



## MCV115

### Hydraulic Displacement Control - PV Series 90

BLN-95-9039-1

Issued: December 1992

## DESCRIPTION

The MCV115 Series 90 Hydraulic Displacement Control (HDC) is a hydromechanical pump stroke control which uses mechanical feedback to establish closed loop control of the swashplate angle of Danfoss Series 90 pumps.

The first stage, provided by the customer, produces a differential pressure to the HDC. The second stage uses the differential pressure to drive its unique spool arrangement and port oil to the pump servo cylinders. The second stage spool configuration allows a null deadband (for machine safety) in the pump's output while maintaining optimum dynamic response to control commands.

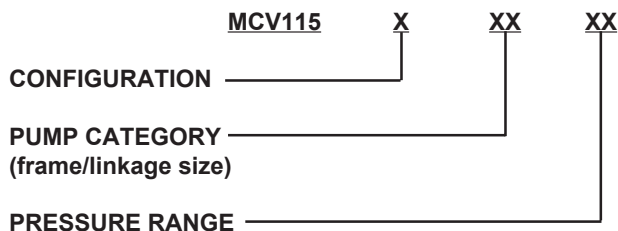


## FEATURES

- Servo control deadband independent of signal null deadband; offers safety combined with accurate and responsive control
- Fully tested to resist the off road environment
- Minimum long term null shift

## ORDERING INFORMATION

The MCV115 HDC is ordered through the following part number scheme:



### CONFIGURATION

- A Standard control
- B Annular control (not available on 30, 42 or 55 cc pumps)

### PUMP CATEGORY

- 05 30, 42, 55 cc
- 07 75 cc
- 10 100 cc
- 13 130 cc (with short pin)
- 18 180 cc

### PRESSURE RANGE

- 01 1.1 - 6.7 bar
- 02 1 - 11 bar
- 03 3 - 11 bar
- 04 8 - 16.5 bar
- 05 0.8 - 4.6 bar
- 06 5 - 15 bar

The pressure ranges available for the HDC are:

MCV115 PART NUMBER	PRESSURE RANGE	COMMENTS
AXX01, BXX01	1.1 - 6.7 bar (16 - 98 psi)	Same Pressure Range as MCV112
AXX02, BXX02	1 - 11 bar (15 - 160 psi)	Same Pressure Range as MCV112
AXX03, BXX03	3 - 11 bar (44 - 160 psi)	Same Pressure Range as MCV112
AXX04, BXX04	8 - 16.5 bar (116 - 239 psi)	Not available as MCV112
AXX05, BXX05	0.8 - 4.6 bar (11 - 66 psi)	Same Pressure Range as MCV114's lower range
AXX06, BXX06	5 - 15 bar (73 - 218 psi)	Not available as MCV112

## ORDERING INFORMATION *(continued)*

HDCs ordered separate from the pump must have mounting kits ordered separately. The following table shows the pump/kit relationships.

### 30/55 cc PUMP KIT (KIT NUMBER KK12655)

PART NUMBER	QUANTITY	DESCRIPTION
K11419	1	Gasket
9007314-0611	6	Screw

### 42 cc PUMP KIT (KIT NUMBER KK12642)

PART NUMBER	QUANTITY	DESCRIPTION
K11419	1	Gasket
9007314-0611	6	Screw
K09123	1	Seal Washer

### 75/100/130 cc PUMP KIT (KIT NUMBER KK12675)

PART NUMBER	QUANTITY	DESCRIPTION
K11420	1	Gasket
9007314-0611	6	Screw

### 180 cc PUMP KIT (KIT NUMBER KK12618)

PART NUMBER	QUANTITY	DESCRIPTION
K11419	1	Gasket
9007314-0611	6	Screw
K09123	1	Seal Washer

## TECHNICAL DATA

Some specifications apply to all HDCs. Others will vary based on the MCV115 number scheme, as outlined in the Ordering Information section.

