

Mixing is an operation in the clinical laboratory that functions to create a uniform heterogeneous system or to promote the union of antigen and antibody. Proper mixing helps maintain the suspension of reagents that otherwise readily separate. Inadequate mixing can result in invalid test data or interpretation. Excessive mixing may cause denaturation of protein, hemolysis of red blood cells or foaming. There are many types of mixers in the laboratory including tube shakers or rockers, orbital mixers such as card and tube rotators, and vortexers.

### *Principles of Operation*

Serological rotators (orbital motion) and shakers (linear motion) are oscillating platforms designed for a variety of reactions requiring reproducible agitation. Latex agglutination and diagnostic testing require smooth, consistent mixing action. The speed and/or stroke length of the moving platform are adjustable on most models. Test tube mixers are available that handle a number of tubes and different sizes. Various mixing motions function to maintain a uniform mixture of plasma and cells.

### *Overview*

All instruments are to be included in a routine maintenance program. Instrument maintenance records must be retained for the life of the instrument.

Laboratory equipment should be kept clean and in good working order. Personnel should be instructed on proper use and care of equipment. Records should be maintained on all equipment to monitor accuracy of performance and to

determine repair or adjustment needs. Choose a flat and level surface to locate the instrument to assure a specified performance and long life of the drive mechanism.

### *Quality Assurance: Operational evaluation*

#### *DAILY*

*Check rotation speed.* Correct rotation speed is very important for maintaining test standards. For most serological procedures the rotator must be checked each day of testing. For rotators without a digital readout, the speed can be estimated by counting the number of rotations made per minute. This can be done easily with a stopwatch and pen. Hold the pen stationary, close to the rotating platform, and allow the rotator to strike the pen. Count the number of taps per minute (or count rotations in 15 seconds and multiply by 4). If the rotator is not operating within the recommended rotation range, it should not be used. Follow the manufacturer's instructions for adjustments if necessary. Record results on a worksheet.

Example: The recommended speed of rotation for the Macro-Vue® RPR Card Test Rotator is 98-102 rpm. If the rotations are less than 98 or greater than 102 rpm then the speed must be adjusted.

*Check sponge in humidifier covers.* Some tests routinely require the use of a humidifying cover during rotation to prevent evaporation of the test material. There are rotators equipped with a high-absorbent insert such as a sponge or foam pad in the cover. Prior to operation, water may be added to the foam to create a self-contained humidity chamber.

**CAUTION:** Never use a sponge/pad in the rotator cover that is cracking apart from dry rot. Particles may fall onto the slide and could be mistaken for flocculation during test interpretation

#### QUARTERLY

*Check timer.* The rotator's timer should be checked for accuracy at least quarterly. Compare the timer against another timer or stopwatch. The rotator's timer should be within  $\pm 15$  seconds of the set time. Record results on a worksheet. Adjust the timer if it is not within the acceptable range. *Do not* turn the timer counterclockwise from the OFF position, as it will strip the knob on the timer shaft.

#### Instrument and equipment maintenance

##### DAILY

1. *Perform general inspection of the instrument.*  
Includes checking the power supply cord and plug. Discontinue use if broken or frayed.
2. *Clean instrument exterior.*
  - a. Refer to the manufacturer's instructions for cleaning and disinfecting solutions. Note that many companies recommend their own brand of solution.
  - b. Use of sodium hypochlorite cleaning solutions (10% diluted household bleach) on metal parts is discouraged because it may cause pitting and rusting. *Do not* use strong alkali or other caustic agents.
  - c. Rinse equipment with tap water to prevent disinfectant residue from attracting dirt. Note: Alcohol does not require rinsing.
  - d. Use paper towels soaked in the recommended disinfectant solution (e.g. 70% alcohol or diluted phenolic disinfectant).

##### WEEKLY

*Clean sponge/foam pads with a disinfectant solution.*

#### ANNUALLY/OR AS NEEDED

1. *Tighten set screw on shaker frame.*  
Constant shaking loosens screws and bolts over the entire apparatus and especially on the shaker frame and motor. These screws and bolts should be tightened periodically.
2. *Oil motor.* The motor should be lubricated at regular intervals, if required by the manufacturer.
3. *Check brushes for wear.* The motor should be checked for worn brushes at regular intervals as indicated in the manufacturer's manual.
4. *Check moving parts for wear.* Replace when worn.

**PRECAUTION: NEVER PLACE HANDS ON OR AROUND PLATFORM WHILE MIXER IS IN OPERATION.**

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#### References:

- Kroll, MH, et al. Laboratory Instrument Evaluation, Verification and Maintenance Manual. 5<sup>th</sup> ed., College of American Pathologists. p. 105. Northfield, Illinois. 1999.
- North Carolina State Laboratory of Public Health. Syphilis Serology Workshop Manual, 1996.
- Baron, EJ., *General Guidelines to Instrument Maintenance and Quality Control*, pp 12.1.1-12.1.2. In Isenberg, HD., *Clinical Microbiology Procedures Handbook*. Vol. 2. American Society for Microbiology, Washington, DC. 1992.
- Larsen, SA, et al. *A Manual of Tests for Syphilis*. 9<sup>th</sup> ed., pp 95-96, 165. American Public Health Association. Washington, DC.

Clinical Rotator Model 341, package insert. Fisher Scientific, Part #46014, Rev. B, second issue 4-1115-04/1417. 4/2000.