

# **MPG2-H / MPG2-H-HV**

Manual Pressure Generator/Controller for Hydraulic Pressure

## Operation and Maintenance Manual



High pressure liquids and gases are potentially hazardous. Energy stored in these liquids and gases can be released unexpectedly and with extreme force. High pressure systems should be assembled and operated only by personnel who have been instructed in proper safety practices.

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# ABOUT THIS MANUAL

This manual provides the user with the information necessary to operate an MPG2-H Manual Pressure Generator/Controller for Hydraulic pressure. It also includes additional information provided to help you optimize MPG2 use and take full advantage of its many features and functions.

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*For those of you who “don’t read manuals”, go directly to Section 2.3 to set up your MPG2. Then go to Section 3.2. This will get you running quickly with minimal risk of causing damage to yourself or your MPG2. Then... when you have questions or start to wonder about all the great features you might be missing, get into the manual!*

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## Manual Conventions

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*(CAUTION) is used throughout the manual to identify user warnings and cautions.*

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*(NOTE) is used throughout the manual to identify operating and applications advice and additional explanations.*

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## NOTES

# 1. INTRODUCTION

## 1.1 PRODUCT OVERVIEW

The **DHI** Manual Pressure Generator/Controller for Hydraulic Pressure (MPG2-H) provides a compact and easy to use system for manually generating, setting and finely adjusting pressures between atmosphere and 200 MPa (30 000 psi) in closed volumes. MPG2 is a standard pressure generation and control component for working with **DHI** PG7302 piston gauges or liquid operated RPM4 reference pressure monitors. MGP2 and RPM4 are available as a single, integrated pressure calibration instrument designated E-DWT

The MPG2-H-HV has a larger displacement variable volume (7 cc rather than 3 cc) and is intended for applications with higher test volumes to reduce variable volume stroke needed to generate the desired pressure. The maximum working pressure of MPG2-H-HV is 100 MPa (15 000 psi). The MPG2-H requires less variable volume torque and adjusts pressure more precisely.

## 1.2 SPECIFICATIONS

	MPG2-H	MPG2-H-HV
<b>Pressure range</b>	Atmosphere to 200 MPa (30 000 psi)	Atmosphere to 100 MPa (15 000 psi)
<b>Variable volume piston diameter</b>	7.9 mm	12 mm
<b>Variable volume stroke</b>	6 cm	6 cm
<b>Variable volume displacement</b>	3 cc (0.18 in. <sup>3</sup> )	7 cc (43 in. <sup>3</sup> )
<b>Priming pump displacement</b>	3.7 cc (0.23 in. <sup>3</sup> )	
<b>Reservoir capacity</b>	300 cc (18 in. <sup>3</sup> )	
<b>TEST1, TEST2 connections</b>	DH 500 (DH500 is a gland and collar type fitting for ¼ in. (6 mm) coned and left hand threaded tube. DH500 is equivalent to AE F250C, HIP HF4, etc.)	
<b>Operating fluid</b>	Any non-corrosive oil, water, water/alcohol. Inquire about other fluids	
<b>Dimensions</b>	400 mm W x 136 mm H x 300 mm D (15.8 in. x 5.4 in. x 11.8 in.) (see Section 1.4 )	
<b>Weight:</b>	10 kg (22 lbs.)	



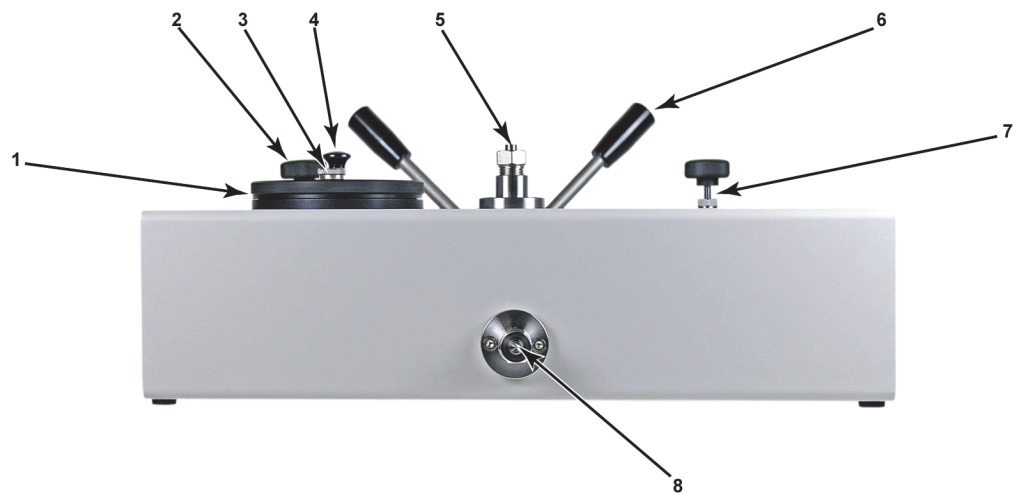
*Due to a policy of continuous product improvement all specifications are subject to change without notice.*

