ENGINEERING
TOMORROW

Service Manual

Axial Piston Closed Circuit Pumps
Series 42

www.danfoss.com

Revision history

Table of revisions

Date	Changed	Rev
July 2020	Changed document number from '520L0638' to 'AX152886481696'	0501
December 2018	Corrected technical data	0401
July 2015	Danfoss layout	0300
Nov 2010	new back page	CB
Dec 2009	Major update	CA
Jul 2007	Major update	BA

Contents

Contents

Introduction

Hydrostatics Servicing Overview

This manual includes information on installation, maintenance, and minor repair of the . It includes a description of the unit and its individual components, troubleshooting information, and minor repair procedures.

Performing minor repairs may require the unit to be removed from the vehicle/machine. Thoroughly clean the unit before beginning maintenance or repair activities. Since dirt and contamination are the greatest enemies of any type of hydraulic equipment, follow cleanliness requirements strictly. This is especially important when changing the system filter and when removing hoses or plumbing.

A worldwide network of Danfoss Global Service Partners is available for major repairs. Danfoss trains and certifies Global Service Partners on a regular basis. You can locate your nearest Global Service Partner using the distributor locator at *http://www.danfoss.com*.

For detailed technical information about the , please see the relevant technical information document.

Attention

Major repairs requiring the removal of a unit's center section, servo sleeves, or front flange voids the warranty unless a Danfoss Authorized Service Center performs them.

General instructions

Follow these general procedures when repairing this product.

Remove the unit

If necessary, remove the unit from the vehicle/machine. Chock the wheels on the vehicle or lock the mechanism to inhibit movement. Be aware that hydraulic fluid may be under high pressure and/or hot. Inspect the outside of the pump and fittings for damage. Cap hoses after removal to prevent contamination.

Keep it clean

Cleanliness is a primary means of assuring satisfactory pump life, on either new or repaired units. Clean the outside of the pump thoroughly before disassembly. Take care to avoid contamination of the system ports. Cleaning parts by using a clean solvent wash and air drying is usually adequate.

As with any precision equipment, keep all parts free of foreign materials and chemicals. Protect all exposed sealing surfaces and open cavities from damage and foreign material. If left unattended, cover the pump with a protective layer of plastic.

Replace all O-rings and gaskets

Danfoss recommends that you replace all O-rings, seals and gaskets. Lightly lubricate all O-rings with clean petroleum jelly prior to assembly.

Secure the unit

For repair, place the unit in a stable position with the shaft pointing downward. It will be necessary to secure the pump while removing and torquing end covers, controls, and valves.

Introduction

Safety Precautions

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

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 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.
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. Use caution when dealing with hydraulic fluid under pressure. 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

Symbols used in Danfoss literature


WARNING may result in injury


CAUTION may result in damage to product or property


Reusable part


Non-reusable part, use a new part


Non-removable item


Option - either part may exist


Superseded - parts are not interchangeable


Measurement required


Flatness specification


Parallelism specification


External hex head


Internal hex head


Torx head


O-ring boss port


Tip, helpful suggestion


Lubricate with hydraulic fluid


Apply grease / petroleum jelly


Apply locking compound


Inspect for wear or damage


Clean area or part


Be careful not to scratch or damage


Note correct orientation


Mark orientation for reinstallation


Torque specification


Press in - press fit


Pull out with tool – press fit


Cover splines with installation sleeve


Pressure measurement/gauge location or specification

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

Description of change

Housing

The port cover for the control spool (FOB option - 28 cm3 only) changed from a flat plate with two screws to an SAE O-ring boss plug. The screw holes for the servo covers and four of the six screw holes for the side cover are deeper to accept a 10 mm longer screw. The two holes next to the charge pump cover stayed the same length.

Charge pump

The gerotor drive pin changed to a parallel key. A retaining ring was added to the charge pump shaft to locate the gerotor. The outer step on the gerotor cover was eliminated and the locating pin slot depth increased.

Auxiliary flange shipping cover

The cover changed to a flat cover plate with a special seal ring (not to be used to seal an auxiliary pump) under the cover (A pad only).

Charge relief valve

The relief valve changed from a non-adjustable to an adjustable relief valve. This change requires a 1998 upgrade housing.

Spool - loop flushing

Introduction

The spool changed to become common between the 28 and 41/51 cm3 pumps. This change requires a 1998 upgrade housing.

Functional Description

Overview

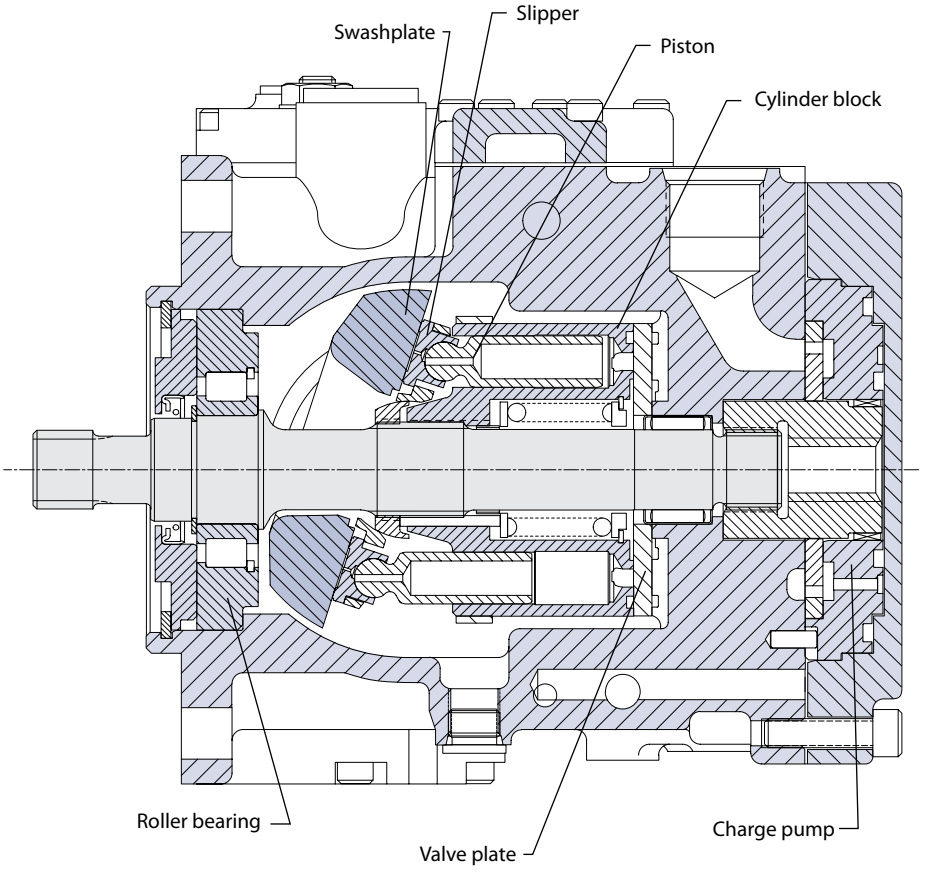
This section describes the operation of pumps and their serviceable features. It is a useful reference for readers unfamiliar with the function of this specific pump.

General description and cross-sectional view

The Series 42 pumps are servo controlled, axial piston pumps designed for closed circuit applications. The input shaft turns the pump cylinder block containing nine reciprocating pistons that are held to the swashplate with a block spring. Each piston has a brass slipper connected to one end by a ball joint. The reciprocating movement occurs as the slippers slide along the inclined swashplate during rotation. As each piston cycles in and out of its bore, fluid is drawn from the inlet and displaced to the outlet thereby imparting hydraulic power to the system. Via the valve plate, one half of the cylinder block is connected to low pressure and the other to high pressure. Clearances allow a small amount of fluid to flow from the cylinder block/valve plate and slipper/swashplate interfaces for lubrication and cooling. Case drain ports return this fluid to the reservoir.

The angle of the swashplate controls the volume of fluid displaced into the system. The servo piston forces the swashplate into an inclined position (into stroke). Internal moments and centering springs within the servo piston return the swashplate to the neutral position (out of stroke).

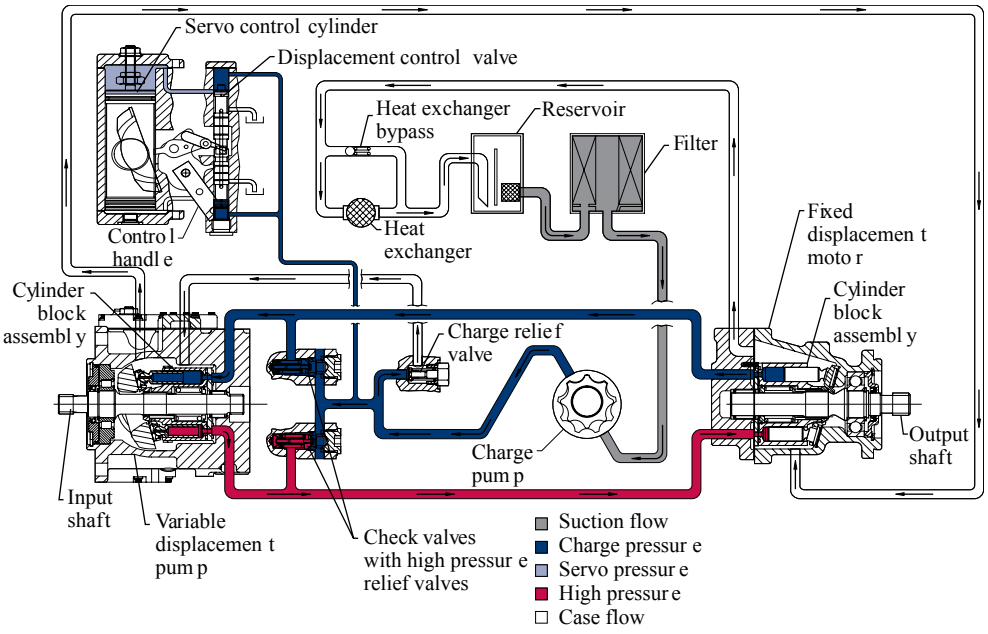
Cross section



Functional Description

The system circuit

System circuit diagram



Closed circuit operation

Hydraulic lines connect the main ports of the pump to the main ports of the motor. Fluid flows in either direction from the pump to the motor and back. Either of the hydraulic lines can be under high pressure. The position of pump swashplate determines which line is high pressure as well as the direction of flow.

Case drain and heat exchanger

Both the pump and motor must drain fluid. A case drain line achieves this. The line connects to the pump or motor at the top-most drain port in order to maintain an adequate fluid level in the components. Fluid cooling demands may require a heat exchanger with a bypass valve to cool the case drain fluid before it returns to the reservoir.

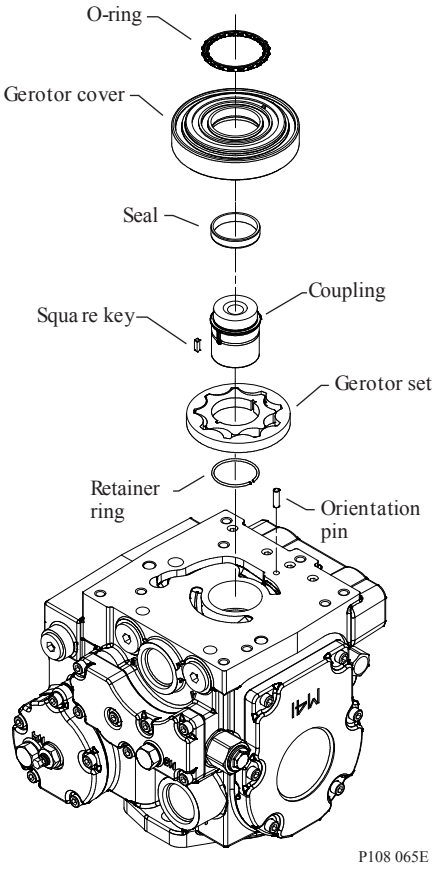
Pump features

Charge pump

The charge pump is necessary to supply fluid to maintain positive pressure in the system loop, to provide pressure to operate the control system, and to make up for internal leakage and loop flushing flow. To prevent damage to the transmission, the pump must maintain the specified charge pressure under all conditions of operation.

Functional Description

Charge pump



The charge pump is a fixed-displacement, gerotor type pump. The main pump drives the charge pump off the main shaft. A spring and poppet style relief valve limits charge pressure.

The standard charge pump is satisfactory for most applications; however, other displacements are available. A gear pump, mounted to the auxiliary pad, may augment charge flow if additional volume is required.

Charge relief valve

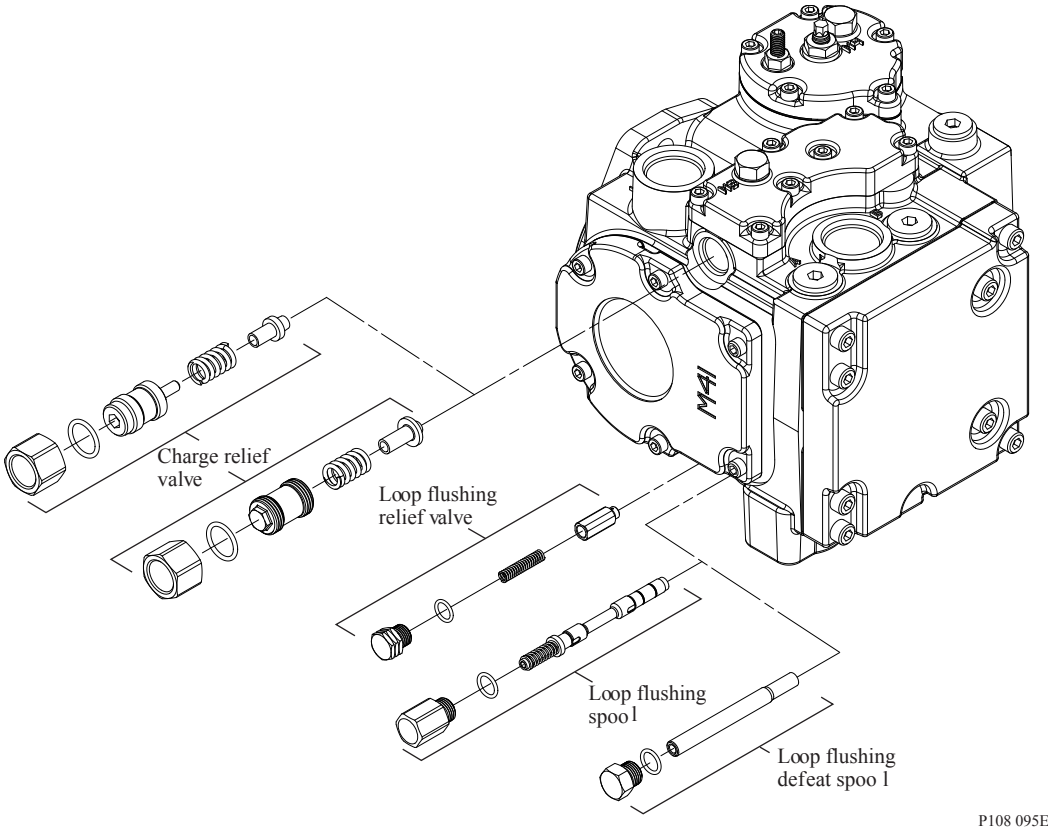
The charge relief valve maintains charge pressure at a designated level. The charge relief valve is a direct acting poppet valve which opens and discharges fluid to the pump case when pressure reaches that level. It is nominally set with the pump running at 1800 rpm. In forward or reverse, charge pressure is slightly lower than when in neutral position. The model code of the pump specifies the charge relief valve setting.

Loop flushing valve

A loop flushing valve dumps flow from the low side of the main loop, removing heat and contaminants. Pumps equipped with an integral loop flushing valve also include a loop flushing relief valve. The loop flushing relief valve poppet includes an orifice that controls flushing flow under most conditions. A combination of orifice size and charge pressure relief setting produces a specific flushing flow.

Functional Description

Charge relief, loop flushing relief, and loop flushing valve



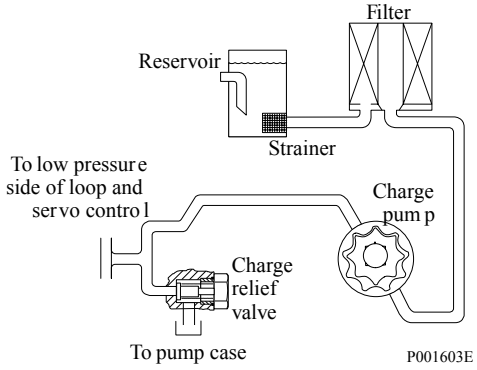
Filtration options

Series 42 pumps may be equipped with provisions for either suction or charge pressure filtration to filter the fluid entering the circuit.

Suction filtration

The suction filter is in the circuit between the reservoir and the inlet to the charge pump.

Suction filtration



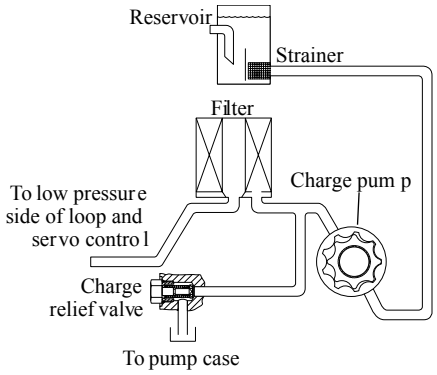
Charge pressure filtration

The pressure filter is remotely mounted in the circuit after the charge pump.

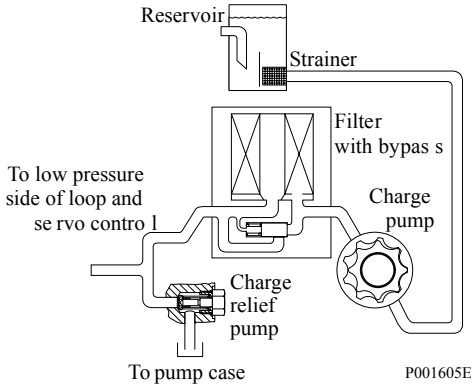
Functional Description

You may use partial or full flow pressure filtration circuits with Series 42 pumps. Without a filter adapter, suction filtration is the only option.

Partial flow pressure filtration

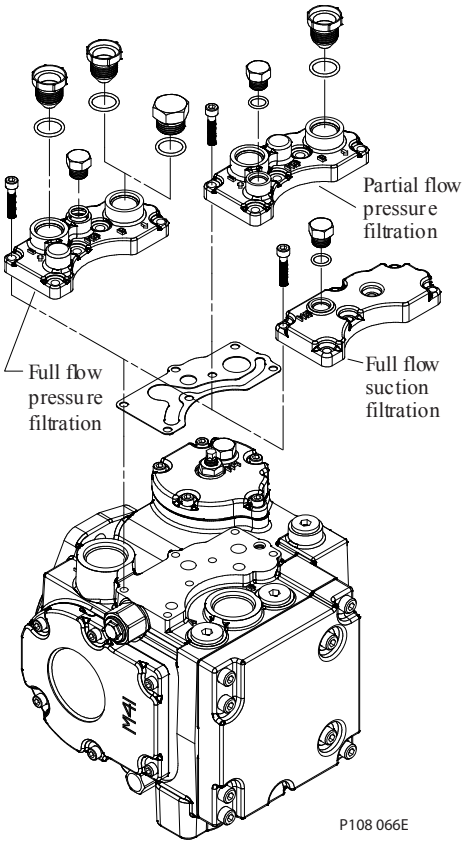


Full flow pressure filtration



Functional Description

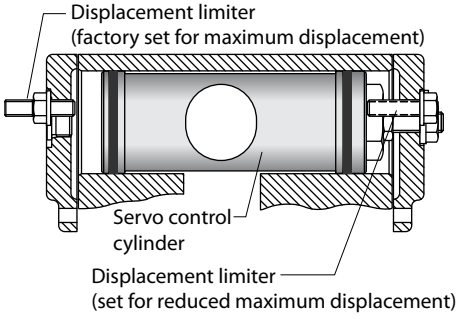
Filtration adapters



Displacement limiters

Series 42 pumps are available with mechanical displacement limiters in the servo covers. The displacement limiters can limit displacement of the pump to any value from maximum to zero in either direction.

