

---

Mooney Viscometer

MV 3000 Basic

---



## Technical Part

### 1.1 Mooney Viscometer MV 3000 Basic

The MV 3000 Basic is a table model rotational shear viscometer of advanced design according to Mooney for performing

- **Viscosity tests (ML / MS 1+X)**
- **Stress Relaxation testing**
- **Mooney Scorch**
- **Delta Mooney testing**

on polymers as well as rubber compounds for quality control, research and development applications.

Data are presented as a continuous plot of compound / polymer physical properties vs. test time in accordance with ISO 289, ASTM D 1646 and DIN 53525 part 1-3.



The MV 3000 Basic is supplied as a complete, ready-to-test instrument system including a personal computer, MonControl Software, cables, connectors and regulators as well as a standard set of tools and consumables.

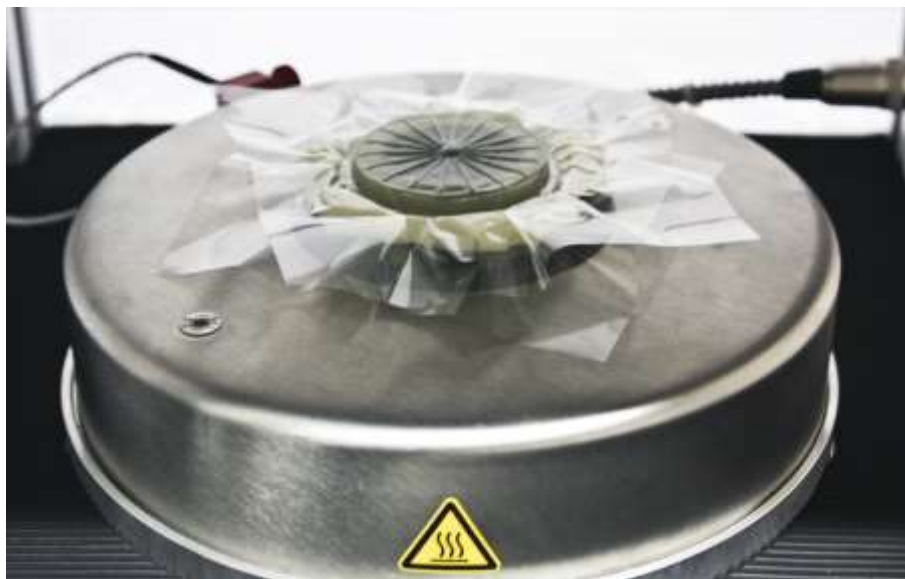
The instrument is designed for continuous operation in applications such as in-process quality control in rubber plants and other areas requiring repetitive testing of rubber and polymer samples, such as compound development.

### **Key features of the MV 3000 Basic:**

- Easy to use:** All test parameters are pre-programmed through the MonControl Software - the instrument is equipped with a single button for starting the test sequence.
- Direct feedback:** A integrated multi-color LED status bar clearly displays the current machine state.
- Rugged:** The compact and highly rigid frame is made from high strength aluminum. Along with direct-drive technology, this guarantees stable and accurate test results in every environment.

The instrument consists of a rugged, stylish aluminium corpus, a PC and 19" TFT screen, keyboard and mouse as well as an optionally integrated 5.7" Touch-Display. All control and measuring tasks are handled either by the external PC or the integrated display unit with touchscreen and 10 additional control buttons. For data acquisition and result recording the external PC is equipped with the high-tech analysis software MonControl, manufactured also by MonTech Werkstoffprüfmaschinen.

For performing a test, the elastomeric specimen is placed below and above the rotor into the electrically heated, positive pressure die cavity which is formed by 2 directly heated dies – with or without testing film. Then the upper die is lowered onto the lower die with a force of 11.5kN. After a pre-heat time, the rotor - which is now totally embedded in the test material in the closed die cavity - rotates at a fixed speed of 2 turns per minute, powered by an in-line drive system. The rotor shaft is sealed by a special longlife seal ensures lowest friction and therefore highest precision in torque readings.



During the test sequence all set as well as result values are displayed on the computer screen as well as on the optional instrument display (for example set time, set temperature, actual temperature, Mooney viscosity...).

For generating the constant movement of the rotor, a very powerful motor is used which is connected to the lower die shaft.