### 1.3 LOCATION OF THE COMPONENTS



- |                               |   |
|-------------------------------|---|
| 1. TEST1 connection (DH500)   | 5. Reservoir shut off valve                         |
| 2. Reservoir cover vent valve | 6. Variable volume                                  |
| 3. Priming pump               | 7. Test shut off valve and fine pressure adjustment |
| 4. Reservoir cover            |   |

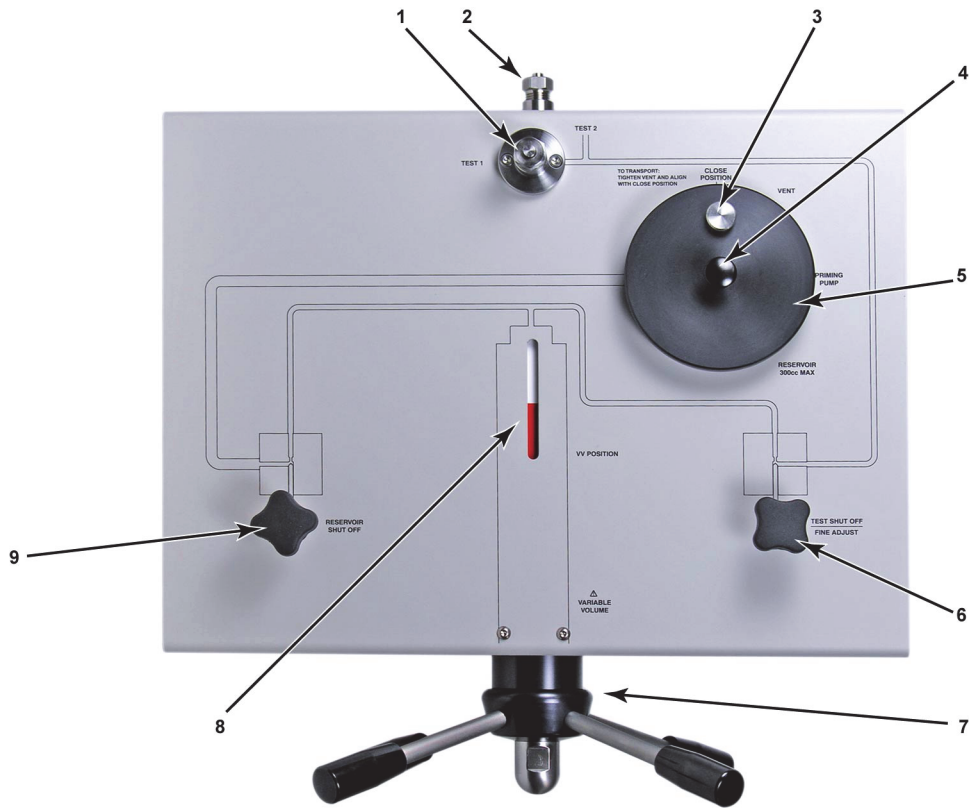
Figure 1. Front view



- |                         |  |
|-------------------------|--|
| 1. Reservoir            | 5. TEST1 connection                                      |
| 2. Test shut off valve  | 6. Variable volume                                       |
| 3. Reservoir vent valve | 7. Reservoir shut off valve and fine pressure adjustment |
| 4. Priming pump         |  |

Figure 2. Rear view





- |                               |   |
|-------------------------------|---|
| 1. TEST1 connection           | 6. Test shut off valve and fine pressure adjustment |
| 2. TEST2 connection           | 7. Variable volume                                  |
| 3. Reservoir cover vent valve | 8. Variable volume piston position indicator        |
| 4. Priming pump               | 9. Reservoir shut off valve                         |
| 5. Reservoir cover            |   |