Displacement limiters



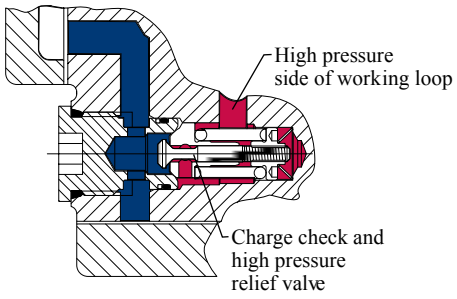
Charge check / high pressure relief valves

All series 42 pumps have a combination charge check/high pressure relief valve. The charge check function allows pressurized flow from the charge pump to enter the low pressure side of the loop. This flow is necessary to replenish fluid discharged to the pump/motor case for lubrication and cooling requirements. Since the pump can operate in either direction, it uses two charge check valves to direct the charge supply into the low pressure side.

Functional Description

High pressure relief valves are available in a range of settings as shown in the model code. The model code may specify individual pressure settings. The high pressure relief valve settings are referenced to charge pressure and are set at 3.8 l/min [1 US gal/min] of flow.

High pressure relief valve



Bypass valves

Optional bypass plungers are available for use when it is necessary to move the vehicle or mechanical function and the prime mover is not running.

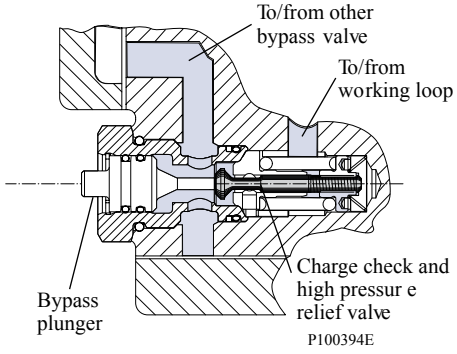
Together, these valves connect both sides of the main hydraulic circuit, allowing fluid to circulate without rotating the pump and prime mover.

The bypass function is integral to the charge check/high pressure relief valve assembly. Depressing the plunger in the plug of the valve assembly opens the valve. The valve remains open until the prime mover restarts or pressure builds in the system and causes the valve the close. You must depress the plungers in both of the check/relief valve assemblies for proper bypass operation.

Caution

Bypass valves are for moving a machine or vehicle for very short distances at very slow speeds. They are not tow valves. If pressure builds within the system, the valves may close causing damage to the pump and motor or prime mover. Move the vehicle/machine at no more than 20% of top speed for no more than three minutes.

Charge check and high pressure relief valves with bypass

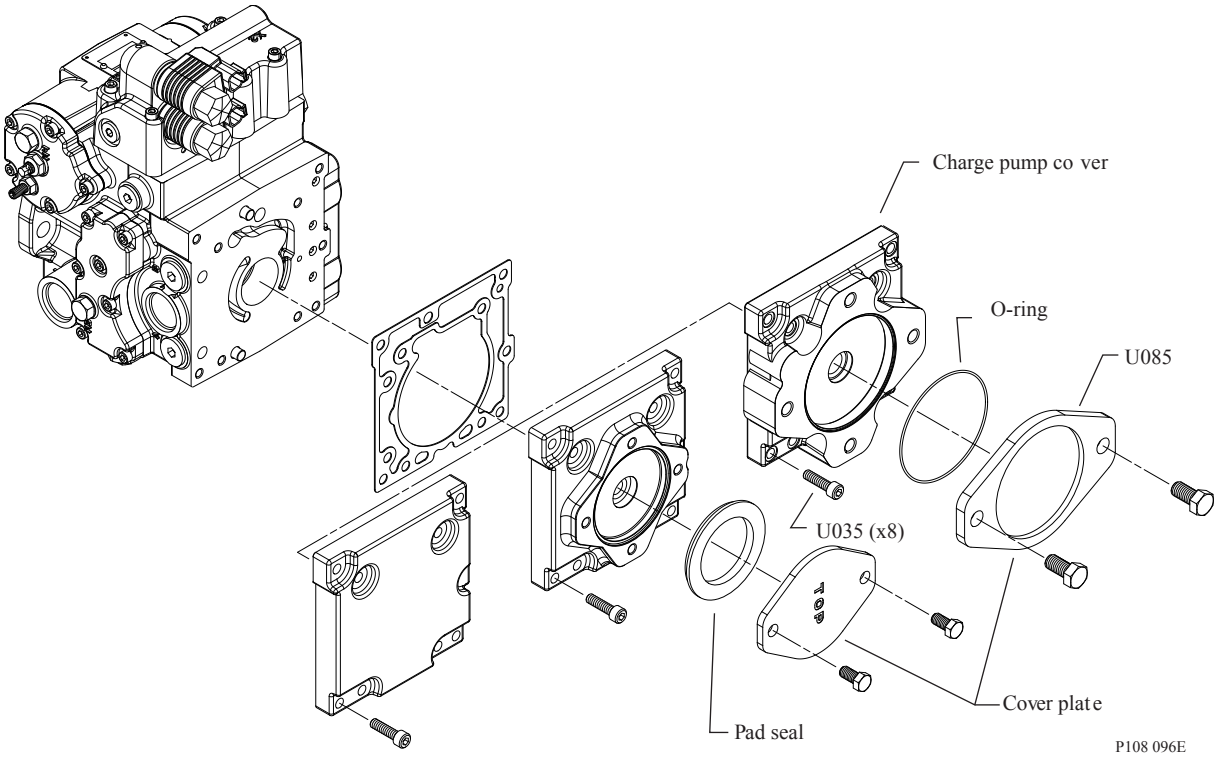


Auxiliary mounting pads

SAE A and SAE B auxiliary mounting flanges are available on all Series 42 pumps and are integral to the charge pump cover. This flange allows mounting of auxiliary hydraulic pumps and mounting of additional Series 42 pumps to make tandem pumps. The pads allow full through-torque capability.

Functional Description

Auxiliary mounting pads

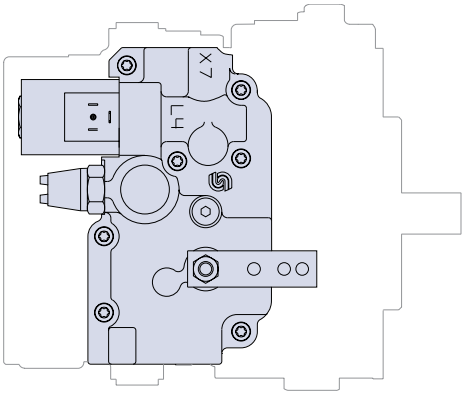


Control Options

Manual displacement control (MDC)

The Manual Displacement Control (MDC) uses a mechanical input to operate the control spool in the pump. A cam connects the input handle to the control spool allowing manipulation of the operating curve using different cam profiles. The control spool modulates the pressure balance across the pump's servo piston. The angle of the swashplate is proportional to the angular position of the control input. A mechanical feedback linkage moves the control spool toward neutral as the swashplate angle reaches the commanded position. Mechanical feedback allows the pump to hold very accurately at the commanded displacement. Centering springs and internal moments return the swashplate to neutral position in the absence of control input.

MDC on series 42 pump



Solenoid override valve

A solenoid override valve is available for the manual displacement control. This safety feature shunts the servo piston allowing the pump to return to neutral when activated. Normally open or normally closed options are available.

Neutral start switch (NSS) for MDC

The neutral start switch is an optional feature available with the MDC. When connected properly with the vehicle's electrical system, the neutral start switch ensures that the prime mover can start only when the control is in neutral position.

Back-up alarm switch (BAS)

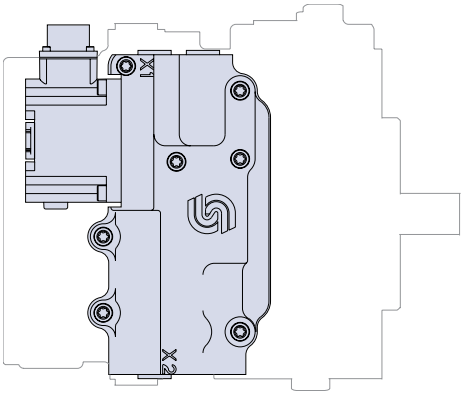
The Back-up Alarm Switch (BAS) is available for the MDC and works in association with the NSS. When connected properly to the vehicle's electrical system, the BAS can sound an alarm when the control commands the vehicle into reverse. One cam and switch assembly controls both functions. Repositioning the cam accommodates both clockwise and counterclockwise control handle rotation to reverse direction.

Electrical displacement control (EDC)

The Electrical Displacement Control (EDC) is a two-stage control using a DC input current to control pump displacement. Stage one, the Pressure Control Pilot (PCP) valve, uses the DC input to operate a torque motor which drives a flapper valve. The flap in the PCP blocks a portion of flow from one or the other of two nozzles. The two nozzles modulate pressure balance across a sensing piston in the control. The control piston is connected to the control spool in the pump by a pin and linkage. The control spool modulates the differential pressure across the pump's servo piston, this is stage two. The angle of the swashplate is proportional to the input current. A mechanical feedback linkage moves the control spool toward neutral as the swashplate angle reaches the commanded position. Mechanical feedback allows the pump to hold very accurately at the commanded displacement. Centering springs and internal moments return the swashplate to neutral position in the absence of control input.

Control Options

EDC on series 42 pump



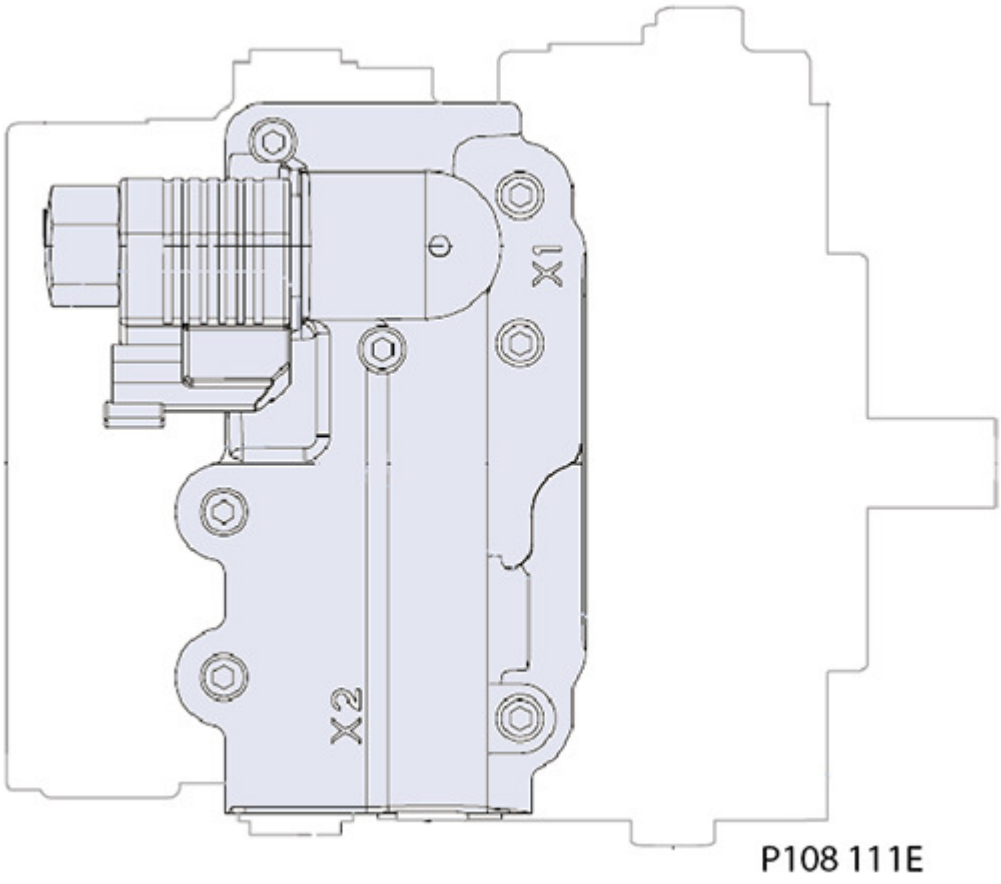
High current electrical displacement control (HC-EDC)

The High Current Electrical Displacement Control (HC-EDC) is a two-stage control using a DC input current with Pulse With Modulation (PWM) to control pump displacement. Stage one uses two Proportional Pressure Reducing Valves (PPRV), to provide reducing pressure proportional to the input current. The pressure from each PPRV is provided to each end of the sensing piston in the control: this is stage one. The sensing piston is connected to the control spool in the pump by a pin and linkage. The control spool modulates the differential pressure across the pump's servo piston, this is stage two. The angle of the swashplate is proportional to the input current.

A mechanical feedback linkage moves the control spool toward neutral as the swashplate angle reaches the commanded position. Mechanical feedback allows the pump to hold very accurately at the commanded displacement. Centering springs and internal moments return the swashplate to neutral position in the absence of control input.

Control Options

HC-EDC on series 42 pump



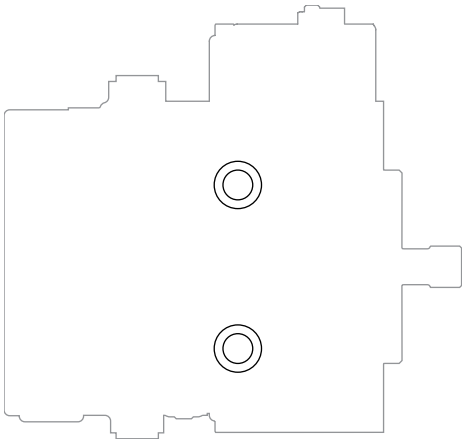
Non-feedback proportional hydraulic (NFPH) control

The Non-Feedback Proportional Hydraulic (NFPH) control is a hydraulic displacement control. External valving supplies an input pressure directly to the pump servo piston via control ports X1 and X2 to control pump displacement.

Pump displacement is proportional to the pressure difference across the servo piston. However, because this control does not use mechanical feedback, displacement also depends upon input speed and system pressure. This characteristic provides a power limiting function by reducing displacement as system pressure increases.

Control Options

NFPH control on series 42 pump

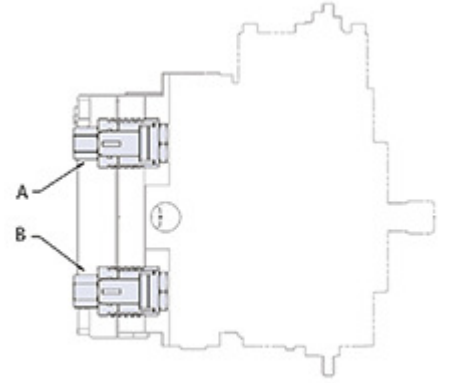


Non-feedback proportional electric (NFPE) control

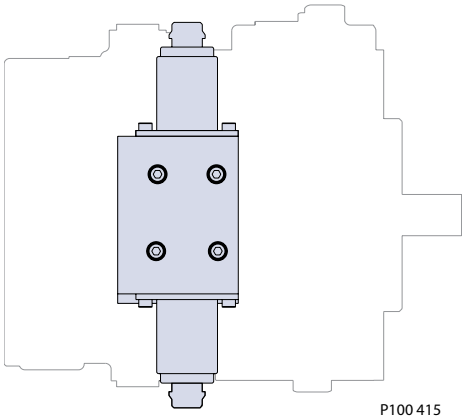
The Non-Feedback Proportional Electric (NFPE) control is an electric control. A PWM input signal to one of two solenoids on the control valve ports charge pressure to one side of the servo piston.

Pump displacement is proportional to the signal current. However, because this control does not use mechanical feedback, displacement also depends on input speed and system pressure. This characteristic provides a power limiting function by reducing displacement as system pressure increases.

NFPE control on series 42 pump (28/32cc)



NFPE control on series 42 pump (41/51cc)



Control Options

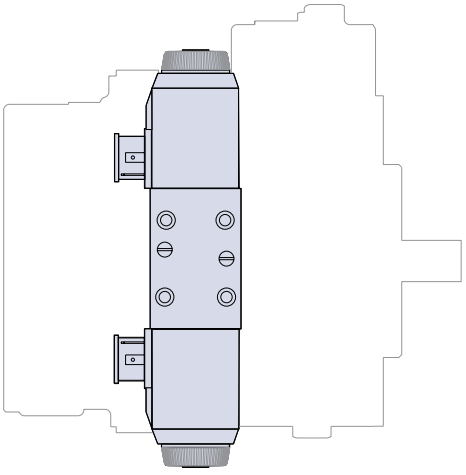
Forward-Neutral-Reverse (FNR) three-position electric control

The Forward-Neutral-Reverse (FNR) is a three-position control. It uses a 12 or 24 Vdc electrically operated spool valve to port pressure to either side of the servo piston. Energizing one of the two solenoids will cause the pump to go to its maximum displacement in the corresponding direction. The FNR control does not use mechanical feedback.

All functions of the three position (FNR) electric control are preset at the factory.

FNR control on series 42 pump (28/32cc)

FNR control on series 42 pump (41/51cc)



Technical Specifications

Specifications

General specifications

Product line	Series 42 pumps
Pump type	In-line, axial piston, positive displacement variable pumps including cradle swashplate and servo control
Direction of input rotation	Clockwise or counterclockwise available
Installation position	Pump installation recommended with the control at the top or side. Consult Danfoss for non-conformance guidelines. Housing must always be filled with hydraulic fluid.
Filtration configuration	Suction or charge pressure filtration
Other system requirements	Independent braking system, suitable reservoir and heat exchanger.

Hardware specifications

Model	**28**	**32**	**41**	**51**
Pump configuration	Single pump	Single pump	Single pump	Single pump
Displacement cm^3/rev [in^3/rev]	28 [1.71]	31.8 [1.94]	40.9 [2.50]	51 [3.11]
Mass kg [lbm]	34.5 [76]	34.5 [76]	42 [92]	42 [92]

Case pressure

Rated pressure bar [psi]	3 [44]
Maximum pressure (cold start) bar [psi]	5 [73]

Speed limits

Frame size cm^3	**28**	**32**	**41**	**51**
Minimum speed min^{-1} (rpm)	500	500	500	500
Rated speed at maximum displacement min^{-1} (rpm)	3400	3000	3200	2900
Maximum speed at maximum displacement min^{-1} (rpm)	3750	3400	3450	3400

System pressure

Frame size cm^3	**28**	**32**	**41**	**51**
Rated pressure bar [psi]	385 [5584]	385 [5584]	385 [5584]	350 [5076]
Maximum pressure bar [psi]	450 [6525]	400 [5800]	450 [6525]	400 [5800]

Theoretical flow

Frame size cm^3	**28**	**32**	**41**	**51**
Theoretical flow at rated speed l/min [US gal/min]	95.2 [25.1]	95.4 [25.2]	131 [34.6]	148 [39.1]

Inlet pressure

Rated pressure (absolute) bar [in Hg vacuum]	0.8 [6]
Minimum pressure (absolute) (cold start) bar [in Hg vacuum]	0.2 [24]

Pressure Measurement

Required tools

You can perform the service procedures in this manual using common mechanic's hand-tools. Calibrate gauges frequently to ensure accuracy. Use snubbers to protect pressure gauges.

Port locations and pressure gauge installation

A pump with a manual displacement control (MDC) and no filtration adapter is shown. With non-feedback controls, the positions of the case drains may vary. With a filtration adapter, the porting in the filtration options area varies.

