



Dependable Products From People You Trust



CLF-40 Automated Compressive Load Frame

#120-285: 115 Volt

#120-285-230: 230 Volt

#120-285-DAS: With Computer, 115 Volt

#120-285-230-DAS: With Computer, 230 Volt

Instruction Manual

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Ver. 6

OFI Testing Equipment, Inc.

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Intro

The OFITE CLF-40 Automated Compressive Load Frame was designed to determine the compressive strength of a well cement. The most common means of determining the compressive strength of a cement involves applying a force to the sample at a constant rate until the sample fails. The maximum loading at which the cement fails is defined as the cement's compressive strength. Manually operated hydraulic presses are normally used for testing purposes and maintaining a constant loading rate is very difficult. Unfortunately, data obtained from this type of testing is typically inconsistent and widely varied. The CLF-40 improves upon the manually-operated design by incorporating a computer-controlled ram that can maintain a specified loading rate. Operator inconsistencies are significantly reduced in comparison to manually operated hydraulic presses.

Description

A cement slurry is prepared and cured according to the guidelines outlined in API Specification 10A. A cured cement sample is then placed onto the testing platen of the CLF-40. The unit is turned on, a loading rate is selected, and the test is started. The automatic ram will begin applying an increasing load at a controlled rate until the cement sample fails. At that point, the maximum compressive load on the sample is recorded and reported to the user.

Specifications

- Maximum press capacity: 40,000 lbf
- Maximum Compressive Strength: 10,000 psi (based on a 2" cement cube with surface area of 4 in²)
- Minimum press threshold: 1,000 lbf
- Minimum Compressive Strength: 250 psi (based on a 2" cement cube with surface area of 4 in²)
- Self-aligning hardened platens
- Microprocessor controller
- Variable loading rates from 250 to 40,000 lbf/min (in increments of 250)
- Safety head and rupture disk prevent over pressurization
- Proportional control valve accurately controls load rate
- Safety shield protects operator
- Stand alone or remote control operation
- Size: 23" W × 23" D × 26.5" H (58 × 58 × 67 cm)
- Weight: 225 lb (102 kg)

Requirements

- 115 / 220 Volt, 50/60 Hz

Components

| | |
|-------------|-------|
| #120-28-061 | Brush |
| #122-074 | Fuse |

Setup

Hardware

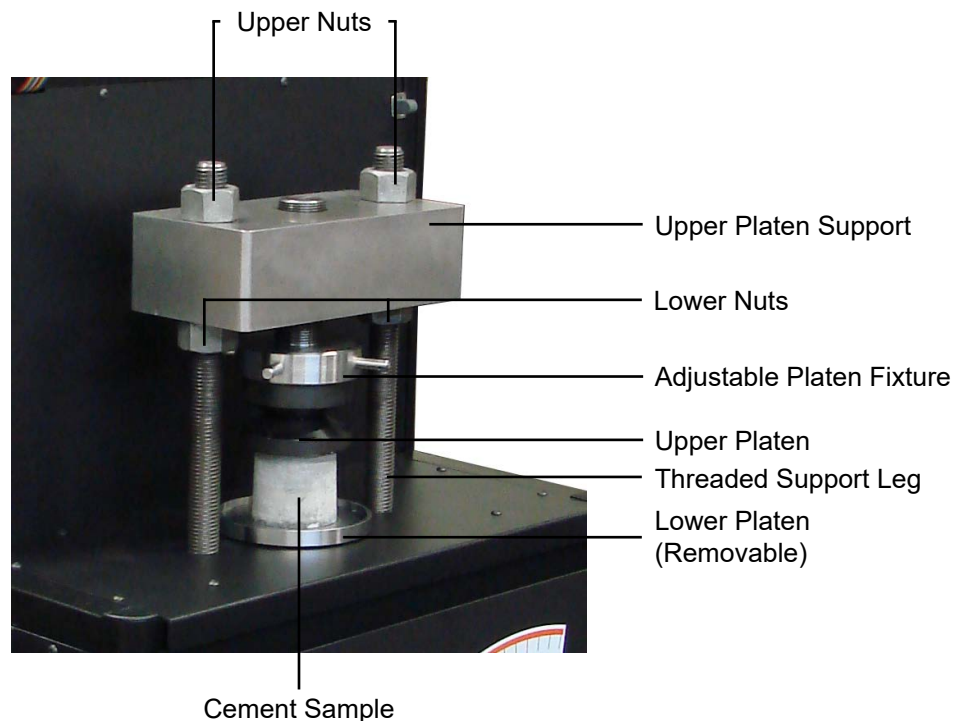
1. Carefully remove the instrument from the wooden crate.
2. Leveling legs are provided to level the instrument. Rotate the legs until the instrument is level.
3. Plug the unit into a suitable grounded electrical supply.
4. The upper platen support has been lowered to protect the platens during shipping. Raise the upper platen support high enough to allow room for a cement sample to be placed on the lower platen underneath:
 - a. Unscrew the upper nuts. They should be about an inch from the top of the threaded support legs.
 - b. Raise the upper platen support up to the upper nuts. Tighten the lower nuts until they are holding the upper platen support in place.

