

Service Manual

Digital Displacement DDP096 pump



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Revision history

Table of revisions

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Introduction

DDP servicing overview



This manual includes maintenance information and minor repair procedures of the Digital Displacement[®] Pump DDP096. Performing maintenance and minor repair of Digital Displacement[®] Pumps DDP096 according to the procedures detailed in this manual will not affect your warranty. Any other repair operation voids the warranty. For more information about the DDP096 service parts, please refer to the DDP096 Parts Manual.

Performing minor repairs requires the DDP096 pump to be disconnected from the DPC12 controller and removed from the vehicle/machine. Thoroughly clean the pump before beginning maintenance or repair activities. Since dirt and contamination are the greatest enemies of any type of hydraulic equipment, follow cleanliness requirements strictly, especially when changing the system filter and when removing hoses or plumbing.

When removing hoses or plumbing, add port covers – the port covers shipped with the pump are appropriate. Do not plug ports with rags, especially the inlet port as any pieces left behind can cause pump to malfunction.

Safety precautions

Always consider safety precautions before beginning a service procedure. Take the following general precautions whenever servicing a hydraulic system in addition to other vehicle or machine precautions.

Unintended machine movement

Unintended movement of the machine or mechanism may cause injury to the technician or bystanders. Secure the machine or disable/disconnect the mechanism while servicing to protect against unintended movement.

Flammable cleaning solvents

Some cleaning solvents are flammable. Do not use cleaning solvents in an area where a source of ignition may be present to avoid possible fire.

Fluid under high pressure

Escaping hydraulic fluid under pressure can have sufficient force to penetrate skin causing serious injury and/or infection.

Additionally, the fluid may cause burns.

Use caution when dealing with hydraulic fluid under pressure.

Always relieve pressure in the system before removing hoses, fittings, gauges, or other components. Never use hands or any other body parts to check for leaks in a pressurized component; seek medical attention immediately if you are cut by hydraulic fluid.

Personal safety

Protect yourself from injury whenever servicing a hydraulic system. Use proper safety equipment, including safety glasses, at all times.

Hazardous material

Hydraulic fluid contains hazardous material. Avoid prolonged contact with hydraulic fluid. Always dispose of used hydraulic fluid according to state, and federal environmental regulations.



Introduction

Pump handling

There is potential to damage the product during transportation. Do not hit the shaft.

Avoid any damage to wires, connectors, sensors, and coils when transporting the pump.

DP096 pump

Information for servicing DDP096

DDP component identification

The DDP096 is a 12-cylinder radial piston hydraulic pump.

The 12 cylinders are arranged into 3 banks (A, B and C) with A being the closest to the mounting flange. The cylinders are identified by their bank followed by their pumplet number (1, 2, 3 or 4). For instance, the cylinder from the pumplet 3 positioned in the bank C (the closest to the endcap) is the cylinder C3.

The figure below shows the pump housing with the cylinder labels. These labels are used to identify any specific components of the pump (e.g., the coil B2). Note that the pumplet numbers are visible on the pump housing when looking at the pump from the endcap.



Depending on the type of endcap, the pump can either provide flow to one outlet or multiple independent outlets. Refer to the DDP096 Technical Information manual, **BC306384089197**, for more information.

Wiring harness

General harness information

The wiring harness of DDP096 pumps requires the three following sub-harnesses:

- Two coil harnesses ("A" and "B")
- One sensor harness

These wiring harnesses can be individually replaced if needed and are supplied with cable ties (securing one harness branch to the pump housing or to another branch). The wiring harnesses are tied together at the main anchor.

Most of the wiring harness is covered in black nylon braid for protection. There is a gap of approximately 10 mm between the end of the braid and each connector to ensure that each harness branch is connected to the correct coil or sensor. Each connector can be identified by the colors of its wires (visible in the unbraided part), the number of wires, and the length of the branch.

When securing a cable tie, make sure to tension it to form a snug fit but not to crush the wires. The loose end of the tie should be cut to maximum 1 mm of protrusion.

In certain scenarios, handling brackets can restrict access to anchoring tie screws and may need to be temporarily removed during servicing. They should be torqued back to the value specified in *Fasteners and torque*.



