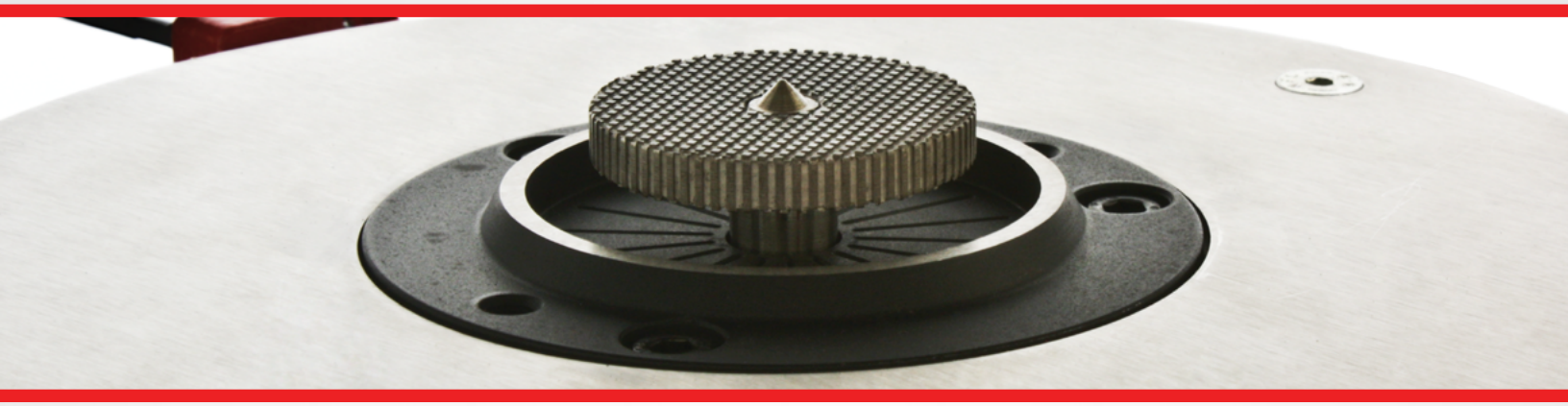
Mooney Viscometer Preventive Maintenance Guide



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Rubber Testing Solutions

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Mooney Viscometer Overview

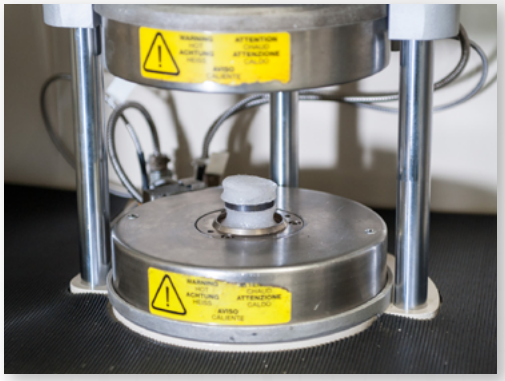
What is a Mooney Viscometer?

Invented by Melvin Mooney, the Mooney Viscometer is a testing instrument used for measuring the Mooney Viscosity, among other readings, of rubber and polymer compounds. Since the instrument's inception, it has become a staple quality test in the production of nearly all compounds.

The Mooney Viscometer test is very simple. Once the instrument reaches the desired test temperature, rubber or polymer compound is placed directly around the rotor inside the cylindrical platens.

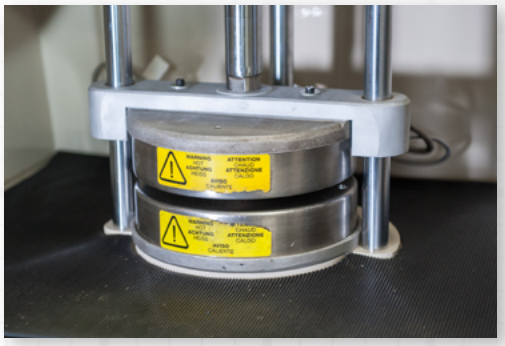
When the test starts, the platens close, encircling and applying heat to the rotor and compound for one minute.