**Figure 3.** Top view

## 1.4 DIMENSIONAL SCHEMATICS

All dimensions are in millimeter [mm]

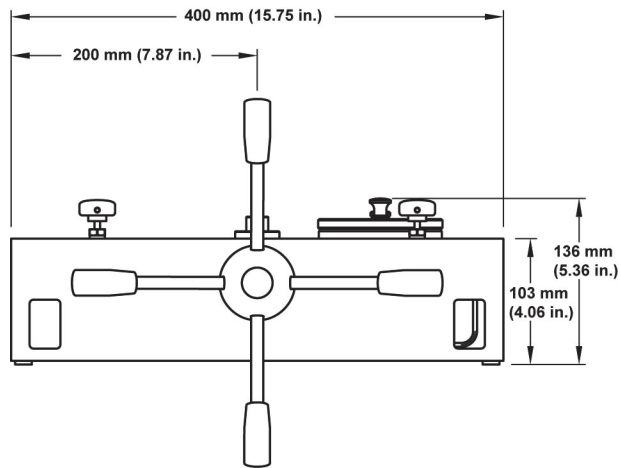


Figure 4. Front view dimensions

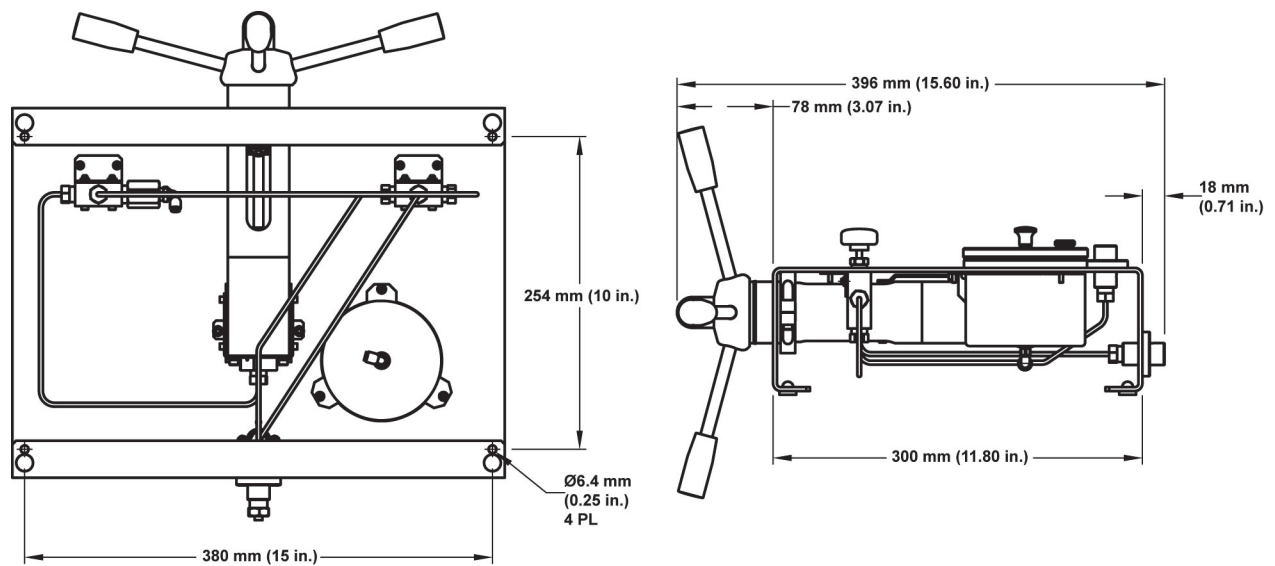
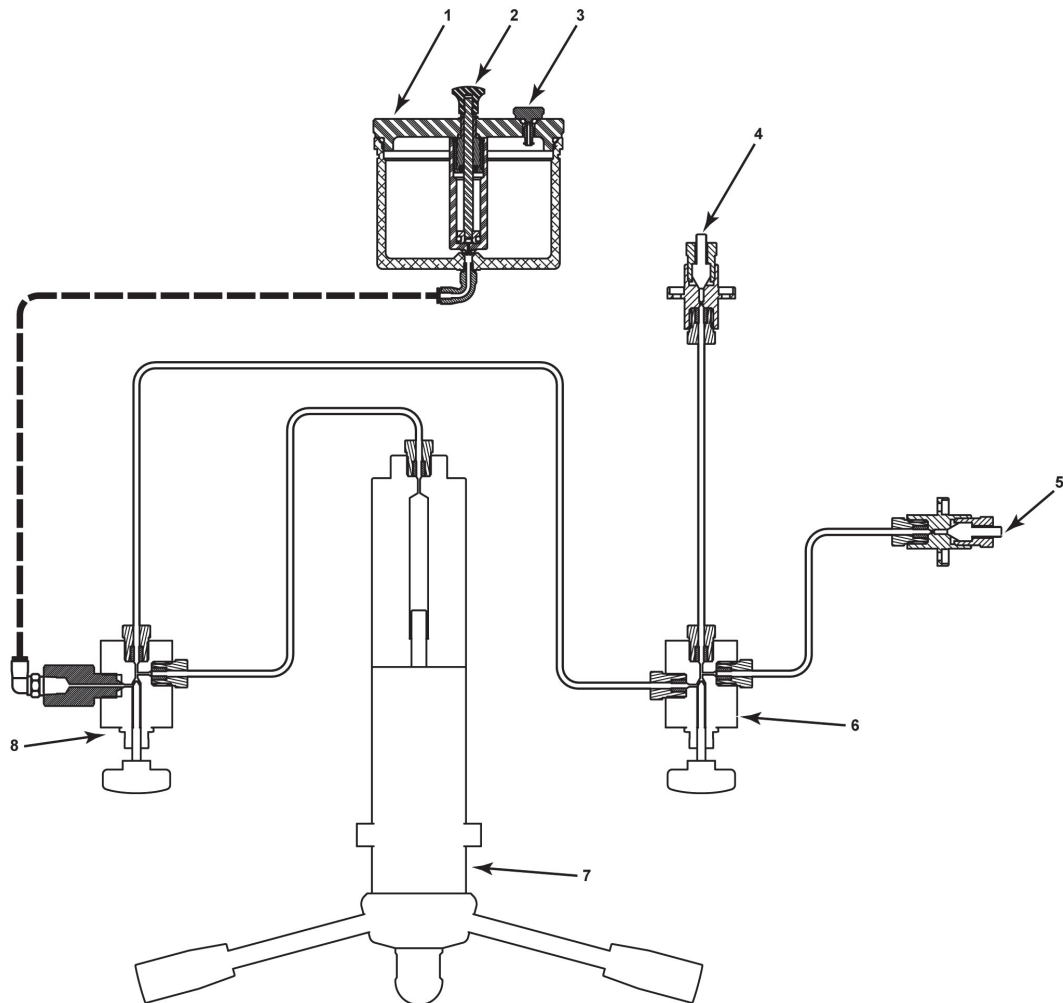