### THRESHOLD

See Pressure Range in the Ordering Information section. Defined as the center of hysteresis extracted to the pump start stroke.

### DEADBAND

Twice the threshold,  $\pm 7\%$  of the rated pressure.

### RATED PRESSURE

See Pressure Range, in the Ordering Information section. Tolerance is  $\pm 10\%$ . Defined as the pressure required to reach rated pump output. Maximum pressure is 500 psid above rated pump case pressure. See the Input Pressure Vs. Swashplate Angle Curve.

### HYSTERESIS (Maximum)

7% of rated pressure. Measured on the hysteresis curve generated at a frequency of 0.01 Hz with an excursion of  $\pm$  rated pressure. The hysteresis measurement will be made between 1 and 16 degrees of swash angle.

### SYMMETRY

Input current required to reach rated output in each direction must be equal within 15%.

### LINEARITY

10% maximum of swashplate angle change between any two points except within  $1^\circ$  of neutral.

### RETURN TO NEUTRAL

The spool will return to neutral if the input differential pressure signal is zero and mechanical feedback is present.

### OPERATING CHARGE PRESSURE

300 psi above case pressure (nominal).

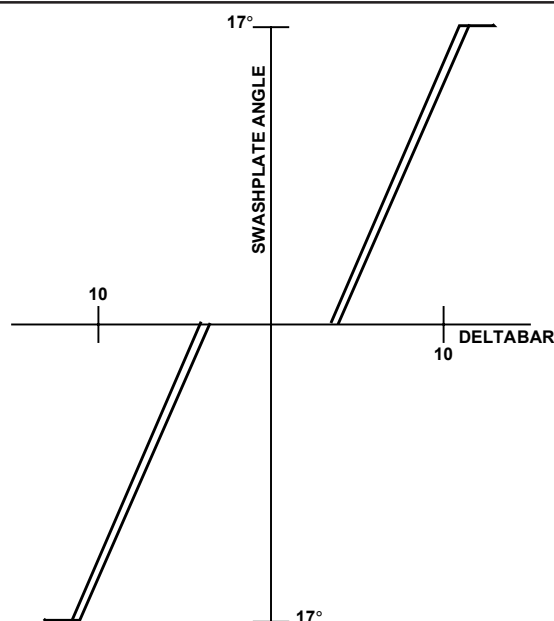
### TIME RESPONSE (Maximum)

- 1.0 seconds (0 to full stroke) (pressure limited valves)
- 2.0 seconds (full to full stroke) (pressure limited valves)
- 0.30 seconds (0 to full stroke) (non-pressure limited valves)
- 0.40 seconds (full to full stroke) (non-pressure limited valves)

### SENSITIVITY

The valve will respond to a 2% change in input pressure throughout the rated pressure range except for the deadband region.

## INPUT PRESSURE VS. SWASHPLATE ANGLE



Input Delta Pressure Vs. Swashplate Angle for the MCV115 (Typical).

## THEORY OF OPERATION

The HDC uses a unique spool-barrel-feedback arrangement that serves to separate the null deadband from the feedback, giving both safety against null drift and quick dynamic response to command changes. The barrel contains the spring which provides the matching requirements for differential pressure rating to output swashplate angle rating. The barrel is driven directly by the feedback linkage from the swashplate. See the Internal Workings Schematic.

The HDC's null adjust is set with a feedback spring to provide an effective pressure-preload threshold, which is the amount of differential pressure required to move the spool one direction or the other. By tightening or loosening the main null adjust screw, the fixed deadband is adjusted to the pump to create the pump stroking start differential pressures.

