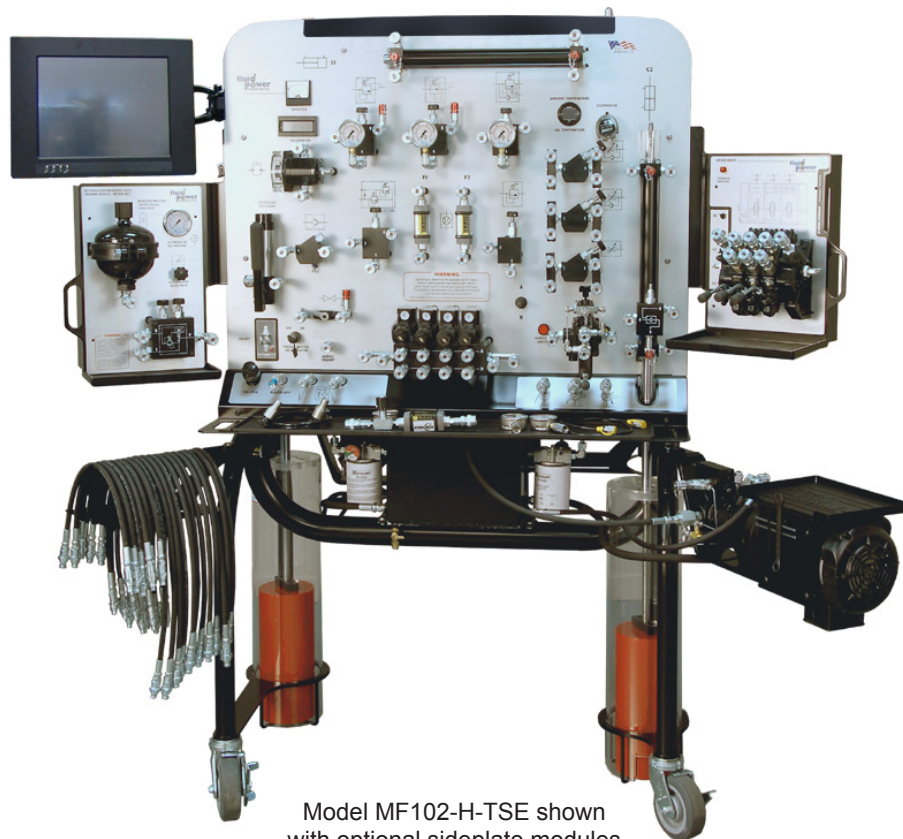


# MF102 Series Hydraulic Simulators

---

## OWNERS MANUAL

---



Model MF102-H-TSE shown  
with optional sideplate modules

---

**For your safety and the safety of the students,  
read this manual carefully**

---

**This handbook covers the following simulator models:**

- MF102-H - Practical Simulator
- MF102-H-TS - Troubleshooting Simulator
- MF102-H-TSE - Troubleshooting Electronic Simulator



## IMPORTANT NOTICE

---

Before unpacking your simulator, inspect the outside of the shipping container for damage or abuse. If there is any penetration of the shipping container, e.g. forklift forks, photograph and document the damage before opening the container.

Remove the cover and inspect for damage to the simulator. Photograph and document any damage which the penetration may have caused to the simulator. Show the relationship of the penetration (if any) to the damage on the simulator.

Report the damage to the shipping company immediately. Also, report the damage to the Fluid Power Training Institute™ - 1-888-222-3421 - as soon as possible.

MF102-OM

Revised February 04, 2013

COPYRIGHT © 2012 FLUID POWER TRAINING INSTITUTE™

All rights reserved. No part of this manual may be used or reproduced in any manner whatsoever without the written permission of the Publisher. Printed in the United States of America. **Violations will be pursued vigorously by all legal means available against the companies and individuals involved.**





## CONGRATULATIONS!

You have purchased the most advanced fluid power simulator in the world - ***the MF102 series***.

The MF102 series simulator was designed to make the task of teaching hydraulics simple and rewarding, and to make the job of learning hydraulics downright fascinating.

This owners manual contains all the information you need to become familiar with the MF102's unique features, which include many safety features.

You will get many years of safe and reliable operation if you carefully follow the safety, operation, and maintenance guidelines and recommendations in this handbook.



# CONTENTS

---

<b>1.0</b>	<b>SAFETY FIRST! - Safety Instructions</b> .....	<b>1</b>
<b>2.0</b>	<b>Unpacking Your Simulator</b> .....	<b>3</b>
<b>3.0</b>	<b>Parts and Accessories Checklist</b> .....	<b>7</b>
<b>4.0</b>	<b>Familiarizing yourself with the MF102 Simulator</b> ..... <i>(MF102-H and MF102-TS models)</i>	<b>9</b>
<b>5.0</b>	<b>Familiarizing yourself with the additional components included with the MF102-TS and TSE simulators</b> .....	<b>20</b>
<b>6.0</b>	<b>Troubleshooting Switch Reference Guide</b> .....	<b>26</b>
	<i>(MF102-TS models only)</i>	
<b>7.0</b>	<b>Touchscreen Monitor Startup Instructions</b> .....	<b>27</b>
	<i>(MF102-TSE models only)</i>	
<b>8.0</b>	<b>Troubleshooting Switch Reference Guide</b> .....	<b>29</b>
<b>9.0</b>	<b>Installing the Optional Package(s)</b> .....	<b>30</b>
<b>10.0</b>	<b>Preparing your Simulator for Use</b> .....	<b>35</b>
<b>11.0</b>	<b>Safety Features</b> .....	<b>38</b>
<b>12.0</b>	<b>Powering up your Simulator</b> .....	<b>39</b>
<b>13.0</b>	<b>Simulator Specifications</b> .....	<b>40</b>
<b>14.0</b>	<b>Service and Maintenance</b> .....	<b>41</b>
<b>15.0</b>	<b>Troubleshooting your Simulator</b> .....	<b>43</b>
<b>16.0</b>	<b>Where to Get Help</b> .....	<b>43</b>
<b>17.0</b>	<b>Recommended Spare Parts List</b> .....	<b>43</b>
<b>18.0</b>	<b>Manufacturer's Service/Operation Literature</b> .....	<b>44</b>
<b>19.0</b>	<b>Manufacturer's Warranty Information</b> .....	<b>44</b>
<b>20.0</b>	<b>Index</b> .....	<b>I</b>





## 1.0 SAFETY FIRST! - Safety Instructions

---

### Electrical Connections -

**Model (MF102)** simulators are equipped with AC male receptacles which are located on the lower, left-hand side of the simulator. Dual-station simulators have an additional AC receptacle on the opposite side of the simulator.

**If an extension cord is used, it must meet or exceed the following specifications:**

- a. Heavy duty (15 amps).
- b. Must be grounded.
- c. Must be taped to the floor to avoid a trip hazard.

If your simulator is placed in a permanent position, for safety purposes run the wiring in from overhead if possible. This will prevent unnecessary trip hazards associated with laying extension cords on the floor.

Your simulator is equipped with safety fuses/breakers to protect the simulator's electrical system in the event of a power spike or surge (see Section 13.0 for further details).



### CAUTION

*The simulator is shipped without hydraulic oil. **DO NOT** start the simulator until it has been filled with the recommended oil. Running the pump without oil will result in severe and irreparable pump damage.*



### WARNING

**DO NOT PUT YOUR HANDS NEAR A LEAK OR ATTEMPT TO SEARCH FOR A LEAK WITH YOUR HANDS.**

- *Hydraulic oil can inflict three types of injuries:  
- skin penetration, burn, and eye.*
- *Hydraulic oil can penetrate skin at pressures as low as 100 PSI (6.9 bar). Skin penetration can result in severe injury, permanent loss of hand or finger motion, hand or finger amputation, or death.*
- *If you get injected, see a physician immediately. Do not eat or drink.*
- *Take the MSDS sheet of the injected material with you. If the physician wants to simply clean and bandage the wound, refer him/her to <http://www.fluidpowersafety.com>.*
- *Hydraulic oil can inflict second and third degree burns at normal operating temperature - as low as 130°F (54.4°C).*

## 1.0 SAFETY FIRST! - Safety Instructions

---



### WARNING

*Operating or observing the operation of this simulator without safety glasses may lead to an accident which could result in severe eye injury or blindness. This simulator is to be operated only under the supervision of a trained, authorized instructor.*

*Follow all safety instructions in the operator handbook before using this simulator.*



### WARNING

*Prevention is better than cure! An eye-wash station must be located in an accessible location that requires no more than ten (10) seconds to reach and should be located within a travel distance no greater than 100 feet (30.5 m) from the hazard (ANSI Z358.1-1998).*



### WARNING

*Post a warning sign on the entry door into the hydraulic training center. Warn people who enter the room that hydraulic system(s) are in operation and that they must wear safety glasses with side-shields which conform to ANSI Z87.1.*



### WARNING

*The simulators have been designed to operate safely. Any type of change or modification could have a detrimental effect on that safety. Accordingly, ALL modifications or changes, regardless of how minor, must be approved in writing, by the FPTI™ - these include:*

- *Changes in the design of the simulator.*
  - *Adding component(s) to the simulator.*
  - *Removing component(s) from the simulator.*
  - *Failing to properly maintain the simulator.*
  - *Making component substitutions.*
  - *Using the simulator for any purpose other than training and education.*
- Failure to heed this warning may result in voiding of simulator warranty.*

## 2.0 Unpacking Your Simulator -

---

### SAFETY INSTRUCTIONS:

- a. Before unpacking the simulator, make sure the shipping container is standing on a smooth, level surface.
- b. At least two people must be in attendance when the simulator is being unpacked. While there is no need to lift the simulator, the people who unpack it must be strong enough to hold it as it is rolled off the pallet.
- c. Wear safety glasses and steel-toe boots when unpacking the simulator.

### TOOLS REQUIRED:

- a. Phillips-head screwdriver.
- b. Scissors.
- c. 7/16" wrench (2).

**Step 1:** Using a Phillips-head screwdriver, remove the screws from around the base of the cardboard container (Figure 2-1).

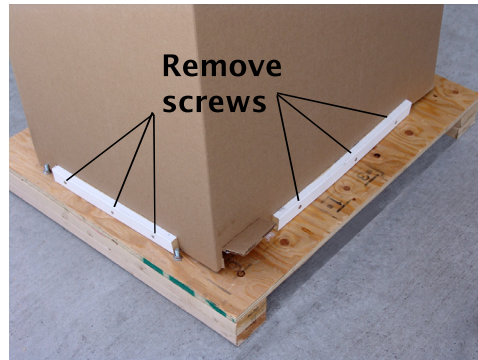


Figure 2-1

**Step 2:** With a person positioned on either side of the cardboard container, carefully lift it up and over the top of the simulator. If there is no evidence of damage to the simulator, fold the cardboard container and please recycle it.

**NOTE:** *IF THE SHIPPING CONTAINER IS DAMAGED KEEP IT INTACT UNTIL THE FREIGHT COMPANY HAS COMPLETED ITS INVESTIGATION.*

**Step 3:** Carefully remove the protective plastic wrap from the simulator. DO NOT use a sharp instrument as the cutting tool may damage the simulator. Please recycle the plastic wrap!

**Step 4:** Carefully remove the boxes (if any) which are stowed below the simulator.

**Step 5:** Loosen and remove the ratchet straps which secure the simulator to the pallet.

## 2.0 Unpacking Your Simulator - *cont'd.*

---

**Step 6:** Apply all caster brakes. To apply the brakes, push down firmly on the individual brake levers. (Figures 2-2 & Figures 2-3).

**Brake applied**



Figure 2-2

**Brake released**



Figure 2-3

## 2.0 Unpacking Your Simulator - *cont'd.*

---

**Step 7:** Using a 7/16" wrench, loosen the bolts which secure the 1" x 1" timbers from either side of the pallet between the casters (Figure 2-4).



Figure 2-4



### CAUTION

*When the bolts are removed, the simulator may roll. Before removing the bolts, make sure the pallet is standing on a smooth, level surface. Make sure the caster brakes are applied and have a person hold onto the simulator.*

**Step 8:** Place the two (2) 1" x 1" timbers you removed from the pallet and lay them across the edge of the pallet to form a step (Figure 2-5).

The timbers on the inside of the caster wheels will guide the wheels as the simulator rolls off the end of the pallet.