Information for servicing DDP096

Main anchor

The main anchor is installed on the web between pumplets 2 and 3. A cable tie secures the two coil harnesses and the sensor one to the main anchor.

Coil harness

There are two coil harnesses ("A" and "B") for the DDP096. Each valve coil needs to be connected to a coil harness for full pump function and control.

On the pump-to-controller harness end, they can be quickly differentiated by the color and key insert of the DEUTSCH connector:

- The coil harness "A" has a gray 12-pin DEUTSCH connector and connects to the valve coils of pumplets 1 and 2
- The coil harness "B" has a black 12-pin DEUTSCH connector and connects to valve coils of pumplets 3 and 4

On the valve connection end, each branch of the coil harness can be paired with the corresponding coil according to its length and the wire colors:

- Red for the valves of bank A
- Black for the valves of bank B
- White for the valves of bank C

Customer-specific harness may not follow the same color codes; please contact your Danfoss representative.

Sensor harness

A sensor wiring harness is typically composed of:

- One branch for the speed and temperature sensor (which has 4 wires in total)
- One or several branches for the pressure sensor(s) (which each has 2 wires)

There are 2 variants of sensor connectors:

- 4-pin male circular connector with straight output and M12x1 thread referred to as the M12 connector.
- 3- or 4-pin DEUTSCH connector (respectively DT04-3 or DTM04-4) referred to as the DEUTSCH connector.

On the pump-to-controller end, the sensor harness has a green 12-pin DEUTSCH connector.

A sensor harness exists for each DDP096 service configuration:

- 1-service pump [P]: one pressure sensor is used in port M (single-outlet pump)
- 2-service pump [P1 / (P2 + P4)] or [(P1 + P2) / P4]: two pressure sensors are used in ports M1 and M4 (multi-outlet pump)
- 3-service pump [P1 / P2 / P4]: three pressure sensors are used in ports M1, M2 and M4 (multi-outlet pump)

More wiring harness options are available on request; please contact your Danfoss representative.



Mechanical installation and maintenance

Start-up procedure

Follow the DDP096 commissioning procedure of the Technical Information manual when restarting an installation in which the pump has been removed. The DPC12 controller should already be mounted properly in the system.

Absolute cleanliness is required, and the pump must be installed in clean conditions. Any contamination of the pump or hydraulic fluid can have a significant detrimental impact on the service life of the pump.

1. Make certain all system components (reservoir, hoses, valves, fittings, heat exchanger, etc.) are clean prior to filling with fluid.

Do not use any cleaning materials that may deposit lint or other debris in the hydraulic system. Do not use PTFE tapes to seal fittings.

2. Make certain that the case of the pump is fully filled with hydraulic fluid before being brought into operation.

Use hydraulic fluid free of air and water. Excess bubbles or moisture can cause damage to the pump's internal components.

3. Remove air from the pump - refer to the Air removal section of the Technical Information manual for more information.

Fluid and filter recommendations

To ensure optimum life of the Digital Displacement[®] Pump DDP096, perform regular maintenance of the fluid and filter. Contaminated fluid is the main cause of unit failure. Take care to maintain fluid cleanliness when servicing.

Check the reservoir daily for proper fluid level, the presence of water, and rancid fluid odor. Water in the fluid may be noted by a cloudy or milky appearance or free water in the bottom of the reservoir. Rancid odor indicates the fluid has been exposed to excessive heat. Change the fluid immediately if these conditions occur. Correct the problem immediately.

Change the fluid and filter per the vehicle/machine manufacturer's recommendations or at the below intervals. Change the fluid more frequently if it becomes contaminated with foreign matter (dirt, water, grease, etc.) or if the fluid is subjected to temperature levels greater that the recommended maximum.

Dispose of used hydraulic fluid properly. Never reuse hydraulic fluid.

Change filters whenever the fluid is changed or when the filter indicator shows that it is necessary to change the filter. Replace all fluid lost during filter change.

Fluid and filter change interval

Reservoir type	Maximum change interval		
Sealed	2000 hours		
Breather	500 hours		



Required tools

Mechanical tools

This list shows the required tools to disassemble/assemble the pump.