Figure 5. Bottom and side view dimensions

## 1.5 HYDRAULIC SCHEMATIC



- |                               |   |
|-------------------------------|---|
| 1. Reservoir cover            | 5. TEST2 connection                                 |
| 2. Priming pump               | 6. Test shut off valve and fine pressure adjustment |
| 3. Reservoir cover vent valve | 7. Variable volume                                  |
| 4. TEST1 connection           | 8. Reservoir shut off valve                         |

**Figure 6.** System schematic

**NOTES**

## 2. INSTALLATION

### 2.1 UNPACKING AND INSPECTION

MPG2-H is delivered, along with its standard accessories, in a corrugated container held in place by expandable foam.

The MPG2 is delivered with its valves closed and the variable volume (VV) fully screwed in. The reservoir and the MPG2 plumbing are free of fluid.

Remove MPG2 and its accessories from the shipping container and remove each item from its protective bag.

Check that all items are present and have no visible signs of damage.

**Table 1.** MPG2-H and MPG2-H-HV Parts List

DESCRIPTION	ITEM NO.
MPG2-H or MPG2-H-HV instrument	3323107 or 3341293
<b>Accessories including:</b>	
4 ea. Variable volume handle	3329907
1 ea. Plug, DH500	3068470
1 Operation and Maintenance Manual	3340765

### 2.2 SITE REQUIREMENTS

- MPG2 should be installed on a stable surface. It may be necessary to anchor MPG2 using the mounting holes in the bottom of the housing. This is to hold the housing firmly in place when turning the variable volume, particularly at high pressures and to avoid applying the torque from variable volume rotation to the tubing and fittings which may be connected to the MPG2. "C" clamps may also be used, fitting in the openings on the lower front corners of the MPG2 housing.
- As the span of the variable volume handles is wider than the MPG2 housing, the MPG2 needs to be mounted so that the handles hang over the edge of the mounting surface, for example over the front of a work bench.