Figure 2-5



### CAUTION

*At least two (2) people must be in attendance when rolling the simulator off the pallet (one on either side of the simulator).*

## 2.0 Unpacking Your Simulator - *cont'd.*

---



### CAUTION

*The simulator is heavy. DO NOT place feet or hands in the path of the casters. If the casters roll over your feet or hands, it could cause severe injury.*

**Step 9:** While holding the simulator, release the caster brakes and gently roll it off the pallet.

**Step 10:** Once the simulator is off the pallet, apply the brakes and proceed with the start-up procedure.

### 3.0 Parts and Accessories Checklist -

---

#### 3.1 MF102 Model Simulators - *Single-station and Dual-station*

Parts and accessories are contained in the boxes which are stored on the shipping crate below the simulator and can also be found on the tray.

We recommend that you inspect the contents for damage. Although we exercise care in packing the parts, we recommend that you check each item, and quantity, against the following parts list.

MF102S		MF102D		DESCRIPTION of ITEM
<input type="checkbox"/>	4	<input type="checkbox"/>	8	1/4"x 60" hydraulic hoses w/quick-connect couplings (6.35mm x 152cm)
<input type="checkbox"/>	8	<input type="checkbox"/>	16	1/4"x 42" hydraulic hoses w/quick-connect couplings (6.35mm x 107cm)
<input type="checkbox"/>	6	<input type="checkbox"/>	12	1/4"x 28" hydraulic hoses w/quick-connect couplings (6.35mm x 71cm)
<input type="checkbox"/>	6	<input type="checkbox"/>	12	"T"s" with quick-connect couplings.
<input type="checkbox"/>	3	<input type="checkbox"/>	6	0-1500 PSI pressure gauges marked P1, P2, and P3. (0-103.4 bar)
<input type="checkbox"/>	1	<input type="checkbox"/>	2	Set of laminated hydraulic schematic activities. (Not included with MF102-H-TSE models).
<input type="checkbox"/>	1	<input type="checkbox"/>	1	Oil funnel with 3/8" NPT male connector.
<input type="checkbox"/>	4	<input type="checkbox"/>	4	Laminated instructor switch setting cards. (TS models only)

#### Recommended diagnostic accessories (not included):

<input type="checkbox"/>	1	<input type="checkbox"/>	2	Flow meter kit with pressure gauge, adjustable load-cell, and quick-couplers.
<input type="checkbox"/>	1	<input type="checkbox"/>	2	0-30" Hg vacuum gauge.
<input type="checkbox"/>	1	<input type="checkbox"/>	2	0-100 PSI pressure gauge. (0-6.9 bar)
<input type="checkbox"/>	1	<input type="checkbox"/>	2	Hand-held, non-contact/contact laser tachometer.

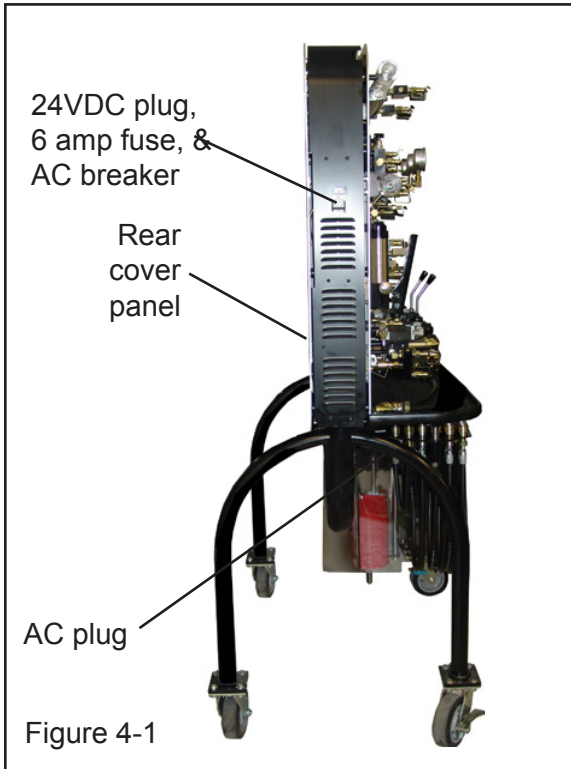
**NOTE:** Report damages or missing components to the Fluid Power Training Institute™ immediately. Damaged components must be returned to the manufacturer.

THIS PAGE INTENTIONALLY LEFT BLANK

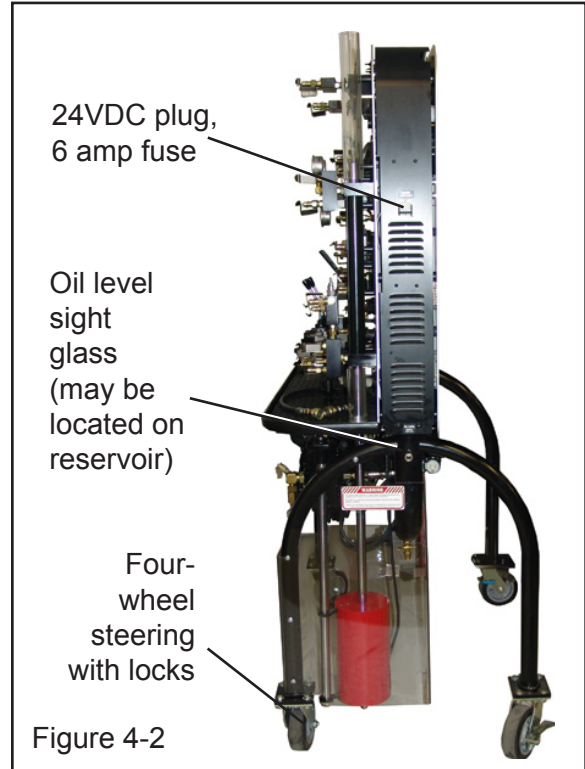


## 4.0 Familiarizing yourself with the MF102 Simulator

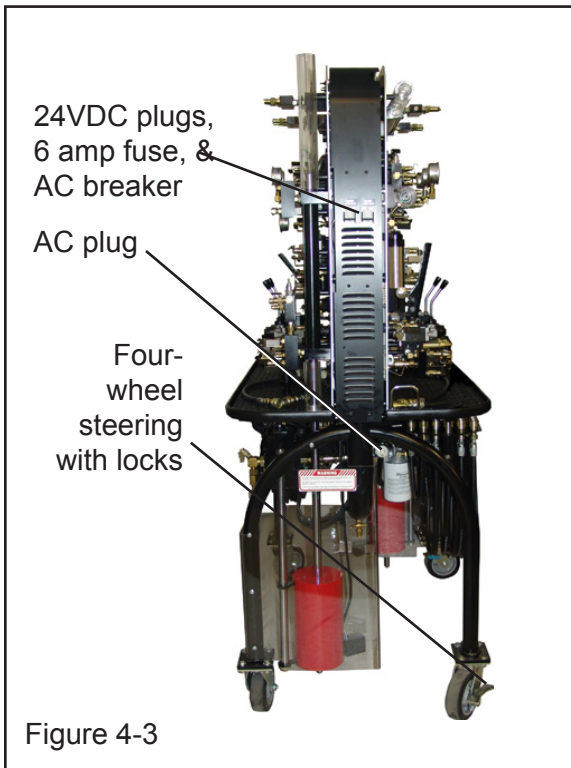
### 4.1 Left-hand side view (single-station) - (Figure 4-1)



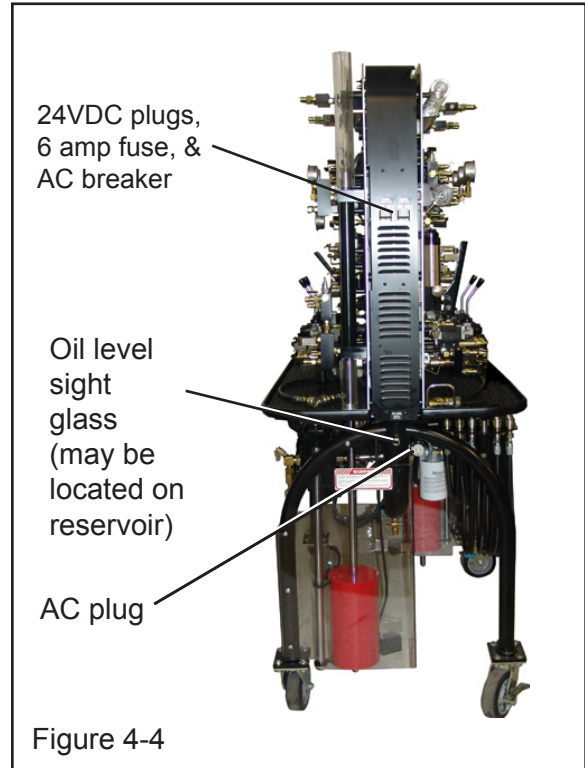
### 4.2 Right-hand side view (single-station) - (Figure 4-2)



### 4.3 Left-hand side view (dual-station) - (Figure 4-3)



### 4.4 Right-hand side view (dual-station) - (Figure 4-4)



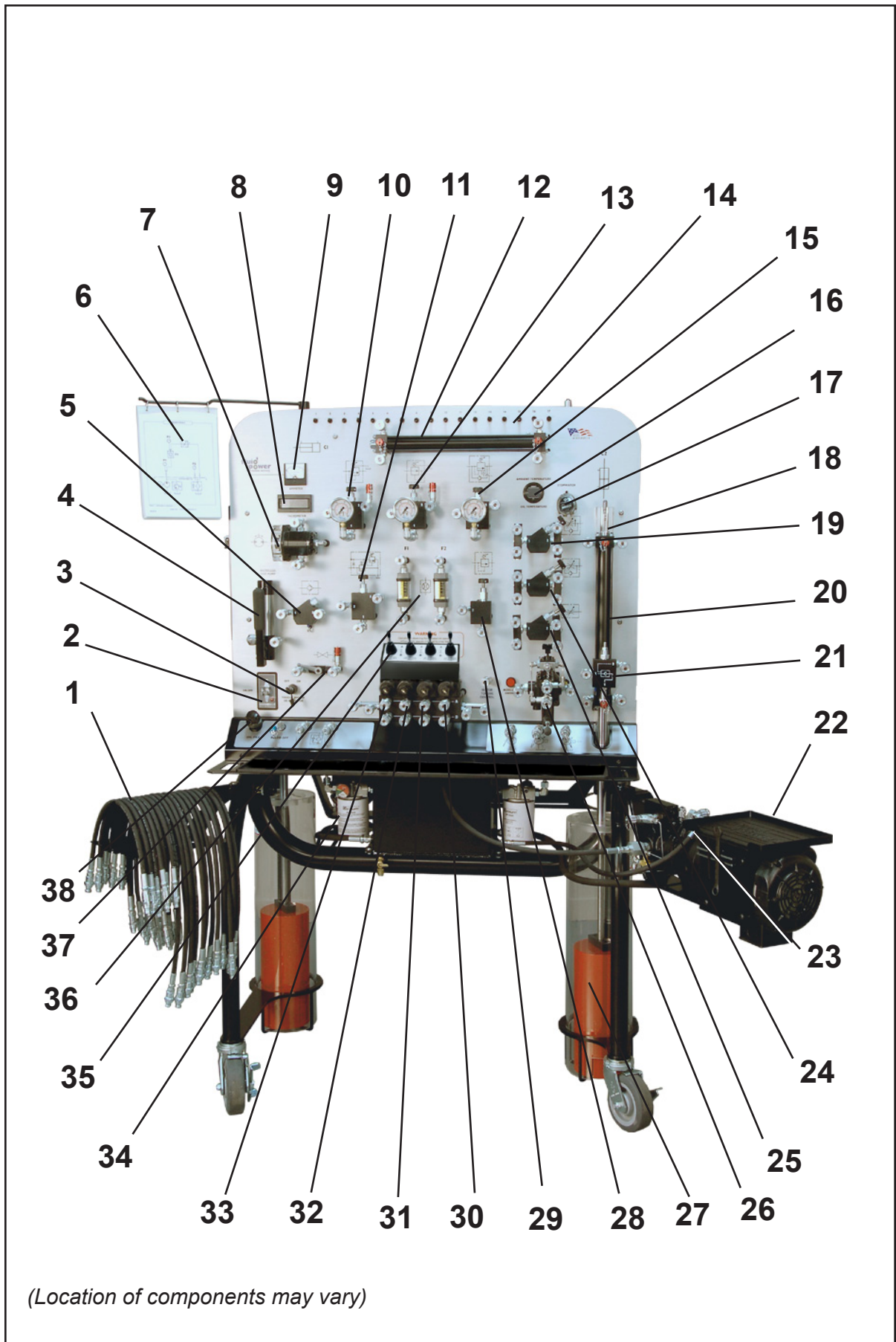


Figure 4-5

## 4.0 Familiarizing yourself with the MF102 Series Simulator (MF102-H and MF102-H-TS Models only) -

---

Your MF102 series Hydraulic Simulator is loaded with components. Take a moment to familiarize yourself with the components found on your simulator (*Location of components may vary*).