- Snap-ring pliers (suitable for 58 mm internal circlips)
- Cable tie cutters
- Cable tie tensioner and cutter (optional)
- 3 mm hex key
- 19 mm hex wrench with deep socket
- Special tool for speed & temperature sensor with DEUTSCH connector
- 22 mm hex wrench (deep socket recommended)
- 22 mm oxygen sensor socket with ~20 mm slot
- Phoenix Contact torque screwdriver TSD 04 SAC (Phoenix Contact part number: 1208429)
- Phoenix Contact tool SACC BIT M12-D20 (Phoenix Contact part number: 1208445)
- Appropriate torque wrenches (see *Fasteners and torque*)

For more information on tools, please contact your Danfoss representative.

Electrical tools

This list contains tools needed for testing electrical components of the pump.

• Multimeter

Additional tools

This list contains tools or other objects for the maintenance of the pump that are not categorically mechanical or electrical.

- Thread sealant Loctite 243 or similar thread locking compound
- Pump stand

For most of the minor repairs, it is recommended to mount and secure the DDP096 to a 4-bolt SAE C stand in a horizontal position or in a vertical position with the input shaft pointing downwards (with a minimum ground clearance of 80 mm).



DDP shaft seal

The Digital Displacement[®] Pump DDP096 uses a lip-type shaft seal.

DDP shaft seal removal

- 1. Orient the pump with the input shaft pointing upward.
- 2. Clean the surfaces of the seal and around the seal to prevent any contamination.
- 3. Using snap-ring pliers, remove the circlip (E102) retaining the shaft seal.
- **4.** Remove the shaft seal (E103) following the process described below:
 - a) Carefully drive a small sheet-metal self-tapping screw into the shaft seal to facilitate removal. Be careful not to damage the bearing below the seal and be careful to not mark the shaft seal running surface on the shaft.
 - b) Attach a slide hammer or appropriate puller to the screw head and pull to remove the seal.
 - c) Discard the seal.

A Warning

Do not damage the housing bore, shaft or bearing when removing the shaft seal.

Shaft seal and circlip (retaining ring)







DDP shaft seal installation

- 1. Orient the pump with the input shaft pointing upward.
- **2.** Inspect the pump housing seal bore and the sealing area on the shaft for rust, wear, and contamination.
- 3. Clean the shaft and the housing if necessary taking care not to damage the running surfaces.
- **4.** Cover the shaft splines with a protective sleeve or packaging tape to prevent damage to the seal during installation.
- 5. Inspect the new seal (E103).

The inner diameter is supplied pre-greased; do not wipe this grease away and maintain cleanliness during the entire process.

- 6. Lubricate the outer diameter of the new shaft seal and the shaft surface with clean hydraulic fluid.
- Insert the seal evenly and concentrically to the shaft such that the flat face is facing outwards.
 Take care not to press on the dust lip on the inside or scratch the shaft surface to avoid binding and damaging the seal.
- 8. Press by hand into housing until it bottoms out.

Seal may need to be pressed or tapped into place. If a tool is used, a ring with inner diameter of 49 mm \pm 0.1 mm, outer diameter of 56.9 mm \pm 0.1mm and rounded edges is recommended.

- 9. Using snap-ring pliers, install the circlip (E102) that retains the shaft seal.
- **10.** Remove the installation sleeve on the shaft end.



DDP coil

There are 12 coils in a Digital Displacement[®] Pump DDP096 pump. Each valve is controlled by a coil which is mounted over the coil core. If multiple coils need to be replaced, repeat the procedure below.

DDP coil removal

- 1. Clean and dry the area around the coil and the coil connector to remove any contamination and fluids.
- **2.** Disconnect the desired coil connector (K600) from the coil harness (J001 or J002) by pushing on the retaining clip at the top of the connector.

Caution

Do not bend the coil wires excessively in any direction. It may be necessary to loosen an anchoring tie by removing an M5x12 screw (J008) using a 3 mm internal key. Make sure to torque the screw back within the value range specified in *Fasteners and torque*.

- **3.** Using a 3 mm hex key, remove the central M5x12 screw (K700) retaining the coil from the coil core. Check that the coil core has not come loose. If so, do not remove the coil core as this will introduce contamination and may cause loss or damage of the axial O-ring. Please contact your Danfoss representative for advice.
- 4. Before removing the coil, note the direction in which the MCON connector is pointing.
- 5. Remove the coil and discard the screw.

