



**US Environmental Protection Agency  
Office of Pesticide Programs**

**Office of Pesticide Programs  
Microbiology Laboratory  
Environmental Science Center, Ft. Meade, MD**

**Standard Operating Procedure for  
Use and Maintenance of Orbital Shakers**

**SOP Number: EQ-10-02**

**Date Revised: 09-12-14**

SOP Number	EQ-10-02
Title	Use and Maintenance of Orbital Shakers
Scope	This SOP describes the use and maintenance of orbital shakers (Forma model 420).
Application	Shakers are used to grow microbial cultures under agitated conditions.

	Approval	Date
SOP Developer:	_____	_____
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<b>1. Definitions</b>	<ol style="list-style-type: none"> <li>1. Additional abbreviations/definitions are provided in the text.</li> <li>2. Manual = Operating and Maintenance Manual 7000420 Rev. 7</li> <li>3. RPM = Rotations per minute</li> <li>4. LCD = Liquid crystal display</li> <li>5. ISO = International Organization for Standardization</li> </ol>
<b>2. Health and Safety</b>	<p>Follow procedures specified in SOP MB-01, Laboratory Biosafety. The Study Director and/or lead analyst should consult the Material Safety Data Sheet for specific hazards associated with products.</p>
<b>3. Personnel Qualifications and Training</b>	<p>Refer to SOP ADM-04, OPP Microbiology Laboratory Training.</p>
<b>4. Instrument Calibration</b>	<ol style="list-style-type: none"> <li>1. Temperature calibration.       <ol style="list-style-type: none"> <li>a. Access the Configuration menu by first pressing the down arrow, then the up arrow, and then the Silence button.</li> <li>b. Press the Temperature button beneath Temp. Use the up and down arrows to increase or decrease the temperature value to match an independent, accurate temperature measuring device. When selected, press the Time, Speed, or Temp button to save the setting.</li> </ol> </li> </ol>
<b>5. Sample Handling and Storage</b>	<p>Refer to SOP MB-22, Disinfectant Sample Preparation, and SOP COC-01, Chain of Custody Procedures.</p>
<b>6. Quality Control</b>	<ol style="list-style-type: none"> <li>1. Record the temperature of each unit on each working day on the appropriate Temperature Record form (see section 14) when the instrument is in use.</li> <li>2. The thermometers are point checked annually against an ISO accredited verification thermometer.</li> </ol>
<b>7. Interferences</b>	<ol style="list-style-type: none"> <li>1. If the shaker is to be operated at a temperature 5-10°C above ambient, the circular vent at the rear of the cabinet must be 1 inch from the wall and the rear vent must be fully opened by turning the Phillips screw clockwise. If the operating temperatures are more than 10°C above ambient, the rear vent must remain closed (fully counterclockwise).</li> <li>2. Before inserting tubes or flasks, make sure the screws that attach the racks to the platform are tight</li> <li>3. The lid must be closed to operate the shaker.</li> <li>4. The shaker should not be operated without a load.</li> </ol>