### 4.5 Front view (Dual-station) - (Figure 4-5)

1. Swing-out hose storage caddy
2. Power unit ON/OFF switch
3. \*Troubleshooting master switch
4. \*Microleak test pump
5. Check valve
6. Overhead laminated schematic holder
7. Loadable bi-directional hydraulic motor
8. Digital motor shaft speed tachometer
9. Ammeter
10. Sequence valve (equipped with Safe-T-Bleed® bleed-off connectors)
11. Pilot-operated relief valve
12. Cylinder - double-acting, single-rod (equipped with Safe-T-Bleed® bleed-off connectors)
13. Pressure reducing valve (equipped with Safe-T-Bleed® bleed-off connectors)
14. \*Solenoid toggle switches
15. Counterbalance valve
16. Digital temperature gauge - oil/ambient
17. Stopwatch
18. Mechanical load engage mechanism
19. Pressure-compensated flow control valve - restrictor type
20. Cylinder - double-acting, double-rod (equipped with Safe-T-Bleed® bleed-off connectors)
21. Pilot-operated check valve
22. Swing-out power unit assembly with convenient work tray
23. Variable displacement, pressure-compensated piston pump
24. One-way flow control valve
25. Needle valve
26. Flex Plate w/solenoid activation button (open-center, handlever-operated, mobile directional control valve included)
27. Cylinder load - mechanically-actuated
28. Direct-operated relief valve
29. Motor Torque Control port
30. Directional control valve - (float-center) - solenoid-operated with dual one-way flow control module
31. Directional control valve - (closed-center) - solenoid-operated with dual one-way flow control module
32. Directional control valve - (closed-center) - solenoid-operated with dual one-way flow control module
33. Directional control valve - (tandem-center) - solenoid-operated with dual one-way flow control module
34. Return line filter
35. Four (4) joysticks - For directional control valve operation
36. Dual 0-2.0 GPM (0-7.57 Lpm) inline flow meters
37. Ball valve (equipped with Safe-T-Bleed® bleed-off connectors)
38. Oil fill port (one-side only)

*\*MF102-H-TS models only.*

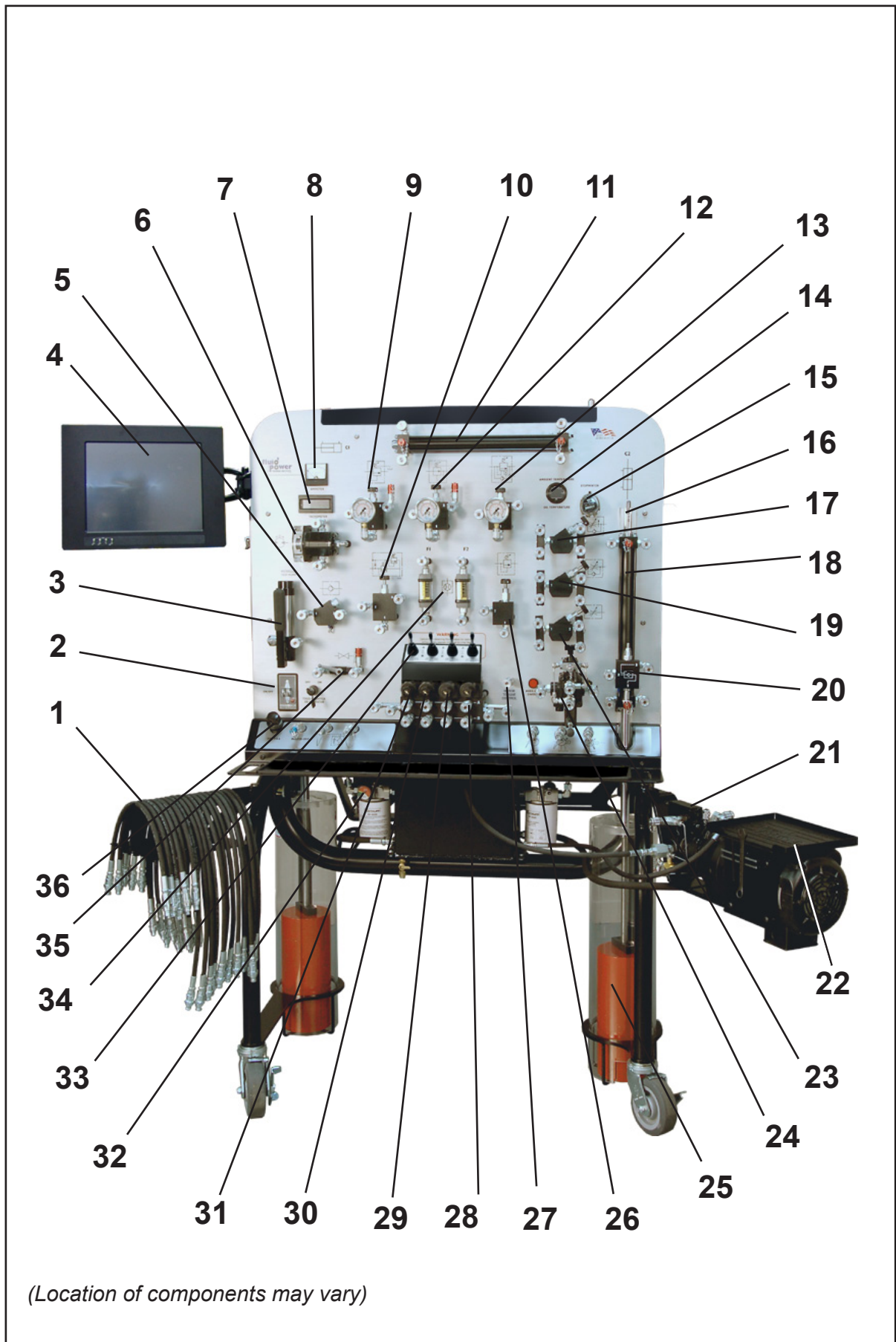


Figure 4-6



## 4.0 Familiarizing yourself with the MF102-H-TSE Simulator

---

Your MF102-H-TSE Hydraulic Simulator is loaded with components. Take a moment to familiarize yourself with the components found on your simulator (*Location of components may vary*).

### 4.6 Front view (Dual-station) - (Figure 4-6)

1. Swing-out hose storage caddy
2. Power unit ON/OFF switch
3. Pressure/leak test pump
4. Touchscreen monitor
5. Check valve
6. Loadable bi-directional hydraulic motor
7. Digital motor shaft speed tachometer
8. Ammeter
9. Sequence valve (equipped with Safe-T-Bleed® bleed-off connectors)
10. Pilot-operated relief valve
11. Cylinder - double-acting, single-rod (equipped with Safe-T-Bleed® bleed-off connectors)
12. Pressure reducing valve (equipped with Safe-T-Bleed® bleed-off connectors)
13. Counterbalance valve
14. Digital temperature gauge - oil/ambient
15. Retractable stopwatch
16. Mechanical load engage mechanism
17. Pressure-compensated flow control valve - restrictor type
18. Cylinder - double-acting, double-rod (equipped with Safe-T-Bleed® bleed-off connectors)
19. One-way flow control valve
20. Pilot-operated check valve
21. Variable displacement, load-sensing, pressure-compensated piston pump
22. Swing-out power unit assembly with convenient work tray
23. Needle valve
24. Flex Plate w/solenoid activation button (open-center, handlever-operated, mobile directional control valve included)
25. Cylinder load - mechanically-actuated
26. Direct-operated relief valve
27. Motor Torque Control port
28. Directional control valve - (float-center) - solenoid-operated with dual one-way flow control module
29. Directional control valve - (closed-center) - solenoid-operated with dual one-way flow control module
30. Directional control valve - (closed-center) - solenoid-operated with dual one-way flow control module
31. Directional control valve - (tandem-center) - solenoid-operated with dual one-way flow control module
32. Return line filter
33. Four (4) joysticks - For directional control valve operation
34. Dual 0 - 2.0 GPM (0 - 7.57 Lpm) inline flow meters
35. Ball valve (equipped with Safe-T-Bleed® bleed-off connectors)
36. Oil fill port (one-side only)

## 4.0 Familiarizing yourself with the MF102 Simulator

Let's take a walk around the Simulator

---

### 4.7 Ball Valve -

When the ball valve handle is at right angles to the oil transmission line it is closed (*Figure 4-6*).



Figure 4-6

Shift the handle until it is more or less parallel with the oil transmission line to open it (*Figure 4-7*).



Figure 4-7

### 4.8 Retractable Stopwatch (*Figure 4-8*) -

For security and ease of functionality, the stopwatch is permanently mounted to the simulator with a retractable cord (*Figure 4-9*) which is approximately 48" long (122cm).



Figure 4-8



Figure 4-9

## 4.0 Familiarizing yourself with the MF102 Simulator

Let's take a walk around the Simulator

### 4.9 \*Fixed Displacement and Pressure-Compensated Hydraulic Pumps -

The simulator is designed so students can learn how both conventional fixed-displacement, “open-center” type hydraulic systems, and pressure-compensated, “closed-center” type systems operate.

It is important, when learning hydraulics, for the transition from an “open-center” environment to a “closed-center” environment to be “realistic” and seamless.

To accomplish this, instead of putting two different types of pumps on the simulator, the MF102 models employ a unique 4-station manifold design, which accomplishes the same thing.

On the right-hand side of the tray there is a quick-coupler which is adjacent to the symbol for a fixed displacement pump (*Figure 4-10*). To the right of that quick-coupler there is a symbol for a variable volume, pressure-compensated pump (*Figure 4-11*).



Figure 4-10

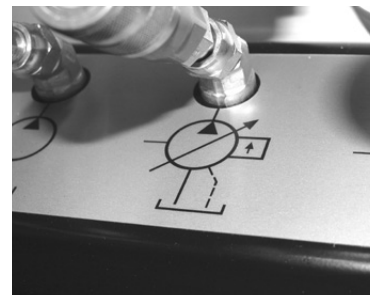


Figure 4-11

The left-hand directional control valve on the MF102 series simulator (*Figure 4-12*) is generally used in “open-center” hydraulic system designs which, are typically tandem-center or open-center.

The three right-hand directional control valves on the MF102 series simulators (*Figure 4-13*) are generally used in “pressure manifold” or “closed-center” hydraulic design. They are typically float-center or closed-center.



Figure 4-12



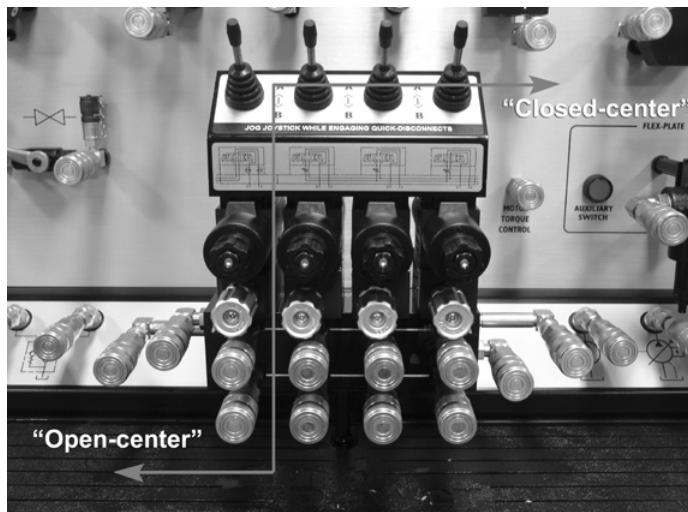
Figure 4-13

## 4.0 Familiarizing yourself with the MF102 Simulator

Let's take a walk around the Simulator

Although it is not visually detectable, the manifold is divided into two completely separate chambers (*Figure 4-14*).

Figure 4-14



When a student is doing “hands-on” activities pertaining to a fixed-displacement type pump, either the open-center or tandem-center valve is used.

When doing activities associated with a variable-displacement, pressure-compensated pump, either the closed-center or float-center valve is used. This unique design helps the students learn how “open-center” and “closed-center” systems work without any confusion - the transition is absolutely seamless!

