the pressure setting on a test panel according to valve setting specification, see Relief valve section.

3. Insert rubber protection plug (93).

Assembly

Insert plugs near pilot relief valve into housing

Plugs and housing are shown



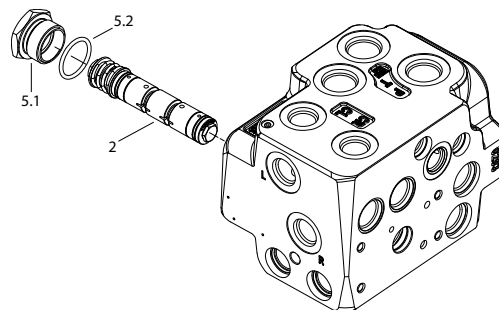
Wrench size and torque

Item	Description	Wrench size	Torque
33	Plug with O-ring	8 mm internal hex	$45 \pm 5 \text{ N}\cdot\text{m}$ [$398.3 \pm 44.3 \text{ lbf}\cdot\text{in}$]
44	Plug with O-ring	8 mm internal hex	$45 \pm 5 \text{ N}\cdot\text{m}$ [$398.3 \pm 44.3 \text{ lbf}\cdot\text{in}$]

1. Place O-ring (44.2) on the plug (44.1).
2. Screw in the plug (44) using an 8 mm Hex key.
Torque: $45 \pm 5 \text{ N}\cdot\text{m}$ [$398.3 \pm 44.3 \text{ lbf}\cdot\text{in}$]
3. Place O-ring (33.2) on the plug (33.1).
4. Screw in the plug (33) using an 8 mm Hex key.
Torque: $45 \pm 5 \text{ N}\cdot\text{m}$ [$398.3 \pm 44.3 \text{ lbf}\cdot\text{in}$]

Insert directional valve into housing

Directional valve parts and housing



Wrench size and torque

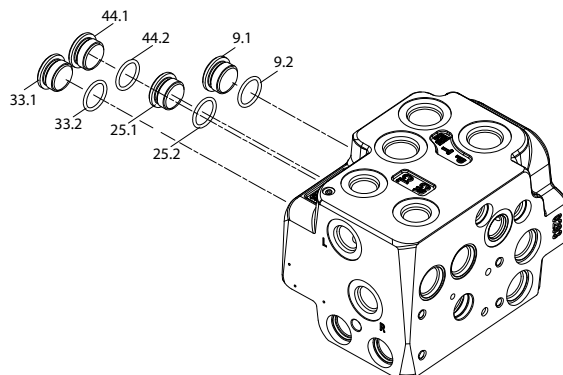
Item	Description	Wrench size	Torque
5	Plug with O-ring	32 mm external hex	$45 \pm 5 \text{ N}\cdot\text{m}$ [$398.3 \pm 44.3 \text{ lbf}\cdot\text{in}$]

1. Insert the directional spool (2).
2. Place O-ring (5.2) on the plug (5.1).
3. Screw in the plug (5) using a 32 mm socket spanner.
 $45 \pm 5 \text{ N}\cdot\text{m}$ [$398.3 \pm 44.3 \text{ lbf}\cdot\text{in}$]

Assembly

Insert plugs near directional valve into housing

Remaining two of four plugs nearby



Wrench size and torque

Item	Description	Wrench size	Torque
9	Plug with O-ring	8 mm internal hex	45 ± 5 N·m [398.3 ± 44.3 lbf·in]
25	Plug with O-ring	8 mm internal hex	45 ± 5 N·m [398.3 ± 44.3 lbf·in]

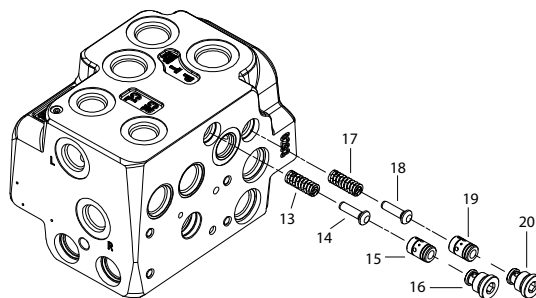
1. Place O-ring (25.2) on the plug (25.1).
2. Screw in the plug (25) using an 8 mm Hex key.
Torque: 45 ± 5 N·m [398.3 ± 44.3 lbf·in]
3. Place O-ring (9.2) on the plug (9.1).
4. Screw in the plug (9) using an 8 mm Hex key.
Torque: 45 ± 5 N·m [398.3 ± 44.3 lbf·in]

Insert pilot reduction valve(s) into housing

Insert the pilot reduction valve. item 13, 14, 15, and 16 are present in any EHi valve.