Make sure the upper platen support is level.

- c. Tighten the upper nuts hand tight.



Note



Setup

Software

The CLF-40 can be connected to a computer via a serial connection (RS-232) or over a network (ethernet).

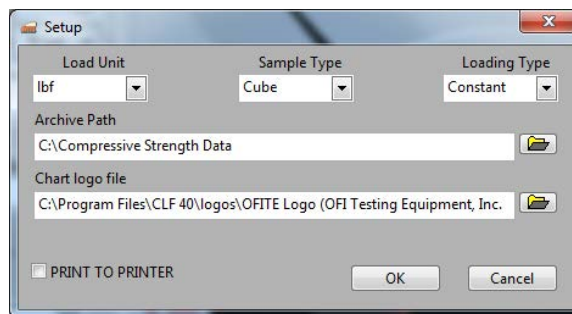
If the CLF-40 will be used in standalone mode only, skip the following steps and proceed to page 6.

1. Open the CLF-40 software by double-clicking the icon on the desktop.
2. Select "Setup" from the "Utilities" menu.
3. Select a load unit: MPa, psi, or lbf
4. Select a sample type: Cylinder or Cube
5. Select the loading type.

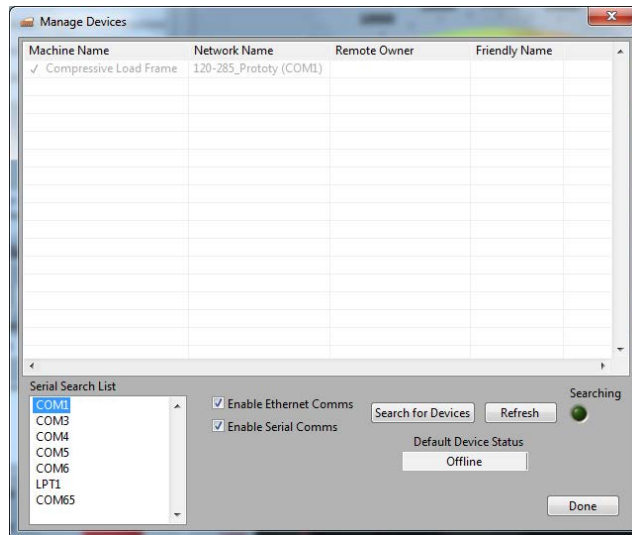
Constant: Increase the load at the maximum loading rate until the specified load is reached and maintains the load until the end of the test.

Ramp: Increase the load at the specified rate until the sample fails or until it reaches the maximum load of 40,000 lbf.

6. Select an archive path. This is where all test results will be saved.
7. Choose a logo file to print on the chart at the end of the test.
8. Select the "Print to Printer" option if you want the software to automatically print the test results on the default printer at the end of a test.
9. Click OK to save your changes.