Note: Mooney Viscometers are supplied with two separate rotors because of the limitations of the torque transducer. Stiffer compounds may require a smaller rotor while softer materials may require the large rotor.



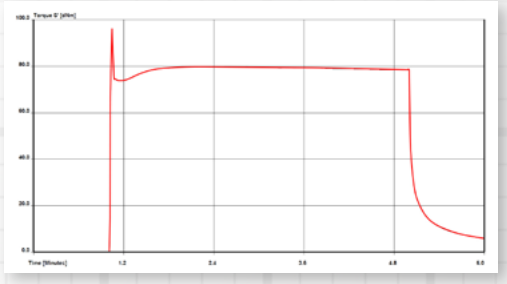
Rotor with Compound

After one minute, the motor is activated, spinning the rotor at a constant 2 RPM. Simultaneously, a torque sensor reads the amount of resistance applied to the rotor as it rotates with the compound. This rotation continues for typically 4 minutes, plotting the Mooney Viscometer curve as torque resistance over time on the screen.



Platens Closed During Test

The initial onset of the test will show that there is no reading because the motor is inactive, thus the torque sensor is acquiring no data. After the preheat stage, there is a spike in the torque curve signifying the onset of the motor and applied 2 RPM of the rotor. Over the next few seconds, torque decreases as the material flows between the grooves of the rotor and die cavity. The rotation will continue for an additional four minutes, acquiring the ML 1 + 4 or Mooney Unit value.



Mooney Test Curve

Standard Mooney Values According to ASTM D1646

Initial Viscosity:

Initially Viscosity is indicated at the top of the curve, or initial onset of torque applied to the polymer. The point of onset dictates the state of material as found.
Example: If a compound was in a cold warehouse, there will be a higher initial viscosity. If the compound was fresh off a heated mill, the initial viscosity will be less.

ML 1 + 4:

ML 1 + 4 is the reading acquired after one minute of material preheat followed by four minutes of the rotor torque readings at a consistent 2 RPM. This recorded data point is the industry standard Mooney unit.

The Mooney unit reading allows each operator to see powerful insights as to the flow characteristics of the material. This hints at compound performance while extruding, mixing, or molding.

Higher Mooney readings indicate a higher viscosity material, therefore the expectations of should be that the material will require more energy to process.

Some manufacturers may require modifications to this test, such as ML 1 + 8.

Stress Relaxation:

Stress relaxation measurements hint at the elasticity of the polymer and how it may rebound back into it's normal state before, during, or after processing. This is especially useful during mold release and extrusions.

Regression Coefficient: Insinuates the linearity of the relaxation.

Viscosity % of relaxation: Viscosity readings may be taken at a certain points during relaxation.

Time at % relaxation: Defines the amount of time the polymer took to relax at a specific viscosity

Mooney Scorch:

Mooney Scorch indicates temperatures at which a compound will begin curing. These readings can be used to determine time on mills, or within certain points of processing.

Safety Checks

1. Visually inspect the power cable, main fuse and plug. With a multimeter, please ensure the Mooney Viscometer is grounded properly. Grounded items include:

- Cabinet
- Upper and Lower Platens
- Main Frame
- Power Cable

Checking Grounding on Lower Platen

2. If applicable, check the twist lock plug and ensure it is seated properly. There should be no exposed or bare wires.

3. Inspect and exercise the motor and door interlock. The motor should disengage upon opening the cabinet door.

4. If applicable, ensure the finger guard is present on the blower assembly. Verify the filter is clean and replace if it is dirty or damaged.

Finger Guard on Blower

5. Check that all thermal covers are in place and that wiring is free of fraying, exposures, cracks or looseness.

6. Short cycle the machine to ensure all of its main functions are operating correctly (i.e. weights, shield, motor, platen exercising, heating and stabilizing and ensure indicator lights).