There may be two pilot reduction valves in some EHi models. If so, follow steps 5-8 as well.

Pilot reduction valve parts and housing.



Wrench size and torque

Item	Description	Wrench size	Torque
16	Plug with O-ring	6 mm internal hex	30 ± 3 N·m [265.5 ± 26.6 lbf·in]
20	Plug with O-ring	6 mm internal hex	30 ± 3 N·m [265.5 ± 26.6 lbf·in]

1. Insert the spring (13).
2. Insert the cone (14).

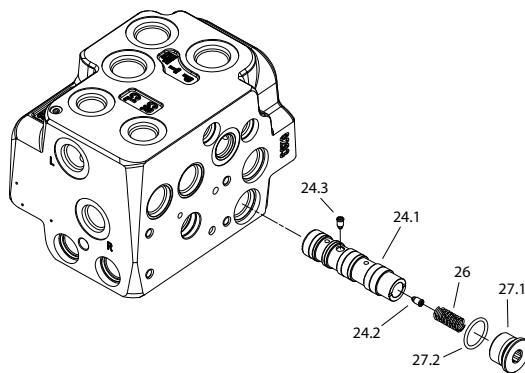
Assembly

3. Insert the spool (15).
4. Screw in the plug (16), using a 6 mm Hex key. O-ring is fitted on plug. Plug (16) with O-ring is included in the seal kit for EHi.
Torque: $30 \pm 3 \text{ N}\cdot\text{m}$ [$265.5 \pm 26.6 \text{ lbf}\cdot\text{in}$]
5. Insert the spring (17).
6. Insert the cone (18).
7. Insert the spool (19).
8. Screw in the plug (20) using a 6 mm Hex key.
O-ring is fitted on plug.
Plug (20) with O-ring is included in the seal kit for EHi.
Torque: $30 \pm 3 \text{ N}\cdot\text{m}$ [$265.5 \pm 26.6 \text{ lbf}\cdot\text{in}$]

Insert PVFC/LS copy or LS shuttle valve into housing

If PVFC/LS copy valve is present, follow steps 1-4 below. Alternative to PVFC/LS copy valve can be LS shuttle valve (88 and 87), in which case follow steps 5-7, below. Alternative to PVFC/LS copy valve or LS shuttle valve can be no valves in this position at all. Then only plug (88) will be present. Screw in this plug as described in step 7, below.

PVFC/LS copy valve parts and housing



Wrench size and torque

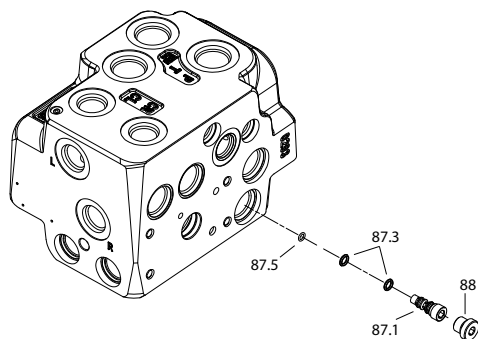
Item	Description	Wrench size	Torque
27	Plug with O-ring	8 mm internal hex	$45 \pm 5 \text{ N}\cdot\text{m}$ [$398.3 \pm 44.3 \text{ lbf}\cdot\text{in}$]
24.2	Check Valve	-	$1.4 \pm 0.2 \text{ N}\cdot\text{m}$ [$12.4 \pm 1.8 \text{ lbf}\cdot\text{in}$]
24.3	Check Valve	-	$1.4 \pm 0.2 \text{ N}\cdot\text{m}$ [$12.4 \pm 1.8 \text{ lbf}\cdot\text{in}$]

Some PVFC spools have check valves (24.2 and 24.3), which are screwed into spool (24.1).