It is important to note that when a student is working with either the open-center or float center directional control valves, the “pump” and “tank” connections **MUST** be made on the corresponding side of the manifold (*Figure 4-15*).

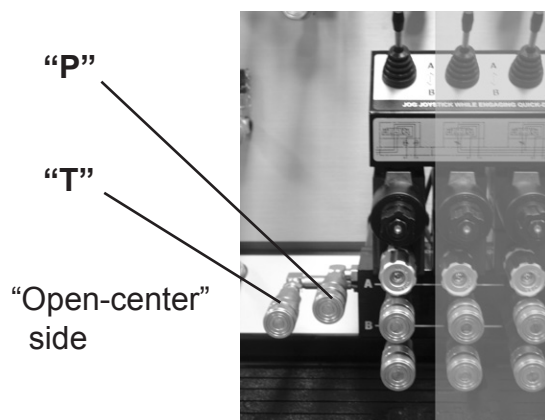


Figure 4-15

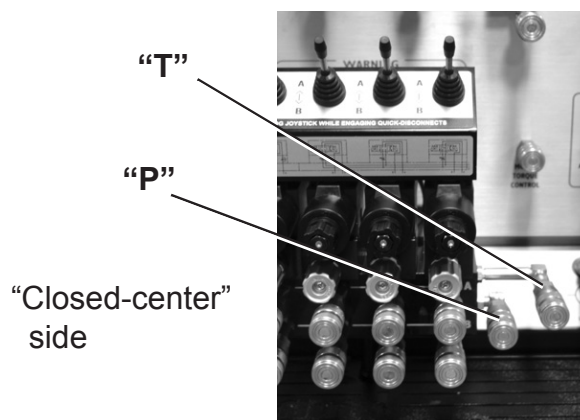


Figure 4-16

When working with the closed-center or float-center directional control valves, the “pump” and “tank” connections **MUST** be made on the opposite side of the manifold (*Figure 4-16*).



## 4.0 Familiarizing yourself with the MF102 Simulator

Let's take a walk around the Simulator

### 4.10 Variable Displacement, Pressure-compensated Pump -

The variable displacement, pressure-compensated pump has two adjustments:

#### 1. Pressure adjustment:

The pressure adjusting screw is located on the pressure-compensator (*Figure 4-17*). It consists of a threaded rod with a jam-nut. The pressure compensator is pre-set at 1000 PSI (69 bar). The pressure adjusting screw, for trainers equipped with the load-sense pump option, is located on the block on top of the pump.

#### 2. Flow adjustment:

The flow adjusting screw is located on the back of the pump housing (*Figure 4-18*). It consists of a threaded rod with a jam-nut. The pump flow is pre-set at 1.0 GPM (3.8 liters).

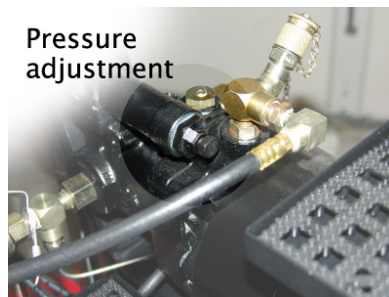


Figure 4-17

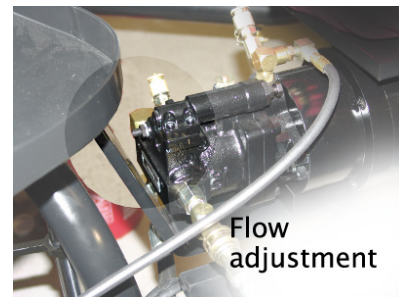


Figure 4-18

### 4.11 Load-sense pump (optional) -

To operate the pump in load-sense mode, the handle of the ball valve on the pump must be in the horizontal position (*Figure 4-19*).



Figure 4-19

### 4.12 Component Adjustment Screws -

You will notice that many of the valves on the trainer have adjusting screws with knurled knobs. One of them - the pilot-operated check valve (*Figure 4-20*) does not have a knob. This is the only valve which is non-adjustable.



Figure 4-20

With the exception of the counterbalance valve, turning the adjusting knob in (clockwise from the top of the valve) increases pressure and turning it out (counter-clockwise), decreases the pressure.

The counterbalance valve adjustment is totally opposite to the other valves - turning the valve adjustment knob in (clockwise from the top of the valve), decreases pressure, and turning it out (counter-clockwise), increases the pressure.

## 4.0 Familiarizing yourself with the MF102 Simulator

Let's take a walk around the Simulator

---

### 4.13 Valve Body Markings -

A critical component in the design of the MF102 series simulators was to keep all component markings consistent with what is typically found in the “real world.” Generally, these markings consist of letters and numbers. The only deviation from an actual valve is that the markings are bold.

The markings on a directional control valve manifold consist of the letters “P” and “T” which represent “pump” and “tank.” “A” and “B” typically represent the “work ports.”

Cartridge valve manufacturers generally mark the ports on their respective valves with numbers - “1,” “2,” and, if it's a 3-port valve, the number “3” (*Figure 4-21*).



Figure 4-21

The cartridge valves on the MF102 model simulators are manufactured by Sun Hydraulics™. All markings on the valve bodies are made in accordance with the manufacturer's specifications.



### WARNING

*There are no standards, that FPTI™ is aware of, with regard to what symbol a manufacturer uses to mark cartridge valve bodies, or the relationship of that symbol to the port.*

*NEVER assume, for example, that if one manufacturer marks the inlet port with the number “1” that all cartridge valve manufacturers use the same marking.*

*ALWAYS check the respective cartridge valve manufacturers specifications with respect to port markings before making connections.*

*An error could result in severe injury or death.*

## 4.0 Familiarizing yourself with the MF102 Simulator

Let's take a walk around the Simulator

### 4.14 Flex Plate -

The Flex Plate is a standard fixture on all MF102 series simulators. The Flex Plate allows the instructor to add a number of optional valves to the simulator to extend its teaching capabilities to the students (Figure 4-22).

Figure 4-22



### 4.15 24VDC Electrical Fuse -

All MF102 series simulators are equipped with 24VDC slow-blow 6 amp fuses to protect the electrical system in the event of a power spike or surge (Figure 4-23). See Section 13.0 for further details.

Figure 4-23



### 4.16 AC Electrical Fuse Breaker -

All MF102 series simulators are equipped with AC fuse breakers to protect the electrical system in the event of a power spike or surge (Figure 4-23). See Section 13.0 for further details.

### 4.17 Digital Ambient/Oil Temperature Gauge -

The ambient temperature and the system oil temperature are both displayed on a single panel-mounted digital gauge (Figure 4-24).

Figure 4-24



## 5.0 Familiarizing yourself with the Additional Components included with the MF102-H-TS & MF102-H-TSE Simulators

(These items are included on both the single-station and dual-station troubleshooting simulators and are NOT included with the MF102-H simulators).

---

### 5.1 Pressure/Leak Test Pump (Microleak Tester) -

The pressure/leak test pump is designed for testing a variety of hydraulic components. While it bears resemblance to a commercial porta-power, it is not a porta-power. The pressure/leak test pump does not need to be filled with oil. It automatically fills whenever the power unit is operating.

If, while the pressure/leak test pump is being used, it runs out of oil, simply connect the pump directly to a tank port and let the pump run for approximately 30 seconds, and it will re-fill.

To operate the pressure/leak test pump, simply rotate the knob (*Figure 5-1*) clockwise until it stops, and move the hand-lever backwards and forwards.

To release the pressure, rotate the knob counterclockwise until it stops.



Figure 5-1

### 5.2 Toggle-switches (*MF102-H-TS models only*) -

The row of 2-position toggle switches located across the top of the simulator (*Figure 5-2*) activate miniature solenoids which cause various components to “wear out.” This unique feature creates “real world” faults for students to find.

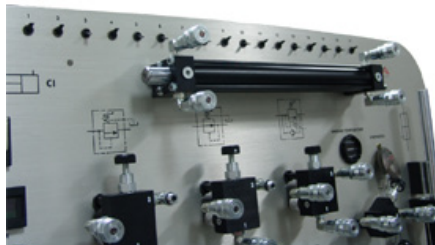


Figure 5-2

## 5.0 Familiarizing yourself with the Additional Components included with the MF102-H-TS & MF102-H-TSE Simulators

---

### 5.3 Troubleshooting Toggle Switch Deactivator (*MF102-H-TS model only*)

If, during the course of training, a toggle switch is inadvertently activated, it could cause a component malfunction which could lead to student frustration.

To avoid this problem, the simulator is equipped with a troubleshooting toggle switch deactivator which can be locked in the “ON” or “OFF” position (*Figure 5-3*).

Turn the key-lock switch to the “ON” position only when needed for troubleshooting skills training.



Figure 5-3

### 5.4 Digital, Hand-Held, Laser-Type Tachometer -

The hand-held tachometer is used primarily when students are learning troubleshooting skills. Its main purpose is for students to observe and record prime-mover (electric motor) speed.

The state-of-the-art tachometer needs a reflective feedback medium to operate properly. A piece of self-adhesive reflective tape has been attached to the electric motor’s cooling fan (*Figure 5-4*) for this purpose.



Figure 5-4

**Step 1:** To operate the tachometer, first rotate the dial to the correct position - “non-contact RPM” (*Figure 5-5*).



Figure 5-5



## 5.0 Familiarizing yourself with the Additional Components included with the MF102-H-TS & MF102-H-TSE Simulators

---

**Step 2:** Next, carefully aim the laser between the openings in the fan safety guard at the reflective tape (*Figure 5-6*). Hold the tachometer steady, and depress the white button.



Figure 5-6

Wait a few seconds for the tachometer to respond. Pushing the black button on the tachometer will automatically submit the indicated speed to the tachometer's memory.

### 5.5 Flow Meter Test Kit -

The flow meter test kit consists of an in-line, 0-2.0 GPM (0.76 liters) flow meter, a load-cell, a 0-1000 PSI (0-69 bar) glycerine-filled pressure gauge, and quick-connectors (*Figure 5-7*).



Figure 5-7

It is identical to the two (2) which are mounted on the panel. The only difference is that this one is configured identically to those used in the field.

To operate the flow meter simply connect it in-series with the appropriate oil transmission line. Open the load-valve (turn counter-clockwise) and proceed. Closing the load-valve will restrict the flow and create an “artificially generated load” which is necessary when executing certain component test procedures.

## 5.0 Familiarizing yourself with the Additional Components included with the MF102-H-TS & MF102-H-TSE Simulators

---

### 5.6 Case Pressure Gauge (0-100 PSI/0-6.9 bar) -

There are two pressure checkpoints on the pump—one for checking pump case pressure, and the other for checking case drain-line resistance. Two pressure check points are needed because excessive case pressure can be caused by excessive internal leakage or, excessive case drain-line resistance.

The 0-100 PSI (6.9 bar) pressure gauge is equipped with a special connector, which permits safe installation and removal on both the case pressure connector and the case drain-line connector, under pressure.

**Step 1:** To install the case pressure gauge, remove the metal dust cap from the appropriate connector (*Figure 5-8*).

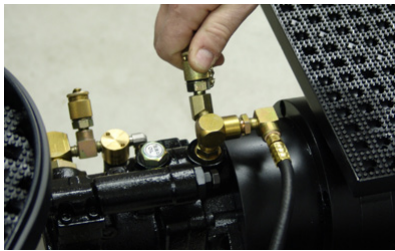


Figure 5-8

**Step 2:** Screw the knurled female swivel connector on the gauge onto the male connector on the pump. Hand-tighten only (*Figure 5-9 & Figure 5-10*). Always replace the dust cap after use to keep contamination out of the connector.

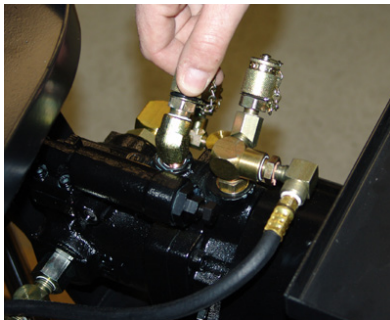


Figure 5-9

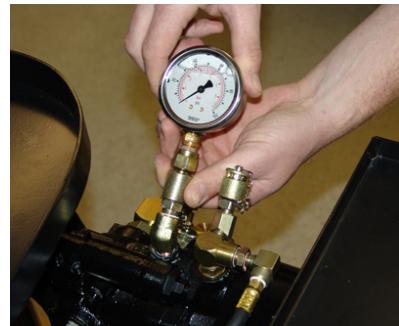


Figure 5-10

**NOTE:** *Once the case drain pressure gauge is installed, DO NOT attempt to store the power unit under the oil drip tray as damage to the gauge and/or tray may occur (Figure 5-11).*

When the case pressure gauge is not in use, store on the power unit tray (*Figure 5-12*).



