

OPERATING/MAINTENANCE INSTRUCTIONS

OFI BENCHTOP HPHT CURING CHAMBER

GENERAL

The Model 200 HPHT Curing Chamber is utilized to prepare well cement specimens for compressive strength tests. It is necessary to determine the amount of time required for a cement to develop compressive strength so that drilling\production operations can be resumed as quickly as possible. The goal is to design a slurry which can quickly develop compressive strength so that the "waiting on cement time" may be minimized. OFI's HPHT Curing Chambers were designed to provide a means of curing cement specimens under typical downhole temperatures and pressures.

METHOD OF OPERATION

Cement is poured into a special mold which produces specimens that measure 2" X 2" X 2". The mold is placed into the test cell and the pressure of the test cell is increased via an air driven hydraulic pump. Test temperature is governed by a PID temperature controller which actuates the heater. After a predetermined amount of time the temperature of the test cell is reduced by the cooling system. Specimens are removed and the compressive strength is determined as outlined in API Specification 10.

INSTALLATION

1. Carefully remove the instrument from the wooden crate.
2. Please note that leveling legs are provided to level the instrument. These legs can be screwed in and out to level the cabinet.
3. An air/nitrogen (100-120 psi) supply should be connected to the air supply on the back of the instrument.

PLEASE NOTE THAT OFI UTILIZES 1/4 INCH NPT FEMALE CONNECTORS FOR ALL SUPPLY LINES.

4. The drain and water supply lines should be connected in similar manner.
5. Ensure that all electrical switches are in the "OFF" position and make the necessary electrical connections in accordance to local codes. Ensure that the unit is grounded.

PERFORMING A TEST

1. Before starting a test turn all electrical switches to the "OFF" position and close all valves.
2. Turn the "MAIN SWITCH" to the "ON" position.
3. Prepare the cement molds as outlined below. Note that these procedures are stated within API Specification 10.

PREPARATION OF MOLDS

The interior faces of the molds and the contact surfaces of the plates shall be thinly covered with grease. The contact surfaces of the halves of each mold shall also be coated with grease to make the joint water tight when assembled. Excess grease shall be removed from the interior faces of the assembled molds, giving particular attention to the corners. The molds shall be placed on a thinly greased plate. It is necessary that grease be applied to the exterior contact line of the mold and the base plate.

PREPARATION OF SLURRY

The cement slurry shall be prepared in accordance with Sect. 5 of API Specification 10.

FILLING SLURRY MOLDS

The slurry shall be placed in the prepared molds in a layer equal to one-half of the mold depth and puddled 25 times per specimen with a puddling rod. The slurry shall be placed in all the specimen compartments before commencing the puddling operation. After puddling the layer, the remaining slurry shall be stirred by hand using a puddling rod or spatula to eliminate segregation, the molds filled to overflowing, and puddled as for the first layer. After puddling, the excess slurry shall be struck off even with the top of the mold, using a straight-edge. Specimens in molds which show evidence of leaking shall be discarded. A greased cover plate shall be placed on top of the mold. For one test determination, not less than three specimens shall be employed.

LOADING THE TEST CELL

- A. Carefully lower the cement molds into the test cell insuring that the thermocouple port is aligned correctly.
- B. Remove the handle and the wing nuts from the mold. The sealing ring and threads should be lubricated periodically with a high temperature grease.
- C. The test cell cap should be screwed into the test cell as far as possible.

- D. The allen cap screws should be tightened with the torque wrench to 20 foot-lbs in a rotational sequence. The torque wrench will click when the specified torque is achieved. This sequence should be repeated two or three times until the twelve screws are completely tight. It is imperative that the cap be tightened in a consistent and uniform manner to obtain a good seal. Loosen the top fitting on the cap approximately 1/8 turn.
- E. Insert the sample thermocouple through the side of the test cell and tighten the threaded gland finger tight and then loosen 1/8 turn.

TEMPERATURE CONTROLLER

The temperature controller utilizes a high alarm setpoint which will bring the unit to an alarm condition if the temperature ever exceeds this value. An alarm condition is evidenced by the illumination of the "AL1" annunciator in the upper left hand corner of the display.

If the slurry thermocouple is unplugged an alarm condition will occur.

To adjust the high alarm setpoint perform the following.

1. The front cover located on the lower portion of the controller hinges downward.
2. Depress the scroll key (the right key behind the hinged panel) until a parameter appears. Continue to press the key until the parameter "AL1" appears.
3. Press the "UP" or "DOWN" arrow keys until the desired high alarm setpoint is obtained.
4. Wait approximately 10 seconds and the controller will automatically return to the normal display mode.