1. Insert the PVFC spool (24)
2. Insert the spring (26).
3. Place O-ring (27.2) on the plug (27.1).
4. Screw in the plug (27) using an 8 mm Hex key.
Torque: $45 \pm 5 \text{ N}\cdot\text{m}$ [$398.3 \pm 44.3 \text{ lbf}\cdot\text{in}$]

Assembly

LS Shuttle valve/plug and housing



Wrench size and torque

Item	Description	Wrench size	Torque
88	Plug	5 mm internal hex	12.6 ± 0.6 N·m [111.5 ± 5.3 lbf·in]
87	LS Shuttle valve	5 mm internal hex	10 ± 1 N·m [88.5 ± 8.9 lbf·in]

5. Place O-rings (2x 87.3 and 1x 87.5) on the cartridge housing (87.1).

6. Screw in the cartridge (87) using a 5 mm Hex key.

Torque: 10 ± 1 N·m [88.5 ± 8.9 lbf·in]

7. Screw in the plug (88) using a 5 mm Hex key.

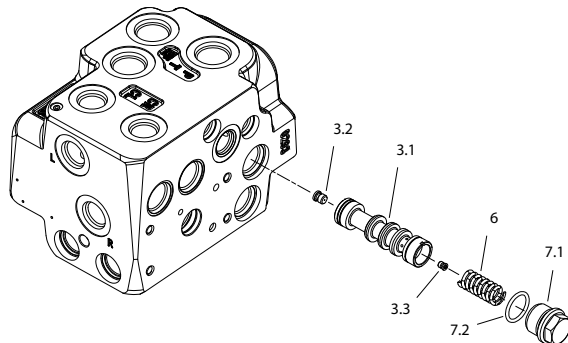
Seal-ring is fitted on plug. Plug (88) with seal-ring is included in the seal kit for EHi.

Torque: 12.6 ± 0.6 N·m [111.5 ± 5.3 lbf·in]

Insert priority valve into housing

If a priority valve is present, assemble the priority valve spool (3) with orifices. Before assembling orifices (3.2) and (3.3) to the spool, fix the spool in a vice with aluminum jaws.

Priority valve parts and housing



Assembly

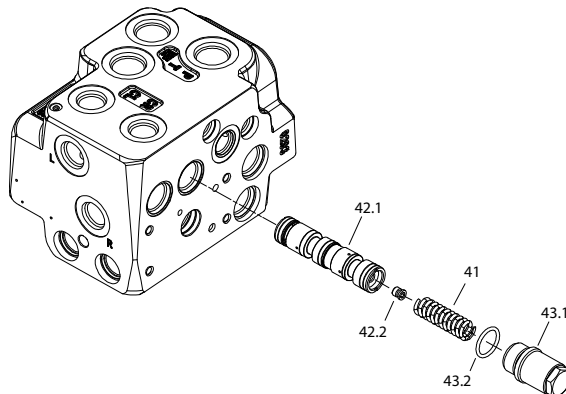
Wrench size and torque

Item	Description	Wrench size	Torque
7	Plug with O-ring	18 mm external hex	45 ± 5 N·m [398.3 ± 44.3 lbf·in]
3.2	Orifice, PP	3 mm internal hex	3.5 ± 0.5 N·m [31 ± 4.4 lbf·in]
3.3	Orifice, dynamic	2 mm internal hex	1 ± 0.1 N·m [8.9 ± 0.9 lbf·in]

1. Screw in the PP orifice (3.2) using a 3 mm Hex key.
Torque: 3.5 ± 0.5 N·m [31 ± 4.4 lbf·in]
2. If present: screw in the dynamic orifice (3.3) using a 2 mm Hex key.
Torque: 1 ± 0.1 N·m [8.9 ± 0.9 lbf·in]
3. Insert the priority valve spool (3) with the spring bore pointing outwards.
4. Insert the spring (6).
5. Place O-ring (7.2) on the plug (7.1).
6. Screw in the plug (7) using an 8 mm Hex key.
Torque: 45 ± 5 N·m [398.3 ± 44.3 lbf·in]

Insert cut off valve into housing

Cut off valve parts and housing



Wrench size and torque

Item	Description	Wrench size	Torque
43	Plug with O-ring	18 mm external hex	45 ± 5 N·m [398.3 ± 44.3 lbf·in]
42.2	Plug	3 mm internal hex	3.5 ± 0.5 N·m [31 ± 4.4 lbf·in]