## 2.3 INITIAL SETUP

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*High pressure fluids are potentially hazardous. Energy stored in pressurized fluids can be released unexpectedly and with extreme force. High pressure systems should be assembled and operated only by personnel who have been instructed in proper safety practices.*

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To set up the MPG2 for operation, proceed as follows:

- ❶ Set the MPG2 on a hard, flat surface. If desired, anchor the MPG2 to a stable working surface using the mounting holes on the bottom of the MPG2 platform or the clamp openings on the front. The mounting hole diameter is 6.4 mm (0.26 in.) suitable for M6 or 1/4 in. screws. If mounting to a wood bench top, use of threaded inserts and machine screws is recommended.
  - ❷ Connect the TEST1 and/or TEST2 port to the system into which pressure is to be generated and controlled. All MPG2 pressure connections are DH500 female (DH500 is a gland and collar type fitting for 1/4 in. (6 mm) coned and left hand threaded tube. DH500 is equivalent to AE F250C, HIP HF4, etc.). If a TEST port is not being used, plug it using the DH500 plug supplied in the MPG2 accessories.
- 



*ALWAYS use external tubing and fittings rated for pressures equal to or greater than the maximum pressure which MPG2 will be used to generate.*

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*DH500 F fittings are delivered with disposable, orange, plastic dummy plugs installed. These are NOT intended to hold high pressure. They should be removed and replaced with appropriate fittings or stainless steel plugs before high pressure operation. Each dummy plug carries a DH500 collar. Remove and retain the collar for use in connecting to the mating tube.*

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- ❸ Fill the fluid reservoir: Close the reservoir shutoff valve. Remove the reservoir cover by rotating it CW. Pour the desired fluid into the reservoir. Do not overfill. MPG2 is tested with a low viscosity, fluorinated liquid and should be free of significant fluid residue as delivered.
- ❹ Prime and leak check pressurized system (see Section 3.2.1).

## 3. OPERATION

### 3.1 GENERAL OPERATING PRINCIPLES AND INFORMATION

#### 3.1.1 OVERVIEW

See Section 1.5, Figure 6

MPG2-H is used to manually generate and adjust liquid pressure from atmosphere to 200 MPa (30 000 psi) (limited to 100 MPa (15 000 psi) with MPG2-H-HV) or using a priming pump, two valves and a variable volume. Fittings for connecting to a device or system under test are located on the top and middle rear of the instrument housing. A reservoir holds a supply of fluid.

#### 3.1.2 VALVES

The reservoir shutoff and test shutoff valves are manually operated needle valves.

The reservoir shut valve isolates the reservoir from the pressurized circuit. It is opened use the priming pump, to fill the variable volume with fluid and to open the pressurized circuit to atmosphere (vent).

The test shutoff valve isolates the TEST1 and TEST2 ports from the rest of the MPG2 circuit. It can be used to isolate the variable volume and reservoir from the pressurized test system, for example, if it becomes necessary to refill the variable volume with fluid when it reaches end of stroke.

As test shutoff the valve needle displaces fluid when it is operated, it can also be used as a very fine variable volume for very fine pressure adjustment.

#### 3.1.3 PRIMING PUMP

The priming pump is a syringe style fluid injector, built into the reservoir cover. On its plunger upstroke, it draws oil from the reservoir into its barrel. On the down stroke, the barrel tip seals with the connection on the bottom of the reservoir and the plunger pushes oil into the rest of MPG2 and out the test port.

The priming pump is used to fill the MPG2 and system to which it is connected with hydraulic fluid and then generate a low, starting pressure.

#### 3.1.4 VARIABLE VOLUME (VV)

The variable volume (VV) is a piston-cylinder type screw press. Rotating the variable volume handles, moves the piston in or out decreasing or increasing the volume and therefore increasing or decreasing pressure.

The VV is used to generate and adjust pressure in the system to which MPG2 is connected when the reservoir shut valve is closed and test shut off valve is open. The torque necessary to rotate the VV handle is proportional to the pressure in the variable volume.

Generally, the starting position of the VV when beginning to generate pressure from atmosphere is with the piston fully retracted (handles rotated maximum CCW) so that the full stroke of the VV is available to fill the test system and generate pressure.

