

Model MF200 Cavitation Simulator

OWNERS MANUAL



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

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.

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CONGRATULATIONS!

You have purchased the most advanced cavitation simulator in the world - ***the MF200***.

The MF200 cavitation 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 MF200'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

1.0	SAFETY FIRST! - Safety Instructions	1-1
2.0	Unpacking Your MF200 Cavitation Simulator	2-1
3.0	Familiarizing yourself with the MF200 Cavitation Simulator .	3-1
4.0	Preparing your MF200 Cavitation Simulator for Use.....	4-1
5.0	MF200 Cavitation Simulator Specifications	5-1
6.0	Service and Maintenance	6-1
7.0	Troubleshooting your MF200 Cavitation Simulator	7-1
8.0	Where to Get Help	8-1
9.0	Recommended Spare Parts List	9-1
10.0	Manufacturer's Service/Operation Literature	10-1
11.0	Index	11-1



1.0 SAFETY FIRST! - Safety Instructions

Electrical Connections -

The MF200 cavitation simulator is equipped with a 120VAC cord fitted with a male receptacle.

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 MF200 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.



CAUTION

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



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

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.

1.0 SAFETY FIRST! - Safety Instructions



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

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).*



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.*

2.0 Unpacking Your MF200 Cavitation 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 container screws and retainers from around the base of the cardboard container (12 screws total (Figure 2-1)).

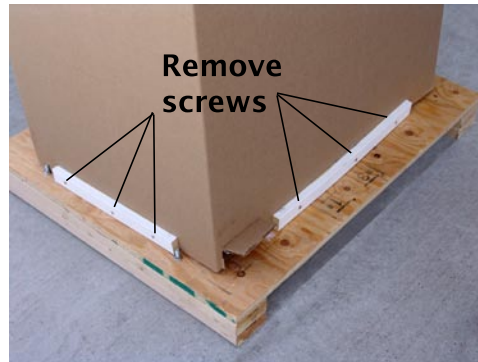


Figure 2-1

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.

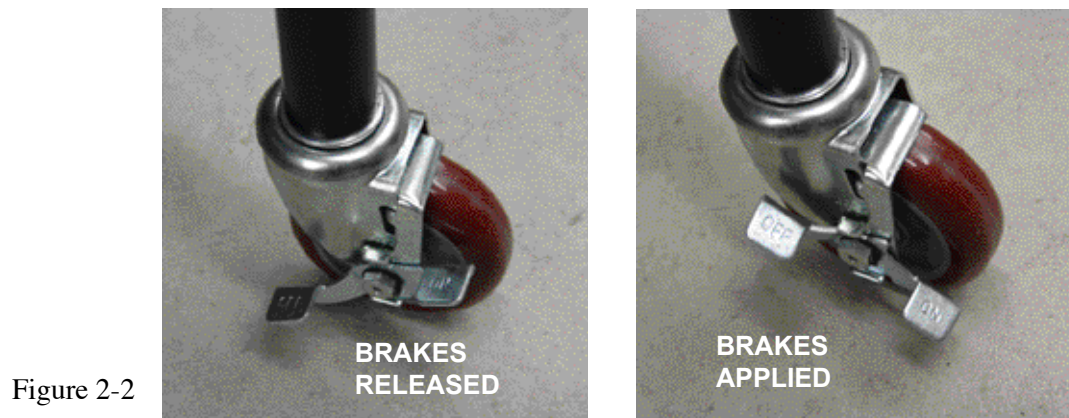
NOTE: IF THE SHIPPING CONTAINER IS DAMAGED KEEP IT INTACT UNTIL THE FREIGHT COMPANY HAS COMPLETED ITS INVESTIGATION.

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!