Figure 5-11

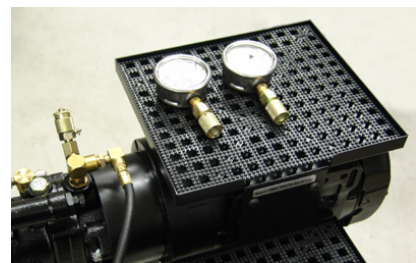


Figure 5-12

## 5.0 Familiarizing yourself with the Additional Components included with the MF102-H-TS & MF102-H-TSE Simulators

---

### 5.7 Vacuum Gauge -

A glycerine-filled vacuum gauge is provided for students to learn how to check pump inlet restriction. A vacuum gauge is an extremely sensitive instrument. When a gauge is filled with glycerine it will have a sealed case to prevent the glycerine from leaking out.

Changes in ambient temperature will cause minor fluctuations in the case pressure as expansion and contraction naturally occurs. These pressure fluctuations could have a negative effect on the gauge's accuracy.

To overcome this problem, the vacuum gauge is equipped with a plastic case plug. When the case plug is moved to the OPEN position it momentarily opens the case to atmosphere and allows the pressures to equalize.

Before using the vacuum gauge - especially if the needle is not pointing to the "0 Hg" position - hold the gauge in the upright position, move the small plastic plug to the OPEN position (*Figure 5-13*) for a few seconds, and then move it back to the CLOSED position (*Figure 5-14*). The vacuum gauge should now be ready for use.



Figure 5-13



Figure 5-14



## 5.0 Familiarizing yourself with the Additional Components included with the MF102-H-TS & MF102-H-TSE Simulators

---

The vacuum gauge and pump, are equipped with a special pressure coupling system. This coupling system makes it possible to safely install and remove the vacuum gauge while the pump is operating.

The female swivel on the vacuum gauge mates with a threaded male coupling which is fastened to the connector at the inlet port of the pump (*Figure 5-15*). The connector is equipped with a metal dust cap which is chained to the connector to prevent it from falling to the ground or from being misplaced.

To install the vacuum gauge, screw the metal dust cap off, and place the connector on the thread and rotate the knurled swivel - hand-tighten only! Always replace the dust cap after use to keep contamination out of the connector.



Figure 5-15

### 5.8 Motor Torque Control port -

Whenever the hydraulic motor is used in an activity, a hose must be connected from the Motor Torque Control port to the hydraulic oil tank return line (*Figure 5-15*) unless otherwise instructed.

This enables the oil to flow from the motor directly back to the reservoir which allows the hydraulic motor to run at no-load.

## 6.0 Installing the Touchscreen Monitor(s) (TSE models only)

---

**NOTE:** *The touchscreen monitor is shipped separately from the mainframe simulator and requires two (2) people to safely attach it to the bracket. The mounting hardware (eight [8] screws) is included inside the touchscreen monitor packaging.*

**Step 1:** Unplug the simulator power source before attaching the USB cable and power plug to the touchscreen monitor.



### WARNING

*NEVER unplug the simulator power source until the touchscreen monitor(s) have been shut off using the button on the side of the monitor.*

**Step 2:** With one person holding the monitor in place, screw the eight (8) screws into the monitor arm firmly securing the monitor to the bracket (*Figure 6-1*).

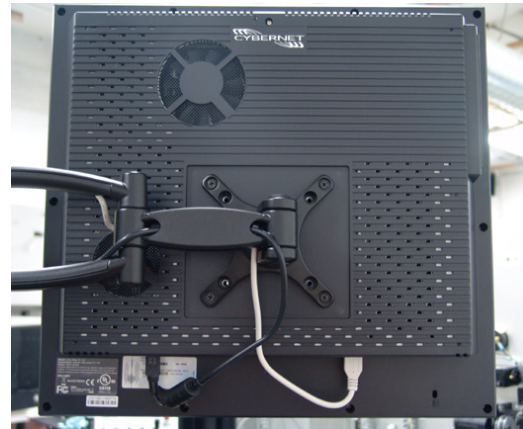


Figure 6-1

**Step 3:** Plug in the gray USB cable FIRST before plugging in the black power cable on the back of the monitor (*Figure 6-2*).

Failure to follow this sequence may cause the touchscreen to operate erratically.

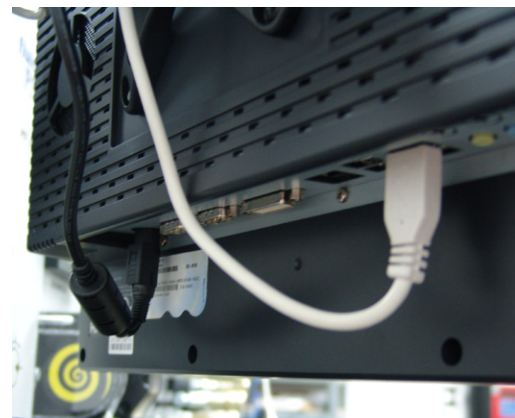


Figure 6-2

**Step 4:** You may now plug the simulator back into the power source and turn on the monitor by pressing the power button located on the side of the monitor.

## 7.0 Touchscreen Monitor Startup Instructions (TSE models only)

---



### WARNING

*Plugging the power cord into the back of the monitor BEFORE plugging the USB cable into the monitor may cause erratic monitor operation.*



### WARNING

*NEVER unplug the simulator power source until the touchscreen monitor(s) have been shut off using the BLACK button on the side of the monitor.*

### START-UP

Once the simulator has been plugged back in and turned on, the USB cable and power cable have been plugged into the monitor, and the power button on the side of the monitor has been pressed, the touchscreen monitor will automatically begin startup.

### HOW TO EXIT THE TRAINING PROGRAM

There are two (2) instances in which the instructor will need to exit the training program completely and access the operating system:

1. System/software upgrades.
2. Manual activation of troubleshooting solenoids.

#### To exit the the training program for upgrades follow these steps:

1. Go to the MAIN MENU screen and, using the supplied stylus, double-click the <sup>TM</sup> (trademark) on the Fluid Power Training Institute logo (*Figure 7-1*). It may take several tries to get the Key-Pad screen to appear.
2. When the Key-Pad screen appears enter the following code: **9989**  
Press ENTER.
3. The I/O CONTROL screen will appear.
4. Press the EXIT PROGRAM button. The Key-Pad screen will appear again.
5. When the Key-Pad screen appears enter the following code: **9909**  
Press ENTER.

The Windows<sup>TM</sup> operating system will now be accessible by touching the bottom left corner of the screen with the stylus (*Figure 7-2*).

## 7.0 Touchscreen Monitor Instructions (MF102-H-TSE models only)

---

To re-enter the training program without upgrading or making any changes, press the FPTI icon.

To update the training software, insert the upgrade disk (when necessary) and the upgrade installer will run automatically.

**To exit the the training program to manually activate the troubleshooting solenoids follow these steps:**

1. Go to the MAIN MENU screen and, using the supplied stylus, double-click the <sup>TM</sup> (trademark) on the Fluid Power Training Institute logo (*Figure 7-1*). It may take several tries to get the Key-Pad screen to appear.
2. When the Key-Pad screen appears enter the following code: **9989**  
Press ENTER.
3. The I/O CONTROL screen will appear.
4. Press the component label that you wish to open (energize). The box will turn GREEN indicating that the component has been "faulted."
5. To return the component to its original state (closed), press the component label again and the box will turn RED.
6. When finished, press the MAIN MENU button to return to the training program.

**IMPORTANT NOTE:** *When a component has been manually faulted it must also be manually reset after the activity has been completed otherwise it will remain in the "faulted" position.*

### ADDITIONAL INFORMATION

Holding down the stylus for one second on the touchscreen, when you are in the Windows<sup>TM</sup> operating system, will give you the same options as if you have right-clicked a mouse.

To change the time/date displayed on the monitor, exit the training program, go to the Windows<sup>TM</sup> operating system, click the bottom left-hand corner of the screen to make the Windows<sup>TM</sup> bar accessible, and click on the time/date icon in the bottom right-hand corner of the screen.

To re-enter the FPTI training program from the Windows<sup>TM</sup> operating system, click the FPTI icon displayed in the upper left-hand corner of the Start menu (*Figure 7-3*).

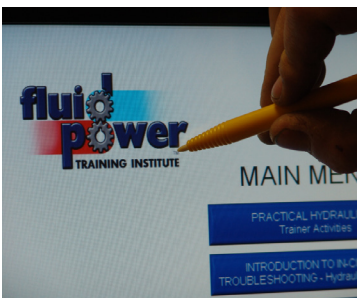


Figure 7-1

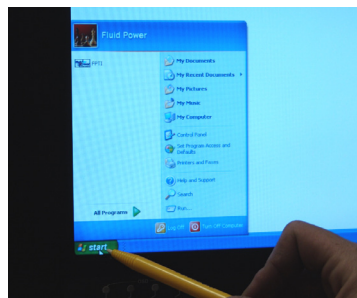


Figure 7-2

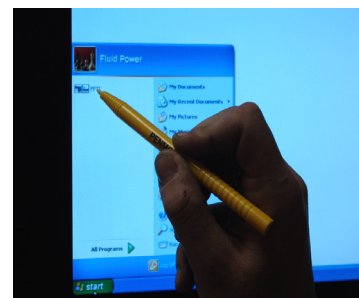


Figure 7-3

## 8.0 Troubleshooting Switch Reference Guide

The following diagram (*Figure 8-1*) indicates the switch number, component type, and switch position for the normal operation and fault mode.

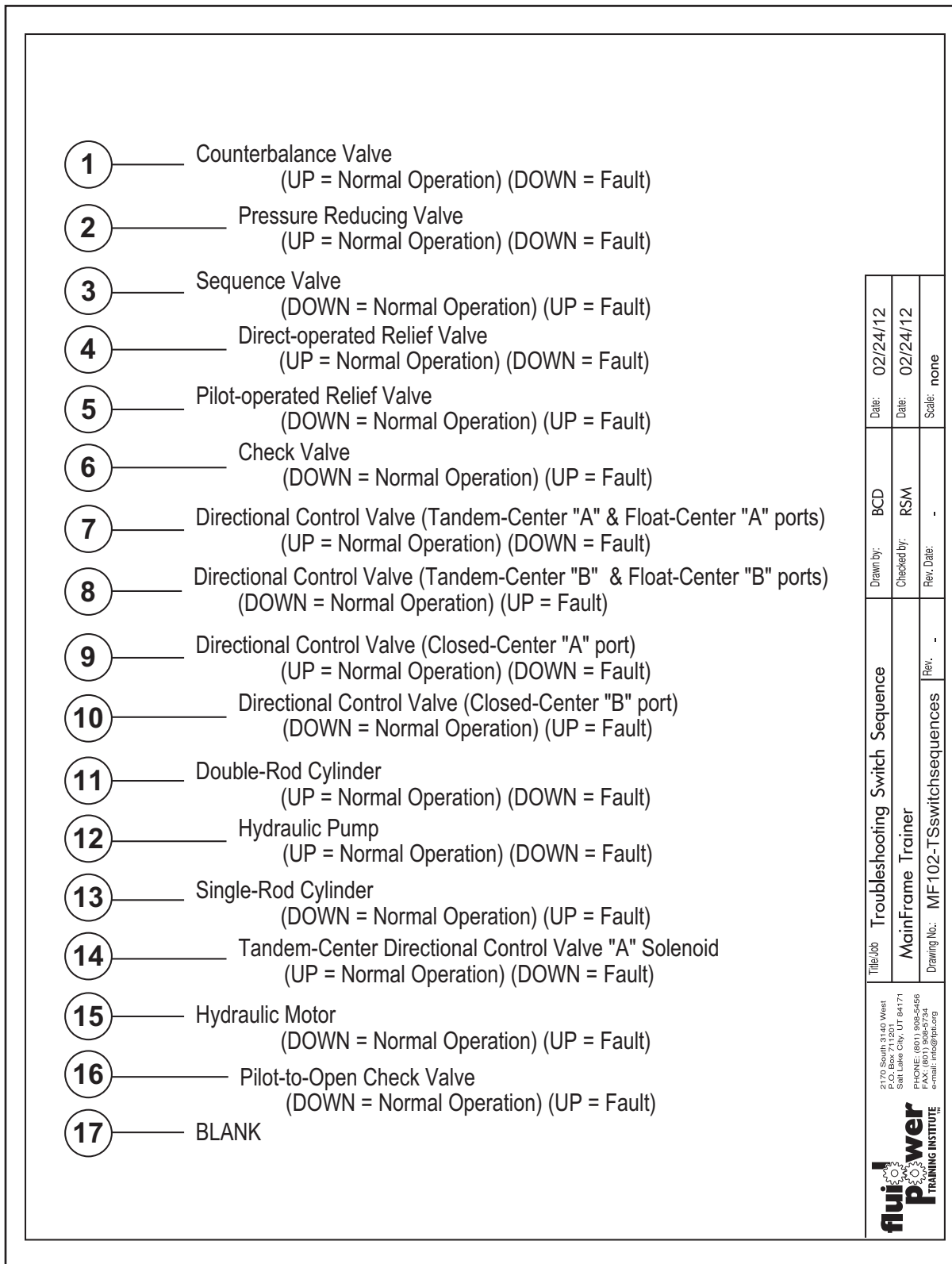


Figure 8-1

## 9.0 Installing the Option Package(s)

---

### 9.1 MF100-ACC - Accumulator Unloading Valve module (if applicable) -

#### SAFETY INSTRUCTIONS:

- a. Wear safety glasses when installing the accumulator package.
- b. Due to the unbalanced weight of the optional sideplate modules, at least two people are required to perform this job safely.