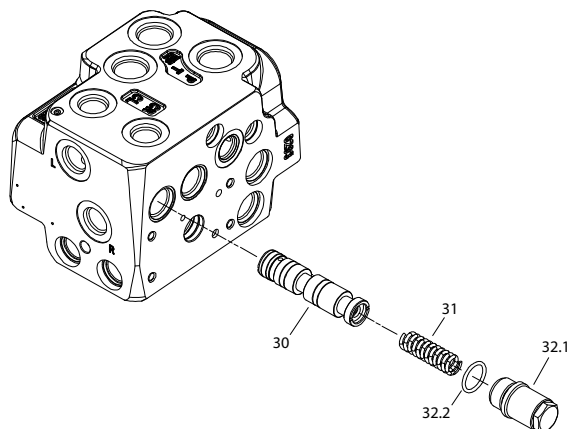
1. If cut off spool (42) has plug (42.2), screw in the plug using a 3 mm Hex key and multi grip pliers.
3.5 ± 0.5 N·m [31 ± 4.4 lbf·in]
2. Insert the cut off spool (42) with the spring bore pointing outwards.
3. Place O-ring (43.2) on the plug (43.1).
4. Insert the spring (41) in the plug (43).
5. Screw in the plug (43) using an 18 mm socket spanner.
Torque: 45 ± 5 N·m [398.3 ± 44.3 lbf·in]

Insert reaction switch valve (RSV) into housing

If RSV is present:

Assembly

RSV parts and housing



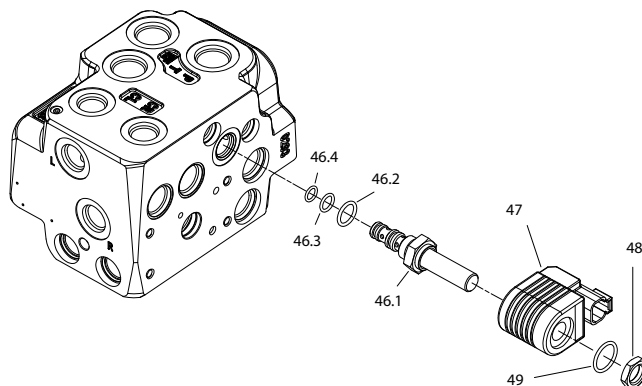
Wrench size and torque

Item	Description	Wrench size	Torque
32	Plug with O-ring	18 mm external hex	45 ± 5 N·m [398.3 ± 44.3 lbf·in]

1. Insert RSV spool (30) with the spring bore pointing outwards.
2. Place O-ring (32.2) on the plug (32.1).
3. Insert the spring (31) in the plug (32).
4. Screw in the plug (32) using an 18 mm socket spanner.
Torque: 45 ± 5 N·m [398.3 ± 44.3 lbf·in]

Attach coil to housing

Coil parts and EHi housing



Wrench size and torque

Item	Description	Wrench size	Torque
48	Nut	19 mm external hex	5 ± 1 N·m [44.3 ± 8.9 lbf·in]
46.1	Spool, pilot dump	7/8 inch external hex	15 ± 2 N·m [132.8 ± 17.7 lbf·in]

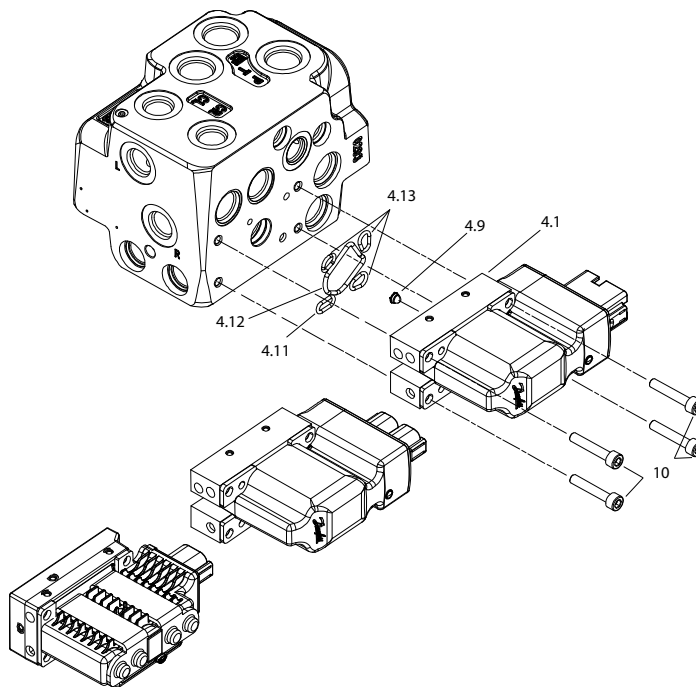
1. Place O-rings (46.2, 46.3, and 46.4) on spool (46.1).
2. Screw in the cartridge spool (46) using a 7/8 inch ring spanner or long socket spanner.
Torque: 15 ± 2 N·m [132.8 ± 17.7 lbf·in]