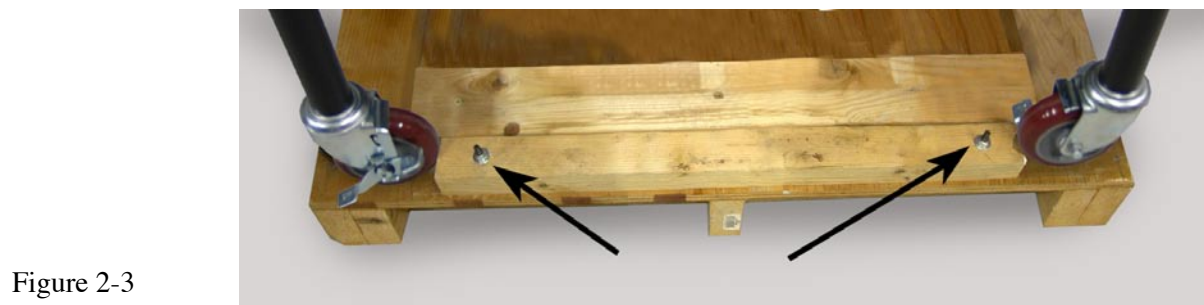
Step 4: Loosen and remove the ratchet straps which secure the simulator to the pallet.

2.0 Unpacking Your MF200 Cavitation Simulator - *cont'd.*

Step 5: Apply all four caster brakes. To apply the brakes, push down firmly on the individual brake levers. (Figure 2-2).



Step 6: 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 2-3).



CAUTION

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

2.0 Unpacking Your MF200 Cavitation Simulator - *cont'd.*

Step 7: 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 2-4).

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



Figure 2-4



CAUTION

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

Step 8: While holding the simulator, release the caster brakes and gently roll it off the pallet.

Step 9: Once the simulator is off the pallet, apply the brakes and proceed with the start-up procedure.