Ports and pressure gauges

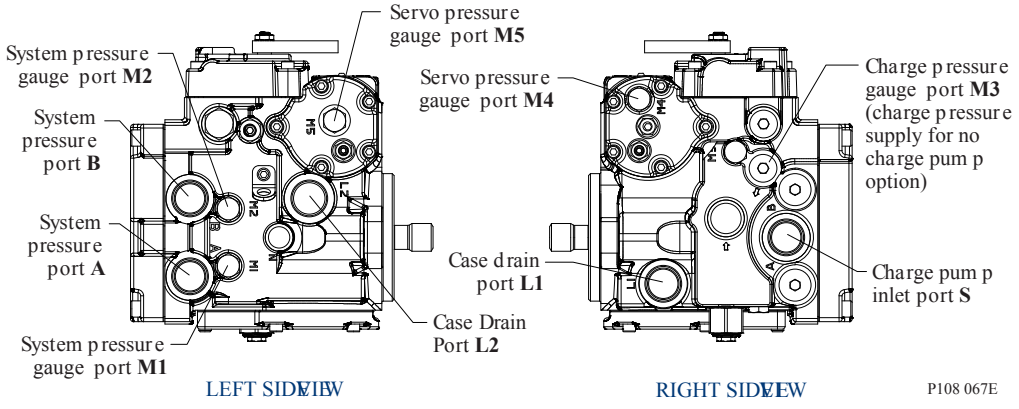
Proper service and diagnosis may require pressure measurement at various points in the hydraulic circuit. The Series 42 pump has several locations at which to take these measurements. The following illustration shows the locations of the various gauge ports. The table shows the recommended gauge size and the fitting size for each port. Refer to this information when installing pressure gauges.

Gauge ports

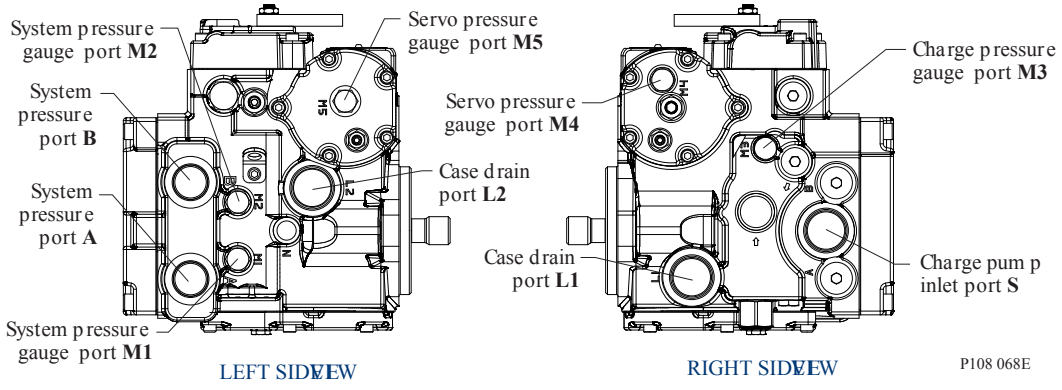
Gauge port	Pressure measured	Recommended gauge size	O-ring boss	
			28/32 cc	41 / 51 cc
M1 & M2	System pressure for ports A and B	600 bar [8700 psi]	9/16/-18	9/16/-18
M3	Charge pressure	60 bar [870 psi]	3/4-16 *	3/4-16 *
M4 & M5	Servo pressure	60 bar [870 psi]	9/16-18	9/16-18
L1 & L2	Case pressure	35 bar [510 psi]	1-1/16-12	1-5/16-12
S	Charge pump inlet pressure	1 bar [30 in Hg vacuum]	1-1/16-12	1-5/16-12

* Some older models may use a 9/16-18 O-ring fitting.

28/32 cm³ base unit with MDC and no filtration adapter

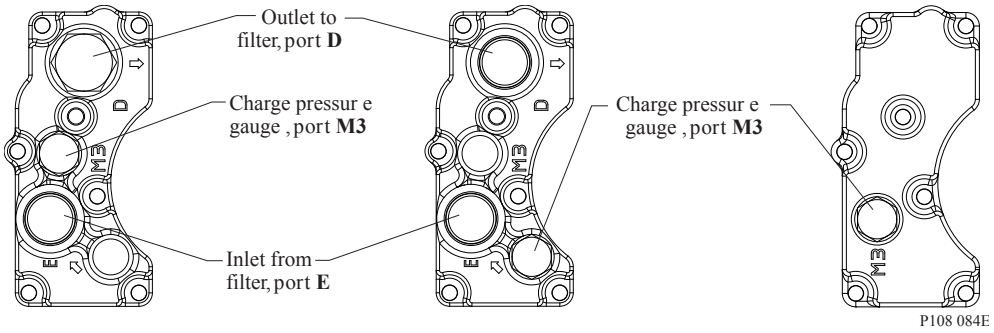


41/51 cm³ base unit with MDC and no filtration adapter



Pressure Measurement

Filtration adapters (28/32 cm³, and 41/51 cm³ models)



Initial Start-Up Procedure

General

Follow this procedure when starting-up a new Series 42 installation or when restarting an installation in which the pump has been removed.

Warning

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

Prior to installing the pump, inspect for damage incurred during shipping. Make certain all system components (reservoir, hoses, valves, fittings, heat exchanger, etc.) are clean prior to filling with fluid.

Start-up procedure

1. Connect the pump to the prime mover. Ensure that pump shaft is properly aligned with the shaft of the prime mover.

   Caution

   Incorrect shaft alignment may result in damage to drive shaft, bearings, or seal which can cause external oil leakage.

2. Fill the reservoir with recommended hydraulic fluid. Always filter fluid through a 10 micron absolute filter pouring into the reservoir. Never reuse hydraulic fluid.
3. Fill the main pump housing with clean hydraulic fluid. Pour filtered oil directly into the upper most case drain port.
4. Fill the inlet line leading from the pump to the reservoir. Check the inlet line for properly tightened fittings and be certain it is free of restrictions and air leaks.
5. To ensure the pump stays filled with oil, install the case drain line in the upper most case drain port.
6. Install a gauge at port M2 to monitor system pressure during start up.

   Follow recommendations in the vehicle/machine operator's manual for prime mover start up procedures.

7. While watching the pressure gauge at M2, jog the prime mover or run at the lowest possible speed until system pressure builds to normal levels (minimum 11 bar [160 psi]). Once system pressure is established, increase to full operating speed. If the pump does not maintain system pressure, shut down the prime mover, determine cause, and take corrective action. Refer to *Troubleshooting*.
8. Operate the hydraulic system for at least fifteen minutes under light load conditions.
9. Check and adjust control settings as necessary after installation. Refer to *Adjustments*.
10. Shut down the prime mover and remove the pressure gauge. Replace plug at port M2.
11. Check the fluid level in the reservoir; add clean filtered fluid if necessary.

The pump is now ready for operation.

Fluid and Filter Maintenance

Recommendations

To ensure optimum life of Series 42 products, 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 these intervals:

Fluid and filter change intervals

Sealed reservoir	2000 hours
Breather reservoir	500 hours

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.

Troubleshooting

Overview

This section provides general steps to follow if you observe certain undesirable system conditions. Some of the items are system specific. Always observe the safety precautions listed in the introduction of this manual. If standard troubleshooting procedures do not remedy the problem, contact a Danfoss Global Service Partner.

System operating hot

Item	Description	Action
Oil level in reservoir	Insufficient hydraulic fluid will not meet the cooling demands of system.	Fill the reservoir to the proper level with clean hydraulic oil.
Heat exchanger (if equipped)	The heat exchanger is not sufficiently cooling the system.	Check the air flow and input air temperature for the heat exchanger. Clean, repair, or replace the heat exchanger as necessary.
Bypass valve	A partially activated bypass valve may result in heat generation within the system.	Verify that the bypass valve is fully closed and that the valve is seating properly. Repair or replace it as necessary.
SCR (System Check / Relief) Valves	A partially activated SCR valve or SCR valves with relief settings too low may result in heat generation within the system.	Verify that the SCR valve is seating properly and is at the correct relief setting. Repair or replace it as necessary.
Oil filters	Clogged oil filters may result in an insufficient supply of cool oil to the system.	Inspect the oil filters and verify that they are still operable. Replace them if necessary.
Machine load	Excessive loads or extreme duty cycles could result in the pump and/ or motor operating at speeds and pressures beyond system design limitations.	Verify that the machine is operating within the parameters for which it was designed. If necessary, reduce the load on the machine.

System response is sluggish

Item	Description	Action
Reservoir oil level	There is an insufficient amount of hydraulic fluid, resulting in an inadequate supply for the system loop.	Fill the reservoir to the proper level with clean hydraulic fluid.
Input control signal (linkage, current, or pressure)	The pump is receiving a faulty control signal: (MDC - binding or broken linkage; EDC - faulty or inadequate electrical signal; HDC - blocked or incorrectly orificed control lines).	Verify that the input signal is correct and identical in both directions.
Pump control	A damaged pump control or control spool will not correctly transmit the control input signal to the pump.	Verify that the pump's control is operating properly and that the control spool is not damaged or worn and moves freely within its bore. Clean, repair, or replace it as necessary.
Bypass valve	A partially activated bypass valve will cause cross port leakage.	Verify that the bypass valve is closed and that the valve is seating properly. Clean, repair, or replace it as necessary.
SCR (system check / relief) valves	One or both of the SCR valves may be binding within their bores.	Verify that the SCR valves operate freely. Repair or replace them as necessary.

Troubleshooting

Item	Description	Action
Charge pressure (in neutral)	The is low charge pressure resulting from a damaged charge pump or low charge pressure relief valve setting.	Inspect the charge pump for damage and verify the charge pressure relief valve setting. Repair or replace it as necessary.
Charge pressure (in stroke)	There is low charge pressure resulting from internal leakage within the system.	Repair or replace the component or components within the system causing the internal leakage.
Servo pressure	There is insufficient pressure differential across the servo piston.	Check servo pressures at port M4 and M5 to verify sufficient pressure delta. Verify that the servo supply and drain paths are unobstructed and that any orifices are of the correct size and free of debris. Clean, repair, or replace as necessary.
Charge pump	The charge pump has been damaged or installed with the incorrect rotational orientation.	Verify that the charge pump is in good working order and that it is correctly installed. Repair or replace it as necessary.

System will not operate in either direction

Item	Description	Action
Oil level in reservoir	There is insufficient hydraulic fluid to supply the system loop.	Fill the reservoir to the proper level with clean hydraulic oil.
Input control signal (linkage, current, or pressure)	The pump is receiving a faulty control signal: (MDC - binding or broken linkage; EDC - faulty or inadequate electrical signal; HDC - blocked or incorrectly orificed control lines).	Verify that the input signal is correct and identical in both directions. Adjust, clean, repair, or replace the input device as necessary.
Oil filters	Clogged oil filters may result in an insufficient supply of oil to the system.	Inspect the oil filters and verify that they are still serviceable. Replace them as necessary.
Bypass valve	A partially activated bypass valve may result in a cross port leakage.	Verify that the bypass valves are closed and that the valves are seating properly. Clean, repair, or replace them as necessary.
Charge pressure (in neutral)	Charge pressure may be insufficient to recharge the system loop.	Inspect the charge pump for damage and verify that the charge pressure relief valve is at the proper setting. Repair or replace it as necessary.
Charge pressure (in stroke)	There is low charge pressure resulting from internal leakage within the system.	Repair or replace the component or components within the system causing the internal leakage.
Servo pressure	There is an insufficient pressure differential across the servo piston.	Check servo pressures to verify sufficient pressure delta. Verify that the servo supply and drain paths are unobstructed and that any orifices are of the correct size and free of debris. Clean, repair, or replace them as necessary.
Charge pump	The charge pump is damaged or has been installed with the incorrect rotational orientation.	Verify that the charge pump is in good working order and that it is correctly installed. Repair or replace it as necessary.

Troubleshooting

Item	Description	Action
SCR (system check / relief) valves	The SCR valves are malfunctioning or improperly set.	Verify that the SCR valves are operating and properly set. Repair or replace them as necessary.
Displacement limiters	Displacement limiters may be improperly adjusted such that the servo piston is locked in place.	Verify that the displacement limiters are adjusted to the proper setting.

System will not operate in one direction

Item	Description	Action
Input control signal (linkage, current, or pressure)	The pump is receiving a faulty control signal: (MDC - binding or broken linkage; EDC - faulty or inadequate electrical signal; HDC - blocked or incorrectly orificed control lines).	Verify that the input signal is correct and identical in both directions. Adjust, clean, repair, or replace the control module as necessary.
SCR (System Check/Relief) valves	The SCR valves are malfunctioning or improperly set.	Verify that the SCR valves are operating properly. Repair or replace them as necessary.
Pump control	A damaged or biased pump control may be sending a signal commanding the pump to stroke only in one direction.	Verify that the pump's control is functioning properly. Repair or replace it as necessary.
Servo pressure	The drain or supply path to one side of the servo piston may be blocked.	Verify that the servo supply and drain paths are unobstructed and that any orifices are of the correct size and free of debris. Clean or repair them as necessary.
Displacement limiters (if equipped)	The displacement limiters may be improperly adjusted such that the servo piston is prevented from moving in one direction.	Verify that the displacement limiters are adjusted properly.

Neutral difficult or impossible to find

Item	Description	Action
Input control signal (linkage, current, or pressure)	The pump is receiving a faulty control signal: (MDC - binding or broken linkage; EDC - faulty or inadequate electrical signal; HDC - blocked or incorrectly orificed control lines).	Verify that the input signal is correct and identical in both directions. Adjust, clean, repair, or replace control module as necessary.
System pressure	With no input signal to the control, a pressure delta may exist between the two sides of the working loop.	Readjust pump neutral setting. Refer to adjustment procedure.
Servo pressure	With no input signal to the control, a pressure delta may exist across the servo piston.	Readjust the control neutral setting. Refer to adjustment procedure.
PCP pressure (EDCs only)	With no input signal to the control, a pressure difference may exist across the control spool.	Replace the EDC.

Adjustments

Overview

This section offers instruction on how to perform adjustments to the Series 42 pump. Read through the entire procedure before beginning any service activity.

Displacement limiter adjustment

Mount the pump on a test stand capable of measuring system flow from the A and B ports.

1. Loosen the displacement limiter seal lock nut (L025), but do not remove it.
2. Start the prime mover and place the pump into full stroke in one direction. Note the system output flow from either the A or B system port.
3. Adjust the displacement limiter adjustment screw (L020) until the desired output flow is reached. Turning the displacement limiter adjustment screw clockwise decreases the maximum output flow setting. Turning the displacement limiter adjustment screw counter clockwise increases the maximum output flow setting.

   Warning

   The seal nut lock nut must be retorqued after every adjustment and the limiter screw must have full thread engagement in the servo piston cover to prevent unexpected changes in operating conditions and to prevent external leakage during unit operation.

   The pump achieves overall maximum flow when the displacement limiter does not contact the servo piston while the unit is in full stroke.

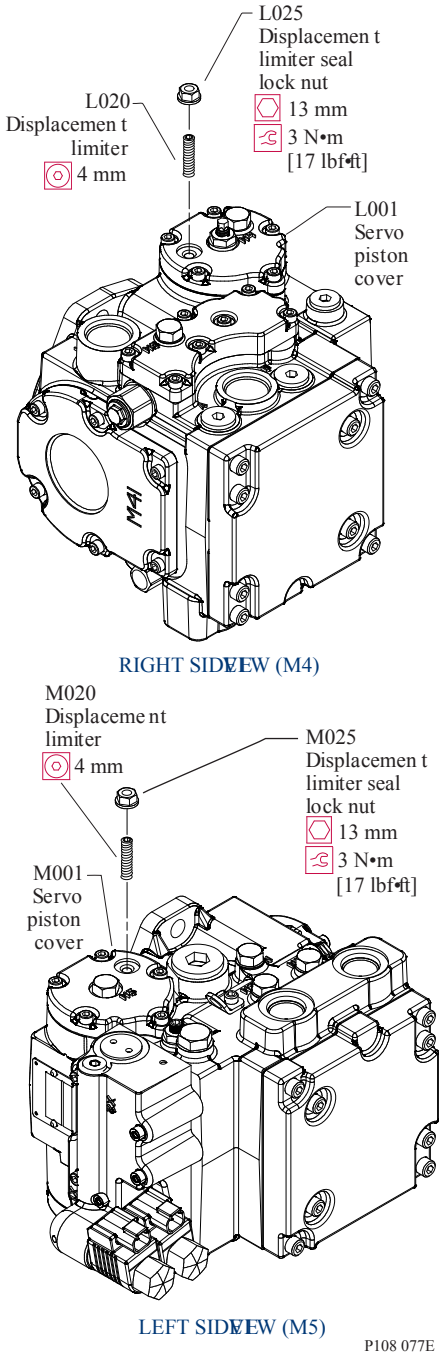
   One full turn of the displacement limiter adjustment screw results in approximate flow output changes per the table.
4. Once you achieve the proper output flow, torque the displacement limiter seal lock nut (L025) to 23 N•m [17 lbf•ft] while holding the position of the adjustment screw (L020).
5. If required, repeat this procedure using the opposite displacement limiter to set the output flow in the other direction.

Displacement limiter adjustment

Size	Displacement change per turn
28 cm^3	3.6 cm^3/rev [0.22 in^3/rev]
32 cm^3	4.1 cm^3/rev [0.25 in^3/rev]
41 cm^3	5.0 cm^3/rev [0.31 in^3/rev]
51 cm^3	6.2 cm^3/rev [0.38 in^3/rev]

Adjustments

Displacement limiters



Pump neutral adjustment

Zero output flow from the pump defines the neutral condition. To attain zero output flow, the pump must achieve both mechanical neutral and control neutral conditions. Mechanical neutral is the condition when the swashplate is at zero angle without any signal input from the control. Set mechanical neutral prior to setting control neutral.

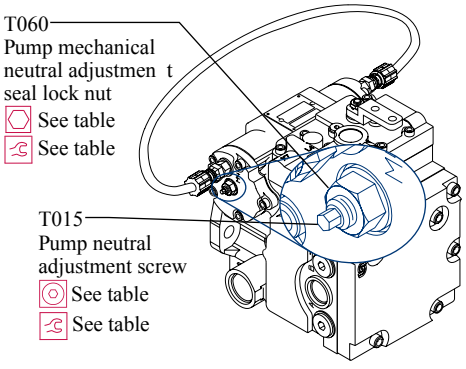
Warning

To prevent injury, disable the machine: raise wheels off the ground or disconnect the mechanism.

Adjustments

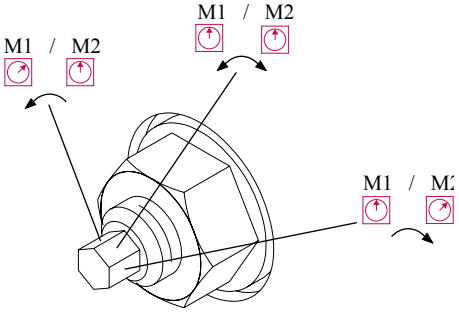
1. Disable the control input to the pump by equalizing the pressures on both ends of the pump servo piston. To accomplish this, connect an SAE 06 hose between servo gauge ports, M4 and M5.
2. Install pressure gauges in gauge ports M1 and M2 to measure system pressure.
3. Start the prime mover and run at normal operating speed.
4. Loosen the pump neutral adjustment seal lock nut (T060) in the center of the servo cover on the right side of the pump.
5. Turn the adjustment screw (T015) clockwise until one of the gauges registers an increase in system pressure. Mark the position of the adjustment screw. Turn the screw counterclockwise until the other gauge registers an increase in system pressure. Mark the position of the adjustment screw. Turn the adjustment screw clockwise to a position halfway between the marks. The system pressure gauges should indicate equal pressures.
6. While holding the adjustment screw in position, torque the seal lock nut (T060). Torque 28/32 cm^3 models with an MDC, EDC or an HC-EDC to 20-26 N•m [15-19 lbf•ft]. Torque all 41/51 cm^3 models and 28/32 cm^3 models with NFP controls to 40 N•m [30 lbf•ft].

   Pump neutral adjustment screw



7. Stop the prime mover and remove the hose between gauge ports M4 and M5. Remove the pressure gauges in gauge ports M1 and M2. Reinstall the plugs in the gauge ports.