Assembly

3. Place the coil (47).
4. Place the O-ring (49).
5. Screw on the nut (48) using a 19 mm socket spanner.
 Torque: $5 \pm 1 \text{ N}\cdot\text{m}$ [$44.3 \pm 8.9 \text{ lbf}\cdot\text{in}$]

Attach PVE to housing

PVE parts and housing



Wrench size and torque

Item	Description	Wrench Size	Torque
10 (x4)	Screw	5 mm internal hex	$8 \pm 1 \text{ N}\cdot\text{m}$ [$70.8 \pm 8.9 \text{ lbf}\cdot\text{in}$]

1. Check proper movement of EH spool (2): press on spool end, the spool must be able to be moved downwards 4 mm with force $< 100\text{N}$ [22.48 lbf], and it must be able to return to starting position by help of the neutral spring package integrated in the spool end facing plug (2).

Press on spool end



Assembly

2. Place O-rings (4.11, 4.12, 4.13) and filter (4.9) on PVE (4.1).

Place O-rings on PVE



3. Place the PVE(4) on EHi housing and screw in the four screws for the PVE (10) using a 5 mm Hex key.
 $8 \pm 1 \text{ N}\cdot\text{m}$ [$70.8 \pm 8.9 \text{ lbf}\cdot\text{in}$]