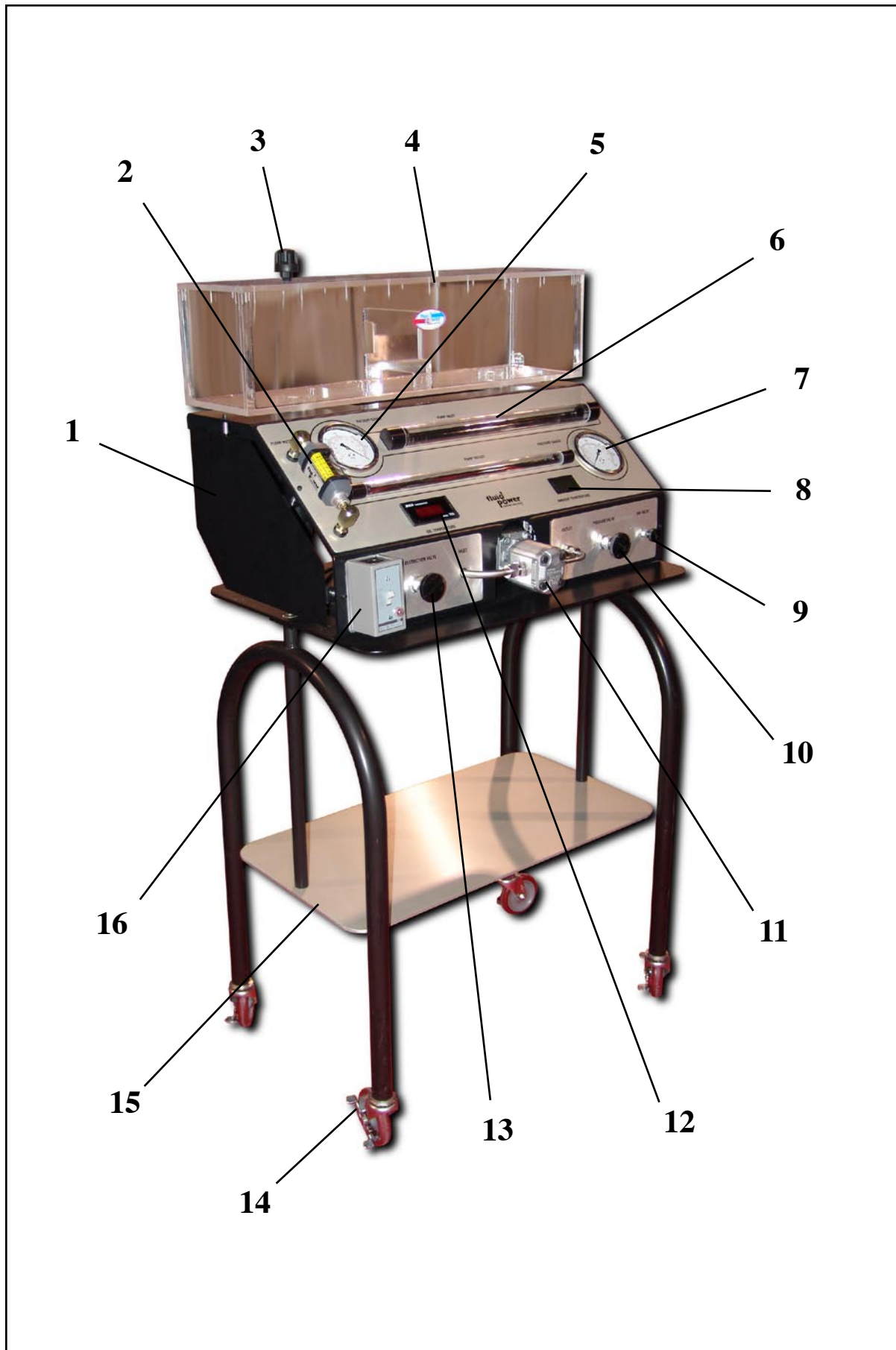


Figure 3-1

3.0 Familiarizing yourself with the MF200 Cavitation Simulator

Let's take a walk around the simulator

Your MF200 Cavitation Simulator is loaded with components. Take a moment to familiarize yourself with the components found on your simulator.

3.1 Front view - (Figure 3-1)

1. Removeable back plate.
2. 0.2-2.0 GPM (0.076- 7.6 Lpm) flow meter.
3. Reservoir oil filler/breather.
4. Baffled reservoir.
5. 0-30" Hg (mercury) vacuum gauge.
6. Transparent, pump inlet oil transmission line.
7. 0-600 PSI (41.4 bar) oil pressure gauge.
8. Digital ambient temperature gauge.
9. Air valve.
10. Pressure valve.
11. Hydraulic pump (gear-type).
12. Digital oil temperature gauge.
13. Air inlet restriction valve.
14. Four-wheel, light-duty casters with brakes.
15. Lower storage plate.
16. ON/OFF switch.

3.0 Familiarizing yourself with the MF200 Cavitation Simulator

Let's take a walk around the simulator

3.2 ON/OFF switch

(Figure 3-2) -



Figure 3-2

The ON/OFF switch turns the electric motor on or off. The red light on the switch plate illuminates when the switch is in the ON position.

The switch is equipped with overload protection. To reset the switch, push the level down "firmly" to the OFF position.

3.3 Inlet restriction valve

(Figure 3-3) -



Figure 3-3

The inlet restriction valve simulates excessive inlet restriction when operated according to markings on the panel.

3.4 Pressure valve

(Figure 3-3) -



Figure 3-4

The "pressure valve" creates pressure by restricting the pump flow.

Turn the knob clockwise to increase resistance and counter-clockwise to decrease resistance.

Turning the knob in fully will stop the flow. To protect the system from damage, the circuit is equipped with a safety relief valve.

3.0 Familiarizing yourself with the MF200 Cavitation Simulator

Let's take a walk around the simulator

3.5 Air valve

(Figure 3-5) -



Figure 3-5

The air valve permits air to enter the pump inlet to simulate pseudo-cavitation (aeration).

The valve must be kept closed until needed for demonstration purposes.

Rotate the knob clockwise to close and counter-clockwise to open.