   Neutral adjustment gauge port readings



8. Proceed to the control neutral adjustment section on the next page.

Frame size cm^3	**28/32**		**41/51**	
Control	**MDC/EDC/HC-EDC**	**NFP**	**MDC/EDC/HC-EDC**	**NFP**
Lock nut mm	13	17	17	17
Servo adjust screw mm [in]	5	7	7	7
Lock nut torque N•m [lbf•ft]	23 [17]	40 [30]	40 [30]	40 [30]

Control neutral adjustment for MDC and EDC/HC-EDC

Control neutral adjustment aligns the pump swashplate and the control spool so that a zero angle control setting provides a zero degree swashplate setting. Perform this adjustment whenever you adjust or move any part of the control or swashplate mechanism or after you adjust the pump neutral setting.

Adjustments

Warning

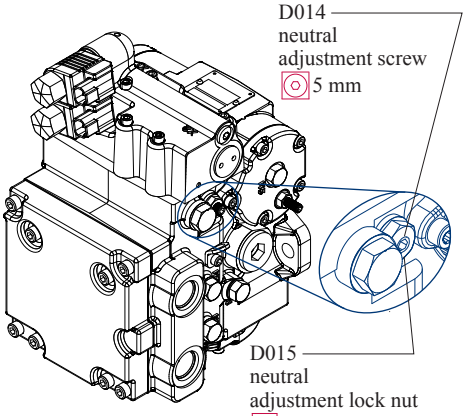
The following procedure requires the vehicle/machine to be disabled (wheels raised off the ground, work function disconnected, etc.) while performing the procedure in order to prevent injury to the technician and bystanders.

1. Disconnect the external control linkage (for MDC) or control signal input (for EDC and HC-EDC) from the pump.
2. Install pressure gauges in the servo gauge ports M4 and M5 to measure pressure on the pump servo piston.
3. Start the prime mover and run at normal operating speed.
4. Loosen the control neutral adjustment seal lock nut (D015).
5. Turn the adjustment screw (D014) clockwise until one of the gauges registers an increase in pressure on the servo piston. Mark the position of the adjustment screw.

   Turn the screw counterclockwise until the other gauge registers an increase in pressure on the servo piston. Mark the position of the adjustment screw.

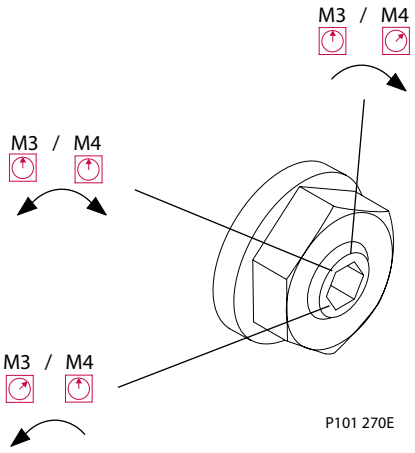
   Turn the adjustment screw clockwise so that it is midway between the marks. Adjustment screw movement produces constant change for both directions, so both the pressure gauges should indicate nearly equal pressures.
6. While holding the adjustment screw (D014) in position, torque the seal lock nut (D015) to 04 N•m [30 lbf•ft].
7. Stop the prime mover and remove the pressure gauges. Remove the plugs in the gauge ports.
8. Connect the external control linkage (for MDC) or control signal input (for EDC and HC-EDC) to the pump. Reconnect the work function.

Control neutral adjustment screw



Adjustments

Equalization of pressure gauges using pump neutral adjustment screw



Minor Repair

Standard procedures

Remove the pump

Prior to performing certain minor repairs on the Series 42 pump, it may be necessary to remove the pump from the machine. Chock the vehicle to prohibit movement. Be aware that hydraulic fluid may be under high pressure and may be hot. Inspect the outside of the pump and fittings for damage.

Keep it clean

Cleanliness is a primary means of assuring satisfactory pump life, on either new or repaired units. Clean the outside of the pump thoroughly before disassembly. Take care to avoid contamination of the system ports. Clean parts using a clean solvent wash and air dry.

As with any precision equipment, keep all parts free of foreign materials and chemicals. Protect all exposed sealing surfaces and open cavities from damage and foreign material. If left unattended, cover the pump with a protective layer of plastic.

Inspect for system contamination

Inspect the pump for system contamination. If you find contamination, fully disassemble, clean, and inspect all components of the pump using **11007277** *Series 42 Axial Piston Closed Circuit Pumps Repair Manual* in conjunction with this manual.

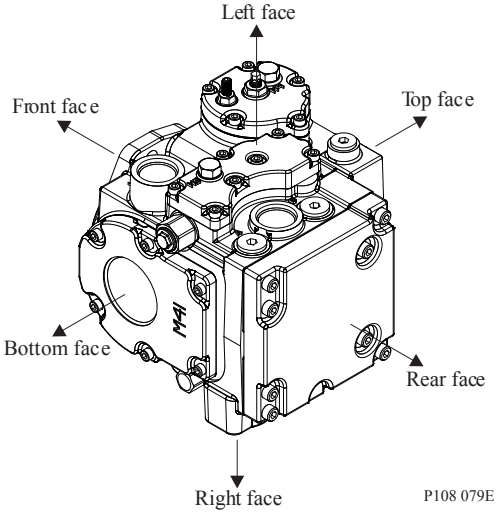
Replace the O-rings and gaskets

Danfoss recommends you replace all O-rings and gaskets. Lightly lubricate O-rings with clean petroleum jelly prior to assembly.

Lubricate all moving parts

During reassembly, coat all moving parts with a film of clean hydraulic oil. This will help to lubricate these parts during start-up. For fluid quality requirements, refer to bulletin BC152886484524 Hydraulic Fluids and Lubricants, Technical Information.

Pump face orientations



Size and torque for plugs and fittings

Plug and fitting sizes appear here. Replace O-rings and lubricate with petroleum jelly whenever a plug is removed. Torque each as indicated.

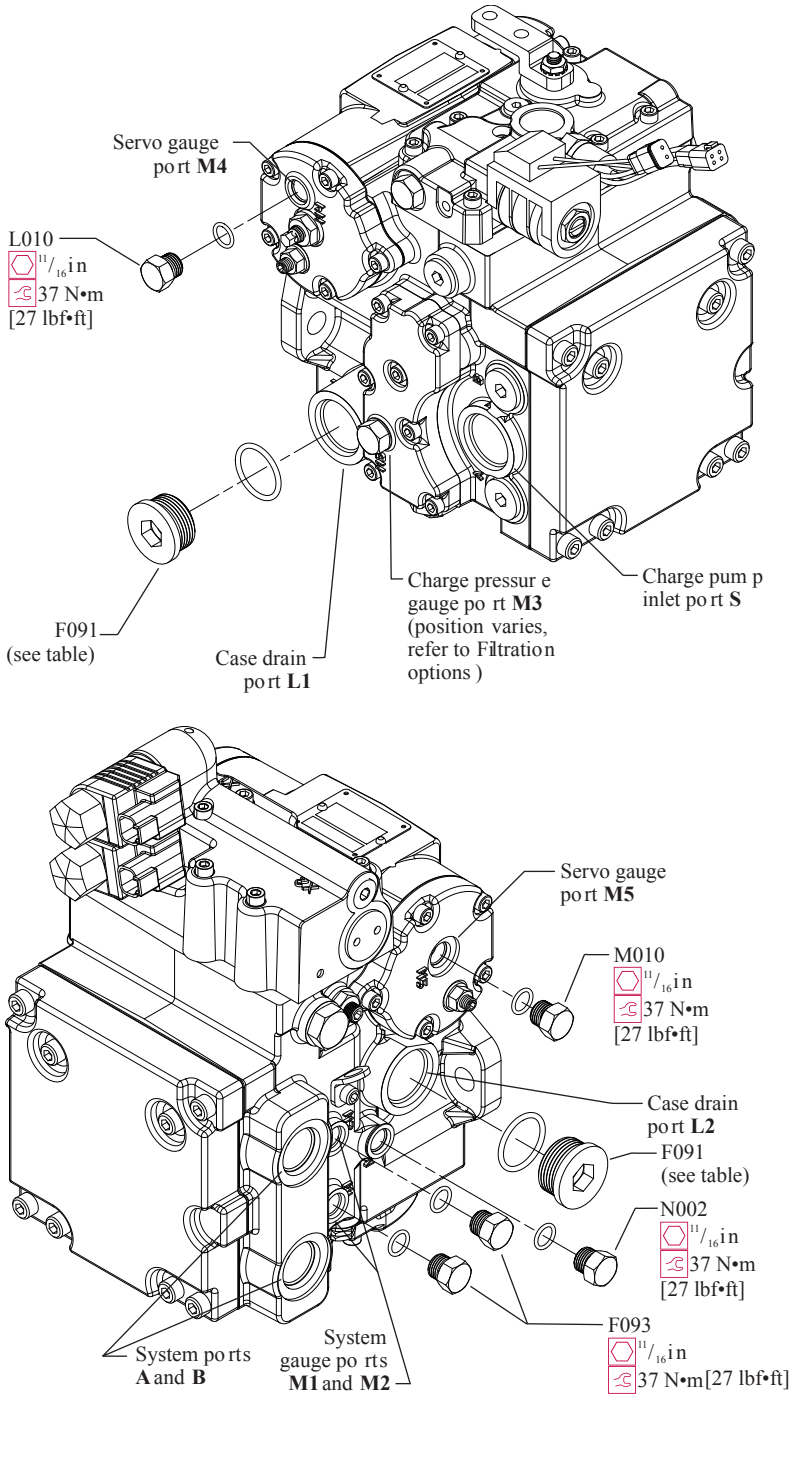
Minor Repair

Case drain plug

F091	28/32 cm³	41/51 cm³
Internal hex	9/16 in	5/8 in
Torque	120 N•m [89 lbf•ft]	200 N•m [150 lbf•ft]

Minor Repair

Size and torque for plugs and fittings



P108 097E

Charge relief valve

You may remove the charge relief valve for cleaning and installation of new O-rings. You may change the pressure setting, however, note that the setting will vary for different charge flows depending on charge pump size and pump speed. The factory setting is set relative to a specific charge flow at 120°F and 1800 min^{-1} (rpm) input speed. The actual charge pressure varies at different speeds.

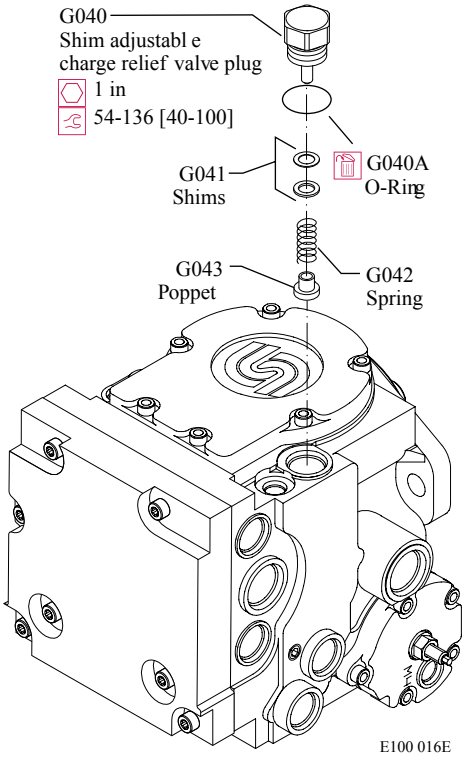
Minor Repair

Shim adjustable style (pre-blockpoint change)

On units manufactured prior to the 1998 block point change, you adjust the charge pressure relief valve by changing the number or size of shims located behind the charge pressure relief valve spring.

1. Remove the shim adjustable charge relief valve plug (G040) from the pump housing. Remove and discard the O-ring (G040A) from the plug.

   Adjustable charge relief valve components



2. Remove shims (G041), spring (G042), and poppet (G043) from housing.
3. Inspect the poppet and mating seat in the housing for damage or foreign material.
4. Install a new O-ring (G040A) on the charge relief valve plug (G040). Reinstall the poppet (G043), spring (G042), and shims (G041), into the pump housing. To confirm the charge relief valve setting, measure the charge pressure at port M3. The charge pressure levels off when it reaches the relief setting.

   Pressure change per shim

Approximate pressure change	Shim thickness
4 bar [58 psi]	1.25 mm [.050 in]

5. Install plug (G040). Torque to 54-136 Nm (40-100 lbf•ft).

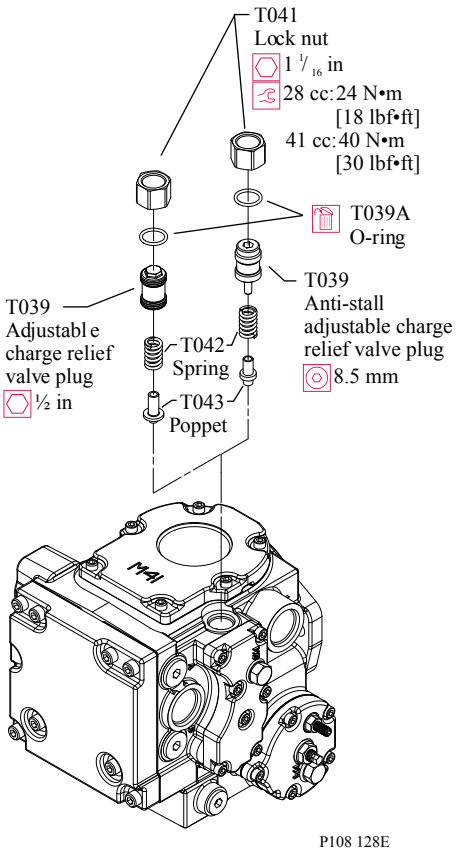
Externally adjustable style

The 1998 block point change discontinued the use of the shim adjustable charge relief valve and made the externally adjustable charge relief valve standard. The charge pressure changes by approximately 1.4 bar (20 psi) per quarter turn of the adjustable charge relief valve plug (this applies to both external and internal hex style plugs).

Minor Repair

1. Mark the adjustable charge relief valve plug (T039), lock nut (T041), and the pump housing prior to removing the charge relief valve in order to approximately duplicate the charge pressure relief valve's original setting upon reassembly.

   Externally adjustable charge relief valve components



2. Loosen the lock nut (T041) and unscrew the adjustable charge relief valve plug (T039).
3. Remove and discard the O-ring (T039A) from the adjustable charge relief valve plug (T039).
4. Remove the spring (T042) and poppet (T043) from the housing.
5. Inspect the poppet (T043) and seat within the housing for damage or foreign material. Replace as necessary.
6. Install the poppet (T043) and spring (T042) into the housing.
7. Install a new O-ring (T039A) onto the adjustable charge relief valve plug (T039).
8. Install the adjustable charge relief valve plug (T039) and the lock nut (T041) into the housing, aligning the marks made prior to disassembly.
9. On 28/32 cm^3 models, torque the lock nut (T041) to 24 N•m [18 lbf•ft], and on 41/51 cm3 models, torque the lock nut (T041) to 40 N•m [30 lbf•ft]. (This may cause misalignment of the original position marks made earlier).
10. Confirm the charge relief valve setting by measuring charge pressure at the charge pressure gauge port, (M3). The charge pressure reading should level off when the relief setting is reached.

Optional speed sensor

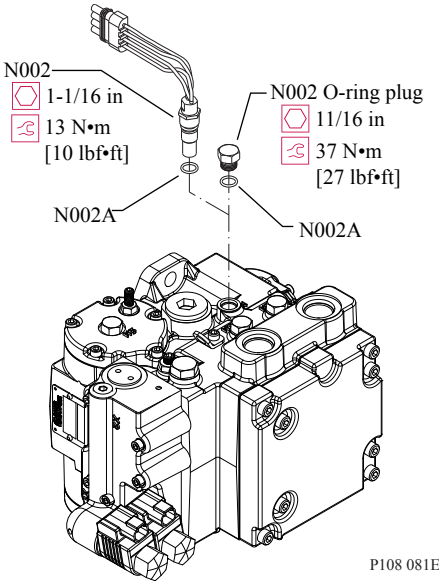
When installing or adjusting the speed sensor on a pump, you must set it to a specific distance from the speed ring on the cylinder block.

Minor Repair

Removal

1. Loosen the lock nut using a 1-1/16 in hex wrench.
2. Unthread the speed sensor (N002) from the pump housing. Remove and discard the O-ring (N002A).

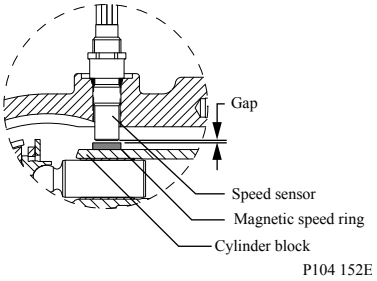
Speed sensor replacement



Reassembly

1. Always install a new O-ring before reinstalling the sensor.
2. Reinstall the speed sensor (with lock nut and O-ring) into the housing. Turn the sensor clockwise (CW) by hand until it contacts the speed ring.
3. Turn the sensor counterclockwise (CCW) 1/2 turn (180°) to establish the nominal gap of 0.71 mm [0.028 inch].

Cross section view of speed sensor in variable pump



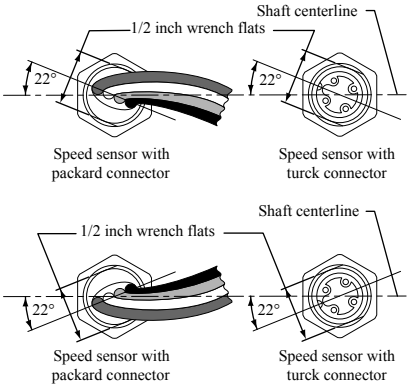
4. Then turn the sensor clockwise (CW) until the wrench flats on sensor body are positioned at a 22° angle to the pump shaft center line.

Most adjustable wrenches have a 22° handle offset.

Minor Repair

5. The final sensor position should be between 1/2 (180°) and 1/4 turn (90°) counterclockwise (CCW) from the point where the sensor contacts the speed ring.

   Positioning speed sensor relative to pump shaft



P104 155E

6. Hold sensor in position with a 1/2 inch hex wrench while tightening the lock nut to 13 N•m [10 lbf•ft].

MDC Module

Removal

The manual displacement control (MDC) actuates the control spool through a connection to the summing link pin. The following procedure describes how to remove and install the control. Control spool and linkage removal is explained on pages 39 and 40.

1. Clean external surfaces of the pump. If necessary, remove the MDC handle (D017) and disconnect NSS wiring (D040).
2. Being careful not to lose the backlash spring (D91), remove the control spool plugs (D032 and D035).
3. Remove the seven (7) control bolts (D002) that secure the control to the pump housing. Remove the control (D070) and gasket (E001) from the pump. Discard the gasket.
4. Ensure that the housing and control surfaces are clean and free of gasket material. If necessary, clean the surfaces with solvent.

Installation

1. Place a new gasket (E001) on the control module

   The control gasket acts as regulating orifices. Check the Parts Manual (28 cm^3, 520L0590; or 41 cm^3, 520L0589) and your order code to confirm you have the correct control gasket.

   Warning

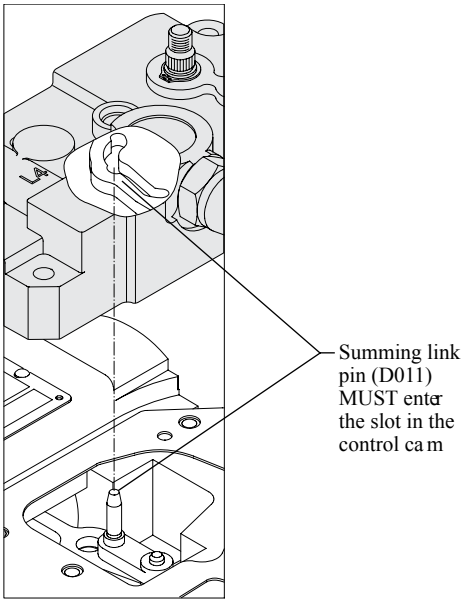
   Unintended vehicle/machine movement hazard. MDC must be aligned to the housing within 0.005 inch. Inaccurate alignment may cause neutral to be off center or make it impossible to set.