4. Make test and valve settings according to description in the following pages.

5. Screw in plastic plugs to the connections ports to keep the ports clean during storage and transportation.

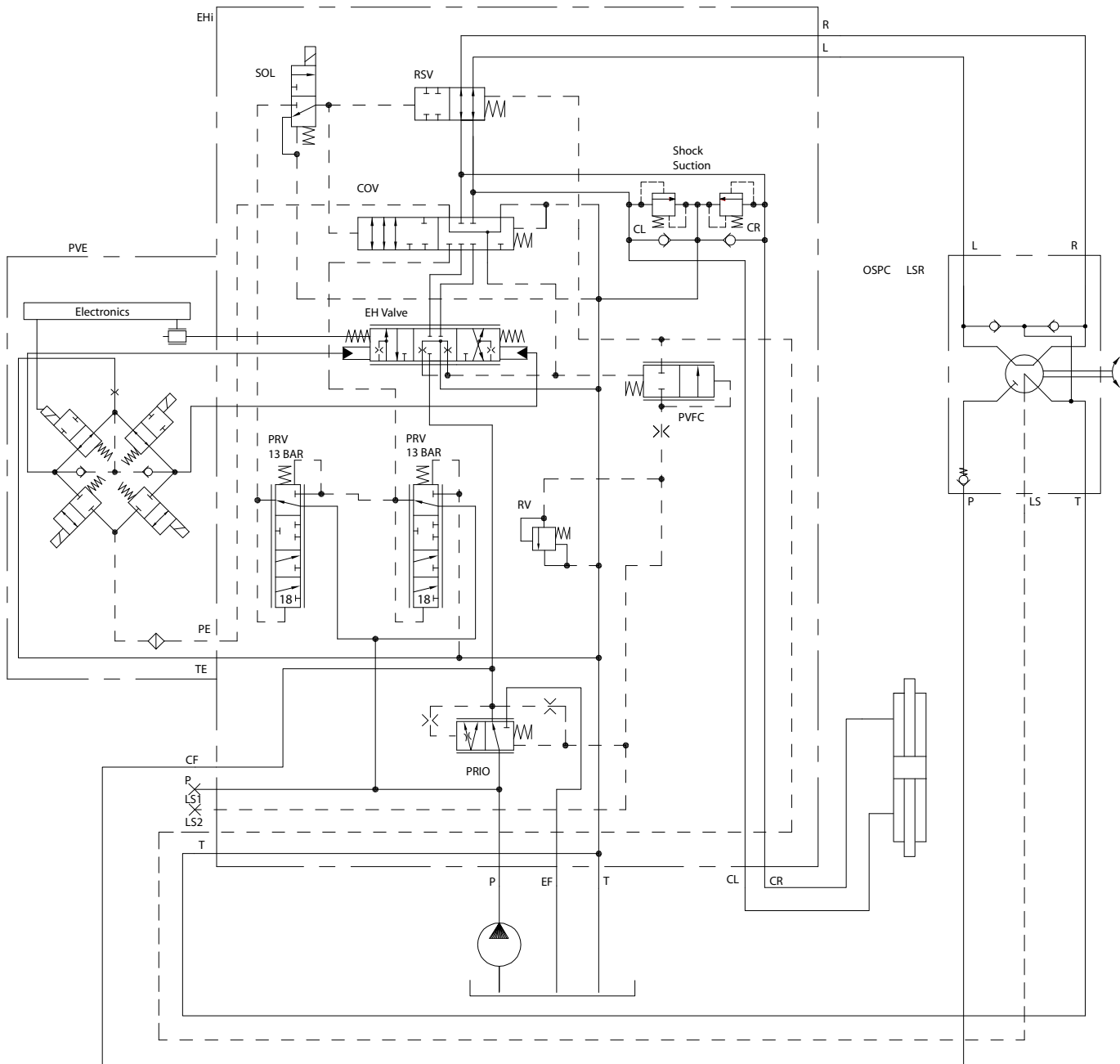
Steel plugs in EHi ports



Testing of EHi

This section describes minimum tests needed, when the EHi steering valve has been disassembled and reassembled.

Example of system setup: EHi5, Load Sensing Reaction to be used with OSPC LSR type steering unit:



Setup for testing

Use universal hydraulic work bench with pump capacity:
 40 l/min [10.6 gal/min] and up to 280 bar [4061 PSI] pressure for relief valve setting and steering test.

Testing of EHi

The hydraulic oil must be with a viscosity of 21 cSt. at 50°C [122°F] and with maximum degree of contamination according to ISO 4406: 21/19/16.

EHi for LS steering units

Description for system setup, when priority valve is integrated in EHi and when EHi is configured to be used with LS type steering unit (as illustrated in system diagram above, EHi5):

1. Connect double rod cylinder to CL and CR ports of EHi.
2. Connect front T and EF port of EHi to tank of pump station.
3. Connect the front P port of EHi to P port from pump.
4. Connect the side P port of EHi to P port of LS steering unit.
5. LS1 of EHi:
 - a) When using pump station with fixed gear pump: Plug LS1 with steel plug
 - b) With LS pump in pump station: connect LS1 of EHi to LS of pump.
6. LS2 of EHi (is only present in EHi's with PVFC spool to be used for dynamic type steering units): connect LS2 to LS port of OSP steering unit. LS dynamic flow will stream out of LS2 port of EHi, and must be able to pass on to tank.
7. Connect side T of EHi to T port of OSP.
8. Connect L and R of EHi to L and R of OSP.
9. Connect pressure gauges to all ports of EHi.
10. Connect voltage supply and signal input for the PVE.