Coils and coil screws



Each pumplet has the same arrangement of coils: coil connectors from banks A and C point anticlockwise around the pump (looking from the front shaft) while the coil connectors from bank B point towards the rear of the pump. More information on the coil identification can be found in *Component identification*.



DDP coil inspection and disposal

- 1. Check the resistance of the coil with a multimeter.
- At 20°C, the resistance should be around 0.67 0.76 Ohms.
- **2.** If there is evidence of short circuit, then dispose the coil according to local regulations or send back to Danfoss.

There is no integrated circuit or electronics in the coil.

DDP coil installation

- 1. Install the coil (K600) with the connector pointing in the same orientation as before.
- 2. Use a new nylon patched M5x12 screw (K700).
- **3.** Using a 3 mm hex key, fasten the coil with the M5x12 screw in the central hole to the coil core and torque within the value range specified in the *Fasteners and torque*.
- **4.** Connect the loose cable of the coil harness (J001 or J002) to the MCON connector of the coil replaced. A click should be heard if properly inserted.



DDP pressure sensor

A DDP096 can have multiple pressure sensors depending on the number of services. The minor repair instruction is given for a single-outlet DDP096 (port M), but the procedure is the same for a multi-outlet pump (port M1, M2 or M4). If multiple pressure sensors need to be replaced, repeat the procedures.

DDP pressure sensor removal

- 1. Clean the exterior of the pump to remove debris.
- **2.** Disconnect the M12 or DEUTSCH connector of the pressure sensor (J004) from the sensor harness (J003).
- **3.** In case of a M12 connector, remove the pressure sensor using a 22 mm hex socket (deep socket recommended).

In case of a DEUTSCH connector, remove the pressure sensor using a 22 mm oxygen sensor socket with 20 mm slot.

4. Discard the sensor.

Pressure sensor

Pumplet 2



DDP pressure sensor installation

- **1.** Check if the O-ring is correctly in place on the pressure sensor (J004) and lubricate with clean hydraulic fluid.
- 2. Install the pressure sensor in the adequate port
 - Using a 22 mm hex wrench (deep socket recommended) in case of a M12 connector
 - Using a 22 mm oxygen sensor socket with 20 mm slot in case of a DEUTSCH connector
 - Torque within the value range specified in *Fasteners and torque*.
- **3.** In case of a M12 connector, spread fresh liquid thread locking compound (1 to 3 drops) on the male M12 thread of the pressure sensor.

In case of a DEUTSCH connector, optionally, smear dielectric grease on the seal of the mating DEUTSCH connector.

4. In case of a M12 connector, connect the loose sensor harness branch (J003) to the pressure sensor and using the Phoenix Contact torque screwdriver and tool, torque with the preset torque setting specified in *Fasteners and torque*.

In case of a DEUTSCH connector, connect the loose harness branch (J003) to the pressure sensor without bending it. A click should be heard if properly inserted.



DDP speed and temperature sensor

All DDP096 pumps feature a speed and temperature sensor. This sensor is installed in the port W between pumplets 2 and 3.

DDP speed and temperature sensor removal

- 1. Clean the exterior of the pump to remove debris.
- 2. Disconnect the M12 or DEUTSCH connector of the speed and temperature sensor (J010) from the sensor harness (J003).
- 3. In case of a M12 connector, remove the speed and temperature sensor using a 22 mm hex socket (deep socket recommended).

In case of a DEUTSCH connector, remove the speed and temperature sensor using a special tool. Contact your Danfoss representative for more details.

Speed and temperature sensor



DDP speed and temperature sensor inspection

- 1. Check if there are particles stuck to the tip of the sensor, especially if it gave erroneous readings.
- 2. If particles are found, determine the cause (e.g., filter clogged, contamination downstream, etc.).
- 3. Clean the sensor then re-install if the particle issue is resolved.

DDP speed and temperature sensor installation

A Warning

Do not remove the protective cap off the speed and temperature sensor until ready for installation. Take care not to expose the tip of the sensor to any metal as the tip is magnetic and can pick up debris.