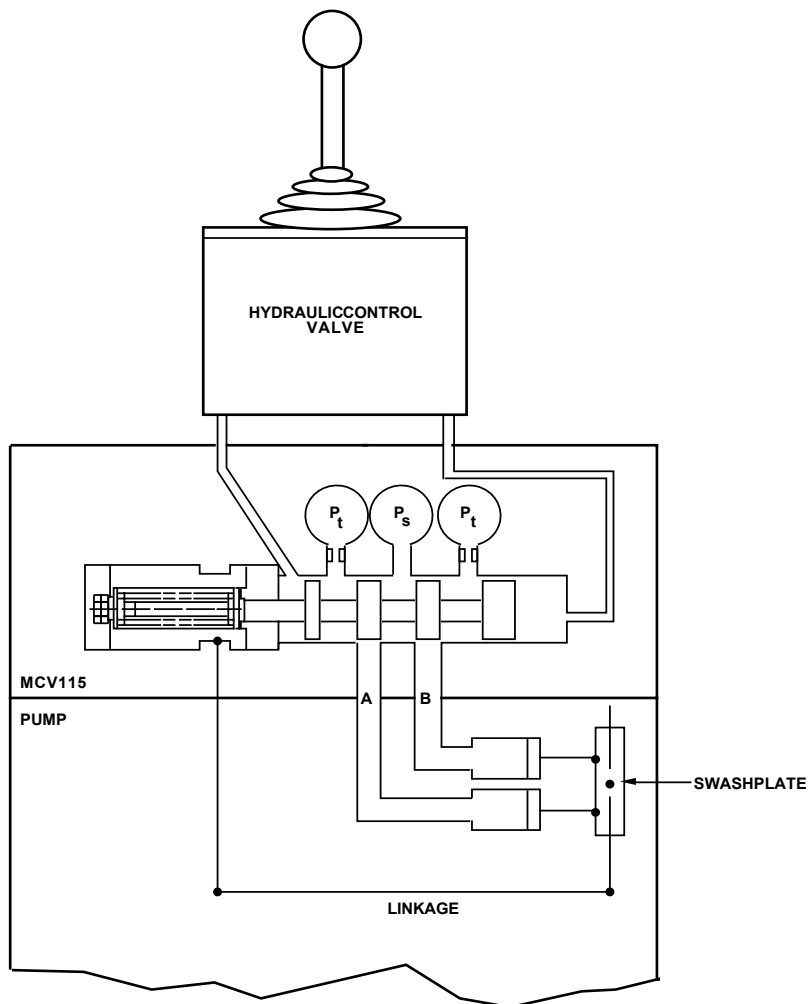
As differential control pressure input from the external source rises beyond the threshold, the spool moves in one direction or the other, opening one of the control ports to charge pressure, which ports oil to one of the pump servocylinders to move the swashplate. As the swashplate moves, the drag

linkage follows, moving the barrel in the opposite direction of the spool input motion, driving the spool back to its neutral position through the feedback spring within the barrel.

The HDC is a removable module from the main pump housing such that no internal hardware changes are required to the basic unit to switch from a manual to a hydraulic displacement control. It will, however, be necessary to add a charge check orifice, spring and retainer (which are part of the pump assembly). The 90 Series HDC is comprised of several physical sizes of controls to meet the requirements of all the pump sizes. High response HDCs are not compatible with pressure limiters. This is a limit set by the design of the pressure limiters within the pump.

Loose parts will be captive so there is no danger of them falling into the pump during servicing. Control pressure ports (from the external hydraulic input device) will be provided on the boost stage as SAE-6 straight thread O-ring ports located on the HDC's surface opposite the pump mounting surface.