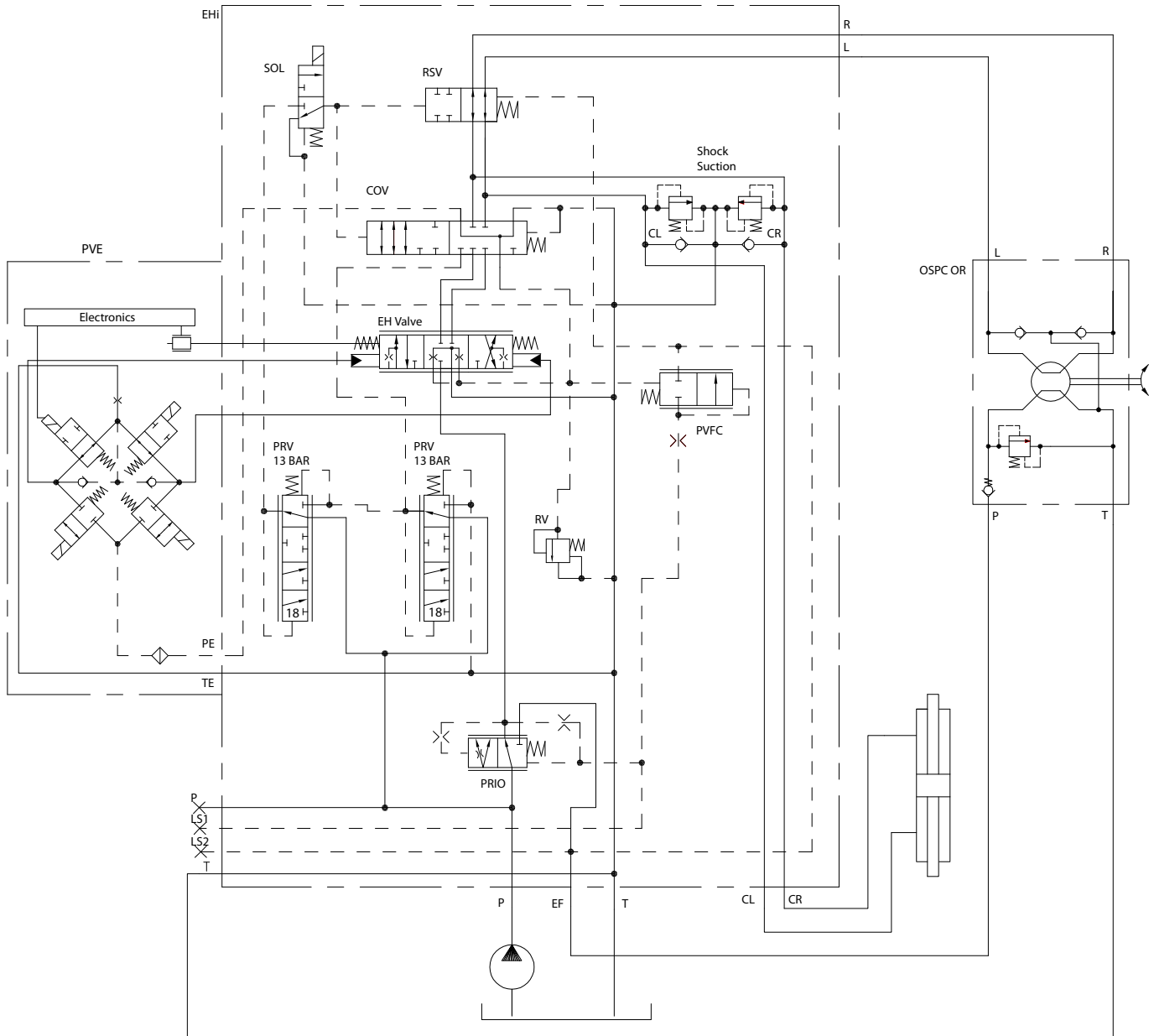
T pressure should not exceed ~5 bar [73 PSI]. Maximum allowed T pressure is 25 bar [363 PSI].
Pump supply circuit must be adjusted not to exceed 280 bar [4061 PSI] P-T.
In case the EHi has no RSV the OSP steering unit can be omitted from the tests.

Testing of EHi

EHi for open center steering units

Description for system setup, when priority valve is integrated in EHi and when EHi is configured to be used with open center type steering unit (as illustrated in system diagram, EHi2).

Example of system setup: EHi2, Open center Reaction to be used with OSPC OR type steering unit:



1. Connect double rod cylinder to CL and CR ports of EHi.
2. Connect T port of EHi to tank of pump station.
3. Connect the front P port of EHi to P port from pump. Plug the side P port of EHi.
4. Connect EF port of EHi to P port of OSP steering unit.
5. LS1 of EHi to be plugged (only gear pump or pump providing fixed flow can be used for this EHi system)
6. LS2 of EHi to be plugged.
7. Connect side T of EHi to T port of OSP.

Testing of EHi

- 8.** Connect L and R of EHi to L and R of OSP.
- 9.** Connect pressure gauges to all ports of EHi.
- 10.** Connect voltage supply and signal input for the PVE.