   For exact positioning, place the MDC alignment tool (see dimensioned diagram , next page) over the exposed summing link pin. If MDC alignment tool is not available, skip to *MDC alignment without tool* (steps 3a-5a).

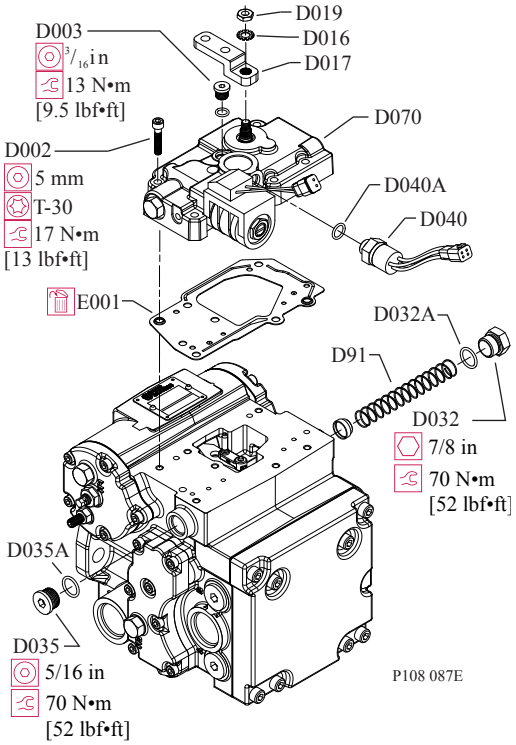
Minor Repair

2. Slide the MDC (D070) over the tool while engaging the tool with the slot in the MDC cam, and allow it to pass through the hole on the front of the MDC housing.

Link pin into cam slot



MDC module assembly



3. Install the control screws (D002) and torque to 15-18 N•m [11-13 lbf•ft].

4. Remove the alignment tool and install plug (D003); torque to 17 N•m [13 lbf•ft].

5. Replace the spring (D91) and spool plugs (D032 and D035).

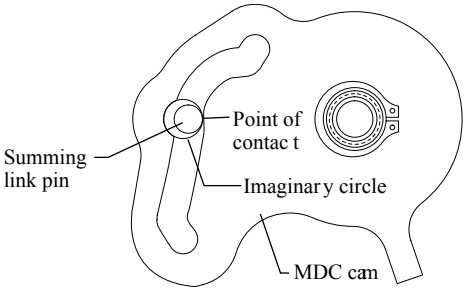
6. Adjust control neutral (see *Control neutral adjustment for MDC and EDC/HC-EDC* on page 32).

Minor Repair

MDC alignment without tool.

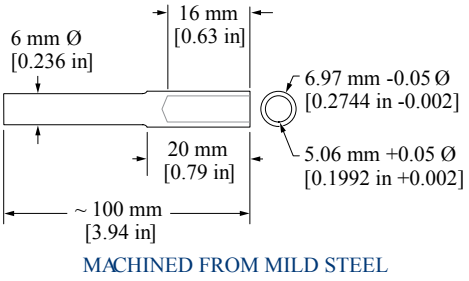
If the MDC alignment tool is not available, it is possible to locate the approximate position of the pin by creating an imaginary circle at the correct location, as indicated in the illustration. The point at which the imaginary circle contacts the slot in the cam is the suggested contact point of the summing link pin. When engaging the pin in the cam slot, you may need to use a flat tool, such as a screwdriver, to position the linkage.

MDC cam



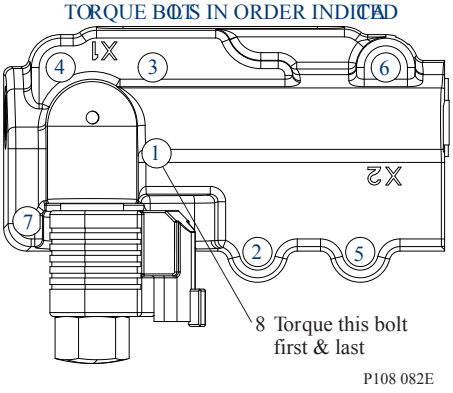
For proper control operation, the summing link must engage the slot on the control module. For exact placement, use the alignment tool shown.

MDC alignment tool



3a. Install and hand-tighten the seven (7) control retaining screws and then back off each screw one turn.

Torque patterns (MDC, EDC and HC-EDC)



4a. Adjust the control position so that the summing link pin is aligned as described above, and torque bolts (D002) to 17 N•m [13 lbf•ft].

5a. Replace the cover plug (D003) and torque to 13 N•m [9.5 lbf•ft].

Continue above to step 6.

Minor Repair

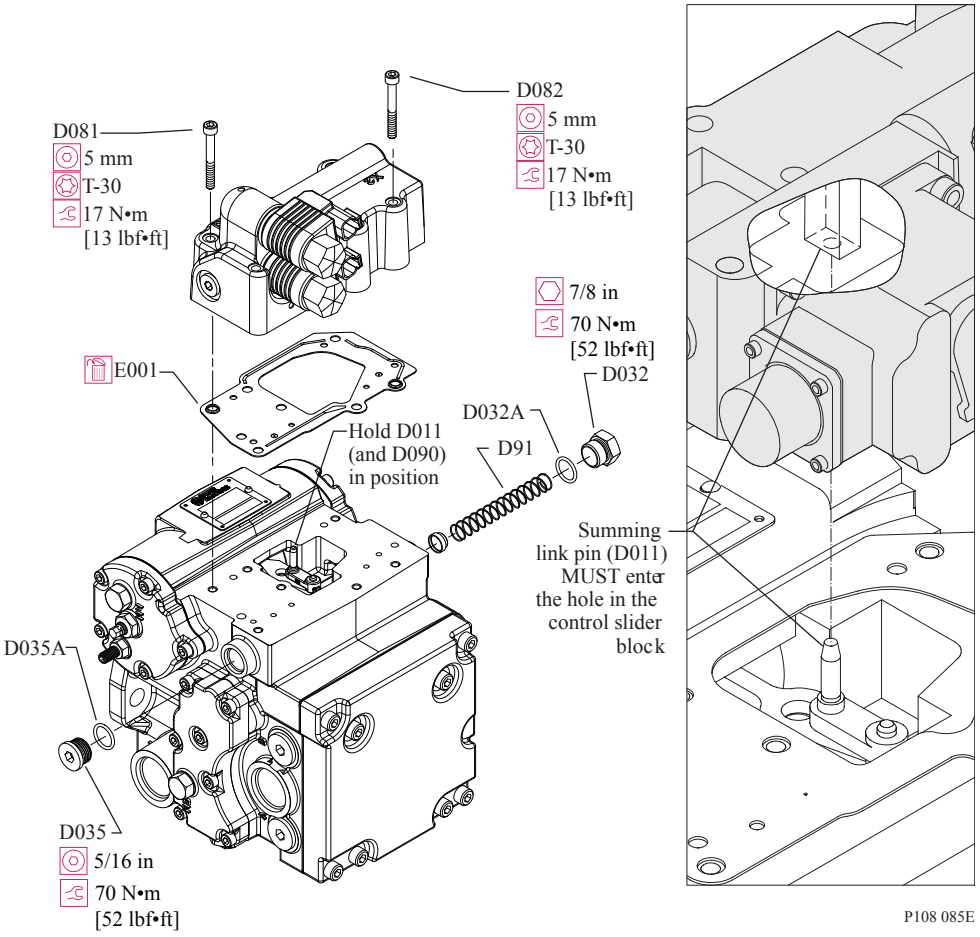
HC-EDC and EDC Module

The High Current Electric Displacement Control (HC-EDC) and the Electric Displacement Control (EDC) actuate the control spool via a connection to the summing link pin. The following procedure describes how to remove and replace the control housing.

Removal

1. Clean the external surfaces of the pump. If necessary, remove control input.
2. Being careful not to lose the backlash spring (D91), remove the control spool plugs (D032 and D035).
3. Remove the seven (7) control bolts (D081/D082). Note the position of the different length screws. Remove the control and control gasket (E001) from the pump.

EDC module assembly



Replacement

1. Clean the sealing surfaces of the control and the pump housing. Place a new gasket (E001) in position on the housing.

The control orifices are part of the control gasket. Refer to the appropriate Service Parts List to determine the correct gasket.

Minor Repair

2. Hold the summing link pin (D011) in position while installing the control. The link pin MUST engage the hole in the control slider block (see diagram on previous page).

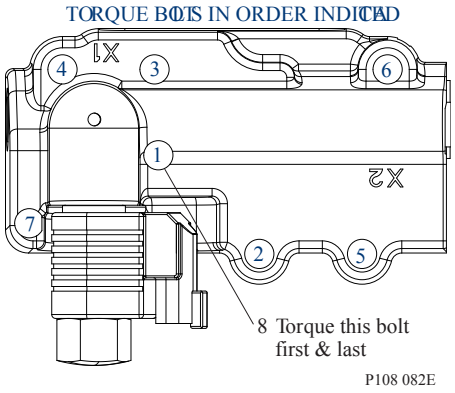
   Warning

   Failure to properly engage the summing link pin with control slider block will result in incorrect control operation, which may lead to loss of control of the vehicle / machine.

   Lay the servo piston side of the control down first, then watch the link pin engage from the charge pump side of the pump.

3. Install the control bolts (D081/D082), torque to 17 N•m [13 lbf•ft].

   Torque patterns (MDC, EDC and HC-EDC)



4. Replace the spring (D91). Install new O-rings on control spool plugs (D032 and D035). Install plugs and torque to 70 N•m [52 lbf•ft].
5. Adjust the neutral position of the control as shown in *Control neutral adjustment for MDC and EDC/HC-EDC* on page 32.

MDC/EDC Spool, linkage, and neutral adjustment screw

You may remove the control spool, control linkage, and control neutral adjustment screw for cleaning and to change the O-rings or the seal lock nut.

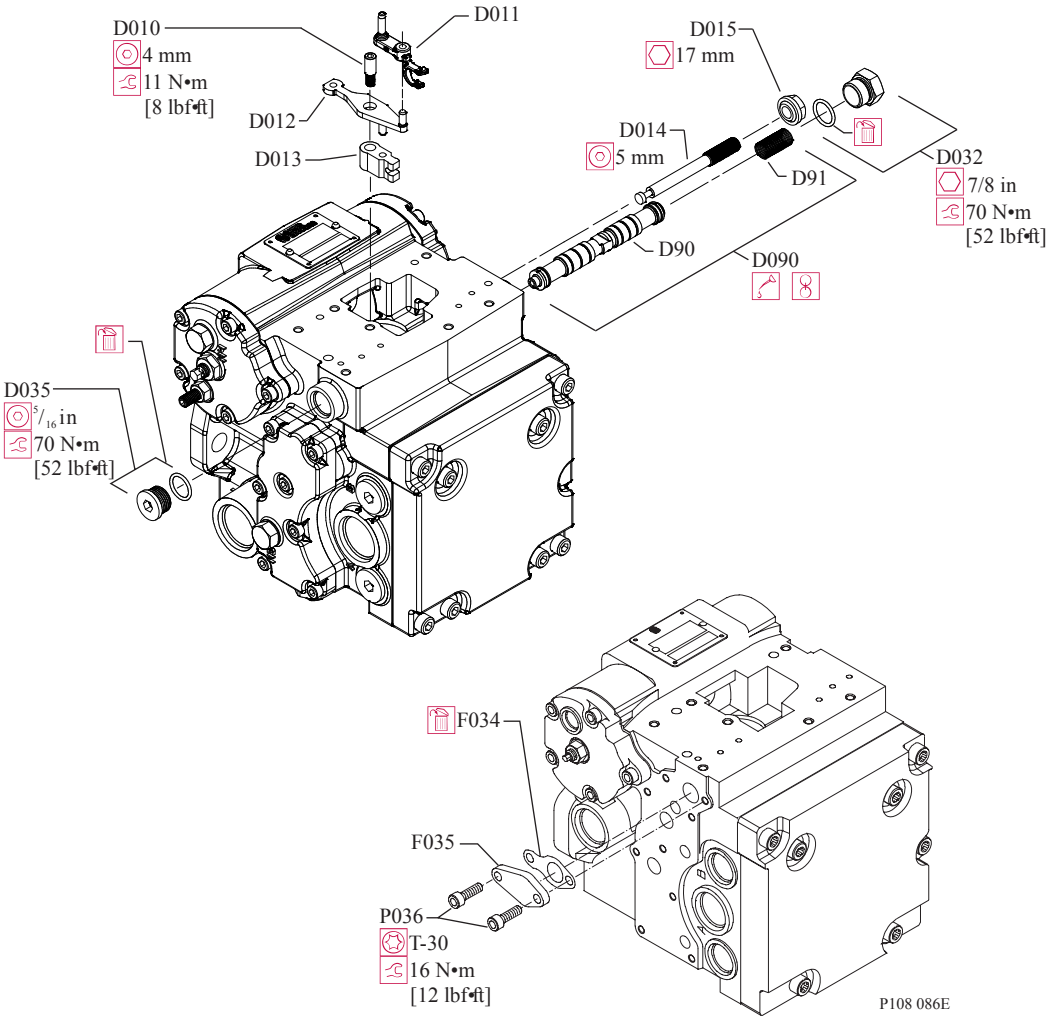
Removal

1. Clean the external surfaces of the pump.
2. Remove the MDC, EDC or HC-EDC module and the control gasket from the pump housing. Discard gasket. See pages 35 through 38 for control removal procedure.
3. Remove the summing link (D011). Note the manner in which the parts are assembled and the way the summing link engages the control spool (D090).

   Remove the summing link by sliding it off the feedback link.

Minor Repair

MDC/EDC/HC-EDC spool and linkage



4. Using a 4mm internal hex wrench, remove the summing link pivot pin (D010). Slide the feedback link (D012) towards the servo piston to disengage the neutral adjustment link (D013). You can now remove all linkages.
5. Remove the two bore plugs (D032 and D035). Note the orientation of the control spool (D90) and which side of the pump the spring (D91) is located (spring is on the opposite side from the filter adapter). Remove spring and spool.

   Prior to the 1998 block point change, the full-featured 28 cm^3 housing for the Series 42 pump used a control spool cover (F035), gasket (F034), and two screws (F036) instead of a bore plug on the control spool's non-spring side. Discard the control gasket (F034) and thoroughly clean the mating surface.
6. Remove the control neutral adjustment seal nut (D015) and screw (D014).

Installation

1. Install the control neutral adjustment screw (D014) and seal lock nut (D015). Do not tighten the nut.
2. Lubricate and install the control spool (D90) and spring (D91), noting proper orientation. Install the two side bore plugs and torque to 70 N•m [52 lbf•ft].
3. Replace the summing link, feedback link, and neutral adjustment link.

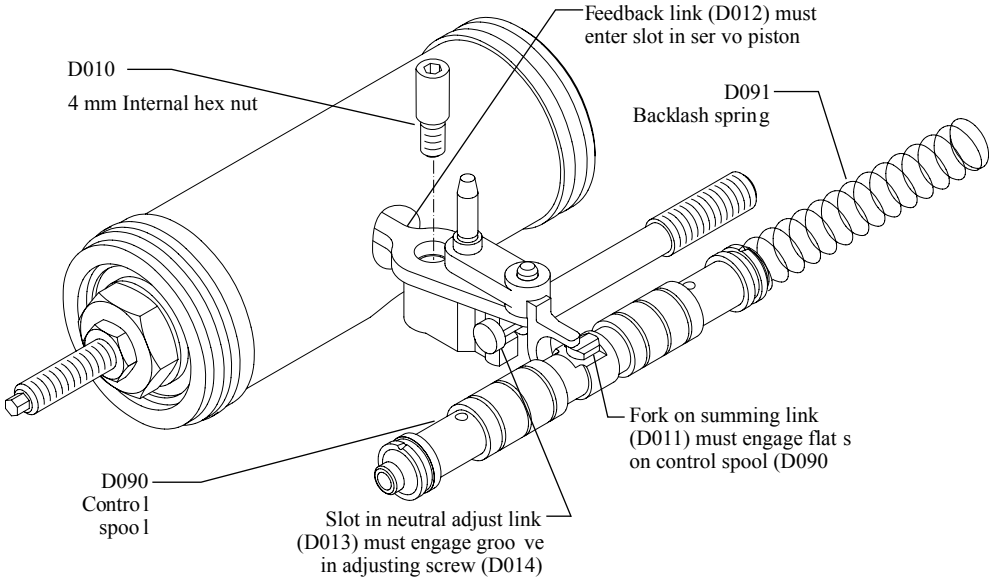
   First combine the center pin of the feedback link (D012) with the mating bore of the neutral adjustment link (D013). Insert the end of the feedback link into the servo piston slot. Mate the neutral adjustment link with the control neutral adjustment screw (D014). Insert the linkage pivot screw

Minor Repair

(D010) and torque to 11 N•m [8 lbf•ft]. Install the summing link (D011). It may be necessary to rotate the control spool so that the summing link fork engages the flats on the control spool.

4. Install the MDC, EDC or HC-EDC according to procedures on pages 35 through 38.

Servo piston linkage and control spool



Internal parts shown with housing removed

MDC Neutral start / backup alarm switch

The Neutral Start Switch (NSS) prevents the engine and pump from starting when the pump control handle is not in neutral. The NSS should be wired in series with the engine starting circuit. The switch contact is closed at the control handle's neutral position and opens when the control handle is rotated 1.5° to 2° from neutral.

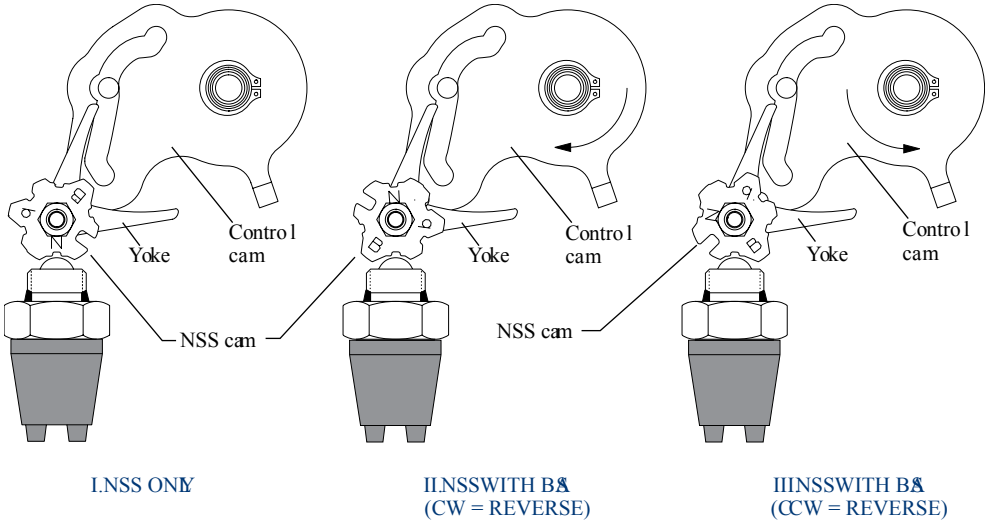
The Backup Alarm Switch (BAS) closes when the control handle is in a reverse position. This switch is normally wired in series with a backup alarm. The switch contact is open until the control handle is rotated 2.6° to 3.75° in the reverse direction.

Warning

The control handle's neutral position must conform to the pump's neutral position for the NSS/BAS to work effectively. See *Control neutral adjustment for MDC and EDC/HC-EDC* on page 32 for control neutral adjustment.