NOTE: *If the air does not enter the pump when the valve is opened, increase the inlet restriction momentarily to break the "oil seal" in the air inlet line.*

3.6 Flow meter

(Figure 3-6) -

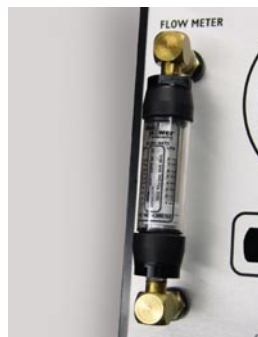


Figure 3-6

The flow meter indicates pump flow whenever the pump is operating.

3.7 Vacuum gauge

(Figure 3-7) -



Figure 3-7

The vacuum gauge indicates pump inlet restriction whenever the pump is operating.

3.0 Familiarizing yourself with the MF200 Cavitation Simulator

Let's take a walk around the simulator

3.8 Pressure gauge

(Figure 3-8) -

The pressure gauge indicates system pressure whenever the pump is operating.

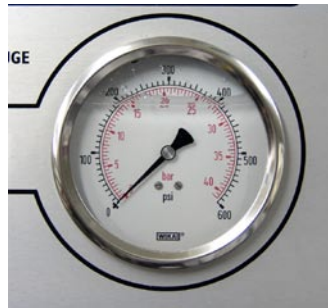


Figure 3-8

3.9 Digital oil temperature gauge

(Figure 3-9) -

The oil temperature gauge indicates the system oil temperature.



Figure 3-9

3.10 Digital ambient temperature gauge

(Figure 3-10) -

The ambient temperature gauge indicates the ambient temperature.

Ambient temperature is the temperature of the environment around the simulator.



Figure 3-10

NOTE: *The oil temperature and ambient temperature gauge is a single unit on newer models.*

3.0 Familiarizing yourself with the MF200 Cavitation Simulator

Let's take a walk around the simulator

3.11 Digital, Hand-Held, Laser-Type Tachometer (optional - *Part # HC-DT207L*) -

The hand-held tachometer is used primarily when students are learning diagnostic 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 3-11*) for this purpose.



Figure 3-11

Step 1: To operate the tachometer, first rotate the dial to the correct position - “non-contact RPM” (*Figure 3-12*).



Figure 3-12

Step 2: Next, carefully aim the laser between the openings in the fan safety guard at the reflective tape (*Figure 3-13*). Hold the tachometer steady, and depress the white button.



Figure 3-13

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. To learn more about the tachometer, read the instruction manual included with the unit.

4.0 Preparing your MF200 Cavitation Simulator for use -

4.1 Filling the MF200 Simulator with Oil -

Fill the simulator with a good quality automatic transmission fluid (ATF).
Reservoir Capacity: approx. 4.5 U.S. gallons (17 liters)

Step 1: Remove the filler/breather (*Figure 4-1*) and place the funnel in the filler port (*Figure 4-2*).



Figure 4-1



Figure 4-2

Step 2: Fill the simulator reservoir until the oil reaches the maximum oil level mark (*Figure 4-3*).

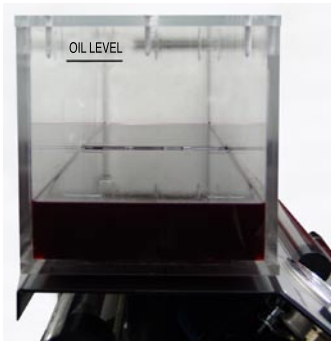


Figure 4-3

4.2 Before Starting -

1. Open the restriction valve fully - Turn the lever counter-clockwise (see markings on the panel).
2. Open the pressure valve fully - Rotate the knob counter-clockwise until it stops.
3. Close the air valve fully - Rotate the knob clockwise until it stops.

4.0 Preparing your MF200 Cavitation Simulator for use -

- 4.3** Start the power unit using the main electrical ON/OFF switch (*Figure 4-4*). After a minute, recheck the oil level and top-up if necessary.