- **1.** Check if the sealing form ring is correctly in place on the speed and temperature sensor (J010) and lubricate with clean hydraulic fluid.
- 2. Install the speed and temperature sensor in port W:

using a 19 mm hex wrench with deep socket recommended in case of a M12 connector

using a special tool (contact your Danfoss representative if needed) in case of a DEUTSCH connector

Torque within the value range specified in *Fasteners and torque*.

3. In case of a M12 connector, spread fresh liquid thread locking compound (1 to 3 drops) on the male M12 thread of the speed and temperature sensor.

In case of a DEUTSCH connector, optionally, smear dielectric grease on the seal of the mating DEUTSCH connector.

4. In case of a M12 connector, connect the loose sensor harness branch (J003) to the speed and temperature sensor and, using the Phoenix Contact torque screwdriver and tool, torque with the preset torque setting specified in *Fasteners and torque*.

In case of a DEUTSCH connector, connect the loose sensor harness branch (J003) to the speed and temperature sensor without bending it. A click should be heard if properly inserted.

DDP coil harness "A"

The coil harness "A" has a gray DEUTSCH connector on one end, and coil connectors to pumplets 1 and 2 on the other end. There are three wire colors (red, black, and white) for each coil connector. The coil harness "A" is tied up to the main anchor (located between pumplets 2 and 3) and has 2 preassembled anchoring ties.

DDP coil harness "A" removal

- **1.** On the pump-to-controller harness end, disconnect the gray DEUTSCH connector of the coil harness "A" (J001).
- Disconnect all MCON connectors (A1, B1, C1, A2, B2, C2) from the valve coils (K600) of pumplets 1 and 2.
- **3.** Using a 3 mm hex key, remove the M5x12 screws (J008) of the two anchoring ties (one is located between pumplets 4 and 1 while the other one is between pumplets 1 and 2).
- **4.** If the unit is a multi-outlet pump with an M1 pressure sensor, use a cable tie cutter to cut the cable tie (J007) positioned under the M2 port.
- 5. If the unit is a multi-outlet pump with an M2 pressure sensor, use a cable tie cutter to cut the cable tie located approximately 50 mm from the main anchor. This cable tie wraps around the coil harness "A" bundle, the M2 pressure sensor branch and the M1 pressure sensor branch (if present).
- Both cable tie positions can be seen in the figure Multi-outlet pump (sensors and harness AE).
- 6. Using cable tie cutters, cut the cable tie of the main anchor.
- 7. Safely remove the loose coil harness "A" from the pump harness and discard the screws.

Warning

Do not damage any wire of the pump harness when cutting cable ties.

Coil harness "A" (other harnesses are not shown for ease of visualization)











DDP coil harness "A" installation

- **1.** Lay out the coil harness "A" (J001) by putting all the tails together.
- 2. Identify the two sets of three MCON connectors that split from the coil harness. Note that each set of connectors should be composed of different wire colors (red, black, and white).
 - a) Connect the set of MCON connectors which is the furthest away from the gray DEUTSCH connector to the valve coils of pumplet 1 (A1, B1, C1).
 - b) Connect the set of MCON connectors which is the closest from the gray DEUTSCH connector to the valve coils of pumplet 2 (A2, B2, C2).

The MCON connector will click when properly inserted.

For both sets, pay attention to the wire color code for the coil connections: red for coils A1 and A2; black for coils B1 and B2; white for coils C1 and C2.

- **3.** Using a 3 mm hex key, insert the new nylon patched M5x12 screws (J008) on the two anchoring ties (one is located between group 1 and 2; the other one between group 1 and 4) and torque within the value range specified in *Fasteners and torque*.
- **4.** If the unit is a multi-outlet pump with an M1 pressure sensor, fasten a cable tie (J007) under the M2 port to secure the coil harness "A" bundle against the M1 pressure sensor branch.
- 5. If the unit is a multi-outlet pump with an M2 pressure sensor, fasten a cable tie (J007) approximately 50 mm from the main anchor which wraps around the coil harness "A" bundle, the M2 pressure sensor branch and the M1 pressure sensor branch (if present).

The cable tie positions can be seen in *Removal* under figure *Multi-outlet pump (sensors and harness AE)*.