Expendable Parts: Filter, Motor Fuses, Heater Fuses, Pneumatic Fuses.

Pneumatics

Step 1

Air Pressure Regulator

1. Visually inspect the air regular set (regulator, water trap, and lubricator). The pressure gauge must read correctly, the water trap must be empty and, if applicable, the lubricator must be filled. If applicable adjust the lubricator as necessary to two drops per four cycles.

Step 2

Exhaust Mufflers

2. Check all air valves for proper operation. Re-cycle and exercise the weight and platen cylinders. The cylinders must open and travel smoothly. If the cylinders are not operating correctly, please clean or replace the exhaust mufflers.

Step 3

Checking Belts on Front Shield

3. Exercise the front shield to check for proper and smooth operation. Also inspect the door belts for any wear and tear.

Step 4

Checking Hose Fittings

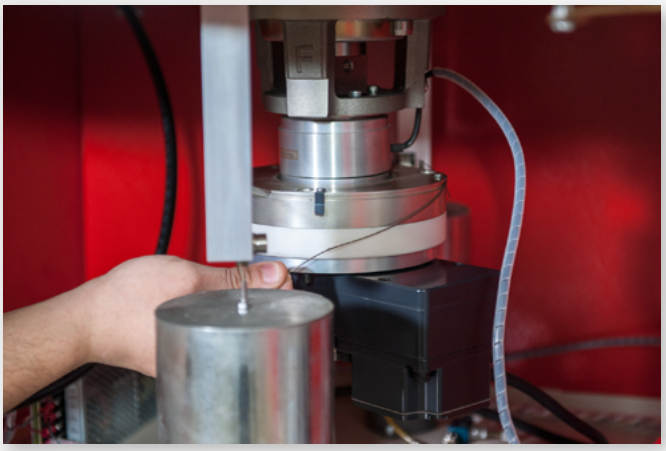
4. Check for and replace leaking hoses and/or hose fittings.

Expendable Parts: Mufflers, Hoses & Fittings, Belts and Valve Seals

Central Shaft and Drive Assembly

SAFETY CHECK: POWER OFF THE MACHINE

Step 1



Removing Weight Cable

1. First, remove the weight cables from the motor assembly and inspect for fraying and cracks. Replace the cables if necessary.

Step 2

Removing Motor Drive Assembly

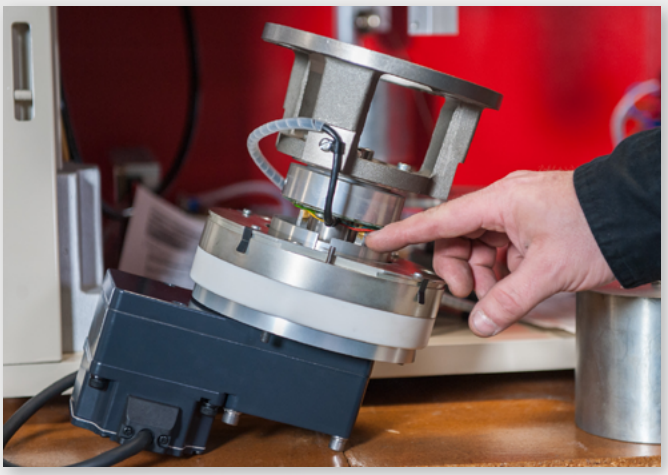
2. In this order: remove the motor drive assembly, central shaft, rotor height adjustment screw inside the shaft and spring.

Step 3

Removing Dust Cover and Inspecting Bearings

3. After this, inspect the bearings and clean the shaft, removing any debris. Verify smooth operation of the bearings and installation of bearing dust cover.

Step 4



Inspecting Torque Transducer

4. Inspect the torque transducer (found on motor assembly) and verify no damage to the wires or the unit itself.

Step 5

Measuring Rotor Dimensions with a Micrometer

5. Clean the rotor(s) and record dimensions. Replace the rotor if its dimensions are out of specification according to the ASTM, if the rotor is bent, or if it is extremely worn. Clean the rotor height pin and spring.