10. Select “Manage Devices” from the “Utilities” menu.



11. If the CLF-40 is connected via Ethernet, make sure the “Enable Ethernet Comms” option is selected. If it is connected via serial, make sure “Enable Serial Comms” is selected.
12. If your CLF-40 does not show up in the list at the top of the screen, click the “Search for Devices” and “Refresh” buttons. If the device still doesn’t show up, check the connection and try again.
13. Locate the device you want to manage in the list at the top of the screen. Right-click the device and click “Select Default Device” to assume control.
14. If another user already has control of the device, the software will show an error message. Disconnect the software on one of the computers to remove the error.
15. Click “Done” to return to the main screen.

Preparation

Cement

The CLF-40 is capable of testing either cubes or cylinders. Samples can be prepared in either a curing chamber (cubes) or an autoclave (cylinders).

1. Open the safety shield.
2. Turn the platen height adjustment to the right until the upper platen is high enough to place a cement sample beneath it.
3. Center the sample on the lower platen.
4. Turn the platen height adjustment to the left until the upper platen touches the cement sample.
5. Firmly close the safety shield.



Important

If the safety shield is not firmly closed, the unit will not allow a test to begin.

6. For cement testing in standalone mode, refer to page 7. For cement testing with a computer, refer to page 9.

Cement Testing

Standalone Mode

The controls for the CLF-40 are on the right-hand side of the unit.

Use the Selection Wheel and Cancel button to navigate through the built-in menus. Push the wheel in to begin or to select an option. Turn the wheel (in either direction) to cycle through the options. Press the Cancel button to return to the previous menu or stop a test.



1. Load the cement sample as described on page 6.
2. Turn the POWER and PUMP on.

To run a standard API test:

Press and hold the 16,000 / 4,000 switch until the cement sample fails.

16,000 - This setting will increase the load at a rate of 16,000 lbf/min.

4,000 - This setting will increase the load at a rate of 4,000 lbf/min.

The maximum load is 40,000 lbf. If the cement sample does not fail, the load will continue to increase until it reaches 40,000 lbf.



Tip

To run a saved test:

1. From the main menu, select option 2 "Run Saved Test".
2. Select the test you wish to run.

To modify an existing test or create a new test, refer to the instructions on page 8.

3. Press the Selection Wheel in to run the test.
4. Press the Cancel button to stop a test.

Creating and Modifying Custom Tests

The CLF-40 unit can store up to 30 custom tests in the onboard computer. These tests can be recalled and run at any time.

1. From the main menu select option 4, "Edit Saved Tests".
2. Select the test you want to modify. If you are creating a new test, select an "Empty" test.
3. Set the loading rate and the maximum load.
4. Press the wheel in to save the test.

To run a custom test:

1. From the main menu, select option 3 "Custom Test".
2. Set the loading rate and maximum load.
3. Press the Selection Wheel in to run the test.

At the end of a test, the maximum load applied before the cement sample failed will be shown on the display.

After each test, clean the debris from the lower platen. Brush the debris into the receptacle on the front of the cabinet. Also, remove the lower cabinet and brush away any remaining debris underneath it. The front receptacle can be removed for easy cement disposal.

Cement Testing

With Computer



Tip



Note

1. Open the software by double-clicking the icon on the desktop.
2. Select “Load Sample Info” from the “Utilities” menu.
3. Enter the information about the cement sample being tested.