- **6.** Secure the coil harness "A" with a cable tie (J007) at the main anchor together with the coil harness "B" (J002) and the sensor harness (J003). Note that the three 12-pin DEUTSCH connectors should be at the same distance (approximately 220 mm) from the main anchor of the pump.
- 7. On the pump-to-controller harness end, connect the gray DEUTSCH connector of the coil harness "A."

DDP coil harness "B"

The coil harness "B" has a black DEUTSCH connector on one end, and coil connectors to pumplets 3 and 4 on the other end. There are three wire colors (red, black, and white) for each coil connector. The coil harness "B" is tied up to the main anchor (located between pumplets 2 and 3) and has 1 preassembled anchoring tie.

DDP coil harness "B" removal

- 1. On the pump-to-controller harness end, disconnect the black DEUTSCH connector of the coil harness "B" (J002).
- 2. Disconnect all MCON connectors (A3, B3, C3, A4, B4, C4) from the valve coils (K600) of pumplets 3 and 4.
- **3.** Using a 3 mm hex key, remove the M5x12 screw (J008) of the anchoring tie (located between pumplets 3 and 4).
- 4. If the unit is a multi-outlet pump with an M4 pressure sensor, two additional cables ties (connecting the M4 pressure sensor branch to the coil harness "B") should be removed using cable tie cutters.
 a) Cut the cable tie (J007) located next to the anchoring tie of coil harness "B" (between pumplets 3 and 4).
 - b) Cut the cable tie located above pumplet 3 (next to the indication "3" on the housing).
- Both cable tie positions can be seen in the figure Multi-outlet pump (sensors and harness AE) below.
- 5. Using cable tie cutters, cut the cable tie of the main anchor.
- 6. Safely remove the loose coil harness "B" from the pump harness and discard the screw.

Warning

Do not damage any wire of the pump harness when cutting cable ties.

Coil harness "B" (other harnesses are not shown for ease of visualization)











DDP coil harness "B" installation

- **1.** Lay out the coil harness "B" (J002) by putting all the tails together.
- 2. Identify the two sets of three MCON connectors that split from the coil harness. Note that each set of connectors should be composed of different wire colors (red, black, and white).
 - a) Connect the set of MCON connectors which is the furthest away from the black DEUTSCH connector to the valve coils of pumplet 4 (A4, B4, C4).
 - b) Connect the set of MCON connectors which is the closest from the black DEUTSCH connector to the valve coils of pumplet 3 (A3, B3, C3).

The MCON connector will click when properly inserted.

For both sets, pay attention to the wire color code for the coil connections: red for coils A3 and A4; black for coils B3 and B4; white for coils C3 and C4.

- **3.** Using a 3 mm hex key, insert the new nylon patched M5x12 screws (J008) on the anchoring tie (located between pumplet 3 and 4) and torque within the value range specified in *Fasteners and torque*.
- 4. If the unit is a multi-outlet pump with an M4 pressure sensor, there are two cable ties to fasten.
 - a) Fasten a cable tie (J007) above pumplet 3 (next to the indication "3" on the housing) to secure the coil harness "B" against the M4 pressure sensor branch.
 - b) Fasten another cable tie next to the anchoring tie of coil harness "B" (located between pumplets 3 and 4) to secure the coil harness "B" against the M4 pressure sensor branch.

Both cable tie positions can be seen in the figure *Multi-outlet pump (sensors and harness AE)* in *Removal*.

- **5.** Secure the coil harness "B" with a cable tie (J007) at the main anchor together with the coil harness "A" (J001) and the sensor harness (J003). Note that the three 12-pin DEUTSCH connectors should be at the same distance (approximately 220 mm) from the main anchor of the pump.
- 6. On the pump-to-controller harness end, connect the black DEUTSCH connector of the coil harness "B."



DDP sensor harness (single-outlet pump)

The single-outlet DDP096 pump has one pressure sensor in port M. The sensor harness is tied up to the main anchor (located between pumplets 2 and 3).

DDP sensor harness (single-outlet pump) removal

- 1. On the pump-to-controller harness end, disconnect the green DEUTSCH connector of the sensor harness (J003).
- 2. Disconnect the M12 or DEUTSCH connector of the pressure sensor (J004) placed in port M from the sensor harness branch.
- **3.** Disconnect the M12 or DEUTSCH connector of the speed and temperature sensor (J010) placed in port W from the sensor harness branch.
- 4. Using cable tie cutters, cut the cable tie (J007) of the main anchor.
- 5. Safely remove the loose sensor harness from the pump harness.