The temperatures of both dies are measured by a separate precision probe on each die and the heaters are accordingly controlled and regulated to precisely maintain the temperature at its setpoint. The upper as well as the lower die work with an extreme fast, PID controlled temperature regulation and recovery system – this ensures a very homogeneous temperature distribution inside the die cavity. The temperature measurement is done by two independent precision platinum resistance sensors (PT100) – one for each die. The sensors are mounted directly underneath the die surfaces for a very high temperature result and regulation quality. The same sensor is used for temperature regulation as well as for recording the temperature.

This directly heated test die design reduce significantly the waiting and unproductive time – the rapid temperature recovery minimizes the effect of operator variables.

The heating of the die is performed by one heating film for the lower and one for the upper die. Both heating channels are directly controlled by the MonControl software on the PC with integrated high speed PID algorithms for temperature regulation - this help to ensure reproducible thermal recovery.



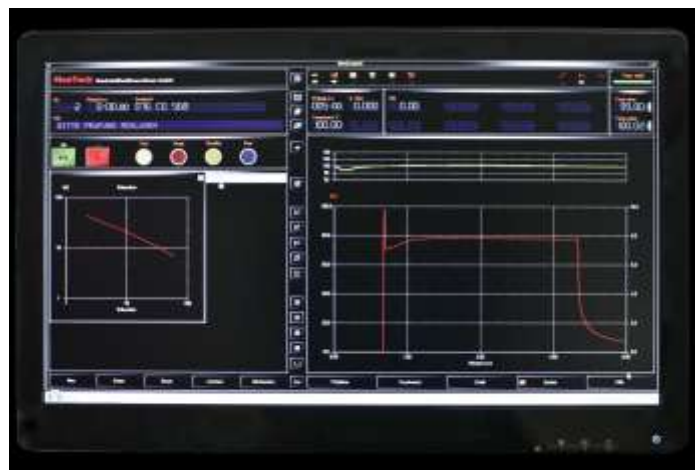
During the test sequence the torque is transferred through the sample from the rotor to the die cavity. Attached to the rotor shaft a very precise strain gauge is mounted to measure the rotational force. This torque signal is processed by a strain amplifier and converted into Mooney Units (MU), to ensure highest and best signal quality for best test results. All data is presented online during the test as well as stored automatically once the test is completed. For easy sample removal and efficient operation the main shaft is fitted with a spring-loaded rotor push system. The main shaft is easily accessible and fitted with snap-in mechanics for fast and easy cleaning of the instrument.

MonTech Instruments feature internal diagnostic and condition monitoring routines for every critical process, enabling the instrument to detect, report and even solve problems before they occur. The calibration of the instrument can be performed by the customer itself – either by a. integrated dead weight calibration system or with MonTech certified reference polymers.

Along with MonTech precision calibration tools, customers are guided through a software sequence, making the verification of the instrument really easy in order to always guarantee and prove the highest instrument precision and most accurate test data. This “MonTech Easy Calibration System” is a graphical, guided tool which explains the calibration procedure to the user as well as it helps him to calibrate the instrument. Calibration weights are already integrated into the machine so the balancing as well as calibration is performed fully automated without any user interference required. This of course also includes automatic compensation of the seal friction of the rotor-shaft.

Integrated self-diagnostic routines alert the operator to a system or operation fault. Optionally a remote service (VPN), diagnostics and maintenance system is available upon request.

The easy-to-use MonControl software identifies the sample as well as measures and calculates Mooney data in digital form using cutting – edge algorithms and data structures. All data is automatically stored in a SQL database.



## Data analysis:

The following data is automatically calculated at the end of each test:

### 1. Mooney Viscosity:

<b>Initial Viscosity</b>	Peak viscosity after preheat time while starting the rotor
<b>M<sub>s</sub> x + 1</b>	Mooney Viscosity Test (Small Rotor) x Minute(s) preheat time + 1 Minutes test Time
<b>M<sub>s</sub> x + 2</b>	Mooney Viscosity Test (Small Rotor) x Minute(s) preheat time + 2 Minutes test Time
<b>M<sub>s</sub> x + 3</b>	Mooney Viscosity Test (Small Rotor) x Minute(s) preheat time + 3 Minutes test Time
<b>M<sub>s</sub> x + 4</b>	Mooney Viscosity Test (Small Rotor) x Minute(s) preheat time + 4 Minutes test Time
<b>M<sub>s</sub> x + 8</b>	Mooney Viscosity Test (Small Rotor) x Minute(s) preheat time + 8 Minutes test Time
<b>M<sub>s</sub> x + y</b>	Mooney Viscosity Test (Small Rotor) x Minute(s) preheat time + y Minutes test Time
<b>M<sub>L</sub> x + 1</b>	Mooney Viscosity Test (Large Rotor) x Minute(s) preheat time + 1 Minutes test Time
<b>M<sub>L</sub> x + 2</b>	Mooney Viscosity Test (Large Rotor) x Minute(s) preheat time + 2 Minutes test Time
<b>M<sub>L</sub> x + 3</b>	Mooney Viscosity Test (Large Rotor) x Minute(s) preheat time + 3 Minutes test Time
<b>M<sub>L</sub> x + 4</b>	Mooney Viscosity Test (Large Rotor) x Minute(s) preheat time + 4 Minutes test Time
<b>M<sub>L</sub> x + 8</b>	Mooney Viscosity Test (Large Rotor) x Minute(s) preheat time + 8 Minutes test Time
<b>M<sub>L</sub> x + y</b>	Mooney Viscosity Test (Large Rotor) x Minute(s) preheat time + y Minutes test Time
<b>Stress Relaxation</b>	Slope, Intercept, Regression Coefficient (according to ISO - MSR)

### 2. Mooney Scorch:

<b>Scorch time @ Ts 18 – Ts 3</b>	Mooney Scorch Test (Small Rotor): Scorch time @ Ts 18 minus Scorch time @ Ts 3
<b>Scorch time @ Ts 35 – Ts 5</b>	Mooney Scorch Test (Large Rotor): Scorch time @ Ts 35 minus Scorch time @ Ts 5

as well as many others (in the external MonControl Software):

Mooney:	MU → Mooney Viscosity
<b>Result Name:</b>	<b>Unit</b>
Delta MU 1...10 - Final Viscosity	MU
Delta Mooney Viscosity	MU
Delta Mooney Viscosity Index	Percent
Delta MU 1...10 - Final Visc. Index	Percent
Delta Time (Max - Min)	Sec
Delta Time (Ts18 - Ts 3)	Sec
Delta Time (Ts35 - Ts 5)	Sec
Delta Viscosity (Max - Min)	MU
Final Decay Index	Percent
Final Decay Value	MU
Final Time	Sec
Final Viscosity	MU
Final Viscosity-Minimum	MU
Initial Time	Sec
Initial Viscosity	MU
Intercept	MU
Log Decay Index @ 10...100s	Percent
ML 1 + 1...12	MU
ML 2 + 1...12	MU
ML 3 + 1...12	MU
MS 1 + 1...12	MU
MS 2 + 1...12	MU
MS 3 + 1...12	MU
Overall M Pass/Fail	-
Regression Coeff.	-
Rel. Decay @ 10...100s	Percent
Scorch Time @ Ts 2...35	Sec
Scorch Viscosity @ Ts 2...35	MU
Slope	MU/Sec
Time @ 10...90% Decay	Sec
Time @ Max	Sec
Time @ Min	Sec
Tolerance Curve	-
Visc. @ Max - Final Visc.	MU
Viscosity @ 10...100s	MU
Viscosity @ 10...90% Decay	MU
Viscosity @ Max	MU
Viscosity @ Min	MU
Viscosity @ V-Time 0.5...9.5'	MU



## Online edition (optional):

The MV 3000 Basic production variant "Online Edition" is equipped with a Touch panel system mounted on the right side of the instrument.

## **Key features:**

- 5,7" QVGA color LC Display mit Touch Screen (resistiv), 10 Touch-Keys,
- Protection class IP65
- Mounted into a rugged holder on the right side of the instrument

## **Display / Controller functions:**

### Set-values:

- Operation mode (Scorch / Viscosity)
- Type of Rotor
- Set temperature
- Set time
- Set preheat time
- Set relaxation time
- Set rotor speed