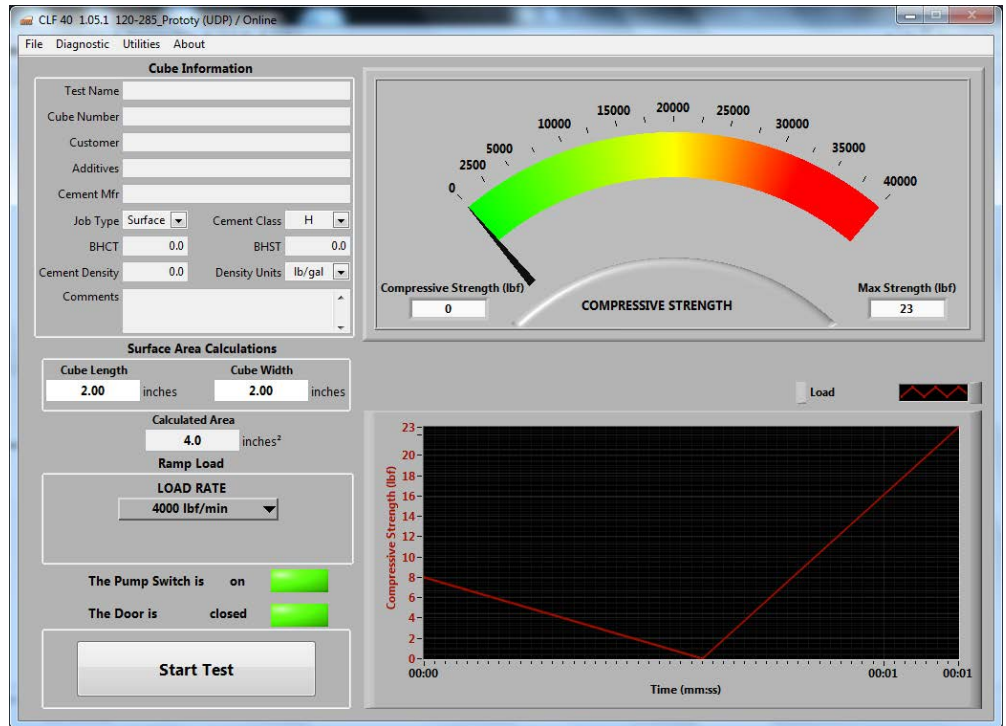
Use the “Cube Number” field when you plan to test multiple cubes from the same cement slurry. The default value is 1. After a test is complete, the “Cube Number” will automatically increase by one. You can leave the rest of the information the same and continue testing cubes. When all cubes have been tested, you will have a series of test results for a single cement slurry.

The rest of the fields on the “Load Sample Info” screen are used for display only. They will show on the test results, but do not affect the test itself.

4. Click OK to save your changes.
5. Enter the sample dimensions.

If you selected “Cylinder” in the “Sample Type” field on the “Setup” screen, enter the sample diameter. If you chose “Cube”, enter the cube length and width. These values are used to convert the force applied to the sample (lbf) to compressive strength (psi).

6. Enter a loading rate.
 - “Constant” - up to 40,000 lbf
 - “Ramp” - 4000 lbf/min, 16000 lbf/min, or Variable
 - “Variable” - Type the loading rate into the field provided
 - “Profile” - Choose a Test Profile from the provided list



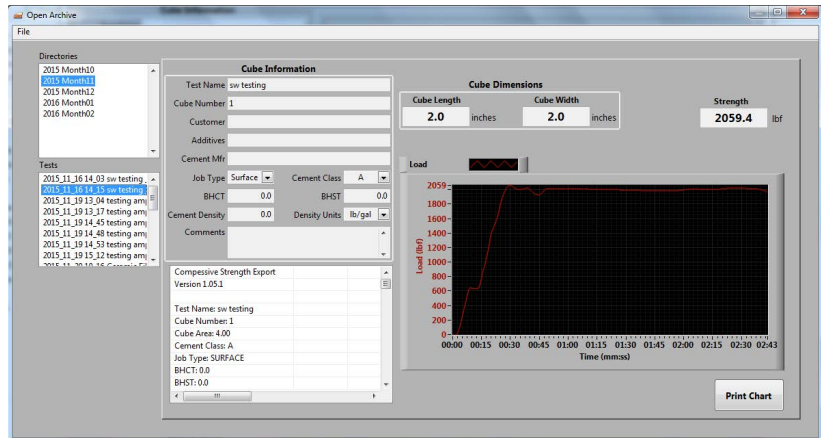
7. Once you have entered all the information, load the cement sample into the unit as described on page 6.
8. At this point, there are two ways to start the test:
 - a. Click and hold the “Start Test” button in the software.
 - b. On the machine, press and hold the “4,000/16,000” button.

