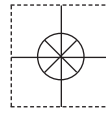


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## **RVB-1** **Rotational Viscometer**



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**WARNING:** These products are not designed for use in, and should not be used for, human applications.

RVB-1

# Rotational Viscometer

## Operation Manual



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## I. Summary

The RVB-1 is used to determine viscosities of greases, paints, plastics, foods, pharmaceuticals, adhesives, and various fluids.

## II. Technical specifications and parameters

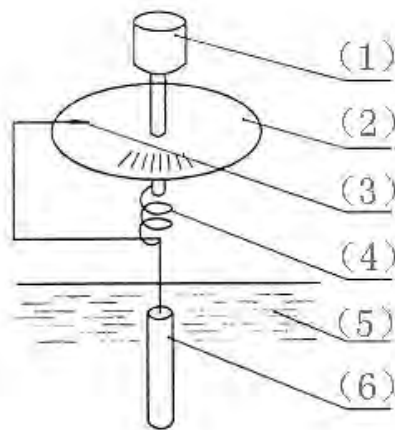
1. Measurement range: 10 cps~100000 cps
2. Measurement error:  $\pm 5\%$  (F·S)
3. Spindles: No.1, 2, 3 and 4 spindles
4. Rotation speed: 6 RPM, 12 RPM, 30 RPM, and 60 RPM
5. Power supply: AC 120V $\pm 10\%$ , 50Hz $\pm 10\%$
6. Size: 300 × 300 × 450 mm (11.81 x 11.81 x 17.71 in)
7. Net weight: 1.5 kg (3.3 lb)(not including the holder)

## III. Instrument structure and installation

### (I) Instrument structure

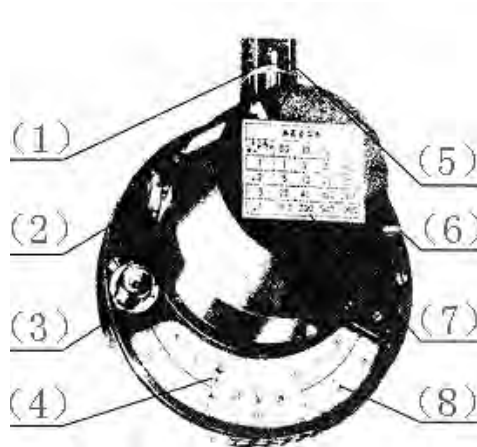
#### 1. Principle of the structure

The structure of the instrument is shown as Figure 1.



- (1) Motor    (2) Dial    (3) Indication needle    (4) Hair spring  
(5) Liquid to be determined    (6) Spindle

Figure 1



- (1) Rubber band    (2) Speed knob    (3) Water level meter  
 (4) Indication needle    (5) Needle control rod    (6) Power switch  
 (7) Coefficient table    (8) Dial

Figure 2

(1) The motor rotates at a stable speed, connecting the dial and rotating the spindle through the hair spring and the rotation shaft. If the spindle is not affected by the liquid resistance, the hair spring, the indication needle and the dial will rotate at the same speed. The reading on the dial is 0. If the spindle is affected by liquid resistance, the hair spring will produce a torque moment to balance with the viscosity resistance producing a reading on the dial (The torque angle of hair spring).

Multiply the reading by a specific coefficient to get the viscosity of liquid (cps).

(2) The RVB-1 uses a gear system and clutch to change rotation speed using the speed knob. The instrument has four grades of speed enabling the user to select a suitable speed per test requirements.

(3) Four different spindles are supplied from No. 1 to 4. The choice of spindle is based on the estimated viscosity of the liquid to be determined.

(4) In order to accurately read the dial, the RVB-1 is equipped with a fixing device for indicator needle (Needle control rod). When the rotation speed is high (30 or 60 RPM), and it is difficult to read the dial, press down the needle control rod to hold the needle for ease of reading.

(5) The protection shield is designed for measurement stability and spindle protection. When the protection shield is used during measurement, a more stable

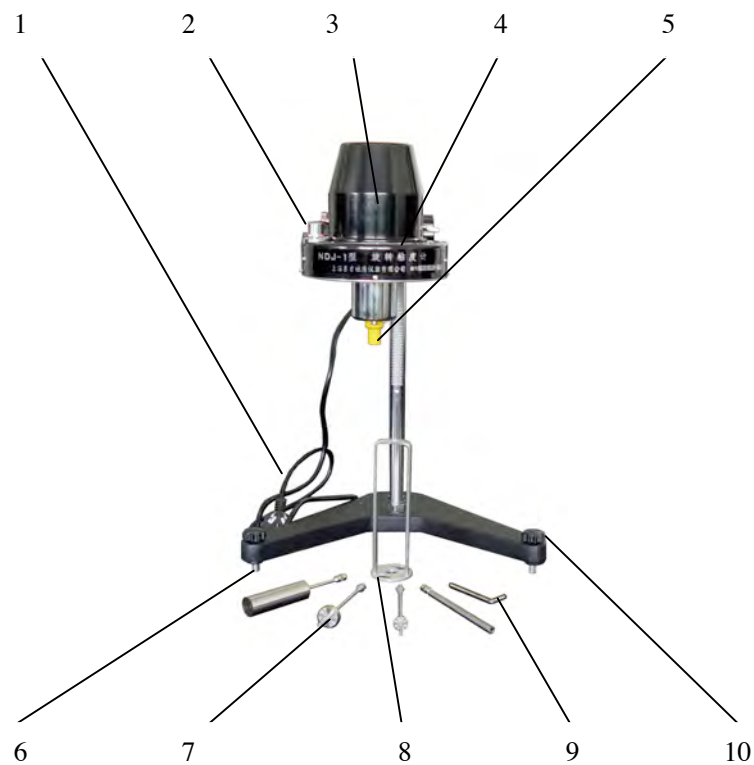
measurement results.