Step 6

Aligning Keyways

6. If applicable, check the keyways and keys for proper alignment of the central shaft.

Step 7

Inspecting Motor Drive Assembly

7. Inspect the motor drive assembly for physical damage or broken cables.

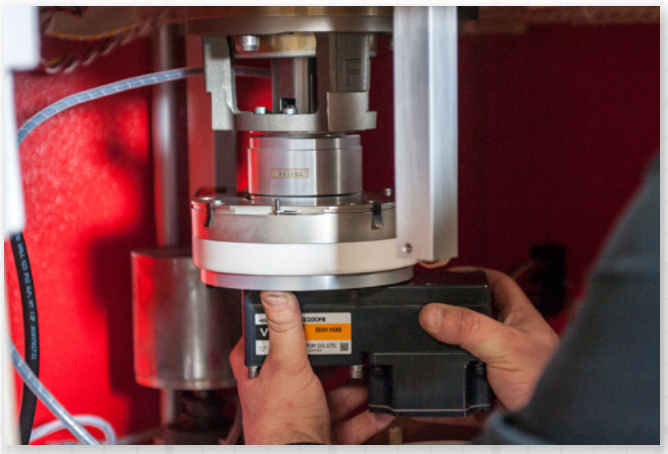
• *If applicable, clean the swash plate and replace grease on needle bearings. If there is no swash plate, inspect central shaft coupler for damage. If necessary replace the swash plate.*

Step 8

Reinstalling Central Shaft

8. Reinstall the central shaft, rotor height adjustment screw. **DO NOT INSTALL THE SPRING AT THIS TIME**. *(The spring will be reinstalled on step 9 of the Lower Platen section)*

Step 9



Reinstalling Motor Drive Assembly

9. Reinstall the motor drive assembly, weights, and weight cables.

General Expendable Parts: Bearings, Rotor Height Screw, Rotor Height Spring, Bearing Dust Cover, Central Shaft, Motor Fuses

Upper Platen

SAFETY CHECK: POWER OFF THE MACHINE

Step 1

RTD and RTD Clip After Removal

1. Remove the RTD. **THE RTD MUST BE REMOVED BEFORE THE DIE.**

Step 2

Removing Die from Upper Platen

2. Remove and clean the die. Ensure its grooves are free of debris. Replace the die if it is extremely worn, cracked, or if its edges are rough.

Step 3

Disassembling Upper Platen

3. Remove the upper platen and disassemble the upper platen heater assembly.

Step 4

Cleaning Upper Platen Insulator

4. Inspect and clean the insulators and upper platen.

Step 5

Inspecting Heater Wiring in Upper Platen

5. Check the heater for any damage to its wiring. Ensure alignment into the heater assembly.

Step 6

Reassembling Upper Platen

6. Reassemble the upper platen assembly and reinstall it in the Mooney Viscometer. Next, reinstall the die.

Step 7

Reinstalling RTD in Upper Platen

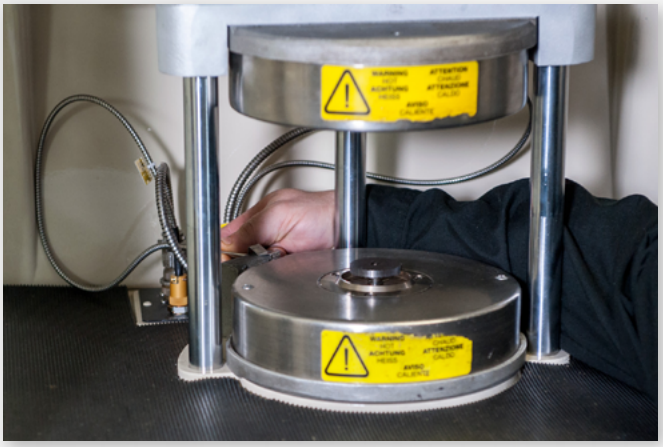
7. Finish by reinstalling the RTD. If applicable, an RTD clip must be installed. If the RTD clip is missing or broken, please replace.