The unit will continue to apply force to the sample as long as you hold the button down. When you release the button, the test will stop, the test data will be saved to the computer, and the “Cube Number” value will increase by one.
9. After each test, clean the debris from the lower platen. Brush the debris into the receptacle on the front of the cabinet. Also, remove the lower platen and brush away any remaining debris underneath it. The front receptacle can be removed for easy cement debris disposal.
10. To test another cube from the same slurry sample, simply reload the machine with the next cube and repeat step 8 for as many cubes as necessary.

Additional Software Functions

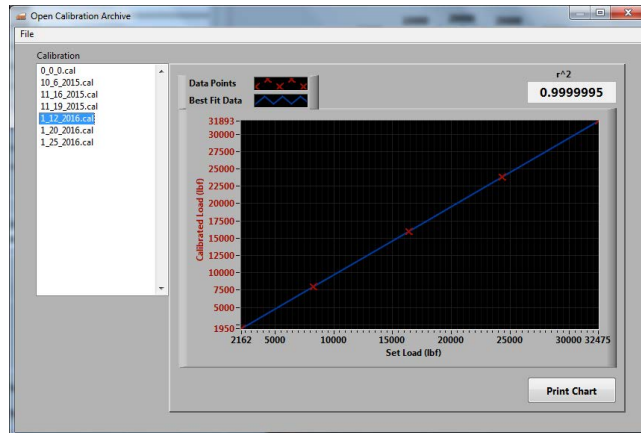
To retrieve data from a previous test:

1. Select “Open Data Archive” from the “File” menu.
2. In the “Directories” box, choose the date of the test you want to retrieve.
3. In the “Tests” box, choose the tests you want to retrieve.
4. To print a chart of the test, click the “Print Chart” button.



To retrieve data from a previous calibration:

1. Select “Open Calibration Archive” from the “File” menu.
2. In the “Calibration” box, choose the calibration you want to retrieve.
3. To print a chart of the calibration, click the “Print Chart” button.



Calibration

The CLF-40 should be calibrated annually or when any part of the loading system is changed.

Calibration requires a specially designed load cell. Refer to the documentation provided with your specific load cell for operating instructions.

To calibrate the unit:

1. Turn the Power on.
2. From the onboard menu, select option 5 “Calibrate”.
3. Enter the current date.
4. Enter the calibration range. The maximum load is 40,000 lbf.
5. Enter the number of points you will be using in your calibration. Five points are recommended.
6. Place the load cell between the two platens. Make sure the upper platen is not touching the cell.
7. Zero the reading on the load cell.
8. Once the load cell is zeroed, turn the platen height adjustment to the left until the upper platen touches the load cell.
9. Firmly close the safety shield.
10. Turn the Pump Power on.
11. Press the wheel to start the calibration.
12. Wait for the reading on the load cell to stabilize. Then enter the load cell reading into the CLF-40 and press the wheel to accept. Repeat this step for each point in the calibration.



The first calibration point will be an offset value. After you enter the offset, the screen will lead you through the number of calibration points specified in step 5 above.

13. When the calibration is complete, you can review the calibration data. If the unit did not pass the calibration, an error will be displayed. Contact OFITE Technical Support to arrange repairs.
14. If there are no errors, push the wheel in to accept the calibration.