(6) The RVB-1 is equipped with a holder that can be adjusted up or down. The instrument should be fixed during measurement.

## 2. The complete structure

(1) The structure of the instrument head is shown as Figure 2.

(2) The complete structure of the instrument is shown as Figure 3.



- (1) Power supply wire    (2) Water level meter    (3) Instrument head    (4) Dial  
(5) Protection cap (Please remove it before operation)    (6) Pedestal    (7) Spindle  
(8) Spindle protection shield    (9) Inside-hexagonal spanner  
(10) Water Level adjustment bolt

Figure 3

(3) Available Spindles:

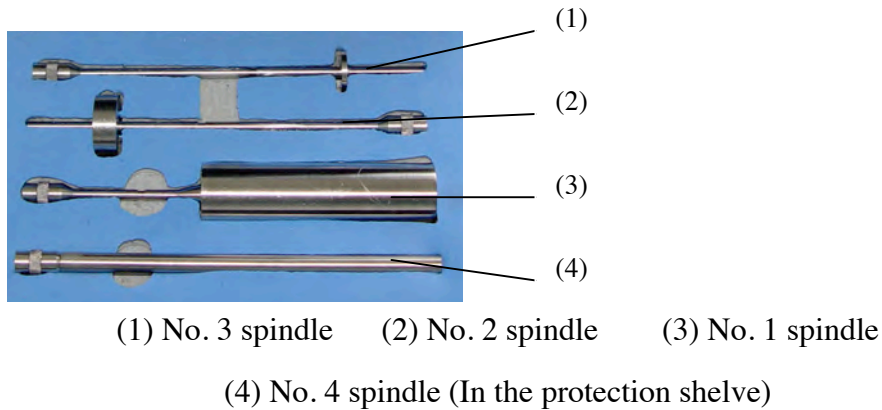


Figure 4

(II) Installation

1. Remove pedestal and vertical shaft from the package.
2. Install the vertical shaft on the pedestal through the hole at the back of the pedestal. The notched side of the vertical shaft should face to the back of the pedestal. Fasten the hexagonal nut to avoid rotation of the vertical shaft.
3. Install the clamp on the vertical shaft and rotate the clamp knob to check flexibility and self-lock function. If the clamp is too tight or too loose, adjust the locknut at the back of the clamp using a screwdriver until it can move up and down. The clamps should be a little tight to avoid the instrument head falling down after installation.
4. Open the storage case and remove the viscometer. Install the viscometer on the clamp. Fasten the fixing bolt and remove the rubber band from the needle control rod.  
**Unscrew the bolt on the protection cap at the bottom of the instrument head and take off the protection cap.**
5. Rotate the level adjustment bolt to level the instrument.
6. Connect the instrument to the power supply.



## IV. Operation methods

1. Prepare the liquid to be measured in a beaker or cylinder not less than 70 mm in diameter. Please control the liquid temperature accurately.

2. Install the protection shield on the instrument (Rotate it right to assemble and rotate it left to disassemble).

3. Screw on the selected spindle on the connection bolt (Rotate it left to assemble and rotate it right to disassemble). Rotate the clamp knob to lower the instrument into the liquid to be determined slowly until the liquid surface sign on the spindle is level with the liquid surface. Level the instrument, turn on the motor switch, and rotate the speed knob to select a suitable speed. The spindle will begin rotating in the liquid. When the indication needle is stable after the spindle rotates a number of times, the measurement can be obtained from the reading on the dial. In general, it takes about 20 to 30 seconds, or longer. Press down the needle control rod to fix the reading, and then turn off the motor when the needle appears in the reading window. (**Note: 1. Please be gentle during operation; 2. If the rotation speed is slow, you can read the reading directly without the help of the needle control rod**).

4. If the reading is too high or too low, you can select a different spindle or a different speed to let the reading stay in the range of 30 to 90.

5. Full scale, coefficient, spindle and speed selection:

(1) Please estimate the viscosity range of the liquid to be determined, and then select a suitable spindle and speed from the full scale table.

For example, the viscosity of liquid to be determined is about 3000 cps, then you can select:

No.2 spindle with 6 RPM or No.3 spindle with 30 RPM;

(2) If the viscosity range of the liquid to be determined is unknown, please proceed based on the highest viscosity. Then select a spindle from small to large volume and a speed from slow to quick. In general, select the smallest volume spindle and the slowest speed for high viscosity liquids and select the largest volume spindle and the quickest speed for low viscosity liquids.