Minor Repair

Top view of NSS showing NSS cam positions



You can configure the NSS/BAS assembly for three different settings:

I. NSS only.

II. NSS with BAS for units where clockwise (CW) handle rotation results in reverse motion.

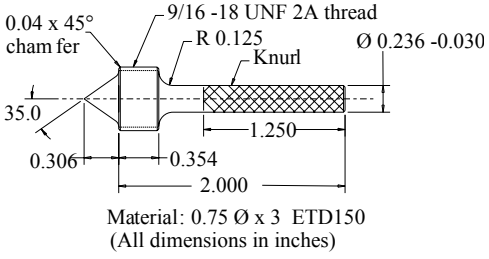
III. NSS with BAS for units where counterclockwise (CCW) handle rotation results in reverse motion.

The setting must be in accordance with the configuration of the unit. See the model code if uncertain of the type of NSS setting the machine is equipped with.

Adjustment is normally not required unless the function of the NSS is changed (between I, II, or III).

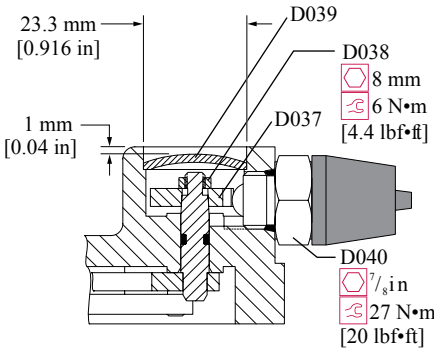
Adjustment of the NSS or NSS and BAS requires a special alignment tool. Dimensions appear at right. The tool positions the cam precisely relative to the control housing.

Alignment tool



1. Remove the MDC module from the pump housing.

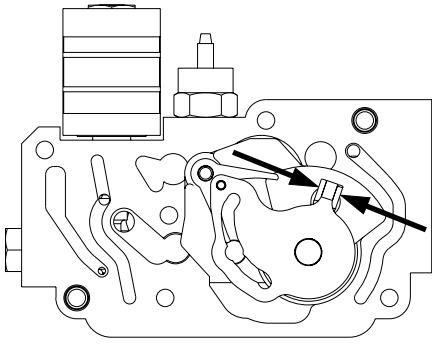
Side view of NSS and NSS cavity



Minor Repair

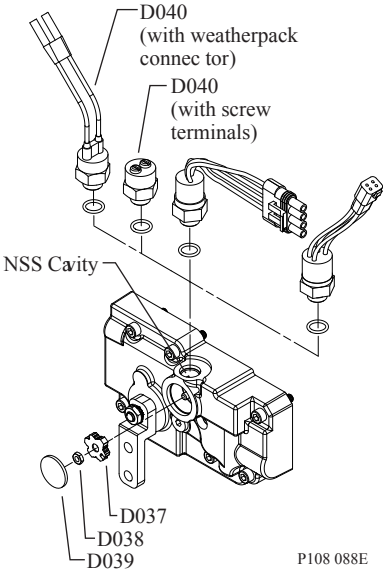
2. Using a 7/8 in hex wrench, remove the NSS/BAS (D040).
3. Using a screwdriver to pry it out, remove and discard the NSS cover (D039). Be careful not to damage the internal hardware.
4. Using an 8mm hex socket, remove the nut (D038).
5. Pry the cam (D037) off the shaft.
6. On the underside of the MDC module, gently clamp a pair of locking pliers around the spring contacts of the control cam. Be careful not to damage the spring wires. The pliers hold the nub on the control cam to the pin underneath. This holds the control cam in neutral position.

   Apply locking pliers here.



7. Set the NSS cam (D037) in the proper orientation (I, II, or III). See the illustration on previous page.

   NSS assembly on MDC



8. Thread the alignment tool into the NSS cavity to hold the cam in place.
9. Install the nut (D038) onto the cam and torque to 6 N•m [4.4 lbf•ft].
10. Using an appropriate press, press a new cover (D039) into the cam cavity. Use a tool with a diameter of 23.3 mm [0.916 in]. Press the new cover so that it sits 1 mm [0.04 in] below the cast surface as illustrated above.
11. Remove the alignment tool and locking pliers.
12. Lubricate and install a new O-ring on the NSS (D040) and install the NSS to the MDC. Torque to 27 N•m [20 lbf•ft].
13. Reinstall the MDC module onto the pump housing as shown on pages 35 and 36.

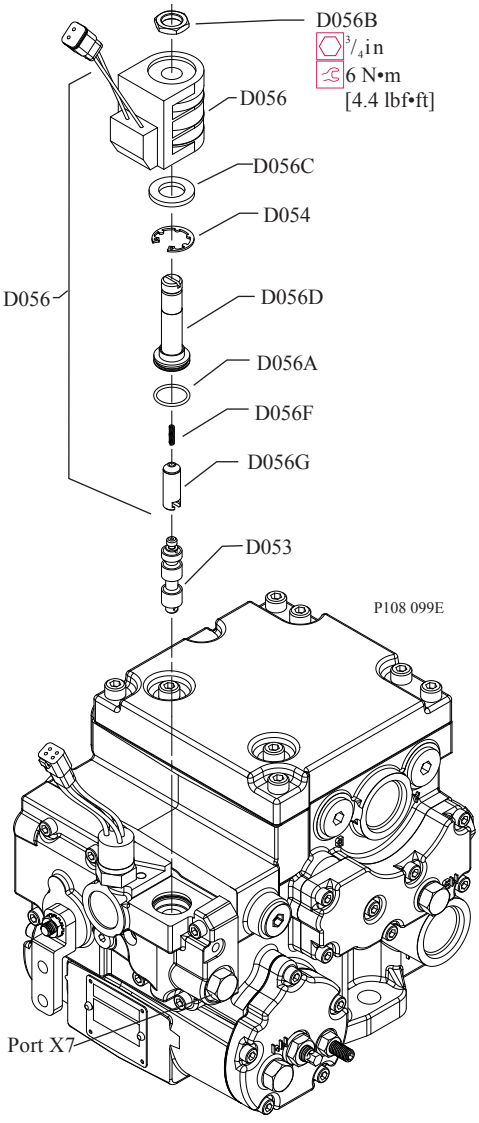
Minor Repair

MDC Solenoid override valve

The solenoid override valve is a safety feature that shunts both ends of the servo control piston when the solenoid is de-energized. The pump will stroke only when the vehicle controls energize the solenoid.

The solenoid override with brake release option allows hydraulic control of a spring-applied, hydraulically-released brake. When de-energized, the brake drains through port X7.

Solenoid override assembly



Removal

1. Using a 3/4 inch wrench, remove the coil nut (D056B) from the valve stem.
2. Remove the coil (D056) and washer (D056C).
3. Using snap-ring pliers, remove the retaining ring (D054) at the base of the solenoid.
4. Remove the valve stem (D056D), plunger (D056G), spring (D056F), and spool (D053).
5. Remove the O-ring (D056A) from the stem, and discard it.

Minor Repair

Installation

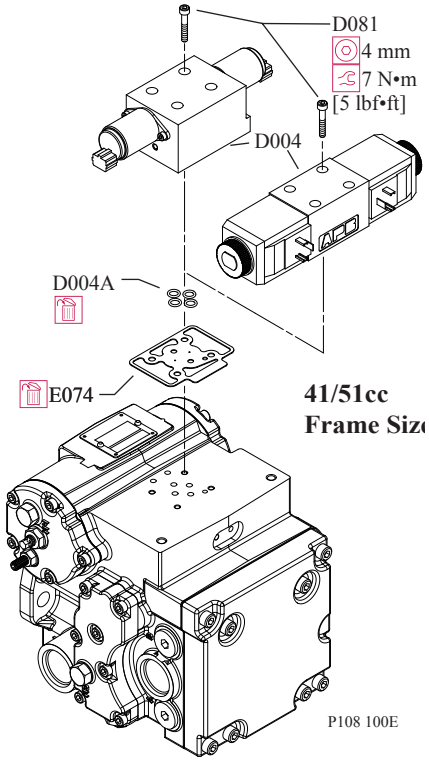
1. Lubricate and install a new O-ring (D056A) on the valve stem (D056D).
2. Place the spring (D056F) and the plunger (D056G) inside of the stem.
3. Attach the spool (D053) to the plunger (D056G).
4. Insert the solenoid/spool assembly into the solenoid override cavity.
5. Using snap-ring pliers, install the retaining ring (D054).
6. Install the washer (D056C) onto the valve stem.
7. Install the coil (D056) and coil nut (D056B) and torque to 6 N•m [4.4 lbf•ft]. Do not over torque coil nut.

FNR, NFPE, and NFPH Controls (bolt-on valves)

The FNR, NFPE, and NFPH are non-feedback type controls. The FNR and NFPE controls consist of external, solenoid-actuated spool valves mounted on the pump housing. The pump receives hydraulic input for NFPH through ports on the pump's control surface (9/16–18 SAE O-ring boss port). These ports connect directly to the servo piston.

You may remove the FNR and NFPE controls to clean the ports and replace the O-rings, however, the controls are not serviceable. The gasket (E074) contains control orifices. Orifice plugs for NFPH pumps are beneath the servo covers.

FNR and NFPE assembly (bolt-on valves)



Removal of FNR and NFPE modules (bolt-on valves)

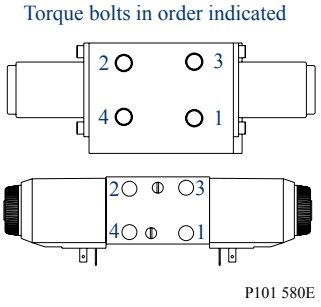
1. Clean the pump and control housings.
2. Remove the four (4) screws (D081) retaining the module to the housing, and remove the module (D004) from the pump housing.
3. Remove and discard the four O-rings (D004A). Examine the ports for cleanliness.

Minor Repair

Installation of FNR and NFPE modules (bolt-on valves)

1. Clean the sealing surfaces. Install new gasket (E074).
2. Using petroleum jelly to retain them, install new O-rings (D004A) in the bottom of the control.
3. Replace the bolts (D081) and torque to 7 N•m [5 lbf•ft]. (neutral adjust bolt side).

Bolt torque patterns

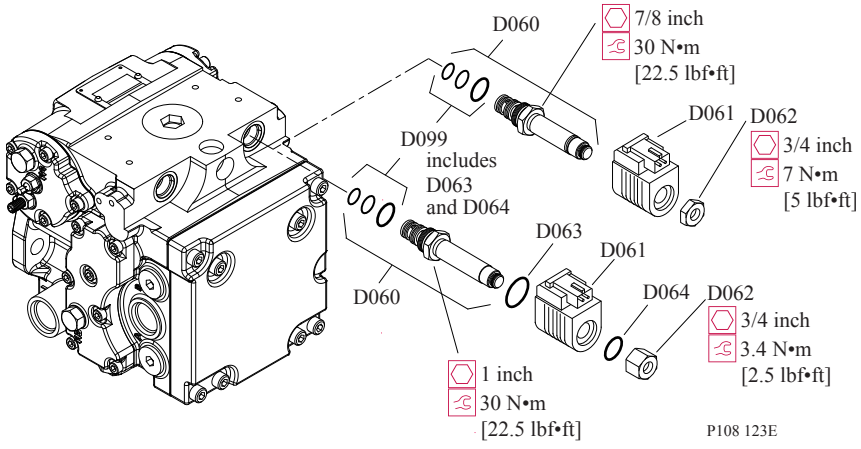


FNR, NFPE, and NFPH Controls (integral valves)

The FNR, and NFPE are non-feedback type controls. The FNR and NFPE controls consist of solenoid-actuated spool valves mounted on the pump housing.

You may remove the valves to clean the ports and replace the O-rings, however, the valves are not serviceable.

FNR and NFPE assembly (integral valves)



Removal of FNR and NFPE modules (integral valve style)

1. Clean the pump and control housings.
2. Remove the coil nuts (D062) and coils (D061). Discard O-rings (D063 and D064) from NFPE coils
3. Remove valve actuater stems (D060) and discard O-rings.
4. Examine the ports for cleanliness.

Minor Repair

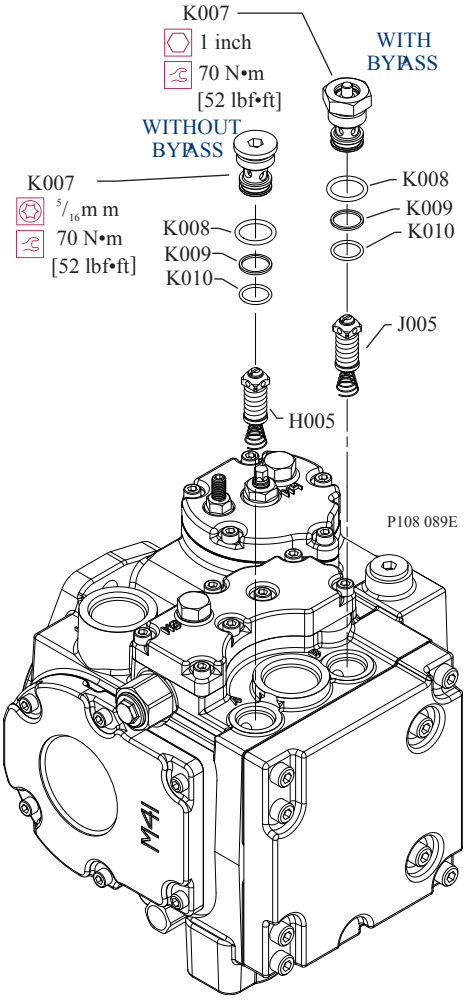
Installation of FNR and NFPE modules (integral valve style)

1. Clean the valves and ports.
2. Install new O-rings on valve actuator stems (D060).
3. Install actuator stems (D060) and torque to 30.5 N•m [22.5 lbf•ft].
4. Install coil (D061). Use new O-rings (D063 and D064) with NFPE coils.
5. Torque coil nut per illustration.

System Check Relief (SCR) valves (high pressure relief, charge check, and bypass valves)

The System Check Relief valve assembly performs the charge check, high pressure relief, and loop bypass functions. You may remove this assembly for cleaning and replacement of O-rings. The model code specifies which configuration of SCR valves your pump uses.

System check relief valve components



1. Using a 1 inch wrench or a 5/16 inch internal hex wrench, remove the valve seat plugs (K007) from the pump housing. Remove and discard the O-rings and backup rings (K008, K009, and K010).
2. Remove the check poppet/relief valve assemblies (H05/J05) from the pump housing.
3. Inspect the valves and mating seats in the valve seat plugs (K007) for damage or foreign material.

The SCR valves (H005/J005) are non-serviceable; replace as a complete unit.

Minor Repair

4. Install new outer O-ring (K008), backup ring (K009), and inner O-ring (K010) on each valve seat plug.
5. Verify that the conical springs are properly retained on the check poppets/relief valves (H005/J005). Install the check poppet/relief valve assemblies into the pump housing. Ensure that the valve assembly moves freely in its bore.
6. Using a 1 inch wrench or a 5/16 inch internal hex wrench, install the valve seat plugs or valve seat/bypass plugs into the pump housing and torque to 70 N•m [52 lbf•ft].

Filtration adapters

Filter-related pump hardware

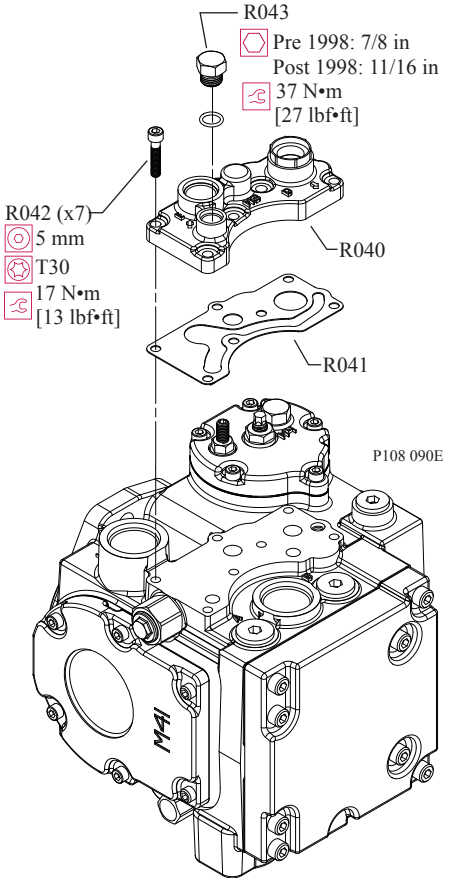
Filtration systems for Series 42 pump include full flow suction filtration, pressure filtration, and partial flow pressure filtration. Danfoss provides a filtration adapter for each configuration. If filtration is provided elsewhere in the hydraulic circuit, the pump may not have a filtration adapter.

Pumps housings without filtration adapters have an unused and plugged construction bore next to the charge relief valve. When these pumps use suction filtration, the factory plugs external charge inlet.

Pump housings with filtration adapters have an appropriate adapter and gasket. The position of the M3 gauge port varries depending on filtration type.

Pumps manufactured after 1998 have filter adapter screws that are 10 mm [0.39 in] longer than the screws used on pre-1998 pumps. The longer screws are only compatible with post-1998 pumps.

Housing with filtration adapter

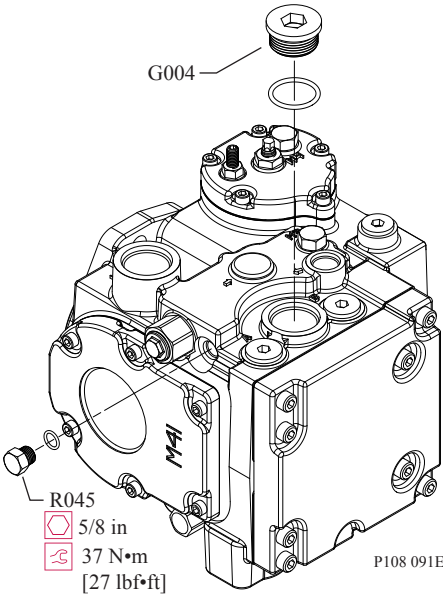


Minor Repair

Removal

1. Clean the exterior of the pump.
2. Remove any hoses or piping from the filter adapter.
3. Using a T30 Torx driver or 5 mm internal hex, remove the six screws (R042) securing the filter adapter to the housing.
4. Remove the filter adapter (R040).

Housing without filtration adapter



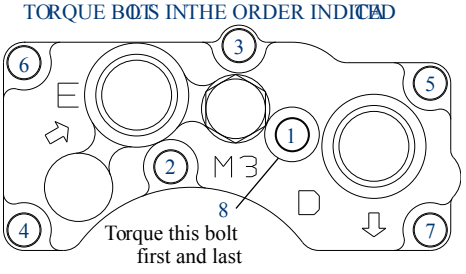
Suction Filtration Only

5. Remove the gasket (R041) and discard. Thoroughly clean all mating surfaces.

Replacement

1. Install a new gasket (R041) and place the filter adapter (R040) on the housing.
2. Using a T30 Torx driver or 5 mm internal hex, install bolts (R042) and torque to 17 N•m [13 lbf•ft].