During operation, if the VV runs out of stroke, the test shut off and reservoir shutoff valves can be used in sequence to allow the variable volume to be refilled without releasing the pressure on the TEST1 and TEST2 port (see Section 3.2.3).



*The maximum operating pressure of the variable volume is 200 MPa (30 000 psi) with MPG2-H and 100 MPa (15 000 psi) with MPG-H-HV and. Do not generate pressure greater than the maximum operating pressure.*

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### 3.1.5 RESERVOIR

The reservoir is a 300 cc (18 in<sup>3</sup>) aluminum vessel mounted inside the MPG2 housing. It is accessed for filling or cleaning by a screw on cover on the top surface of the MPG2 housing. The reservoir is connected to the RESERVOIR ISOLATION valve by flexible tubing.

## 3.2 OPERATION

Operation of the MPG2 can be divided into three common tasks: filling and priming the system under test (See Section 3.2.1); generating and adjusting pressure (see Section 3.2.2); filling or emptying the variable volume while maintaining test system pressure (see Section 3.2.3).

### 3.2.1 FILLING AND PRIMING THE SYSTEM UNDER TEST, PRIMING PUMP

It is important to remove air from the test system by filling and priming it before using the variable volume to generate pressure. Failure to fill and prime will result in the need to use multiple variable volume strokes to generate pressure.

The reservoir pump is designed to push oil through the MPG2 and out the TEST port into the test system. It can also generate an initial pressure, saving variable volume stroke.

To fill and prime the test system, prior to generating pressure with the variable volume, proceed as follows:

- ❶ Leave an open purge point (for example a loose fitting) at the highest point possible in the system that is connected to the MPG2.
- ❷ Open the reservoir shut off valve and the test shut off valve to connect the reservoir to the rest of the system.
- ❸ Position the reservoir cover correctly by rotating it CW until the reservoir vent valve is at the CLOSE position. Do not over tighten; do not turn CW beyond CLOSE position.
- ❹ Be sure that the reservoir cover vent valve is open (loosened CCW).
- ❺ Pull the reservoir handle pump up slowly to fill it with oil from the reservoir. Then push the handle down firmly with moderate speed to seal the tip of the pump against the reservoir seat and inject oil into the MPG2 and out the TEST port.
- ❻ Repeat ❺ while observing the open purge point in the test system. When only oil and no air comes out of the purge point, close and tighten the purge point.
- ❼ If desired, repeat ❻ to set an initial pressure with the reservoir pump. Be sure the variable volume is already filled and in the start position (Section 3.2.2, ❶-❷), and the reservoir shut off valve is open.



Press down on the pump handle but do not release your downward force when the pump gets to end of stroke or becomes too difficult to push down. While maintaining the downward force on the pump handle, close the reservoir shut off valve to capture the priming pressure.



*Do not attempt to generate greater than 700 kPa (100 psi) using the reservoir priming pump.*

- ⑧ Once the system is filled and primed, use the variable volume to generate pressure to the desired pressure set point (see Section 3.2.2).



*When the reservoir cover vent valve is closed, the reservoir is not connected to atmosphere so opening the reservoir shut off valve and the test shut off valve may not fully vent the system connected to the MPG2. To be sure the system is fully vented to atmosphere, OPEN the reservoir cover shut off valve and/or disconnect at the TEST port.*

### 3.2.2 GENERATING AND ADJUSTING PRESSURE, VARIABLE VOLUME AND FINE ADJUST VALVE



*The variable volume can generate very high pressure very quickly. When using the variable volume, use caution not to generate pressure more quickly than desired and not to exceed the pressure rating of the MPG2 (see Section 1.2) or any component of the system to which it is connected.*

Before attempting to use the MPG2 to generate pressure, the system to which it is connected should be as free of air as possible. See Section 3.2.1 to fill and prime the test system.

Once the system to which MPG2 is connected, filled and primed, to generate and adjust pressure proceed as follows:

- ① Open the reservoir shut off valve to connect the reservoir to the variable volume.  
Close the TEST shut off valve to avoid 'pulling' oil out of the test system in step ②.
- ② Rotate the variable volume CCW until the piston position indicator is at the beginning of its stroke (indicator white).
- ③ Close the reservoir shut off valve to shut off the reservoir from the variable volume.
- ④ Open the TEST shut off valve to connect the variable volume to the test system.
- ⑤ Rotate the variable volume CW to increase pressure to the desired set point. Using the variable volume, it should be easy to adjust the set pressure within 700 kPa (100 psi) or less of the desired pressure.