In case the EHi has no RSV the OSP steering unit can be omitted from the tests.

For EHi without integrated priority valve and with fixed gear pump in pump station, use external priority valves:

- For dynamic systems (when PVFC is present in EHi): Use Danfoss priority valve OLS 80 Code 152B8269, or other OLS 80 with same orifice and spring specification. Dynamic orifice: Ø1.0 mm. LS orifice: Ø1.2 mm. Spring: 7 bar [102 PSI].
 - For static systems (when PVFC is not present in EHi): Use Danfoss priority valve OLS 80 code 152B0263, or other OLS 80 with same spring specification: 10 bar [145 PSI].
-

Steering tests

Apply battery power and input signal to the PVE.

- With PVED CLS: The coil must be connected to and actuated by the PVED CLS.
- With other PVE's: connect DC voltage and ground to the coil (12V or 24V depending on voltage marking on the coil).

Start up test

During the testing no disturbing vibrations, noise, or other irregularities must occur.

1. Start the pump, the pump flow is adjusted to approximately 25 l/min and pump pressure control must be set to approximately 70 bar [1015 PSI].
2. Let the supplied oil flow through the steering valve for a few minutes. Then actuate the PVE a few times in both directions to bleed of air from the EHi and the system. Observe that the steering cylinder is moving according to direction of input signal for PVE.
3. Operate the PVE to move the steering cylinder from end stroke to end stroke for at least 5 cycles. Make sure pressure P-T, 70 bar [1015 PSI] can be achieved, when steering against end stroke. If this is not possible, the adjusting screw of the pilot relief valve (item 95 of exploded view) must be turned clockwise until P-T, 70 bar [1015 PSI] is achievable.

Pilot relief valve

1. The pump flow is adjusted to approximately 25 l/min [6.6 gal/min] and pressure to max 280 bar [4061 PSI].
2. Steer the cylinder to an end stroke, keep input signal on PVE for full spool travel.
3. The pilot relief valve (item 95 of exploded view) is set according to specification:
Maximum steering pressure (P-T), bar, for the code in question.
The setting pressure is the pressure on the P-port minus the T-port of EHi.

Neutral positioning test

1. Apply input signal to the PVE to make a cylinder movement.
2. Remove input signal to the PVE, the steering valve must be able to go to neutral later than ~1 second: cylinder movement must stop.
3. The EHi is proper in neutral position when the pressure drop (LS1-T of EHi) is no higher than 10 bar [145 PSI] at pump flow 25 l/min [6.6 gal/min], and there must be no movement of the steering cylinder.

Cut off valve test

The cut off valve spool movement can be controlled by:

1. With electric power on coil and on PVE and with signal on PVE, the steering cylinder must move to end stroke and maximum steering pressure must be build up.
2. Steer in opposite direction to observe cylinder movement.
3. While cylinder is moving, remove electric power to the coil (keep battery power and signal to PVE): cylinder movement must stop and pressure (LS1-T of EHi) must drop to be no higher than 10 bar [145 PSI].

RSV valve test

If the EHi is equipped with an RSV valve, spool movement can be controlled by:

Steering tests

1. With electric power on coil and on PVE and with signal on PVE, the steering cylinder must move to end stroke and maximum steering pressure must be build up.
2. Steer in opposite direction to observe cylinder movement. Apply input for slow movement of cylinder, < 25% of max. signal.
3. Activate steering wheel to steer in opposite direction as movement of cylinder: cylinder movement speed shall decrease/change to opposite direction dependent on steering wheel speed. Steering wheel torque must not exceed 10 N·m [88.5 lbf·in], when cylinder moves inside end strokes.

Check for external leakage

1. Remove the port connections, after testing the former items.
2. 2xP, CF, LS1, LS2, T-side, EF, L, R, CL and RL ports are to be plugged w. steel plugs.
3. Oil pressure of 20 bar [290 PSI] is supplied to the T-front port for approx. 3 minutes: No leakage must be found in any assemblies.

Shock valves

If the EHi is equipped with shock valves, these are preset and locked in setting from factory. Solely no adjustments can be made on these valves.

Tightening torques for connections

Tightening torques for connections EHi

Connections	Maximum tightening torque N·m [lbf·in]			
	With cutting edge	With copper washer	With alum. washer	O-ring
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]

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