### Readings:

- Time
- Temperature
- Viscosity in Mooney-Units

### Results:

- Please refer to the next page for all calculated results

### Service:

- Balance
- Calibration
- 

### Information:

- Machine runtime
- Version info



## Detailed Technical Description MV 3000 Basic:

- International Standards ISO 289:2005, ASTM D 1646, DIN 53523, BS 903: Part 58, AFNOR T43-00/005, BS 1673, GOST 10722-76, JIS K6300, TGL 25-689
- Stress Relaxation According to ISO 289:2005, DIN 53523 Part 4
- Test modes Mooney Scorch, Mooney Viscosity, Delta Mooney Stress Relaxation
- Die configuration V-groove Die in accordance with international standards
- Rotor large ( $\varnothing$  38.1mm) and small ( $\varnothing$  30.48mm) Rotor
- Rotor speed fixed at 2.00 turns per Minute (0.21 Radians / second)
- Rotor shaft seal Standard or longlife seals available
- Closing force 11.5kN
- Torque measurement In-line torque transducer
- Torque range 0.01 to 230 MU  
With integrated overload protection
- Sample Volume Two specimens, having a combined volume of 25 cm<sup>3</sup>  
(a M-VS 3000 constant volume cutter for sample preparation is highly recommended)
- Temperature control system Ambient to 232 °C, precision +/- 0.03 °C, digital, microprocessor controlled
- Temperature check system Recordings of the temperature gradient on the screen, PID microprocessor monitored
- Calibration / Balance Fully automatic by built in calibration weights, Software guided with MonTech Easy calibration system

- Measurement data      Viscosity / Scorch: Mooney Units (MU)  
Temperature:            °C or °F  
Time :                      min-min, min-sec, sec
- Data points              Over 3500 data points available  
Including:  
Initial viscosity, ML / ML 1+X, Y+X+Z,  
Stress Relaxation (log-log),  
Slope, Intercept, Regressions coefficient,  
Scorch viscosities and cure times
- Data interface:        Ethernet (10/100 MBit),  
USB (int.),  
CF card (int.),  
RS232 (opt.)
- Output / Input Display    5.7" Color-Touch-Screen (optional)
- Output languages        English, French, German, Russian, Spanish,  
Hungarian, Chinese, ...  
(others available on request)
- Electrical  
(please specify at order)    100/110/120/130 VAC +/- 10%, 60 Hz +/- 5 Hz,  
8 amp single phase  
OR  
200/220/240/260 VAC +/- 10%, 50/60 Hz +/- 5 Hz  
5 amp single phase  
  
Ground connection required.  
Deviations from these ranges may affect  
performance.
- Pneumatics              4,5 bar (= kg/cm<sup>2</sup>) / 60 psi
- Dimensions  
(net – without  
peripheral devices)        Width 58    cm  
Height 93    cm  
Depth 50    cm
- Weight                    160 kg gross / 115kg net
- Setup                      Table-top, a suitable table with at least 150kgs  
load capacity needs to be provided by the  
customer.

- Available instrument options

- Instrument control panel with 5.7" touchscreen display and printer
- Forced air cooling system
- Low-temperature cooling system M-Cool 10
- M-VS 3000 constant volume sample cutter
- Service and Maintenance package
- Mooney - Logic data interface
- Label and Result printer
- Instrument table or cart
- Forced aspiration system

### Setup and installation requirements of the MV 3000 Basic:

(to be provided from the customer at installation)

- One table 200cm length, 70cm depth, permissible load min. 150kgs
- 4 power sockets 200-260 Volts, 16 Amps
- 1 line of dry, oil-free class 2 instrumentation compressed air, 5 Bars min  
Flexible tube with internal diameter of 10 to 13mm

#### For instrument equipped with a cooling system in addition:

- 1 additional, independent line of dry, oil-free class 2 instrumentation compressed air, 5 Bars min, Flexible tube with internal diameter of 10 to 13mm

---

## 2.1 Mooney Viscometer MV 3000 Basic

*including:*

- Personal Computer, 19" TFT Screen, Keyboard, Mouse
- Ethernet Interface (10/100)
- Software MonTech MonControl
- Large Rotor
- Fully integrated, automatic calibration system
- Standard accessories
- Automatic front shield
- Calibration certificate
- Installation and training at customer site by German engineer

**Optionally available:**

- **Instrument control panel “Online edition”**  
5.7” color Touch control panel fitted to the right side of the instrument.  
The control panel continuously displays status information on the current test as well as allows the user to setup and execute static tests. Furthermore the control panel features calibration and diagnostic functions for a computer independent operation.
  
- **MonTech Volume sample cutter M - VS 3000**  
Pneumatic operated with 2-hand safety control for the fast and easy preparation of Mooney test samples.