🛕 Warning

Do not damage any wire of the pump harness when cutting the cable tie.

Sensor harness – Single-outlet pump (coil harnesses are not shown for ease of visualization)



DDP sensor harness (single-outlet pump) installation

- 1. Lay out the sensor harness (J003).
- 2. In case of a sensor harness with M12 connectors, spread fresh liquid thread locking compound (1 to 3 drops) on the male M12 thread of all the sensors.

In case of a sensor harness with DEUTSCH connectors, optionally, smear dielectric grease on the seal of all mating DEUTSCH sensor connectors.

3. In case of a sensor harness with M12 connectors, connect the M12 connector of the speed and temperature sensor harness branch (the one with 4 wires) to the sensor (J010) in port W and using the Phoenix Contact torque screwdriver and tool, torque with the preset torque setting specified in *Fasteners and torque*.

In case of a sensor harness with DEUTSCH connectors, connect the DEUTSCH connector of the speed and temperature sensor harness branch (the one with 4 wires) to the sensor (J010) in port W. A click should be heard if properly inserted.

4. In case of a sensor harness with M12 connectors, connect the M12 connector of the pressure sensor harness branch (the one with 2 wires) to the sensor (J004) in port M and using the Phoenix Contact torque screwdriver and tool, torque with the preset torque setting specified in *Fasteners and torque*.



In case of a sensor harness with DEUTSCH connectors, connect the DEUTSCH connector of the pressure harness branch (the one with 2 wires) to the sensor (J004) in port M. A click should be heard if properly inserted.

- **5.** Secure the sensor harness with a cable tie (J007) at the main anchor together with the coil harness "A" (J001) and coil harness "B" (J002). Note that the three 12-pin DEUTSCH connectors (gray, black, and green) should be at the same distance (approximately 220 mm) from the main anchor of the pump.
- **6.** On the pump-to-controller harness end, connect the green DEUTSCH connector of the sensor harness.





DDP sensor harness (multi-outlet pump)

The multi-outlet DDP096 pump can have up to three pressure sensors in ports M1, M2 and M4. The sensor harness is tied up to the main anchor (located between pumplets 2 and 3)

DDP sensor harness (multi-outlet pump) removal

- 1. On the pump-to-controller harness end, disconnect the green Deutsch connector of the sensor harness (J003).
- 2. Disconnect the M12 or DEUTSCH connectors of the different pressure sensors (J004) placed in ports M1, M2 and/or M4 from the sensor harness branches.
- 3. Disconnect the M12 or DEUTSCH connector of the speed and temperature sensor (J010) placed in port W from the sensor harness branch.
- **4.** If the multi-outlet pump has an M1 pressure sensor, use cable tie cutters to cut the cable tie (J007) positioned under the M2 port.
- 5. If the multi-outlet pump has an M2 pressure sensor, use cable tie cutters to cut the cable tie located approximately 50 mm from the main anchor. The cable tie wraps around the coil harness "A" bundle, the M2 pressure sensor branch and the M1 pressure sensor branch (if present).
- **6.** If the multi-outlet pump has an M4 pressure sensor, use cable tie cutters to cut the cable tie located next to the anchoring tie of the coil harness "B" (between pumplets 3 and 4). Also, cut the cable tie located above pumplet 3 (next to the indication "3" on the housing).

Cable tie positions can be seen in the figure Multi-outlet pump (sensors and harness AE) below.

- 7. Using cable tie cutters, cut the cable tie of the main anchor.
- 8. Safely remove the loose sensor harness from the pump harness.

A Warning

Do not damage any wire of the pump harness when cutting cable ties.

Sensor harness – Multi-outlet pump (coil harnesses are not shown for ease of visualization)



The cable ties (J007) wrapping around the pressure sensor branches of the sensor harness (J003) are not present on this drawing.







DDP sensor harness (multi-outlet pump) installation

- 1. Lay out the sensor harness (J003) by putting all the tails together.
- 2. In case of a sensor harness with M12 connectors, spread fresh liquid thread locking compound (1 to 3 drops) on the male M12 thread of all the sensors.