<p><b>8. Non-conforming Data</b></p>	<ol style="list-style-type: none"> <li>1. Management of non-conforming data will be consistent with SOP ADM-07, Non-Conformance Reports.</li> <li>2. Any deviation from the standard operating procedures will be documented in the record book and investigated. Problems maintaining the target temperature will be determined and the appropriate corrective action will be taken by the laboratory staff. If the problem cannot be determined or corrected, a service technician will be called in to evaluate the situation and to initiate the service on the equipment.</li> <li>3. For maintenance, service, and troubleshooting refer to sections 3 and 4 of the manual.</li> </ol>
<p><b>9. Data Management</b></p>	<ol style="list-style-type: none"> <li>1. Data will be archived consistent with SOP ADM-03, Records and Archives.</li> <li>2. The temperature of each shaker is to be recorded promptly, legibly and in indelible ink on the appropriate temperature record form (see section 14).</li> </ol>
<p><b>10. Cautions</b></p>	<ol style="list-style-type: none"> <li>1. Do not leave the shaker unattended when starting the unit. Be sure all flasks and test tube racks are firmly seated in the clips and check the security of the flask clip and the platform attachment screws monthly.</li> <li>2. Shaker #1 is attached to a Knee-well Slide Assembly – make sure the lever catches the latch tab after pushing the slide assembly back in prior to turning on the shaker.</li> <li>3. The Model 420 Orbital Shaker control system monitors and provides alarms for nine operating parameters (refer to pages 2-5 and 2-6 of the manual).</li> <li>4. For spills inside of the shaker, refer to section 4 of the manual for dismantling the shaker and refer to SOP MB-13, Handling Spills, for the spill control procedures for biohazardous organisms in biosafety levels 1, 2, and 3.</li> </ol>
<p><b>11. Special Apparatus and Materials</b></p>	<ol style="list-style-type: none"> <li>1. Forma Orbital Shakers (model 420), serial numbers 131375-1815 (Shaker #1) and 131376-1816 (Shaker #2).</li> </ol>
<p><b>12. Procedure and Analysis</b></p>	
<p>12.1 General Shaker Operation</p>	<ol style="list-style-type: none"> <li>a. Turn on the unit using the main power switch (located on the right side of the unit next to the power cord) and press Start to operate the shaker. Be sure Knee-well Slide Assembly is locked prior to turning on shaker #1.</li> <li>b. When starting, the numbers along the top row of the LCD will differ</li> </ol>

	<p>from the Setpoint values shown along the bottom row of the LCD. These numbers will change as the unit begins to operate.</p> <p>c. Record the temperature of each unit when in use (refer to section 1 and 2 of the manual).</p>
12.2 Time Settings	<p>a. Hold. With the time set at Hold, the time display in the upper left portion of the screen begins to count upward, showing the total operating hours and minutes.</p> <p>b. Countdown. When the Hold setpoint is changed to countdown, the shaker will operate for the specified period and automatically shut down. The display will show the total time in the setpoint segment and the operating time remaining in the Actual part of the display as the microprocessor counts down to zero.</p> <p>c. Changing from Hold to Countdown.</p> <p>i. Press the button beneath the Time setpoint. <i>Hold</i> will begin to flash.</p> <p>ii. Press either arrow to access the Countdown Time setpoint. The preset time setpoint will begin to flash.</p> <p>iii. Press the up and down arrows to set the desired operating time in five minute increments.</p> <p>iv. When the desired elapsed time is set, press the Time button to return to the Operating Screen. Pressing the Start button will start the shaker and begin the countdown sequence. When 00:00 is reached, the shaker will automatically shut off and the Cycle Complete alarm will sound.</p>
12.3 Speed Settings	<p>a. The Actual speed will display zero RPM and will gradually rise as the platform begins its motion.</p> <p>b. Changing the speed.</p> <p>i. Press the button beneath the Speed setpoint. The RPM value will begin to flash.</p> <p>ii. Press the up or down arrows to set the new speed in 1 RPM increments.</p> <p>iii. Press the Speed button again to return to the Operating Screen.</p>
12.4 Temperature Settings	<p>a. The temperature, shown in the upper right portion of the LCD, will indicate the actual ambient temperature inside the cabinet and will slowly move toward the setpoint.</p>

	<ol style="list-style-type: none"> <li>b. Changing the temperature setpoint.           <ol style="list-style-type: none"> <li>i. Press the button beneath the temperature setpoint (Temp °C). The temperature value will begin to flash.</li> <li>ii. Press the up or down arrows to set the new temperature in 0.1°C increments.</li> <li>iii. Press the temperature button again to return to the Operating Screen.</li> </ol> </li> </ol>
<b>13. Data Analysis/ Calculations</b>	1. None
<b>14. Forms and Data Sheets</b>	Test Sheets. Test sheets are stored separately from the SOP under the following file names: <div style="display: flex; justify-content: space-around; margin-top: 10px;"> <span>Orbital Shaker Temperature Log</span> <span>EQ-10-02_F1.docx</span> </div>
<b>15. References</b>	1. Forma Orbital Shaker Operating and Maintenance Manual 7000420 Rev. 7.