Calibration

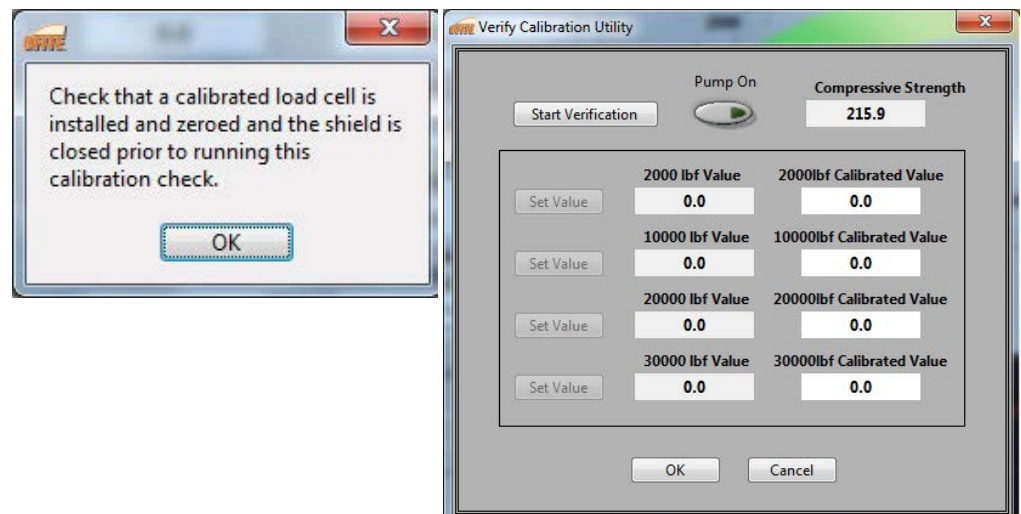
Verification

The CLF-40 software is equipped with a calibration documentation feature which allows the user to verify the calibration and document the readings as needed.

1. Install an external load cell sensor to the CLF-40.
 - a. Place a low profile load cell between the proppant test cell adapter and the lower removable platen with a load sample (any flat piece of metal large enough to cover the lower platen) underneath it.
 - b. Tighten the adjustable platen to secure the load cell and sample.



2. Close the shield.
3. In the software, click Utilities → Check Calibration to access the “Verify Calibration Utility” window.
4. A prompt will appear to ensure that the calibrated load cell is installed and zeroed and the shield is closed. Click “OK”.
5. In the “Verify Calibration Utility” window, click “Start Verification” and the “Pump On” button.

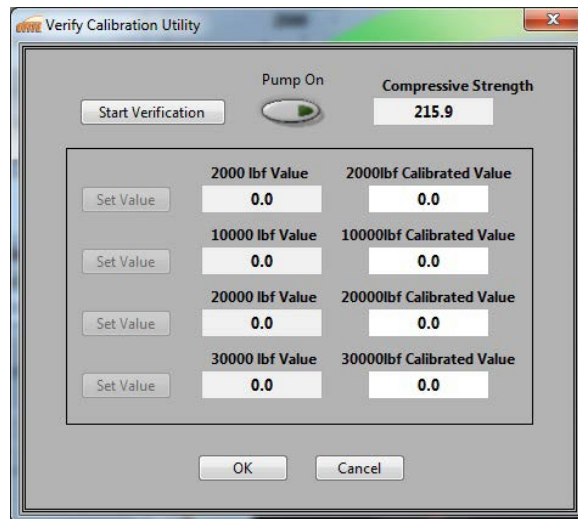


There will be a series of four tests at increasing values. The left column displays the amount of pressure that the CLF-40 pressure sensor is reading. The column on the right is blank until the reading from the external load cell is entered manually.

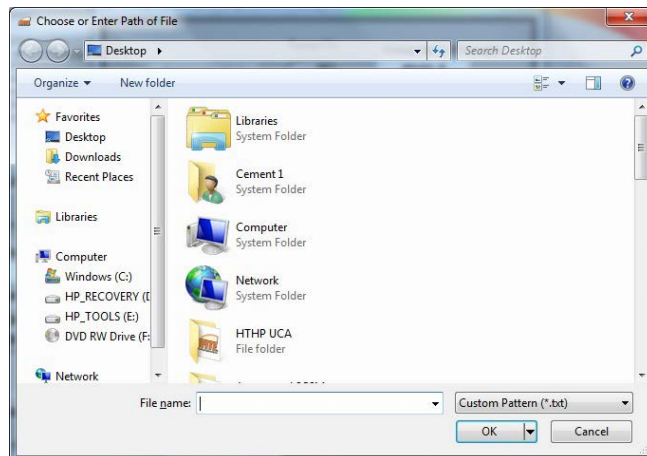
- 6. As the pressure reaches the target pressure for each test, press the “Set Value” button.