TIMER

The Model 200 incorporates a timer for convenience. The timer may be activated by turning the "TIMER" switch to the "ON" position. It may be reset to zero at the beginning of a test by depressing the "R" button on the timer's face. The timer has been set in units of hours and minutes but may be programmed to operate in a variety of units. The timer incorporates a relay which can be used to automatically control the water cooling solenoid.

As an example suppose you wish to ramp the temperature up to 350 F in 1 hour and maintain it for four hours. Setpoint 1 "P1" could be set at 5 hours and set point 2 "P2" could be set for 7 hours. The timer could be reset by depressing the "R" button and the "AUTO COOL" switch placed in the "ON" position. After 5 hours the water solenoid would energize and begin cooling the unit. The unit would cool for 2 hours and then the solenoid de-activate.

Note that the timer would also eliminate power from the heaters and the hydraulic pump during the cooling cycle.

- F. Fill the test cylinder with water by positioning the water supply valve to the "FILL CELL" position. Water will flow into the test cell and air will be expelled from the loosened thermocouple connection. When water begins to flow from the thermocouple connection, tighten the thermocouple gland with a wrench. When water begins to flow from the fitting on the test cell cap tighten the fitting.
- G. Apply pressure to the test cylinder by turning the "PUMP" switch to the "ON" position. The pressure may then be increased by turning the air regulator clockwise until the desired pressure is obtained. This pressure is indicated on the pressure gauge. Pressure may be reduced by turning the regulator counter-clockwise and by slightly opening the "PRESSURE RELIEF" valve.

APPLY HEAT TO THE TEST CELL

The Eurotherm Model 818 is the most important component of the temperature control system and it is strongly recommended that operators carefully study the Model 818 instruction manual.

- A. Program the temperature profile you wish to perform into the Model 818 Controller.
- B. Turn the "HEAT" switch to "ON" to activate the heaters.

NOTE THAT THE PRESSURE WILL INCREASE SIGNIFICANTLY DUE TO THE THERMAL EXPANSION OF THE WATER AND THE TEST CELL SHOULD BE MONITORED CLOSELY UNTIL THE CURING TEMPERATURE IS ACHIEVED. SOME OPERATORS SLIGHTLY OPEN THE "PRESSURE RELIEF" VALVE TO HELP CONTROL THE PRESSURE DURING HEAT UP.

- C. The temperature controller will maintain the temperature schedule which was programmed and upon termination of a test it is imperative that the "HEATER SWITCH" is returned to the "OFF" position.

TERMINATION OF TEST

1. After the cement has cured for the required amount of time the "HEAT" switch should be turned "OFF".
2. Immediately start the cool down procedure by turning the "COOLANT" switch to the "ON" position. DO NOT release the test pressure until the temperature has been reduced to a minimum of 200 degrees F.

3. After cooling to less than 200 degrees, release the pressure by switching the "PUMP" switch to the "OFF" position and by turning the air regulator completely counter-clockwise. Slowly open the "PRESSURE RELEASE" valve. The pressure gauge should return to zero.
4. To remove water from the test cell, slowly open the "AIR TO CYLINDER" valve. Air pressure will force water from the test cell, and when air is escaping out of the vent the "AIR TO CYLINDER" valve should be closed.
5. Slowly loosen the gland on the thermocouple and remove it from the test cell.
6. The cap screws should be loosened and the test cell cap should be unscrewed. Remove the cement specimens and cool as stated within API Specification 10.
7. Return the test cell cap to the test cell to prevent dust and other matter from entering the test cell. Close all valves and return all switches to the "OFF" position.

GENERAL MAINTENANCE

1. One of the most important elements concerning trouble free operation is keeping the interior of the test cell as clean as possible. Never insert a cement covered cement mold into the test cell and periodically examine the test cell to ensure that it is clean. High pressure valves wear quickly when exposed to fluids containing cement and other particulate matter.
2. OFI uses a high pressure filter to protect valve stems. We recommend that filtered water be used in the curing chamber to prevent particulate matter from entering the pump and possibly causing damage. Clean or replace these filters when fluid flow is reduced from that of a clean system. Remember: Filters are inexpensive when compared to the costs of replacing the components they were designed to protect.
3. The test cell cap threads have been lubricated prior to shipment and periodically should be re-lubricated.

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