Turn off the power unit.



Figure 4-4

5.0 MF200 Cavitation Simulator specifications -

Electrical:	120VAC single-phase. 10 amp service.
Hydraulic Pump:	1 GPM (3.79 Lpm) fixed-displacement gear pump.
Operating Pressure (max.):	600 PSI (41.4 bar).
Oil:	Automatic transmission fluid (ATF).
Reservoir Capacity:	approx. 4.5 U.S. gallons (17 liters)
Simulator Weight:	200 lbs (90.7 kg).
Simulator Dimensions: (Figure 5-1)	Height: 58" (147.3 cm) Width: 30" (76.2 cm) Depth: 20" (50.8 cm)
Safety Pressure Relief Valve setting:	600 PSI (41.4 bar).

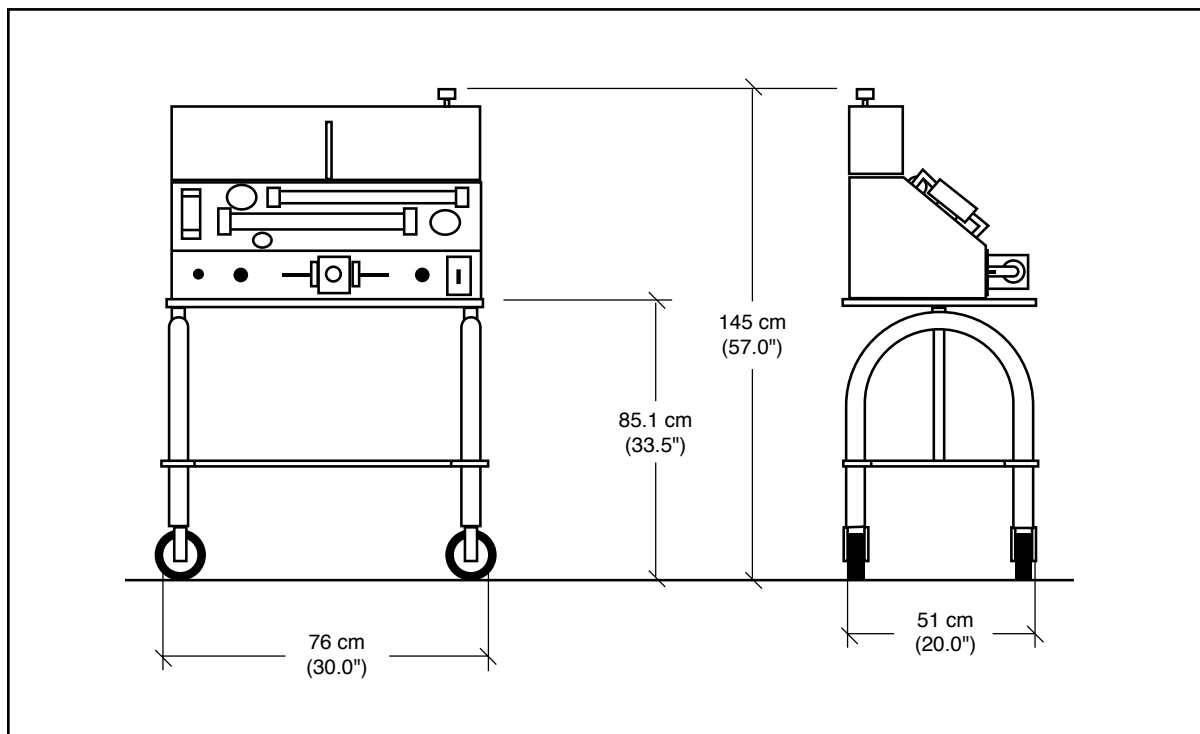


Figure 5-1

6.0 Service and maintenance -

Your MF200 series simulator is 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 electrical wires and connections.
4. Inspect for loose bolts.