Bolt torque patterns



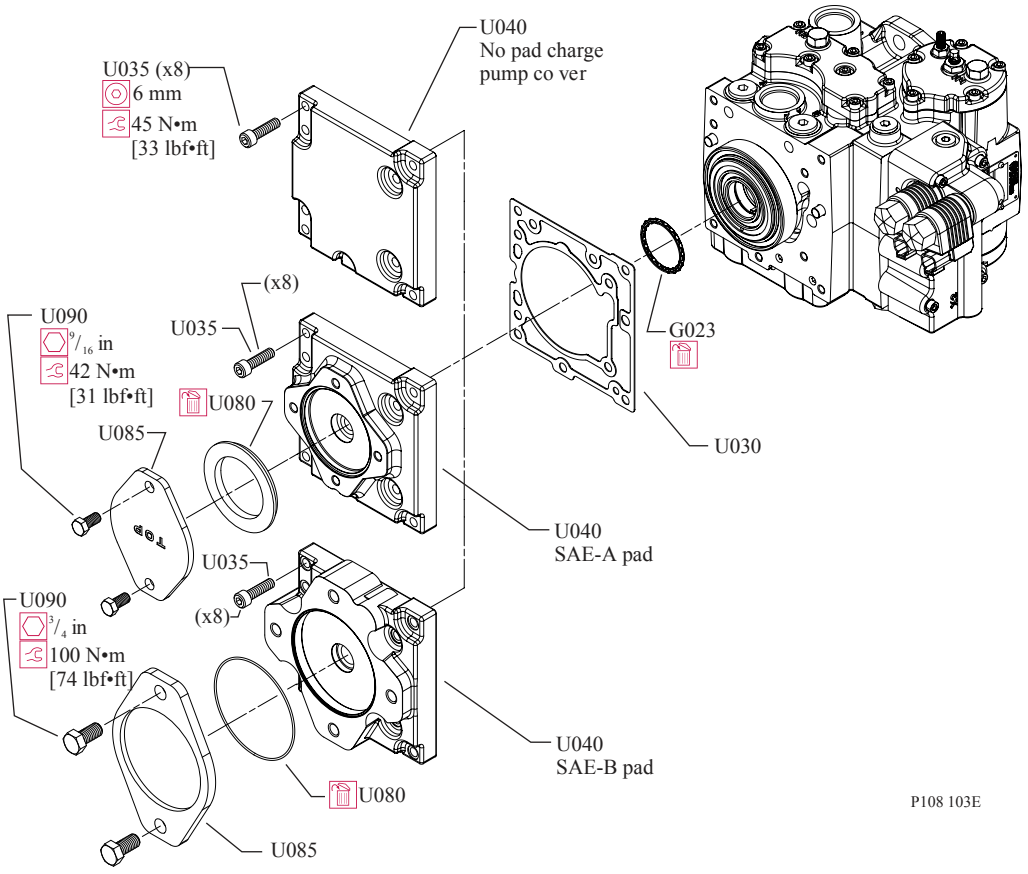
Auxiliary pad/charge pump cover

Use the following procedure to install a new gasket (U030) or to change the auxiliary pad option. Pads are available for SAE A and SAE B auxiliary pumps, or for options with no auxiliary pad.

The charge pump cover integrates the auxiliary mounting pad. When no auxiliary pump is present on an SAE A or SAE B style pad, the pad includes a shipping plate (U085) and O-ring (U080).

Minor Repair

Auxiliary pad options



Removal of charge pump cover/auxiliary pad

1. Orient the pump so that the charge pump cover or pad (U040) is facing up.
2. If present, remove the auxiliary pump or cover (U085) by removing the two screws (U090). Discard the O-ring (U080).
3. Remove screws (U035) retaining the charge pump cover/pad. Remove the charge pump cover/pad (U040) and gasket (U030). You may reuse the gasket. Clean all mating surfaces.
4. Remove and discard charge pump seal (G023). Leave alignment pins in the housing.

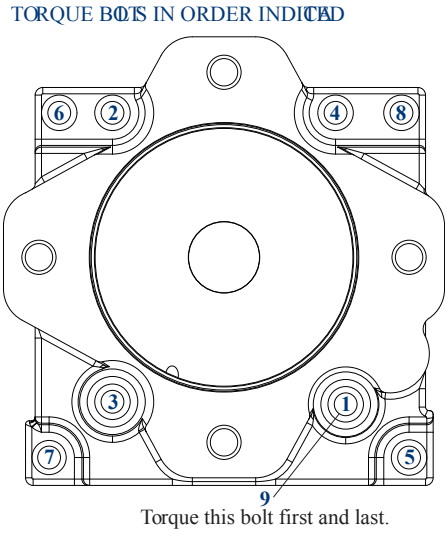
Installation

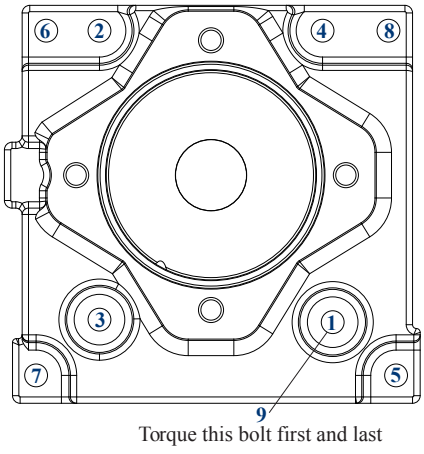
1. Inspect the charge pump cover/pad gasket (U030) and mating surfaces. If undamaged, you may reuse the gasket. Replace the gasket if you suspect leakage. Install the gasket.
2. Install a new charge pump cover/pad seal (G023).
3. Install the charge pump cover/pad (U040) Using a 6 mm internal hex torque the six or seven bolts (U035) to 45 N•m [33 lbf•ft] using the pattern at the right.
4. Replace the O-ring (U080) and cover plate (U085) or auxiliary pump. Install and torque the two mounting screws (U090). For SAE A pads, torque the mounting screws to 42 N•m [31 lbf•ft]. For SAE B pads, torque the mounting screws to 100 N•m [74 lbf•ft].

The threaded screw holes in the auxiliary pump mounting pad in early production pumps with the SAE A pad option go clear through the charge pump cover. Use M8x1.25 internal hex set-screws to plug any holes not used to attach the cover plate or auxiliary pump. Install hand tight to prevent the entrance of foreign material into the pump.

Minor Repair

Bolt torque patterns





P108 083E

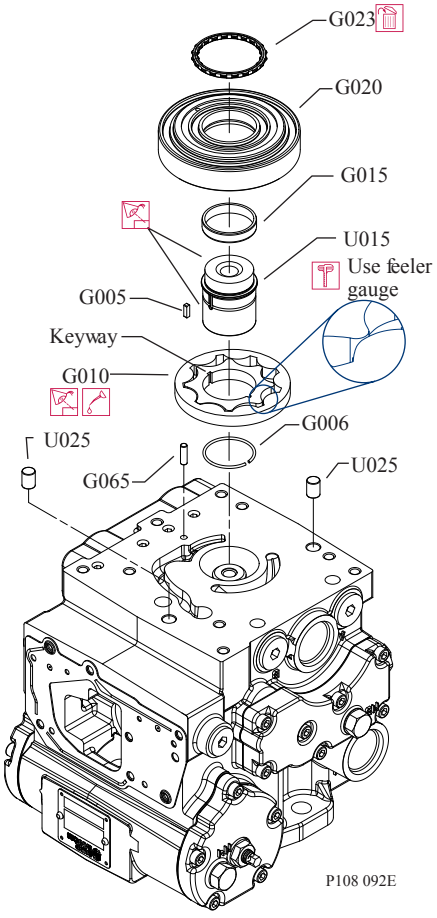
Charge pump

You may disassemble the charge pump to inspect, clean, or to change the auxiliary shaft drive coupling (U015). Post 1998 pumps contain a number of non-interchangeable parts within the charge pump system:

- Pre-1998 pumps have a gerotor drive coupling with a drive pin for the gerotor element, while post 1998 release pumps will contain a coupling with a parallel drive key. This change also results in a change to the gerotor set. When servicing the gerotor, these two elements must be placed in combination. A service kit is available for pre-1998 charge pumps. Refer to service bulletin 1997-029.
- Post 1998 release pumps also contain a coupling with a retaining ring to positively locate the coupling in the assembly. This change eliminated the need for a coupling spacer.
- The outer step on the gerotor cover has been removed on the post 1998 release pumps.

Minor Repair

Charge pump components



Disassembly

1. Remove alignment pins (U025)
2. Remove the gerotor cover assembly (G020). Remove and discard gerotor cover O-ring (G023) (early production SAE A pad models may contain two or three seals: only the inner G023 seal is required).
3. Remove the drive coupling (U015) and gerotor gear set (G010). Remove retaining ring (G006).
4. Remove the gerotor drive pin or key (G005). Remove the gerotor cover locating pin (G065).
5. Inspect the gerotor assembly (G010). Ensure the upper and lower surfaces of the gerotor are free of nicks and grooves. The mating surfaces of the inner and outer gears should fit snugly and create a tight seal. Inspect the keyway for major wear. It is normal to find a small impression from the drive pin (G005). Measure gerotor tip clearance for wear (illustrated above). Seat the gerotor assembly into the gerotor cover and align the assembly so that one of the tips of the inner gear fully engages a valley in the outer gear. Using a feeler gauge, measure the clearance of the opposite tip. Clearance should be 0.127 mm [0.005 inch] or less. Replace the gerotor if necessary. The gerotor assembly is machined as a matched pair.
6. Inspect the drive pin or key (G005) to ensure that the edges are not rounded and that the drive coupling's internal splines are straight and free of damage on both ends. Check for wear on the top and bottom surfaces. Replace the drive pin or key if worn.
7. Inspect the gerotor cover (G020). It should be free of nicks and scratches. The drive coupling journal bearing (G015) is on the inside diameter of the small bore of the aluminum gerotor cover. The drive coupling should fit the journal bearing with a relatively close fit. If the coupling has worn through the bearing and into the aluminum gerotor cover, replace the gerotor cover and drive coupling. If the fit is excessively loose and the drive coupling has not worn into the gerotor cover, remove the old

Minor Repair

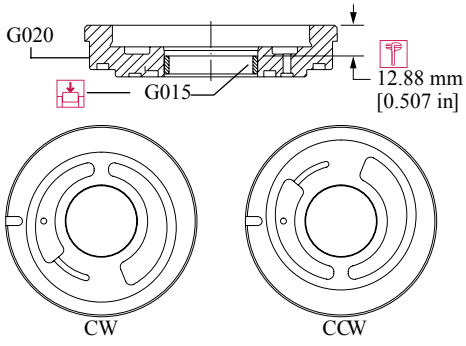
journal bearing from the gerotor cover and press a new journal bearing into the cover from the cavity side. Press the bearing to a depth of 12.88 mm [0.507 in] from the bottom (cavity side) of the gerotor cover.

Assembly

1. Install the two charge pump cover/pad alignment pins (U025).
2. Install the gerotor cover locating pin (G065).
3. Install the 41 cm3 spacer (not shown) if previously removed. (Spacers exist on the older 41 cm3 models.)
4. Install the drive pin or key (G005) into the drive coupling. Use petroleum jelly to hold it in place.
5. Lubricate and install the gerotor set (G010) onto the drive coupling (U015). Align the notch in the inner gear with the drive pin or key (G005).
6. If present, install the retaining ring (G006) onto the drive coupling.
7. With the smaller end of the drive coupling (U015) facing up, install the drive coupling and gerotor onto the shaft.

   Different drive couplings are used with different charge pump covers.
8. Place the gerotor cover assembly (G020/G015) over the gerotor assembly and rotate until the cover engages the orientation pin. The cover fits flat.
9. Lubricate the new gerotor cover O-ring (G023) with petroleum jelly and place it on the gerotor cover (G020). Early production A pad models may contain two or three seals.
10. Install the charge pump cover gasket, charge pump cover, and auxiliary pump

Charge pump orientation looking inside of gerotor pump cover



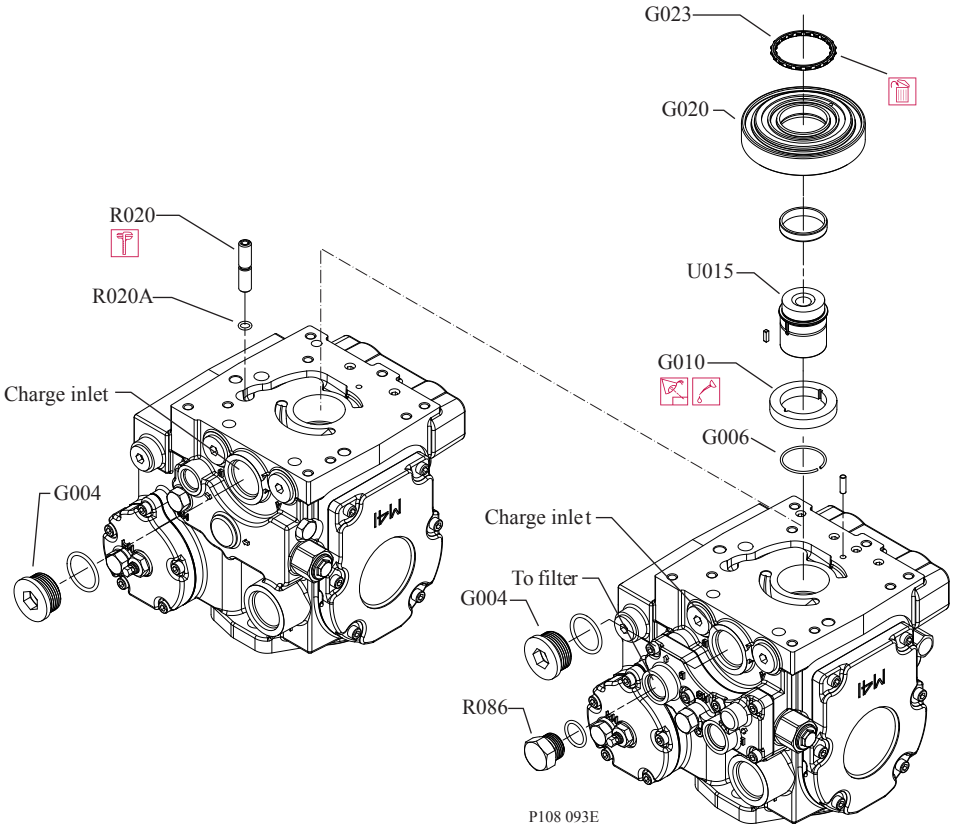
Units without integral charge pump

Variable pumps without an integral charge pump have a spacer (G010) in the location where the gerotor assembly goes. A plug (N004) blocks the charge pump inlet port. Pumps without an integral charge pump that are not machined to accept a filtration adapter, contain a charge pump defeat plug (R020) in the gerotor cavity outlet. An O-ring (R020A) holds this plug in place. Later models have an M6 thread in the exposed end of the plug for easier removal. Replace the O-ring when removing the plug.

Pumps without an integral charge pump that are machined to accept a filtration adapter, do not contain a charge pump defeat plug. Pumps in this configuration use a full-flow pressure filtration adapter with a steel O-ring plug (R086) in the charge flow outlet port. The suction filtration adapter does not suit this configuration; neither does the partial-flow pressure filtration adapter. It bypasses the charge relief valve.

Minor Repair

No charge pump option components



Housing with filtration adapter (left)

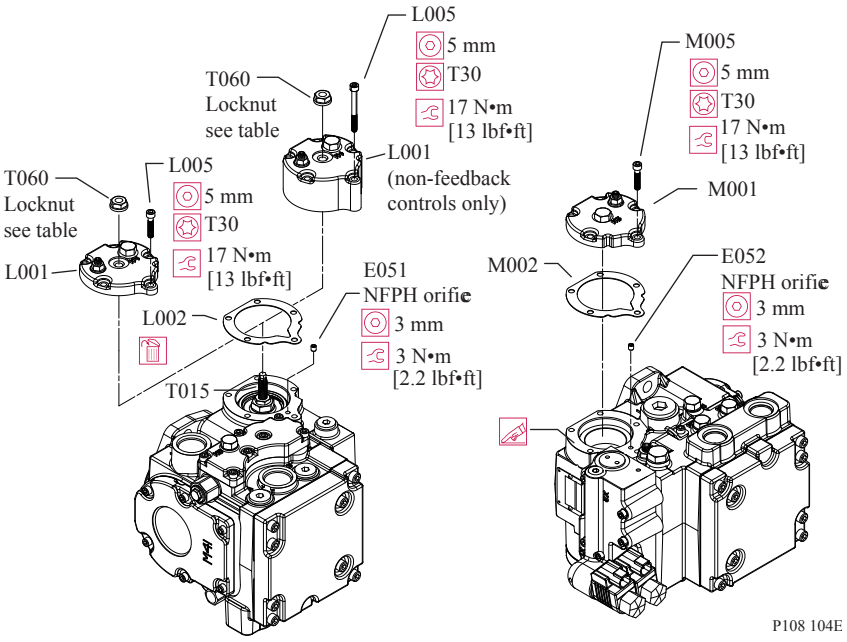
Housing without filtration adapter (right)

Servo piston covers and NFPH control orifice

You can remove the servo piston covers to change the gasket or to inspect/change the NFPH control orifices.

Minor Repair

Servo piston cover components



Frame size cm³	28/32		41/51	
Control	MDC/EDC/HC-EDC	NFPE/NFPH	MDC/EDC/HC-EDC	NFPE/NFPH
Lock nut	13 mm	17 mm	17 mm	17 mm
Servo adjust screw	5 mm	7 mm	7 mm	7 mm

Disassembly

1. Remove locknut (T060) from the right side servo cover.
2. Using a T-30 Torx driver or 5 mm internal hex, remove the servo cover bolts (M005). Post 1998 release pumps have cover bolts that are 10 mm [0.39 in] longer than pre-1998 pumps. The longer bolts are only compatible with post-1998 pump housing.
3. Remove the servo piston covers (L001/M001).

   To remove the right side servo cover turn the neutral adjustment screw (T015) clockwise (inward) far enough for the servo cover to clear the nearby case drain port. Then pull the cover away from the housing and turn the cover counterclockwise to remove it from the adjustment screw.
4. Remove the gaskets (L002/M002). Clean gasket surfaces.
5. NFPH control orifice plugs (E051 and E052) are located beneath the servo covers. If necessary, remove and clean the orifices.

Assembly

1. Replace the NFPH control orifice plugs (E0 51, E052) if they were removed.
2. Install new gaskets (L002/M002).
3. On the right side, thread the servo piston cover (L001) onto the neutral adjustment screw. Then, while holding the cover, turn the neutral adjustment screw (T015) counter-clockwise to run the cover down the screw threads.

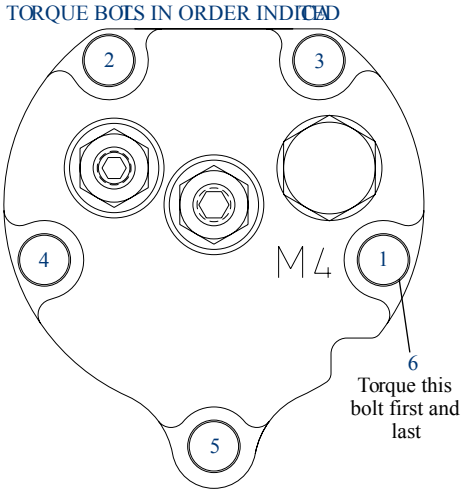
Warning

Unintended vehicle movement hazard: When you remove the right side servo piston cover, you must set neutral and control neutral. Refer to *Control neutral adjustment for MDC and EDC/HC-EDC* on page 32.

Minor Repair

4. Using a T30 Torx driver or 5 mm internal hex, install the servo piston cover screws (L005/M005). Torque to 17 N•m [13 lbf•ft] in the pattern shown.

   Bolt torque patterns



5. Install a new seal lock nut (T060) onto the neutral adjustment screw (T015). Do not torque at this time.
6. Perform pump neutral adjustment and control neutral adjustment procedures. Refer to *Control neutral adjustment for MDC and EDC/HC-EDC* on page 32.

Removal of the servo covers may change the position of the displacement limiters; readjust if necessary.