In case of a sensor harness with DEUTSCH connectors, optionally, smear dielectric grease on the seal of all mating DEUTSCH sensor connectors.

3. In case of a sensor harness with M12 connectors, connect the M12 connector of the speed and temperature sensor harness branch (the one with 4 wires) to the sensor (J010) in port W. Use the Phoenix Contact torque screwdriver and tool to torque with the preset torque setting specified in *Fasteners and torque*.

In case of a sensor harness with DEUTSCH connectors, connect the DEUTSCH connector of the speed and temperature sensor harness branch (the one with 4 wires) to the sensor (J010) in port W. A click should be heard if properly inserted.

It is required to connect each pressure sensor branch to the correct pressure sensor. Each branch can be identified by the color of the wires or the distance from the pressure sensor to the green DEUTSCH connector. From the shortest to the longest branch:

- M2 pressure sensor branch has 2 wires (red and white)
- M1 pressure sensor branch has 2 wires (black and white)
- M4 pressure sensor branch has 2 wires (black and red)
- **4.** In case of a sensor harness with M12 connectors, connect the M12 connectors of the different pressure sensor harness branches to the corresponding pressure sensors (J004) in ports M1, M2 and/or M4. Use the Phoenix Contact torque screwdriver and tool to torque with the preset torque setting specified in *Fasteners and torque*.

In case of a sensor harness with DEUTSCH connectors, connect the DEUTSCH connectors of the different pressure sensor harness branches to the corresponding pressure sensors (J004) in ports M1, M2 and/or M4. Clicks should be heard if properly inserted.

5. If the multi-outlet pump has an M1 pressure sensor, fasten a cable tie (J007) under the M2 port to secure the M1 pressure sensor branch against the coil harness "A" bundle.



- **6.** If the multi-outlet pump has an M2 pressure sensor, fasten a cable tie approximately 50 mm from the main anchor which wraps around the coil harness "A" bundle, the M2 pressure sensor branch and the M1 pressure sensor branch (if present).
- 7. If the multi-outlet pump has an M4 pressure sensor, fasten a cable tie (J007) above pumplet 3 (next to the indication "3" on the housing) to secure the M4 pressure sensor branch to the coil harness "B." Also, fasten a cable tie (J007) next to the anchoring tie of coil harness "B" (between pumplets 3 and 4) to secure the M4 pressure sensor branch to the coil harness "B".
- **8.** Secure the sensor harness with a cable tie (J007) at the main anchor together with the coil harness "A" (J001) and coil harness "B" (J002). Note that the three 12-pin DEUTSCH connectors should be at the same distance (approximately 220 mm) from the main anchor of the pump.
- **9.** On the pump-to-controller harness end, connect the green DEUTSCH connector of the sensor harness.



Torque chart

DDP096 fasteners and torque

Item	Description	Fastener	ΤοοΙ	Min Torque N•m [ft•lbf]	Max Torque N•m [ft•lbf]
J004	Pressure sensor (M12 connector)	-	22 mm external hex	40 [29.50]	44 [32.45]
J004	Pressure sensor (DEUTSCH connector)	-	22 mm oxygen sensor socket with 22 mm cutout	40 [29.50]	44 [32.45]
J010	Speed and temperature sensor (M12 connector)	-	19 mm external hex (deep)	31.5 [23.23]	38.5 [28.39]
J010	Speed and temperature sensor (DEUTSCH connector)	-	Special tool - contact your Danfoss representative	31.5 [23.23]	38.5 [28.39]
J003	Sensor harness M12 connector (for speed and temperature sensor or pressure sensor)	-	Phoenix Contact tools: - part number 1208445 - part number 1208429	0.36 [0.27]	0.44 [0.32]
800L	Anchoring tie screw for wiring harness	M5x12, 10.9 with nylon patch	3 mm internal hex	1.8 [1.33]	2.2 [1.62]
K700	Coil screw	M5x12, 10.9 with nylon patch	3 mm internal hex	3.2 [2.36]	3.8 [2.80]
E110	Lifting bracket screw	M12x16	10 mm internal hex	94.5 [69]	115.5 [85]
J006	Main anchor screw	M5x16, flange head with dry Loctite	3 mm internal hex	2.9 [2.1]	3.5 [2.6]





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