ANNUALLY:

1. Drain oil and replace - approximately 4.5 U.S. gallons [17 liters] (See 6.1).
2. Remove oil filter and replace (See 6.2).

6.1 Draining the Oil -

An oil drain valve is located on the underside of the trainer (*Figure 6-1*).

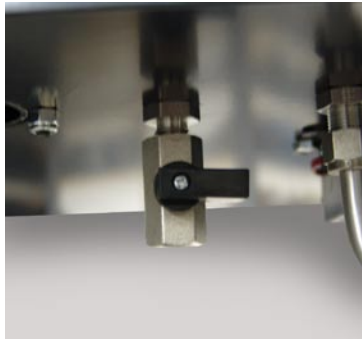


Figure 6-1

- Step 1:** Place the simulator on a level surface and lock the wheel brakes.
- Step 2:** Disconnect the power supply and lock-out the simulator.
- Step 3:** To drain the oil, remove the plug (if supplied) from the drain valve using a 1/4" allen-wrench.
- Step 4:** Place a receptacle that will hold at least 4.5 U.S. gallons (17 liters) under the drain valve.
- Step 5:** Turn the handle to the vertical (open) position. (Photo shows "closed" position).
- Step 6:** When the reservoir is empty, close the oil drain valve by turning the handle to the horizontal (closed) position.
- Step 7:** Replace the plug (if supplied) in the drain valve using a 1/4" allen-wrench.

6.0 Service and Maintenance -

6.2 Oil Filter Service -

The MF200 Simulator is equipped with a spin-on/off type filter element (*Figure 6-2*). To replace the filter element:



Figure 6-2

- Step 1:** Disconnect the power supply and lock the simulator out.
- Step 2:** Drain the hydraulic oil (See 6.1).
- Step 3:** Place a receptacle on the floor beneath the filter to contain leakage.
- Step 4:** Turn the filter element (clockwise from below) 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 (See 4.1).
- 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.
- Step 11:** Wipe residual oil off the 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.

7.0 Troubleshooting your MF200 Cavitation Simulator -

PROBLEM

SOLUTION

- | | |
|---------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1. Simulator does not power up. | <ul style="list-style-type: none">a. Check electrical connections.b. Push down firmly on the ON/OFF switch and reset thermal overload unit. |
| 2. Pump makes a noise (cavitation) when demonstrating "normal" operation. | <ul style="list-style-type: none">a. Close air inlet valve.b. Check oil level. |

7.1 Ambient Temperature Gauge (see Section 10.0 for Manufacturer's Literature) -

The Ambient Temperature Gauge is powered by a #357 watch-type battery. In the event the battery requires changing, the gauge can be easily removed.

To remove the gauge, use a small flat-head screwdriver or flat-edged tool and gently pry the gauge out (*Figure 7-1*).

NOTE: *Place the flat-edged tool directly in the center on the short side of the gauge. Press in the tab while prying the gauge out.*

Once the gauge is loose, pull the gauge out and locate the battery cover on the back side. After replacing the battery, simply push the gauge back into its slot and firmly press it in place until the gauge sits flush with the panel.



Figure 7-1

8.0 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.

NOTES: _____

This image shows a single page of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page, providing a guide for handwriting or typing. There are no margins, text, or other markings on the page.

9.0 Recommended Spare Parts List -

The MF200 simulator is 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.

ITEM	PART #	DESCRIPTION
1.	SF6520	Oil filter.
2.	AA battery (qty. 2)	Tachometer (hand-held) battery.