To adjust pressure more finely than is possible with the variable volume, use the fine adjust valve (see Section 3.1.2).

- ⑥ If the variable volume runs out of stroke (piston position indicator red and variable volume will not rotate CW further) before the desired set pressure is reached, the variable volume can be isolated from the TEST port and refilled to continue generating pressure (see Section 3.2.3).
- ⑦ To reduce pressure, rotate the variable volume CCW.
- ⑧ To vent the system to atmosphere, once the pressure is low enough to be safely be dropped very rapidly, open the reservoir shut off valve (with the test shut off valve open).



Opening the reservoir shut off valve while the MPG2 is under pressure will very rapidly drop the pressure. Generally, it is not recommended to drop the pressure applied to pressure measuring devices very rapidly. To reduce pressure slowly, use the variable volume and only open the reservoir shut off valve to open the system to atmosphere.

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### 3.2.3 REFILLING OR EMPTYING THE VARIABLE VOLUME WITHOUT RELEASING TEST PRESSURE

When working to high pressure with large test volumes or test volumes that are not fully purged of air, the volume displaced by a single stroke of the variable volume may not be sufficient to generate the maximum pressure desired. Conversely, when lowering pressure the variable volume may run out of stroke before it is desirable to use the RESERVOIR ISOLATION valve to release pressure rapidly. In these cases, the variable volume can be backed off and refilled without releasing the pressure in the test system.

To refill or empty the variable volume without releasing test pressure, proceed as follows:

- ❶ Close the test shut off valve. This isolates the system connected to the TEST port(s) from the variable volume and the reservoir shut off valve. Note that after refilling the variable volume, the test shut off valve will be opened again. At that time, the pressure on both sides of the valve will not be perfectly equal so the pressure in the system connected to the TEST port(s) will change. Consider this possibility before closing the test shut off valve. For example, if using a piston gauge, put the piston gauge piston at its bottom stop before closing the test shut off valve.
- ❷ Open the reservoir shut off valve. This vents the pressure in the variable volume and connects it to the reservoir.
- ❸ Back out the variable volume (CCW) to fill it or screw it in (CW) to empty it, as desired.
- ❹ Close the reservoir shut off valve. **DO NOT OPEN THE TEST ISOLATION VALVE YET.**
- ❺ Operate the variable volume as needed to generate a pressure equal to the pressure in the system connected to the TEST port(s). This is the pressure that was present on the variable volume before the test shutoff valve was closed in ❶. The pressure may be reasonably approximated by the feel (torque) on the variable volume.
- ❻ Slowly open the TEST ISOLATION valve to equalize the pressure. Proceed to generate and adjust pressure as desired (see Section 3.2.2).

## **4. MAINTENANCE AND ADJUSTMENTS**

MPG2 was designed for maintenance free operation. The only recommended regular maintenance is to flush the hydraulic system and replace the operating liquid.

### **4.1 REPLACING LIQUID AND FLUSHING HYDRAULIC SYSTEM**

Regular replacement of MPG2's operating liquid and flushing of the hydraulic system is recommended.

To empty the reservoir, remove the reservoir cover and siphon the bulk of liquid out of the reservoir. Remove the balance of liquid from the system by screwing the variable volume all the way in (CW) with the TEST1 port plugged and the TEST2 port open. Then use the filling and priming procedure described in Section 3.2.1 to expel the rest of the liquid from MPG2. Collect the used liquid as it comes out of the TEST2 port.

Refill the reservoir with fresh liquid.

Refill the MPG2 volumes with liquid by plugging the TEST1 port and opening the TEST2 port. Then use the reservoir pump to inject liquid into MPG2 until only liquid and no air comes out of the TEST 2 port. Plug the TEST2 port, and with the reservoir shut off valve open, fully unscrew (CCW) the variable volume.

When flushing the MPG2, repeat the procedure above until the liquid coming out of the TEST2 port is clean.