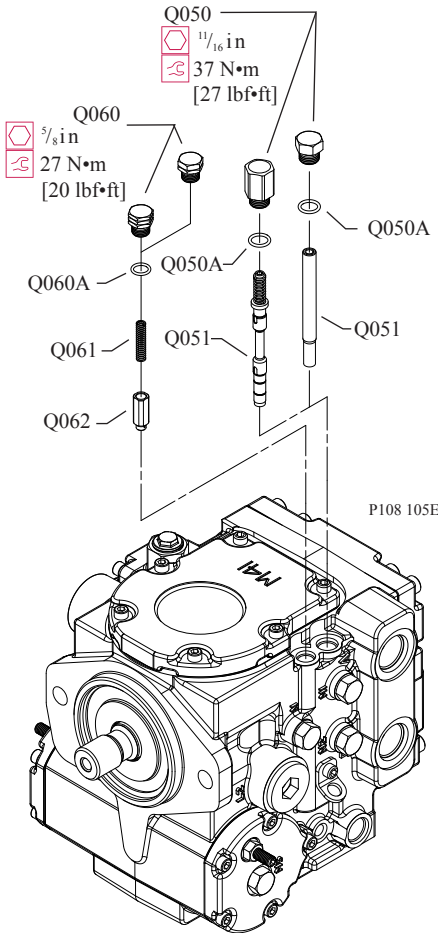
Loop flushing and loop flushing relief valve

The loop flushing function consists of the loop flushing shuttle valve and the loop flushing relief valve. You may remove the assemblies for cleaning and installation of new O-rings. You may exchange the relief valve poppet for one with a different flow rating. Take notice, though, pre 1998 models contained relief shims, do not change these shims unless Danfoss specifically instructs you to do so. You may also defeat the loop flushing function by installing a defeat spool.

Series 42 pumps built prior to 1998 use unique loop flushing spools. Post 1998 release pumps use a common loop flushing spool. They are not interchangeable.

Minor Repair

Loop flushing valve and loop flushing defeat components



Loop flushing valve

1. Remove the loop flushing plug (Q050). Discard the O-ring (Q050A).
2. Remove the loop flushing spool assembly (Q051) from the housing.
3. Inspect the parts for damage or foreign material. Ensure the washer securely retains the centering spring.
4. Install the loop flushing valve spool assembly (Q051) into its bore. Install a new O-ring (Q050A) on the loop flushing plug (Q050); torque to 37 N•m [27 lbf•ft].

Loop flushing relief valve

Two styles of loop flushing relief valve plugs exist. The style of plug is depends on the charge pressure specification. If the charge pressure is greater than or equal to 18 bar [260 psi]: the plug has two identification grooves. If the charge pressure is less than 18 bar [260 psi]: the plug has a single identification groove.

Minor Repair

1. Remove the loop flushing relief valve plug (Q060). Discard the O-ring (Q060A).
2. Remove the spring (Q061) and poppet (Q062) from the housing.
3. Do not alter the shims between the spring and plug, or interchange parts with another valve. Inspect the poppet and mating seat in the housing for damage or foreign material. Inspect the orifice in the valve poppet.
4. Install a new O-ring (Q060A) on the plug (Q060). Install the poppet (Q062), spring (Q061), shims, and plug into the pump housing, torque to 27 N•m [20 lbf•ft].

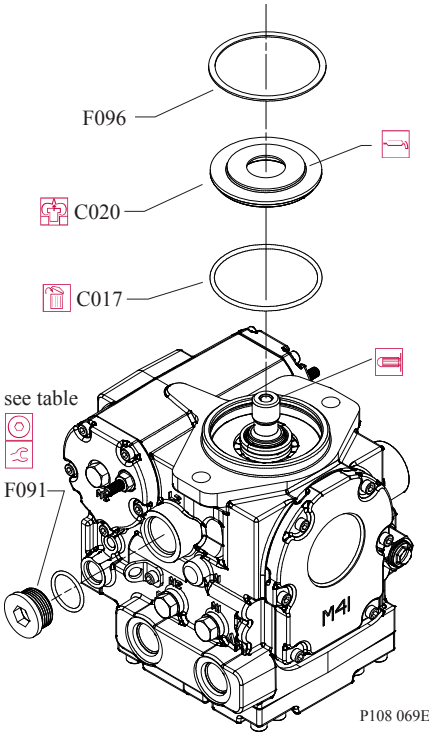
Defeating loop flushing

1. Remove the loop flushing plug (Q050). Discard the O-ring (Q050A).
2. Remove the loop flushing spool assembly (Q051) from the pump housing.
3. Install the defeat spool (Q051) into the spool bore with tapped end facing outwards. Install the standard plug with O-ring into the housing and torque to 37 N•m [27 lbf•ft].
4. Remove the loop flushing relief plug (Q060). Discard the O-ring (Q060A).
5. Remove the loop flushing relief valve components (Q061/Q062).
6. Install the loop flushing relief plug (Q060) with a new O-ring (Q060A) into the housing and torque to 27 N•m [20 lbf•ft].

Shaft seal, roller bearing, and shaft replacement

Series 42 pumps use a lip type shaft seal. You can replace the seal and/or shaft without major disassembly.

Shaft seal components



Minor Repair

Case Drain Plug

Frame Size	28/32 cm3	41/51 cm3
Internal Hex	9/16 in	5/8 in
Torque	120 N•m [89 lbf•ft]	200 N•m [150 lbf•ft]

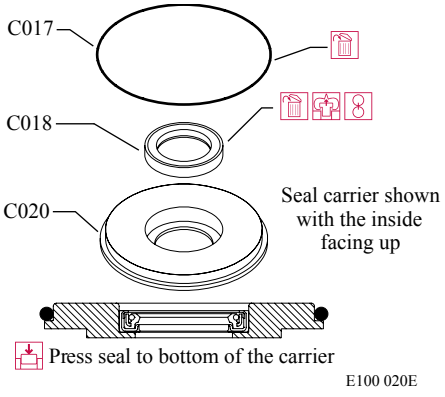
Seal removal

1. Position the pump with the shaft facing up.

   If the unit is positioned horizontally when the shaft is removed, the cylinder block could move out of place, making shaft installation difficult.

2. Remove the case drain plug (F091) to relieve any vacuum that may be present.
3. Remove the spiral retaining ring (F096). Using a screwdriver, pry the end of the ring free and unwind the remainder of the ring out of the groove.
4. Remove the seal carrier assembly (C020). Loosen it from the unit by prying on the raised surface of the seal carrier with a screwdriver.
5. Removeand discard O-ring (C017).
6. Pry or press lip seal (C018) from the seal carrier (C020); use caution to avoid damaging the seal carrier. Discard the seal.
7. Inspect the seal carrier (C020) for damage.
8. Press the new seal (C018) into the shaft bearing side of the seal carrier. Be careful to only press on the outside diameter of the lip seal. Orient the seal as shown in the illustration. Be careful not to damage the seal.

   Installation of shaft seal



Shaft removal

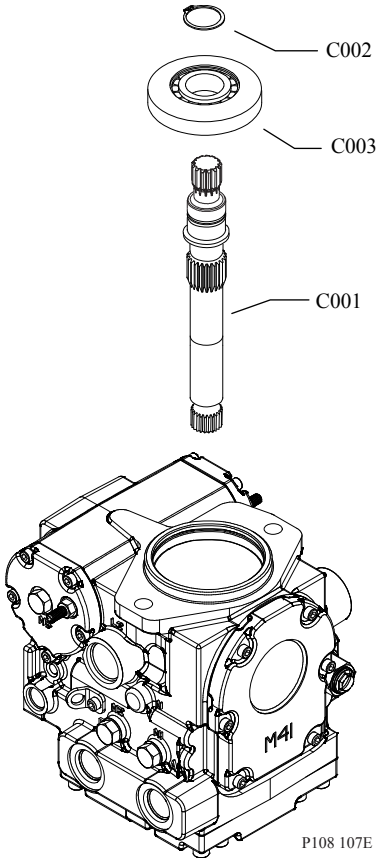
1. Grip the shaft assembly by the splines or keyed end and remove from the pump.
2. Inspect the shaft for damage. Ensure the shaft and splines are straight and free of damage or heavy wear. Inspect the surface where the rear shaft bearing contacts the shaft. If spalling is present, replace the shaft and rear shaft bearing.

   Replacement of shaft rear bearing is a major repair and violates the unit's warranty policy unless performed by an authorized Danfoss Global Service Partner.

   If necessary, clean the sealing area with a nonabrasive material. Lubricate the shaft with a light coating of hydraulic fluid.

Minor Repair

Shaft seal, roller bearing, and shaft replacement



3. Inspect the shaft bearing (C003) for damage and rotate to ensure smoothness. If you suspect contamination or damage, clean with solvent and lubricate with hydraulic fluid. Replace if necessary.

If you are not replacing the shaft or bearing, proceed with reassembly.

Shaft bearing replacement

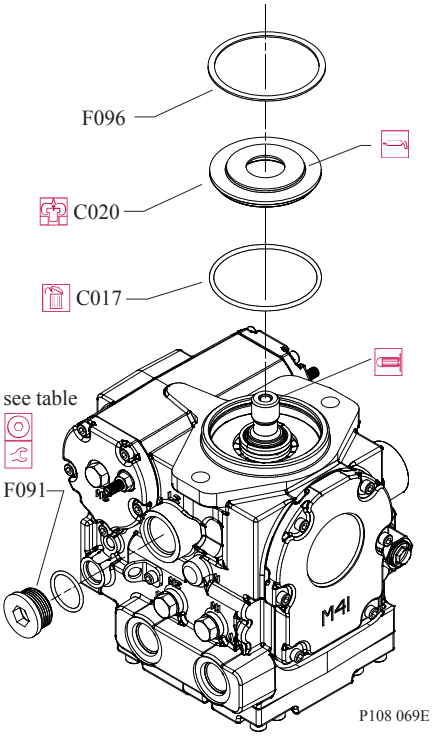
1. Remove the retaining ring (C002) using snap ring pliers.
2. Observe the orientation of the chamfer on the bearing. Press the bearing off of the shaft.
3. Verify the chamfer on the bearing is facing toward the pump. Press the new bearing onto the shaft. Press only on the inner race of the roller bearing.
4. Using snap-ring pliers, install the retaining ring (C002).

Minor Repair

Reassembly

1. Ensure that the cylinder kit and rear bearing are aligned. Insert the shaft assembly into the pump. It may be necessary to grip the splined end of the shaft and twist to align it with the block splines and properly seat it into the rear bearing.

   Shaft seal, roller bearing, and shaft replacement



2. Lubricate a new O-ring (C017) with petroleum jelly and seat it into the housing, on top of the bearing.
3. Cover the end of the shaft with an assembly sleeve. Lubricate shaft seal with petroleum jelly.
4. Slide the seal carrier assembly over the shaft and into the housing. Press the seal carrier against the O-ring. It may be necessary to use a large socket to press the seal carrier down completely.
5. Wind the spiral retaining ring (F096) into the groove in the housing.

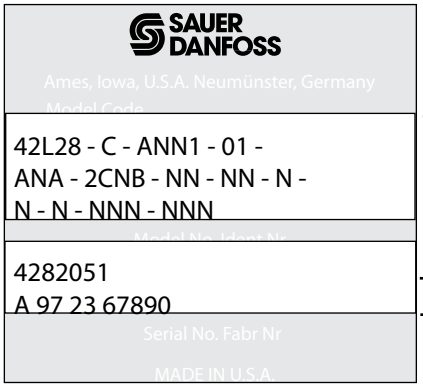
Appendix A - Torques

Torque table

Sequence Number	Part Description	Tool Type	Tool Size	TorqueN•m [lbf•ft]
D002	MDC bolts	Torx wrench/ Internal hex	T-30/5 mm	17 [13]
D003	Cover plug	Internal hex wrench	3/16 in	13 [9.5]
D010	Linkage pivot screw	Internal hex wrench	4 mm	11 [8]
D015	MDC/EDC/HC-EDC neutral adjustment seal lock nut	External hex wrench	17 mm	40 [30]
D032	Control spool bore plug	External hex wrench	7/8 in	70 [52]
D035	Control spool bore plug	Internal hex wrench	5/16 in	70 [52]
D038	Control nut	External hex wrench	8 mm	6 [4.4]
D040	Neutral start switch	External hex wrench	7/8 in	27 [20]
D056A	Retaining nut	External hex wrench	3/4 in	6 [4.4]
D081	FNR/NFPE bolts	Internal hex wrench	4 mm	7 [5]
D081/D082	EDC/HC-EDC bolts	Torx wrench/ Internal hex	T-30/5 mm	17 [13]
E051	NFPH orifice	Internal hex wrench	3 mm	3 [2.2]
F091	Case drain plug (28/32 cm^3)	Internal hex wrench	9/16 in	120 [89]
F091	Case drain plug (41/51 cm^3)	Internal hex wrench	5/8 in	200 [150]
F093	System gauge ports M1 and M2 plugs	External hex wrench	11/16 in	37 [27]
G040	Shim adjustable charge relief valve plug	External hex wrench	1 in	90 [66]
K007	Valve seat plug (with bypass)	External hex wrench	1 in	70 [52]
K007	Valve seat plug (without bypass)	Internal hex wrench	5/16 in	70 [52]
L005/M005	Servo piston cover bolts	Torx wrench/ Internal hex	T-30/5 mm	17 [13]
L010/M010	Servo gauge plug	External hex wrench	11/16 in	37 [27]
L025/M025	Displacement limiter seal lock nut	External hex wrench	13 mm	23 [17]
N002	Port N plug	External hex wrench	11/16 in	37 [27]
P036	Control spool cover screws (pre-block point change)	Torx wrench/ Internal hex	T-30/5 mm	16 [12]
Q050B	Loop flushing plug (pre-block point change)	Internal hex wrench	1/4 in	6 [4.4]
Q050B	Loop flushing plug (post-block point change)	External hex wrench	11/16 in	37 [27]
Q060B	Loop flushing relief valve plug	External hex wrench	5/8 in	27 [20]
R042	Filtration adapter bolts	Torx wrench/ Internal hex	T-30/5 mm	17 [13]
T041	Lock nut (28/32 cm^3)	External hex wrench	1 1/16 in	24 [18]
T041	Lock nut (41/51 cm^3)	External hex wrench	1 1/16 in	40 [30]
T060	Pump mechanical neutral adjustment seal lock nut (28/32 cm^3, MDC/EDC/HC-EDC)	External hex wrench	13 mm	23 [17]
T060	Pump mechanical neutral adjustment seal lock nut (28/32 cm^3, NFP control and 41/51 cm^3, all controls)	External hex wrench	17 mm	40 [30]
U035	Charge pump cover bolts	Torx wrench/ Internal hex	T-45/6 mm	45 [33]
U090	Auxiliary pump screws (SAE-A pad)	External hex wrench	9/16 in	42 [31]
U090	Auxiliary pump screws (SAE-B pad)	External hex wrench	3/4 in	100 [74]

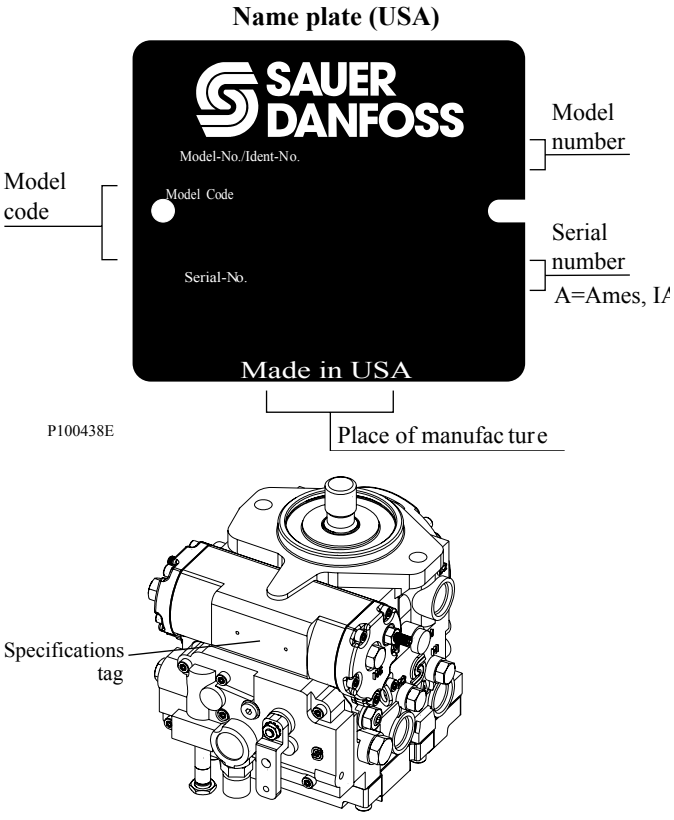
Appendix B - Specification Tags

Pre-block point change



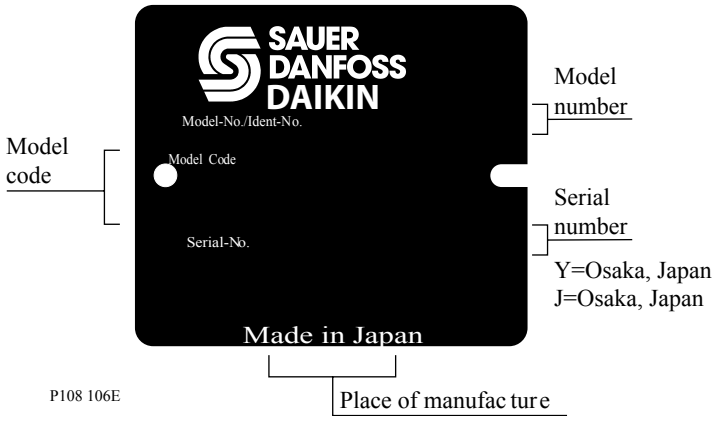
X	XX	XX	XXXXX
Location	Year	Week	Sequence number

Post-block point change



Appendix B - Specification Tags

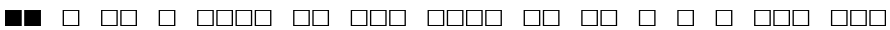
Name plate (Japan)



Appendix C - Nomenclature

Pre-block point change nomenclature

- Series



- Rotation

- Frame Size

- Input Shaft

- Control

- Control Response

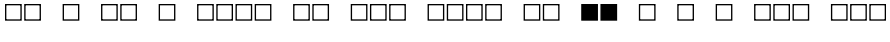
- Housing

- Charge Pump

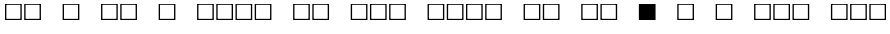
- System Relief - Port A

- System Relief - Port B

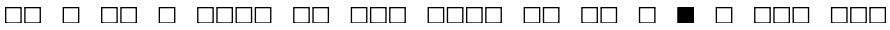
- Bypass Valve



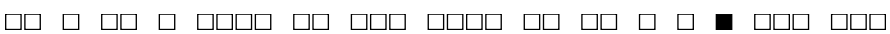
- Displacement Limiters - Side 1



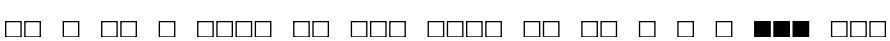
- Displacement Limiters - Side 2



- Special Hardware



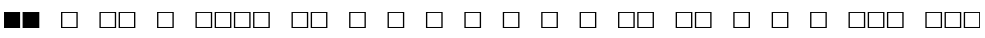
- Special Features



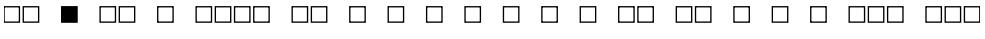
Appendix C - Nomenclature

Post-block point change nomenclature

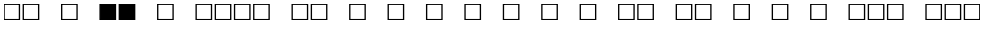
- Series



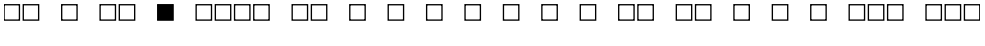
- Rotation



- Frame Size



- Input Shaft



- Control

- Control Response

- Housing

- Loop Flushing

- Filtration

- Charge Pump

- Charge Relief Setting

- Special Drive Features

- Auxiliary Mounting Pad

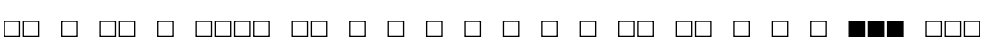
- System Relief - Port A

- System Relief - Port B

- Bypass Valve

- Displacement Limiters - Side 1

- Displacement Limiters - Side 2



- Special Hardware

Appendix C - Nomenclature

• Special Features

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