(3) Coefficient: The dynamic viscosity is calculated by multiplying the reading on

the dial by the specific coefficient on the coefficient table.

$$\eta = K \cdot \alpha$$

Where:

$\eta$  = Dynamic viscosity;

K= Coefficient;

$\alpha$  =Reading on the dial (Deflection angle)

(4) Frequency error modification: when the power frequency is not same with the stipulated frequency, please modify it using the following equation.

Real viscosity= indication viscosity  $\times$  (Rated frequency / Real frequency)

(5) Viscosity unit conversion:

Dynamic viscosity unit conversion

1 cP=1 mPa·s

100 cp= 1 P

1000 mPa·s= 1 Pa·s

Dynamic viscosity and kinematic viscosity conversion

$$\eta = \nu \cdot \rho$$

Where:

$\eta$ = Dynamic viscosity (mPa·s);

$\nu$ = Kinematic viscosity (mm<sup>2</sup>/s);

$\rho$ = Density at the temperature when determining the kinematic viscosity (g/cm<sup>3</sup>);

(6) Full scale table

Full scale cps Spindle	RPM				
	60	30	12	6	
1	100	200	500	1000	
2	500	1000	2500	5000	
3	2000	4000	10000	20000	
4	10000	20000	50000	100000	

(7) Coefficient table

Coefficient K Spindle	RPM				
	60	30	12	6	
1	1	2	5	10	
2	5	10	25	50	
3	20	40	100	200	
4	100	200	500	1000	

**V. Notes:**

1. Operate the instrument under the ambient temperature.
2. Operate the instrument with the stipulated frequency and voltage tolerance range; or, it will affect test accuracy.
3. Use the holder during operation. Keep the instrument stable and level during operation.
4. Use caution when assembling or disassembling the spindle. Do not apply too great a force and do not move the spindle in the transverse direction to avoid bending the

spindle.

5. Do not set the instrument side down or upside down.

6. Change speed only when the motor is running.

7. Keep the connection bolt, connection section and screw thread of spindles clean, or it will affect connection and rotation stability of spindle.

8. Hold the bottom of the instrument head by hand when adjusting the position of the instrument head to avoid instrument head falling.

9. Clean the spindle after each test. Remove RVB-1 from the instrument and clean it. Do not clean spindle when it is still on the instrument. Store in a proper place after cleaning.

10. Do not disassemble the instrument unnecessarily. Do not add any lubricant oils to the instrument.

11. Fix the needle control rod and fasten the connection bolt using the protection cap when moving or transporting the instrument.

12. Suspension, emulsion, high polymer and most other liquids are Non-Newton liquids. Their apparent viscosities will change together with change of the shear speed and time, so it is normal when the test results are different using different spindles, speeds and time. The viscosities of Non-Newton liquids measured using the instrument are only for reference. (In general, you should make determination for Non-Newton liquids using the stipulated spindle, speed and time or make comparative measurement at fixed measurement condition and environment to verify their viscosities).

13. To get more accurate results, pay close attention to the following points:

(1) Control the liquid temperature accurately;

**Note: If necessary, please purchase a circulation constant temperature bath and a double layers sample cup.**

(2) Immerse the spindle in the liquid to be measured for a sufficient time to establish a constant temperature, where both spindle and liquid to be measured are at the same temperature.

(3) Ensure that the liquid is uniform.

(4) Let the spindle stay in the center of the sample container during determination.

(5) Ensure no bubbles adhere to the bottom of the spindle when immersing the spindle into the liquid to be measured.

(6) Select suitable spindle and speed to make sure the reading on the dial is higher.

(7) Use the protection shield during determination.

(8) Keep the spindle clean.

(9) Modify the power frequency affect when it changes.

(10) Make determination as per the operation methods.

14. If the needle does not move during determination, please check the needle control rod to ensure the rubber band is removed. If it is not removed, please remove it and press the needle gently for several times. If the needle can move up or down, the needle is in normal.

15. The hair spring has been preset and the needle will point to zero when the RVB-1 is turned on. If it does not point to zero, check the instrument to make sure it is level.

**Caution: The zero position of the instrument is not at the position “1”. It is at the two black triangles position.**

**Note: The instrument is composed of gear box, hair spring, and bearing. It is a precision instrument, and should be handled gently during installation and operation. Do not disassemble the instrument or change any parts.**

## VI. Package List

### 1. Full set

No.	Name	Unit	Quantity
1	Main unit	Set	1
2	N0.1 to 4 spindles	Piece	1 for each
3	Protection cap (Remove before turning on the instrument)	Piece	1
4	Vertical shaft	Piece	1
5	Pedestal (with two level adjustment bolts)	Pair	1

### 2. Optional part

(1) RVB-T-TB Circulation Constant Temperature Bath 1 set

(2) RVB-1-DLC Double layers sample cup

### 3. Technical documents

(1) Operation Manual 1 piece

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