**NOTES**

## 5. WARRANTY

### LIMITED WARRANTY AND LIMITATION OF LIABILITY

Each Fluke product is warranted to be free from defects in material and workmanship under normal use and service. The warranty period is one year and begins on the date of shipment. Parts, product repairs, and services are warranted for 90 days. This warranty extends only to the original buyer or end-user customer of a Fluke authorized reseller, and does not apply to fuses, disposable batteries, or to any product which, in Fluke's opinion, has been misused, altered, neglected, contaminated, or damaged by accident or abnormal conditions of operation or handling. Fluke warrants that software will operate substantially in accordance with its functional specifications for 90 days and that it has been properly recorded on non-defective media. Fluke does not warrant that software will be error free or operate without interruption.

Fluke authorized resellers shall extend this warranty on new and unused products to end-user customers only but have no authority to extend a greater or different warranty on behalf of Fluke. Warranty support is available only if product is purchased through a Fluke authorized sales outlet or Buyer has paid the applicable international price. Fluke reserves the right to invoice Buyer for importation costs of repair/replacement parts when product purchased in one country is submitted for repair in another country.

Fluke's warranty obligation is limited, at Fluke's option, to refund of the purchase price, free of charge repair, or replacement of a defective product which is returned to a Fluke authorized service center within the warranty period.

To obtain warranty service, contact your nearest Fluke authorized service center to obtain return authorization information, then send the product to that service center, with a description of the difficulty, postage and insurance prepaid (FOB Destination). Fluke assumes no risk for damage in transit. Following warranty repair, the product will be returned to Buyer, transportation prepaid (FOB Destination). If Fluke determines that failure was caused by neglect, misuse, contamination, alteration, accident, or abnormal condition of operation or handling, including overvoltage failures caused by use outside the product's specified rating, or normal wear and tear of mechanical components, Fluke will provide an estimate of repair costs and obtain authorization before commencing the work. Following repair, the product will be returned to the Buyer transportation prepaid and the Buyer will be billed for the repair and return transportation charges (FOB Shipping Point).

THIS WARRANTY IS BUYER'S SOLE AND EXCLUSIVE REMEDY AND IS IN LIEU OF ALL OTHER WARRANTIES, EXPRESS OR IMPLIED, INCLUDING BUT NOT LIMITED TO ANY IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. FLUKE SHALL NOT BE LIABLE FOR ANY SPECIAL, INDIRECT, INCIDENTAL, OR CONSEQUENTIAL DAMAGES OR LOSSES, INCLUDING LOSS OF DATA, ARISING FROM ANY CAUSE OR THEORY.

Since some countries or states do not allow limitation of the term of an implied warranty, or exclusion or limitation of incidental or consequential damages, the limitations and exclusions of this warranty may not apply to every buyer. If any provision of this Warranty is held invalid or unenforceable by a court or other decision-maker of competent jurisdiction, such holding will not affect the validity or enforceability of any other provision.

Fluke Corporation  
P.O. Box 9090  
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Fluke Europe B.V.  
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The Netherlands

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Table 2. DHI Authorized Service Providers

DH INSTRUMENTS, A FLUKE COMPANY <a href="http://WWW.DHINSTRUMENTS.COM">WWW.DHINSTRUMENTS.COM</a> AUTHORIZED SERVICE PROVIDERS			
COMPANY	ADDRESS	TELEPHONE & FAX	EMAIL
<b>DH Instruments, a Fluke Company</b>	4765 East Beautiful Lane Phoenix AZ 85044-5318 USA	Tel 602.431.9100 Fax 602.431.9559	<a href="mailto:cal.repair@dhinstruments.com">cal.repair@dhinstruments.com</a>
<b>Ohte Giken, Inc.</b>	Technology Center 258-1 Nakadai Nihari-Gun Ibaraki 300-0133 JAPAN	Tel 0298-55-8778 Fax 0298-55-8700	<a href="mailto:tohte@ohtegiken.co.jp">tohte@ohtegiken.co.jp</a>
<b>DHI Products Technical Service Division</b>	National Institute of Metrology Heat Division Pressure & Vacuum Lab NO. 18, Bei San Huan Donglu Beijing 100013 PR China	Tel 010-64291994 ext 5 Tel 010-64218637 ext 5 Fax 010-64218703	<a href="mailto:cxcen@mx.cei.go.cn">cxcen@mx.cei.go.cn</a>
<b>Minerva Meettechniek B.V.</b>	Chrysantstraat 1 3812 WX Amersfoort the NETHERLANDS	Tel (+31) 33.46.22.000 Fax (+31) 33.46.22.218	<a href="mailto:info@minervaipm.com">info@minervaipm.com</a>