There is an allowable variance of $\pm 2\%$ for each test.



- 7. If all readings are within the allowable variances, Click “OK”.
- 8. Name the test and save it at a desired location.



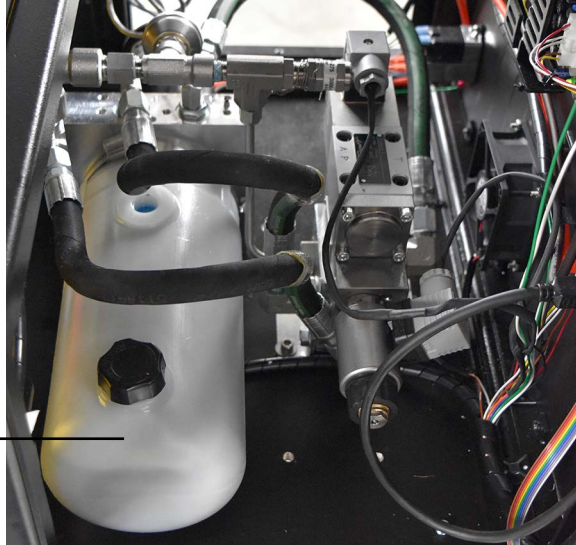
- 9. If the readings are not within the allowable variances, then it is a bad test. Run the verification again. If the tests continue to result in inaccurate verifications, contact OFITE Technical Support.

Maintenance

Hydraulic Oil

The CLF-40 requires a minimum level of clean hydraulic oil to operate. To prevent damage to the pump and other components, periodically check the oil reservoir. If the oil level is low, it will be necessary to add new oil to the reservoir. If the oil is dirty, the reservoir will have to be drained of old oil and refilled with new oil.

1. Remove the right-hand side panel.
2. Locate the oil reservoir and remove the black cap.



3. Fill the reservoir about $\frac{3}{4}$ with oil (#171-96-1).
4. Place the cap back on the reservoir and tighten it completely.
5. Close the side panel door.

Maintenance

Fuses

The CLF-40 has two 4-amp fuses (#122-074) at the main AC Power Inlet. If the unit will not power on, check these fuses and replace them if necessary.

1. Unplug the electrical power cord.
2. Remove the fuse holder from the AC Power Inlet at the back of the unit.
3. Inspect both fuses. If either fuse is blown, replace it with a new one.
4. Re-insert the fuse holder into the AC Power Inlet.
5. Plug in the electrical power cord.



Appendix

Error Codes

When the Universal Control Board in the CLF-40 detects a hardware error, it will display the error code on the display screen. Below is a list of error codes that could be displayed. If you encounter any of these errors, contact OFITE technical services for assistance.

- 0x4000 - Bad Test Switch: Verify the wiring of the 4,000/16,000 switch. Use an ohm meter to verify the switch is functional.
- 0x4001 - Force Too High While Testing: The measured force during a test exceeds the machine's maximum force rating by more than 10%. This can be caused by a defective pressure transducer, a bad calibration, or a problem with the proportioning valve. Try calibrating the machine first.
- 0x4002 - Force Too High While Not Testing: The measured force is more than the allowed limit (75 lbf by default) when the unit is not performing a test. This is usually caused by a bad calibration. Turn the machine off and then back on and then recalibrate.

Appendix

Calculations

The CLF-40 exerts a measured force to a cement. The software can be configured to use pounds of force (lbf), mega pascals (MPa), or pounds per square inch (psi).

To convert a measurement of force (lbf) to pressure (psi or MPa), you must divide the force by the surface area of the sample.