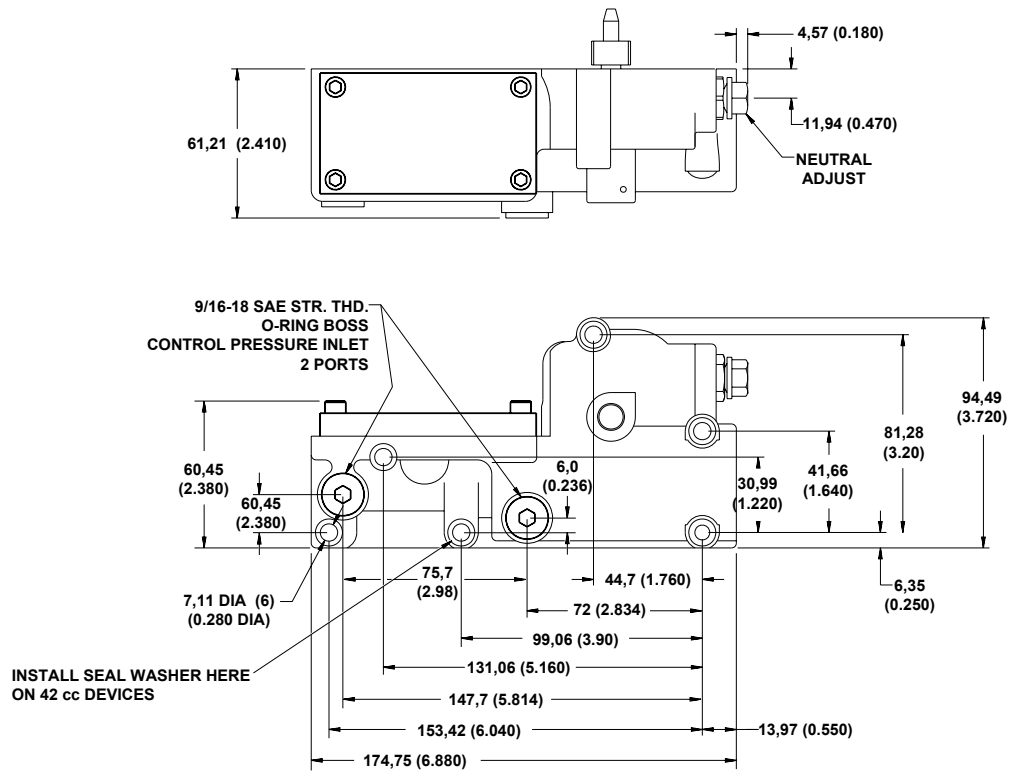
## INTERNAL WORKINGS SCHEMATIC



Schematic of the MCV115.

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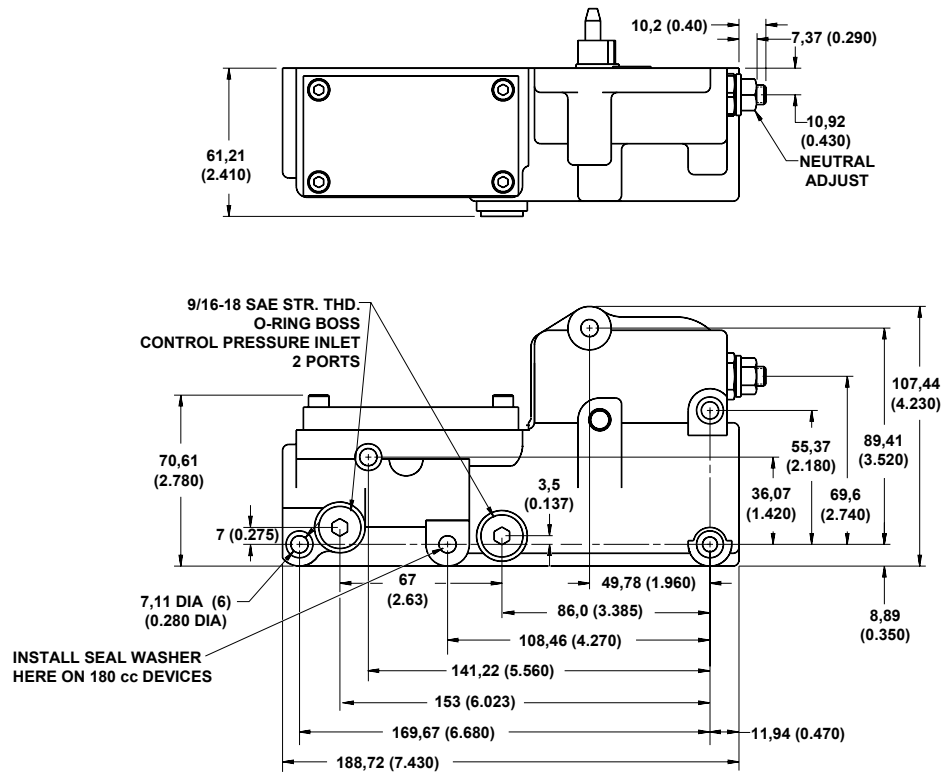
## DIMENSIONS FOR 30, 42, AND 55 CC PUMPS