**Step 1:** Loosen the two (2) hand-latches (Figure 9-1) located on the upper left-hand side of the front panel.



Figure 9-1

**Step 2:** Gently slide the option assembly into the slot (Figure 9-2) in the side cover of the simulator and make sure that the option assembly drops into position (Figure 9-3).



Figure 9-2



Figure 9-3



## 9.0 Installing the Option Package(s)

The diagrams below (*Figures 9-4 & 9-5*) illustrate how to correctly position the bracket on the mounting bosses which are welded to the frame.

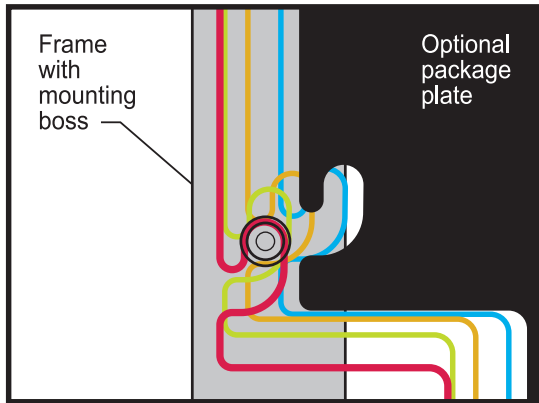


Figure 9-4

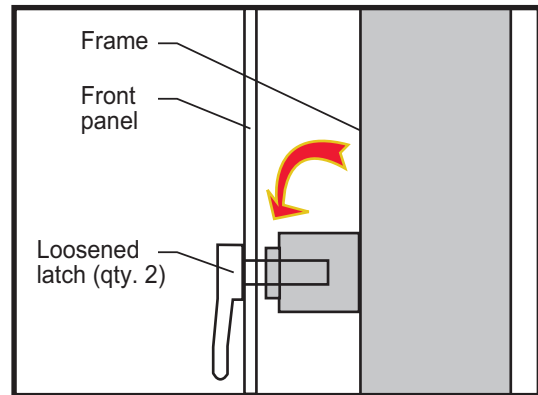


Figure 9-5

**Step 3:** Tighten the two hand latches securely (*Figure 9-6*).

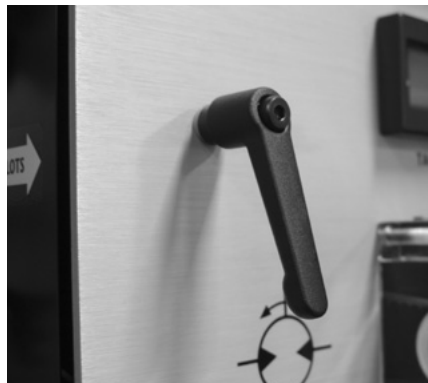


Figure 9-6

**Step 4:** Make the necessary connections to the mainframe simulator.

**Step 5:** Before using the MF100-ACC Accumulator Unloading Valve module, you must first attach the “T” that is fitted with the bleed-off connector (*Figure 9-7*) to a tank return port on the mainframe simulator (*Figure 9-8*). The accumulator safety bleed hose is then connected from the MF100-ACC module to the bleed-off connector on the “T.”



Figure 9-7



Figure 9-8

## 9.0 Installing the Option Package(s)

---

Then you must connect the opposite end of the safety bleed hose into the connector located under the back panel of the accumulator module (*Figure 9-9*). Tighten it securely (by hand only).



Figure 9-9

- Step 6:** Close the bleed valve located on the front of the Accumulator assembly panel (rotate clockwise to close).
- Step 7:** Using the charging valve and hose assembly, charge the accumulator bladder with nitrogen to 350 PSI (24 bar).



### WARNING

*Accumulator repair and service MUST be done by trained, authorized personnel only. Failure to heed this warning could lead to severe injury or death.*



## 9.0 Installing the Option Package(s)

### 9.2 MF100-PDCV - Proportional Directional/Flow Control Valve package (if applicable) -



#### CAUTION

*DO NOT connect the simulator to an electrical power source until this installation is complete.*

#### SAFETY INSTRUCTIONS:

- Wear safety glasses when installing the Proportional Directional/Flow Control Valve package.
- Due to the unbalanced weight of the optional sideplate modules, at least two people are required to perform this job safely.

**Step 1:** Loosen the two (2) hand-latches (*Figure 9-10*) located on the upper right-hand side of the front panel.



Figure 9-10

**Step 2:** Gently slide the option assembly into the slot in the side cover of the simulator (*Figure 9-11*) and make sure that the option assembly drops into position (*Figure 9-12*).

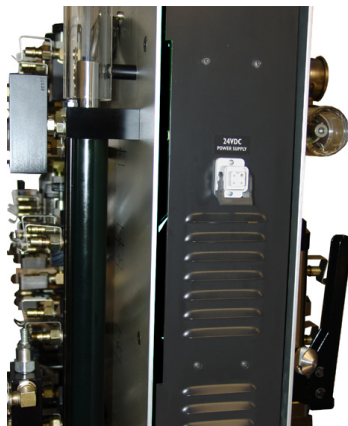


Figure 9-11



Figure 9-12

## 9.0 Installing the Option Package(s)

---

The diagrams below (*Figures 9-13 & 9-14*) illustrate how to correctly position the bracket on the mounting bosses which are welded to the frame.

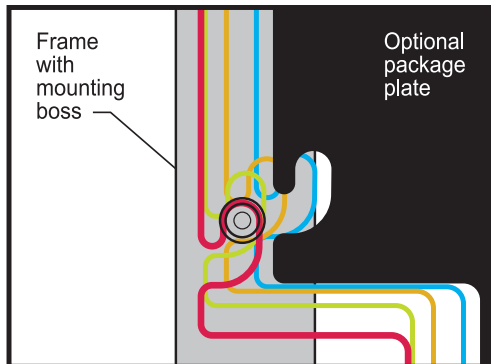


Figure 9-13

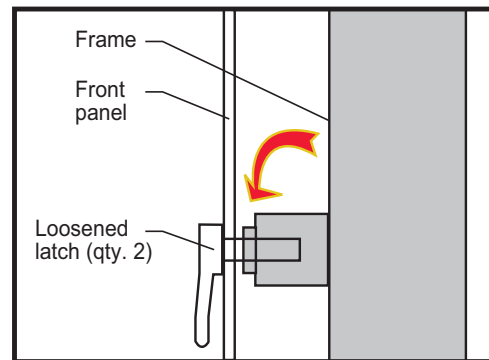


Figure 9-14

**Step 3:** Tighten the two hand-latches securely (*Figure 9-15*).

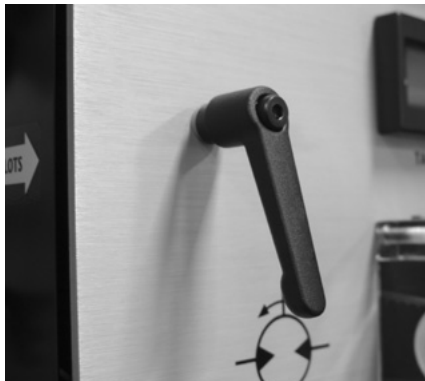


Figure 9-15

**Step 4:** Make the necessary connections to the mainframe trainer.

**Step 5:** There are either one (1) or two (2) 24VDC receptacles located on the side plates of the mainframe simulators (*Figure 9-16*). Plug the Proportional Directional/Flow Control Valve cord into one of the receptacles and slide the locking arm into position.



Figure 9-16

## 10.0 Preparing Your Simulator for Use

---

Once you are satisfied that the parts and accessories are in good condition and accounted for, and, you have familiarized yourself with the MF102 simulator, go ahead and install the parts and accessories into their respective positions on the simulator.

### 10.1 0-1500 PSI (0-103.4 bar) Pressure Gauges -

There are three (3) 0-1500 PSI (0-103.4 bar) pressure gauges which are marked P1, P2, and P3. They may be placed on the power unit tray or on the main tray (*Figure 10-1*).

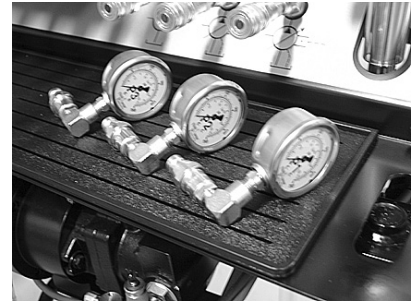


Figure 10-1

### 10.2 Filling the MF102 Simulator with Oil -

Fill the simulator with a good quality AW-32 hydraulic fluid.  
Reservoir Capacity: approximately 4.5 U.S. gallons (17 liters).

**Step 1:** Remove the filler/breather cap (*Figure 10-2*) and screw the oil funnel into the filler boss (*Figure 10-3*). Hand-tighten only. Location of oil filler may vary.

The oil funnel is capable of turning the oil flow ON and OFF. To allow flow, rotate the oil funnel in a counter-clockwise direction. To stop flow, rotate the oil funnel in a clockwise direction.



Figure 10-2

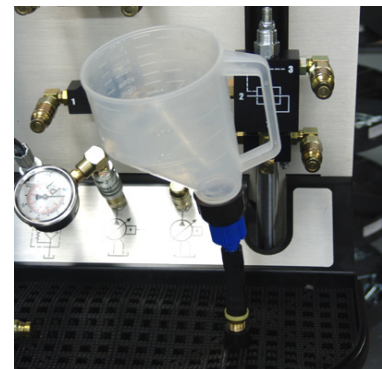


Figure 10-3

**Step 2:** Fill the simulator until oil is visible in the oil level sight glass (*Figure 10-4*).



Figure 10-4

## 10.0 Preparing Your Simulator for Use

---

**Step 3:** Connect a hose from the pump outlet port directly to the tank return port (*Figure 10-5*).

**Step 4:** Connect a suitable grounded electrical cord from the simulator's electrical plug (*Figure 10-6*) to a 115 volt, 15 amp, single-phase electrical circuit (for each motor).

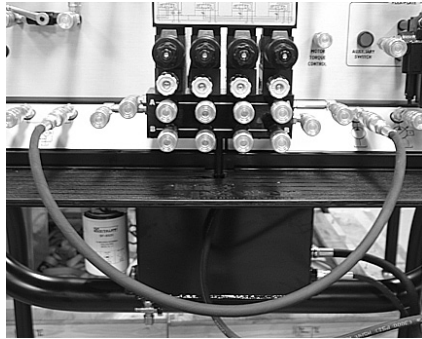


Figure 10-5

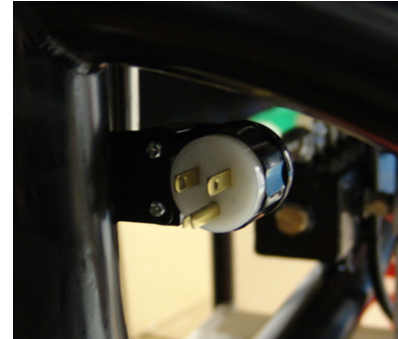


Figure 10-6

**Step 5:** Start the power unit using the main electrical ON/OFF switch (*Figure 10-7*). After waiting a minute, recheck the oil level. Top-up if necessary.