[illegible]

10.0 Manufacturer's Service/Operation Literature -

DIGITAL AMBIENT TEMPERATURE GAUGE SPECIFICATIONS:

Model No.:	ST-9290 C
Functions:	ON/OFF, °F/°C, HIGH alarm, LOW alarm
Features:	<ul style="list-style-type: none">• 60mm• PVC sucker at the back of the unit• 1 sec. normal temperature sensing time• Low battery indicator
Specification:	<ul style="list-style-type: none">• MEASUREMENT RANGE: -50°C ~ +150°C or -58°F ~ +302°F• RESOLUTION: 0.1° F or -19.9° ~ +199.9°, otherwise 1°• ACCURACY: +/- 1°C in the range of -30°C ~ +150°C +/- 1.8°F in the range of -22°F ~ +302°F• AMBIENT TEMPERATURE FOR PLASTIC CASE: -10°C ~ +50°C or +14°F ~ +122°F• BATTERY: 1 X 1.5V "A76" size (LR44, G13) or equivalent

Battery Installation:

- Open the battery door, install one "A76 (LR44, G13)" OR "AAA" size battery into the battery compartment. Close the battery door.
- Replace with new battery when the low battery indicator appears on the screen.

Operation:

- Press "ON/OFF" for power switching.
- Press "F/C" for selecting the desired temperature unit.
- TEMPERATURE ALARM SETTING:
 - Press and hold the "LOW" or "HI" button for setting alarm at the desired minimum or maximum temperature limit. Initially, the display will show -50°C (-58°F) as default value, then it will start to increase up to +150°C (+302°F) or +300°C (+572°F).
 - Release the "LOW" or "HI" button when the desired temperature is reached.
 - The thermometer will return to the NORMAL mode after three (3) seconds. The alarm will beep four (4) times per minute when the current temperature is equal to or exceeds the preset maximum (minimum) value.
 - Press "F/C" or "ON/OFF" button to delete the alarm set function.

Precautions:

- Remove the battery from the battery compartment if the thermometer will not be used for a long duration of time or during storage.

11.0 INDEX -

A

Air valve	3-4
Ambient temperature gauge	
familiarization	3-5
instructions	7-1
Automatic transmission fluid (ATF)	1-1/5-1

B

Battery -	
ambient temperature gauge	9-1
Brakes - caster	2-2

C

Capacity (reservoir)	5-1
Casters	2-2

D

Digital -	
ambient temperature gauge	3-5
oil temperature gauge	3-5
hand-held tachometer	3-6/9-1
Dimensions	5-1
Drain - oil	6-1

E

Electrical power (120 VAC)	1-1/5-1
Extension cord	1-1
Eye-wash station	1-1

F

Familiarization	3-2
Filler/breather	4-1
Filling with oil 4-1	
Filter element - oil	6-2
Flow meter - inline	3-4

11.0 INDEX - *cont'd.*

Funnel - oil4-1

G

Gauges -

 ambient temperature 3-5

 pressure 3-5

 oil temperature 3-5

 vacuum 3-4

Glasses - safety 1-1/1-2

H

Hand-held tachometer 3-6/9-1

Hydraulic reservoir 4-1

I

Inlet restriction valve3-3

J

K

L

M

N

O

Oil -

 drain 6-1

 filler/breather 4-1

 filter 6-2

 funnel 4-1

 reservoir 4-1

 temperature gauge 3-5

 type/grade 5-1

ON/OFF switch 3-3

Operating pressure 5-1

12.0 INDEX - *cont'd.*

P

Pallet	2-1
Pressure -	
gauge	3-5
operating system	5-1
valve	3-3
Pump (hydraulic)	3-2

Q

R

Receptacle - electric (120 VAC)	1-1
Reservoir - hydraulic	4-1

S

Safety -	
glasses	1-1
warnings	1-1
Spare parts	9-1
Specifications	5-1
Station - eye-wash	1-1
Switch -	
electrical (ON/OFF)	4-2

T

Tachometer (hand-held)	3-6/9-1
Temperature gauge -	
ambient	3-5
oil	3-5

Troubleshooting	7-1
-----------------------	-----

U

Unpacking	2-1
-----------------	-----

V

Vacuum gauge	
--------------------	--

11.0 INDEX - *cont'd.*

3-4

Valve -

air 3-4

inlet restriction 3-3

pressure 3-3

W

Weight 5-1

X

Y

Z

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



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