1634

Dimensions in Millimeters (Inches).

## DIMENSIONS FOR 75 - 180 CC PUMPS



1635

Dimension in Millimeters (Inches).

## ENVIRONMENTAL

### TEMPERATURE

The valve will be functional and undamaged at oil temperatures of  $-40^{\circ}$  to  $250^{\circ}$  F ( $-40^{\circ}$  to  $121^{\circ}$  C) with oil viscosities from 40 to 6000 SUS. The valve will meet performance specifications with oil temperatures of  $70^{\circ}$  to  $180^{\circ}$  F ( $21^{\circ}$  to  $82^{\circ}$  C).

### SHOCK

50 g for 11 milliseconds. Three shocks in both directions of the three mutually perpendicular axes for a total of 18 shocks.

### VIBRATION

Withstands a vibration test designed for mobile equipment controls mounted on hydrostatic transmissions consisting of two parts:

1. Cycling from 5 to 2000 Hz in each of the three axis.

2. Resonance dwell for one million cycles for each resonance point in each of the three axis.

Run from 1 g to 46 gs. Acceleration levels vary with frequency.

### FILTRATION

The system hydraulics shall have 10 micron or better filtration. The pump will contain screen filters near the interface to the HDC at the charge port and control ports.

### FLUID

Automatic transmission fluid or hydraulic oil (Ref: Mobile DTE 24 or equivalent).

### DIMENSIONS

See the Dimension drawings.

## TO INSTALL THE NEW CONTROL

### WARNING

*Exercise care when placing the valve on a surface before mounting on a transmission. Dropping or otherwise forcefully setting the valve down may damage the pin.*

### WARNING

*Do not put the MCV115X13XX HDC on an older model pump. Consult factory for proper installation. Older style pumps previously used MCV112 HDCs with a manifold between the HDC and the 130 cc pump. Directly-mounted MCV115s use a pin that is too short for older pumps. Using them improperly will result in pump displacement without feedback signal to the HDC.*

### WARNING

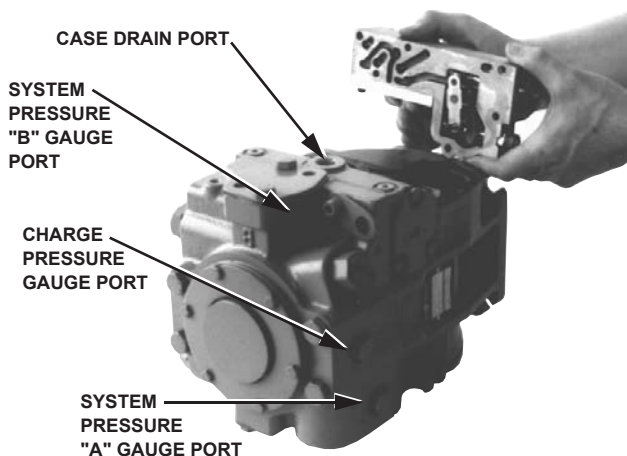
*Uncontrollable vehicle or load movement will occur upon start-up if the control is installed without proper engagement of the control feedback link pin into the swashplate link.*

*During control installation, feel for pin engagement by tipping the control before installing the mounting screws. The control will not tip more than  $5^{\circ}$  if the pin is engaged.*