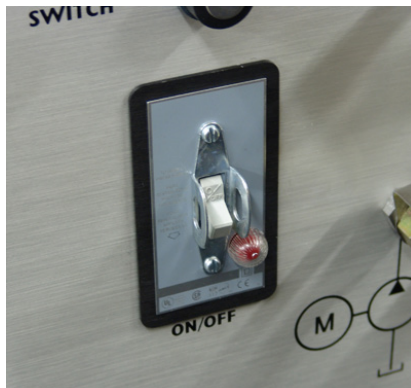


Figure 10-7

**Step 6:** Remove the oil funnel.

**Step 7:** Replace the oil filler/breather cap.

### 10.3 Laminated Schematic Pages Holder (All MF102 models except TSE) -

**Step 1:** Install the laminated schematic holder on the post located on the left-hand side of the simulator (*Figure 10-8*).

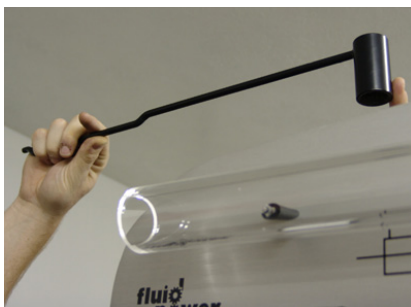


Figure 10-8

## 10.0 Preparing Your Simulator for Use

---

**Step 2:** Remove the laminated schematics from their packaging. Slip the three (3) retaining rings over the arm and into position (*Figure 10-9*).

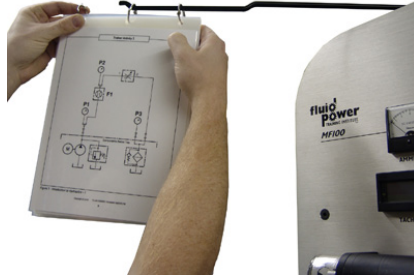


Figure 10-9

### 10.4 Hose Union -

Some of the simulator activities require a longer hose than those provided. When this occurs, hose unions are provided to join hoses together (*Figures 10-11, 10-12, & 10-13*).

When not in use, place the hose union(s) on the tray.



Figure 10-10



Figure 10-11

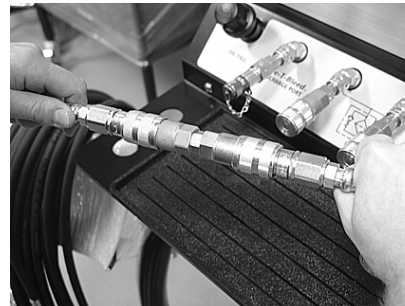


Figure 10-12

### 10.5 Hose Caddy -

The hoses used on the simulator are stored neatly under the left-hand side of the front tray on a swing-out caddy (*Figure 10-13*).



Figure 10-13




# 11.0 Safety Features -

## 11.1 Transparent Safety Covers -

Transparent safety guards allow a person to see how components operate while protecting them from moving mechanisms. There are four (4) safety guards on the MF102 series simulators which cover:

- Hydraulic motor output shaft (Figure 11-1)
- Hydraulic cylinder double-rod C2 - Lower (Figure 11-2)
- Hydraulic cylinder double-rod C2 - Upper (Figure 11-3)
- Weight-load system (Figure 11-4)

 **WARNING**

*DO NOT operate the simulator without the safety covers. If a safety cover is removed, it MUST be replaced BEFORE operating the simulator. Failure to replace the safety cover(s) could result in an accident which could cause severe injury or death.*



Figure 11-1



Figure 11-3

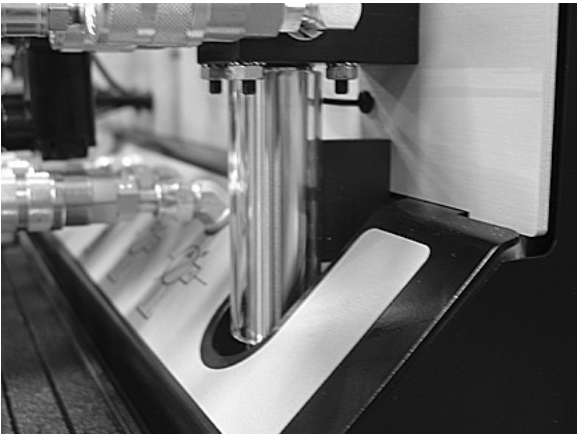


Figure 11-2

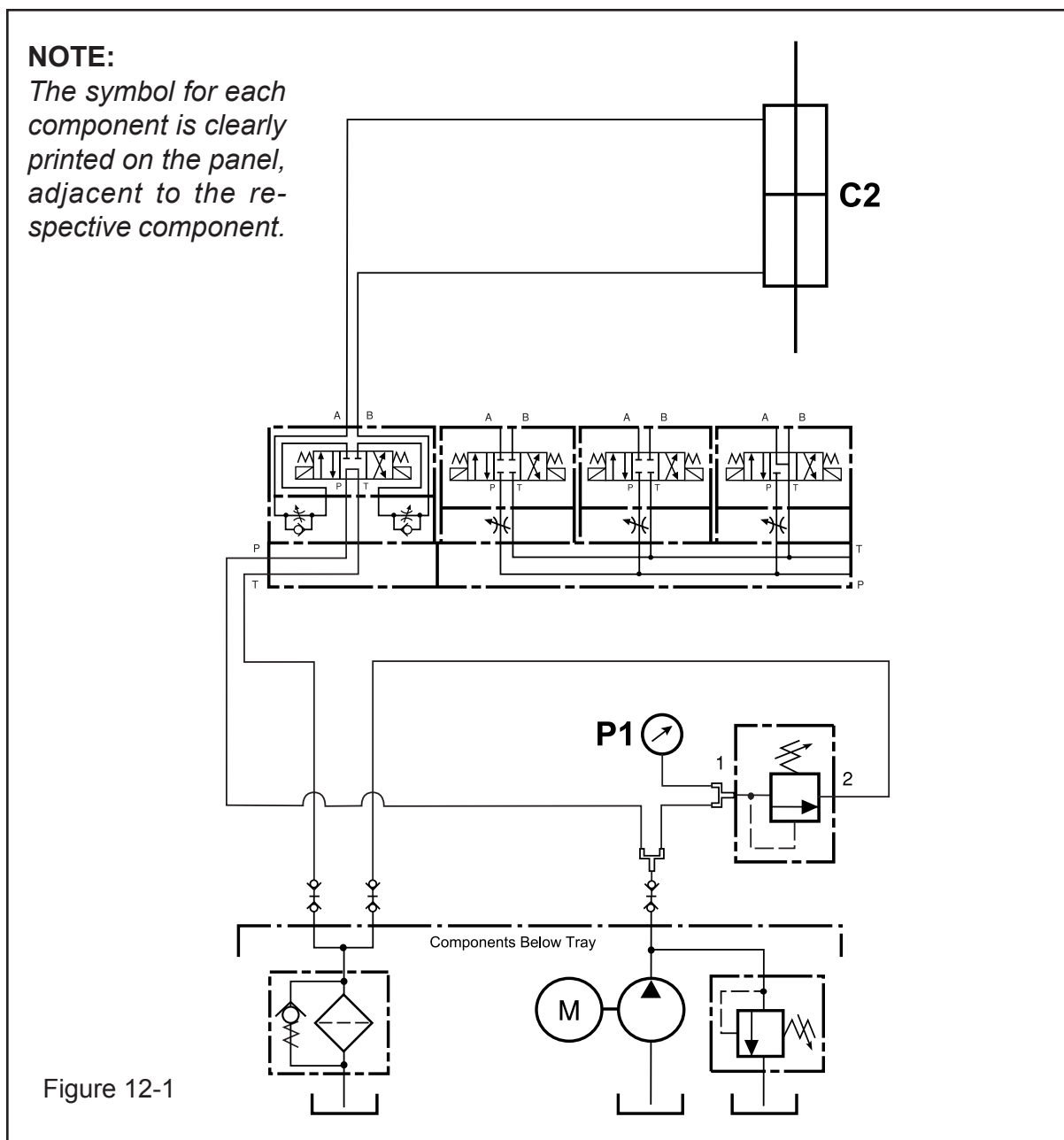


Figure 11-4

## 12.0 Powering up your Simulator -

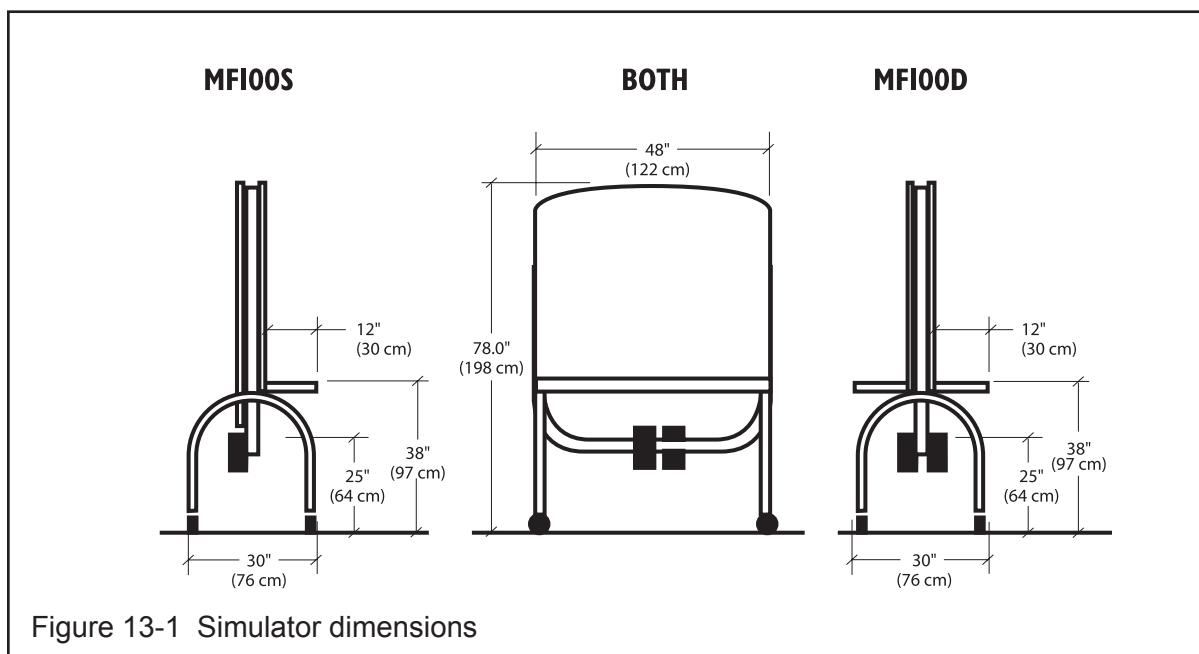
To familiarize yourself with the operation of the MF102 series simulator, go ahead and construct this simple hydraulic circuit shown below.

- Step 1:** Build the circuit as shown on Figure 12-1.
- Step 2:** Start the motor and set the pressure relief valve at 500 PSI (34.5 bar) - dead-head the cylinder to set the pressure relief valve.
- Step 3:** Operate the A-B toggle switch and extend the cylinder rod.
- Step 4:** Now retract the cylinder rod - it's that simple!



## 13.0 Simulator Specifications -

<b>Electrical:</b>	<b>US &amp; Canada -</b>	115VAC single-phase. 10 amp service.	
	<b>International -</b>	220VAC single-phase. 50 Hz.	
<b>Hydraulic Pump:</b>		1.0 GPM (3.79 Lpm) variable-displacement, pressure-compensated piston pump.	
<b>Operating Pressure (max.):</b>		1000 PSI (69 bar)	
<b>Oil:</b>		AW32 hydraulic oil.	
<b>Reservoir Capacity:</b>		approx. 4.5 U.S. gallons (17 liters)	
<b>Motor Displacement:</b>		0.25 cu. in./rev. (4.1 cu. cm/rev.)	
<b>Cylinder Rod Diameter:</b>		1.0" (25.4 mm) Single-rod and Double-rod	
<b>Cylinder Stroke:</b>		14" (355.6 mm) Single-rod and Double-rod	
<b>Trainer Weight:</b>	<b>MODEL</b>	<b>SINGLE UNIT</b>	<b>DOUBLE UNIT</b>
<i>(Does not include packaging weight)</i>	<b>MF102-H</b>	910 lbs (413 kg)	1125 lbs (510 kg)
	<b>MF102-H-TS</b>	920 lbs. (417 kg)	1145 lbs (519 kg)
	<b>MF102-H-TSE</b>	940 lbs (426 kg)	1205 lbs (547 kg)
<b>Fuses and Breakers:</b>		24VDC fuse (6 amp SLOW BLOW)	
		115-220VAC breaker (push button to reset)	





## 14.0 Service and Maintenance

---

Your MF100/101 series simulators are designed to require very little maintenance. However, to give you years of trouble-free operation there are a few things you must do:

- DAILY:**
1. Check oil level.
  2. Check for oil leaks dripping to floor.  
- repair immediately to prevent slip hazard.
  3. Inspect, and replace if necessary, safety covers on hydraulic motor shaft, cylinder rods, and, weight.
  4. Inspect, and replace if necessary, any faulty quick-disconnects.
  5. Inspect electrical wires and connections.
  6. Inspect for loose bolts.