For cylindrical samples:

$$A = \frac{3.14 \times D^2}{4}$$

Where:

A = Surface Area (in²)

D = Sample Diameter (in)

For cube samples:

$$A = L \times W$$

Where:

L = Sample Length (in)

W = Sample Width (in)

To convert lbf to psi:

$$\text{psi} = \frac{F}{A}$$

To convert lbf to MPa:

$$\text{MPa} = \frac{.00689 \times F}{A}$$

To convert psi to lbf:

$$\text{lbf} = \text{psi} \times A$$

To convert MPa to lbf:

$$\text{lbf} = \text{MPa} \times A \times 145$$

Warranty and Return Policy

Warranty:

OFI Testing Equipment, Inc. (OFITE) warrants that the products shall be free from liens and defects in title, and shall conform in all respects to the terms of the sales order and the specifications applicable to the products. All products shall be furnished subject to OFITE's standard manufacturing variations and practices. Unless the warranty period is otherwise extended in writing, the following warranty shall apply: if, at any time prior to twelve (12) months from the date of invoice, the products, or any part thereof, do not conform to these warranties or to the specifications applicable thereto, and OFITE is so notified in writing upon discovery, OFITE shall promptly repair or replace the defective products. Notwithstanding the foregoing, OFITE's warranty obligations shall not extend to any use by the buyer of the products in conditions more severe than OFITE's recommendations, nor to any defects which were visually observable by the buyer but which are not promptly brought to OFITE's attention.

In the event that the buyer has purchased installation and commissioning services on applicable products, the above warranty shall extend for an additional period of twelve (12) months from the date of the original warranty expiration for such products.

In the event that OFITE is requested to provide customized research and development for the buyer, OFITE shall use its best efforts but makes no guarantees to the buyer that any products will be provided.

OFITE makes no other warranties or guarantees to the buyer, either express or implied, and the warranties provided in this clause shall be exclusive of any other warranties including ANY IMPLIED OR STATUTORY WARRANTIES OF FITNESS FOR PURPOSE, MERCHANTABILITY, AND OTHER STATUTORY REMEDIES WHICH ARE WAIVED.

This limited warranty does not cover any losses or damages that occur as a result of:

- Improper installation or maintenance of the products
- Misuse
- Neglect
- Adjustment by non-authorized sources
- Improper environment
- Excessive or inadequate heating or air conditioning or electrical power failures, surges, or other irregularities
- Equipment, products, or material not manufactured by OFITE
- Firmware or hardware that have been modified or altered by a third party
- Consumable parts (bearings, accessories, etc.)

Returns and Repairs:

Items being returned must be carefully packaged to prevent damage in shipment and insured against possible damage or loss. OFITE will not be responsible for equipment damaged due to insufficient packaging.

Any non-defective items returned to OFITE within ninety (90) days of invoice are subject to a 15% restocking fee. Items returned must be received by OFITE in original condition for it to be accepted. Reagents and special order items will not be accepted for return or refund.

OFITE employs experienced personnel to service and repair equipment manufactured by us, as well as other companies. To help expedite the repair process, please include a repair form with all equipment sent to OFITE for repair. Be sure to include your name, company name, phone number, email address, detailed description of work to be done, purchase order number, and a shipping address for returning the equipment. All repairs performed as "repair as needed" are subject to the ninety (90) day limited warranty. All "Certified Repairs" are subject to the twelve (12) month limited warranty.

Returns and potential warranty repairs require a Return Material Authorization (RMA) number. An RMA form is available from your sales or service representative.

Please ship all equipment (with the RMA number for returns or warranty repairs) to the following address:

OFI Testing Equipment, Inc.
Attn: Repair Department
11302 Steeplecrest Dr.
Houston, TX 77065
USA

OFITE also offers competitive service contracts for repairing and/or maintaining your lab equipment, including equipment from other manufacturers. For more information about our technical support and repair services, please contact techservice@ofite.com.