General Expendable Parts: Heaters, Insulators, RTDs and RTD Clips.

Lower Platen

SAFETY CHECK: POWER OFF THE MACHINE

Step 1



Removing RTD in Lower Platen

1. Remove the RTD. **THE RTD MUST BE REMOVED BEFORE THE DIE.**

Step 2

Cleaning Lower Platen Die

2. Remove and clean the die. Ensure its grooves are free of debris. Replace the die if it is extremely worn, cracked, or if its edges are rough.

Step 3

Replacing O-Ring in Lower Platen Die

3. Upon cleaning the die, replace the o-ring seal.

Step 4

Disassembling Lower Platen

4. Remove and disassemble the lower platen.

Step 5

Removing Insulator from Lower Platen

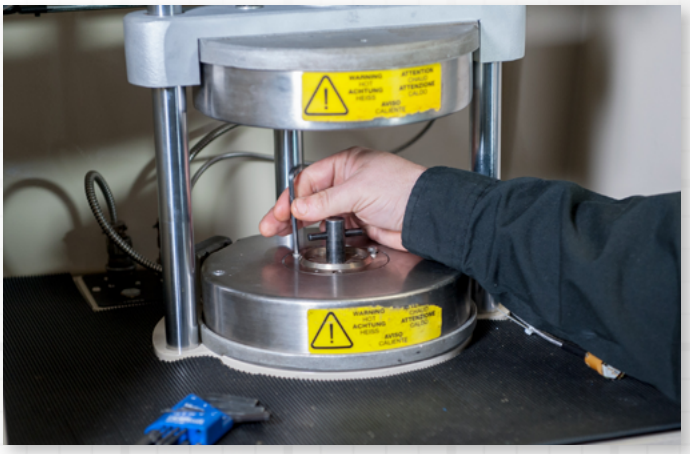
5. Inspect and clean the insulator and lower platen.

Step 6

Inspecting Heater Wiring in Lower Platen

6. Check the heater for damage to wiring. Ensure alignment into assembly.

Step 7



Reinstalling the Lower Platen Die

7. Reassemble the lower platen assembly and reinstall it in the Mooney Viscometer. Next, reinstall the die.

Step 8

Using Rotor Height Gauge to Set Rotor Height

8. Reinstall the rotor and set its height using a rotor height gauge. Adjust the rotor height screw as necessary.

Step 9

Reinstalling Rotor Height Spring

9. Once the height is set, reinstall the rotor height spring.

Step 10

Reinstalling RTD in the Lower Platen

10. Reinstall the RTD. If applicable, an RTD clip must be installed. If the RTD clip is missing or broken, please replace.

General Expendable Parts: Heaters, Insulators, RTDs and RTD Clips, and O-ring seals.

Operational Verification

- If applicable, re-check the twist lock plug and ensure it is seated corrected on the bulkhead connector. There should be no exposed or bare wires.
- Inspect and exercise the motor and door interlock once again. The motor should disengage upon opening the cabinet door.
- If applicable, ensure the finger guard is present on the blower assembly.
- Short cycle the machine to ensure all main functions are operating correctly (i.e. weights, shield, motor, platen exercising, heating and stabilizing and ensure indicator lights).

Calibration

Once the preventative maintenance has been completed on the machine, conduct specified calibration procedure as according to ASTM D-1646.

If you have questions regarding Mooney Viscometer maintenance or calibration, please do not hesitate to reach out to us at:

1-800-552-5115 or find us at **www.montechusa.com**

For yearly 17025 Calibration and Preventative Maintenance, North American contracts are conducted by **Richard J. Bagan Inc.** aka **MonTech USA**.

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