*Vehicle or load movement can also result from lack of or improperly adjusted control neutral. Follow service manual procedures for adjusting neutral after start-up. Always raise the vehicle, or block the vehicle load, from moving upon start-up.*

1. Place a new gasket on the pump housing. Ensure that the control orifice and spring are in the proper position in the control.
2. Engage the pin on the control into the mating hole in the link attached to the swashplate. See the Linkage Assembly and Port Locations photo.
3. Ensure that the pin is engaged in the link by tilting the control upwards from the narrower end. If the pin catches in the link and allows only a slight upward tilt, there is positive engagement. If the control swings up freely, the pin is not properly aligned.
4. Position the control into place against the pump housing. Align the gasket. Install the cap screws (On 42 cc and 180 cc pumps use the included seal washer per the Dimension drawings.) and torque to 10-12 ft-lbs.

## LINKAGE ASSY & PORT LOCATIONS



1646

**Assembly of control linkage and location of pump ports for the MCV115.**

## PUMP NEUTRAL ADJUSTMENT

Use the following procedure to bring the pump to neutral once the hydraulic displacement control has been mounted.

1. Install a 500 psi gauge into the charge pressure gauge port on the pump. See the Linkage Assembly and Port Locations photo.
2. Loosen the null adjust plug on the null adjust screw.
3. Start the prime mover and run at low idle.

### WARNING

*To adjust neutral requires operating the pump. Take the necessary safety precautions, such as having unnecessary personnel stand away from the machine. Maximum system pressure may occur upon start up, and the machine may move. Ensure that the operator is not in a position to be injured should the machine move.*

4. Warm the system up for several minutes to bleed air.
5. Slowly increase the prime mover speed to rated rpm. (Ensure that the input differential pressure is zero.)
6. If the transmission operates as shown by motor shaft rotation, reduce speed to idle. Using a 4 mm internal hex wrench, slowly turn the null adjustment screw clockwise or counterclockwise until the transmission does not operate. Repeat step 5. Note that charge pressure should drop with forward or reverse stroking of the pump swashplate due to the shifting of the shuttle valve in the motor manifold. Slowly turn the null adjust screw clockwise until charge pressure decreases.
7. With the hex wrench, slowly turn the null adjustment screw counterclockwise, observing the wrench angle rotation, until charge pressure decreases again (charge pressure will rise in neutral and drop when going into stroke).
8. Turn the adjustment screw clockwise half the amount of the turn observed in step 7. This should be the center of neutral.
9. Hold the adjustment screw and securely tighten the null adjust plug to 3–5 ft-lbs. Note that if a motor is used that does not have a manifold, neutral should be adjusted (steps 7–9) by observing the motor shaft rotation without a load.
10. Stop the prime mover.
11. Run the system briefly to ensure that it operates proportionally on both sides of null. Swashplate movement can be verified by watching motor shaft rotation without a load.

## CUSTOMER SERVICE

### NORTH AMERICA

#### ORDER FACTORY INSTALLED MCV115s ON PUMPS FROM

Danfoss (US) Company  
2800 East 13th Street  
Ames, Iowa 50010  
Phone: (515) 239-6000  
Fax: (515) 239-6318

#### ORDER INDIVIDUAL MCV115s FROM

Danfoss (US) Company  
Customer Service Department  
3500 Annapolis Lane North  
Minneapolis, Minnesota 55447  
Phone: (763) 509-2084  
Fax: (763) 559-0108

#### DEVICE REPAIR

For devices in need of repair, include a description of the problem, a copy of the purchase order and your name, address and telephone number.

### RETURN TO

Danfoss (US) Company  
Return Goods Department  
3500 Annapolis Lane North  
Minneapolis, Minnesota 55447

### EUROPE

#### ORDER FROM

Danfoss (Neumünster) GmbH & Co.  
Order Entry Department  
Krokamp 35  
Postfach 2460  
D-24531 Neumünster  
Germany  
Phone: 49-4321-8710  
Fax: 49-4321-871355