**ANNUALLY:**

1. Drain oil and replace - approximately 4.5 U.S. gallons [17 liters] (See 14.1).
2. Remove oil filter and replace (See 14.2).

### 14.1 Draining the Oil -

The oil reservoir is located on the frame. An oil drain is located on the underside of the reservoir.

- Step 1:** To drain the oil, first make sure the handle of the drain cock is in the horizontal (closed) position (*Figure 14-1*).

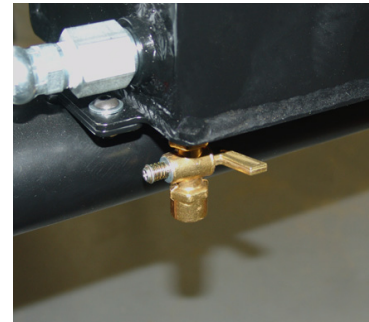


Figure 14-1

- Step 2:** Use a 5/16" allen wrench, and remove the plug from the bottom of the drain valve (*Figure 14-2*).



Figure 14-2

- Step 3:** Place a receptacle, which holds at least 4.5 U.S. gallons (17 liters), under the drain valve and turn the handle to the vertical (open) position (*Figure 14-3*).

**NOTE:** *The reservoir holds about 4.5 U.S. gallons (17 liters) of oil.*

- Step 4:** When the reservoir is empty, close the drain valve and replace the plug.



Figure 14-3

## 14.0 Service and Maintenance

---

### 14.2 Oil Filter Service -

The MF102 series simulators are equipped with a spin-on/off type filter element (*Figure 14-4*).



Figure 14-4

To replace the filter element:

- Step 1:** Disconnect the power supply and lock the simulator out.
- Step 2:** Drain the hydraulic oil (See 14.1).
- Step 3:** Place a receptacle on the floor beneath the filter to contain the small amount of leakage which may occur.
- Step 4:** Turn the filter element, by hand and slowly remove it.
- Step 5:** Discard the filter element in accordance with local and state laws.
- Step 6:** Lubricate the seal on the new filter with hydraulic oil.
- Step 7:** Install the new filter element and tighten securely - DO NOT overtighten.
- Step 8:** Fill the reservoir with new oil until it is present in the sight glass (See 10.2).
- Step 9:** Start the power unit and allow it to run for approximately 30 seconds.
- Step 10:** Recheck the oil level. If necessary, add oil until it is present in the sight glass.
- Step 11:** Wipe residual oil off the new filter element.
- Step 12:** Inspect the floor for signs of oil which may have spilled while removing the filter element. Clean oil spills thoroughly to prevent a slip-type accident.

## 15.0 Troubleshooting your Simulator -

---

<b>PROBLEM</b>	<b>SOLUTION</b>
1. Simulator does not power up.	<ul style="list-style-type: none"><li>a. Check electrical connections.</li><li>b. Push down firmly on power unit ON/OFF switch and reset breaker.</li><li>c. Reset AC fuse breaker by pressing in.</li></ul>
2. Pump makes a noise (cavitation).	<ul style="list-style-type: none"><li>a. Check oil level.</li></ul>
3. Stopwatch does not work.	<ul style="list-style-type: none"><li>a. Replace battery.</li></ul>

## 16.0 Where to Get Help -

---

If, after following the troubleshooting guide the problem still persists, call the Fluid Power Training Institute™ for assistance at 1-888-222-3421.

Please have your model number and serial number available when you call.

## 17.0 Recommended Spare Parts List -

---

The MF102 series simulators are equipped with parts which are designed for high-cycle operation. Given the proper care they should last for many years.

However, certain items need regular service to keep your trainer operating reliably.

<b>ITEM</b>	<b>PART #</b>	<b>DESCRIPTION</b>
1.	SF6520	Oil filter.
2.	-	Stopwatch battery.
3.	AA battery (qty. 2)	*Tachometer (hand-held) battery.
4.	6 amp SLOW-BLOW fuse	Fuse for 24VDC system

\* MF102-H-TS and TSE model simulators only.

## 18.0 Manufacturer's Service/Operation Literature -

---

### 18.1 STOPWATCH OPERATION INSTRUCTIONS:

#### TIME DISPLAY:

1. Normal display: Hours and Minutes.
2. Press S1 once: Month and Date (automatically returns to normal display).
3. Press S1 twice: Seconds displayed (Press S1 again to return to normal display).

#### TIME SETTING:

1. MONTH: Press S2 once, display Alternating TIME and DATE.  
Press S2 twice to MONTH, then depress S1 to set.
2. DATE: Press S2 three (3) times to DATE, then depress S1 to set.
3. HOUR: Press S2 four (4) times to HOUR, then depress S1 to set ("A" for AM or "P" for PM).
4. MINUTE: Press S2 five (5) times to MINUTE then depress S1 to set. Press S2 for the last time to return to normal display but stationary and press S1 to start the time from 00 seconds.

## 19.0 Manufacturer's Warranty Information -

---

The MF102 series simulators are covered by their manufacturer's respective warranty. FPTI™ also offers an additional 2-year warranty, guaranteeing the simulator will be free from defects for that period of time.

If any problems arise, that are not covered by this manual, contact FPTI™ immediately.

If any attempt is made to disassemble or alter any component on the simulator, without the consent of FPTI™, this warranty will be void.

## 20.0 INDEX

---

### **A.**

Accessories .....	8
Accumulator .....	30
Adjustment screws -	
component .....	17
pump .....	17
Ammeter .....	11/13
Ambient temperature gauge	
familiarization .....	11/13/19

### **B**

Ball valve .....	11/13/14
Battery -	
stopwatch .....	44
tachometer (hand-held) .....	44

Brakes - caster .....	5
Breaker .....	19

### **C**

Case-pressure gauge .....	23
Casters .....	5
Cautions .....	1/6/7/33
Check list .....	8
Check valve -	
basic.....	11/13
pilot-operated .....	11/13

Closed-center .....	
11/13	
Counterbalance valve .....	11/13/17

Cylinder -	
double-rod, double-acting .....	11/13
single-rod, double-acting .....	11/13

### **D**

## 20.0 INDEX

---

DC - 24 volt .....	9/34
Digital -	
ambient temperature gauge .....	11/13/19
hand-held tachometer .....	21
oil temperature gauge .....	11/13/19
panel-mount tachometer .....	11/13
Directional control valve -	
tandem-center .....	11/13
open-center .....	11/13
closed-center .....	11/13
float-center .....	11/13
proportional .....	33
Direct-operated relief valve .....	11/13
Drain - oil .....	42
<b>E</b>	
Electrical	
AC .....	9/34
24VDC .....	9/34
connections .....	34
power .....	34
Extension cord .....	1
Eye-wash station .....	2
<b>E</b>	
Familiarization .....	9
Filler/breather .....	
35	
Filling with oil 35	
Filter element – oil .....	43/44
Fixed displacement pump .....	15
Flex Plate .....	19
Float-center .....	11/13

## 20.0 INDEX

---

Flow adjustment - pump .....	17
Flow control valve .....	11/13
Flow meter -	
inline .....	11/13
test kit .....	22
Funnel - oil .....	35
Fuse -	
AC breaker.....	9/19/41
6 amp slow-blow .....	9/19/41/44
<b><u>G</u></b>	
Gauges -	
ambient temperature .....	11/13/19
case pressure .....	23
pressure .....	35
oil temperature .....	11/13/19
vacuum .....	24
Gear Pump .....	11
Glasses - safety .....	2
<b><u>H</u></b>	
Handle - Ball valve .....	14
Holder -	
schematic .....	37
paper towel .....	37
Hose -	
caddy .....	11/13/37
hydraulic .....	8
union .....	38
Hydraulic -	
hose .....	8
oil .....	1/35/41



## 20.0 INDEX

---

reservoir .....	35
<b><u>I/J/K</u></b>	
<b><u>L</u></b>	
Laminated schematics .....	37
Load .....	11/13
<b><u>M</u></b>	
Maintenance .....	42
Manifold .....	16
Meter -	
flow .....	11/13/22
amps .....	1
Microleak Tester .....	20
Monitor .....	26
Motor -	
electric .....	11/13
hydraulic, bi-directional .....	11/13
<b><u>N/O</u></b>	
Oil -	
drain .....	42
filler/breather .....	35
filling.....	35
filter .....	43/44
funnel .....	35
hydraulic .....	35/41
temperature gauge .....	11/13/19
type/grade .....	35/41
<b><u>P</u></b>	
Pallet .....	4
Paper towel holder .....	11/13/37
Parts -	
list .....	8

## 20.0 INDEX

---

spare .....	44
Pilot-operated -	
check valve .....	11/13
relief valve .....	11/13
Powering up .....	40
Power-unit .....	41
Pressure-compensated pump .....	11/13
Pressure compensator .....	17
Pressure -	
adjustment (pump) .....	17
gauge .....	35
gauge - case pressure .....	23
reducing valve .....	11/13
system .....	41
Pressure/leak test pump .....	20
Proportional directional/flow control valve .....	33
Pump -	
adjustment .....	17
fixed-displacement .....	15
gear.....	11
pressure-compensated .....	15
pressure/leak test .....	20
<b><u>Q/R</u></b>	
Receptacle – electric .....	36
Reservoir - hydraulic .....	35/41
Restrictor-type pressure compensated flow control valve .....	11/13
Retractable stopwatch	
familiarization .....	11/13
instructions .....	45

## 20.0 INDEX

---

### **S**

#### Safety -

glasses .....	2
transparent covers - moving items.....	39
warnings .....	1/2/18/26/27/32/39

Service .....	43
---------------	----

Schematic holder .....	37
------------------------	----

Sequence valve .....	11/13
----------------------	-------

Sight glass .....	35
-------------------	----

Specifications .....	
----------------------	--

41

Station – eye-wash .....	2
--------------------------	---

#### Stopwatch

familiarization .....	11/13
instructions .....	45

#### Switch -

electrical (main) .....	36
key-lock.....	21
master .....	21
reference guide .....	29
toggle .....	20
troubleshooting .....	20/29

### **I**

T's .....	8
-----------	---

#### Tachometer -

hand-held .....	21
panel-mounted .....	11/13

Tandem-center .....	11/13
---------------------	-------

#### Temperature gauge -

ambient .....	11/13
---------------	-------

## 20.0 INDEX

---

oil .....	11/13
Toggle switches .....	20
Towel holder (workshop).....	11/13/37
Touchscreen .....	26/27/28
Troubleshooting .....	20/29/44
<b><u>U</u></b>	
Union - hose .....	38
Unpacking .....	4
<b><u>V</u></b>	
Valve -	
ball .....	11/13/14
body markings .....	18
counterbalance .....	11/13/17
direct-operated .....	11/13
pilot-operated .....	11/13
pressure-compensated flow control .....	11/13
pressure reducing .....	11/13
pressure relief .....	11/13
sequence .....	11/13
Vacuum gauge -	
adjustment .....	24
installation .....	25
Variable displacement, pressure-compensated pump .....	17
<b><u>W</u></b>	
Warnings .....	1/2/3/18/26/27/32/39
Warranty .....	45
Weight .....	7
<b><u>X/Y/Z</u></b>	





If you have any questions that this document does not address, please contact us immediately for assistance.



PO Box 711201  
Salt Lake City, UT 84171

PH: 801-908-5456  
FAX: 801-908-5734  
e-mail: [info@fpti.org](mailto:info@fpti.org)  
web: [www.fpti.org](http://www.fpti.org)