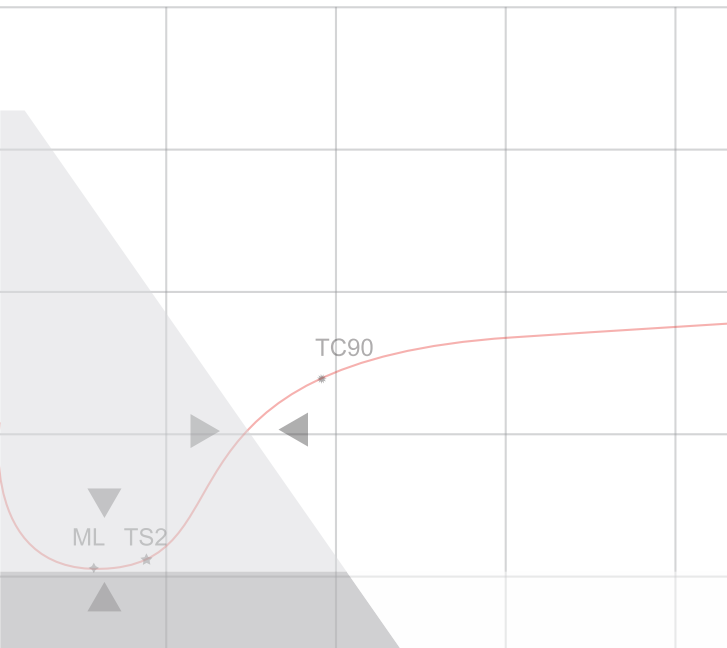
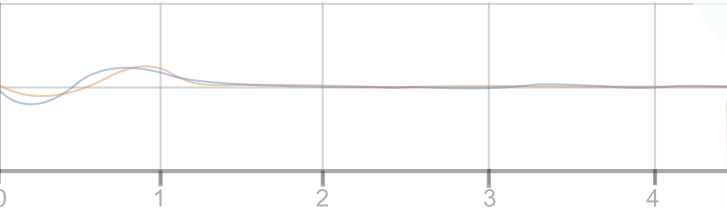


# Micro Vision

Rubber Testing Instruments

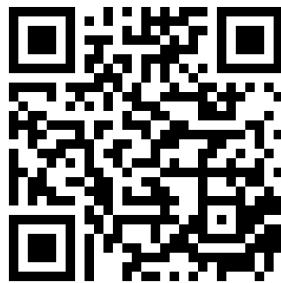


Since 1992



- Oscillating Disc Rheometer
- Moving Die Rheometer
- Mooney Viscometer
- Two in One Rheometer
- Ozone Chamber
- Universal Tensile Machine
- Upgradation of Old Rheometer

India's Leading Manufacturer of Rubber Testing Instruments



Scan to download E-Catalogue

<http://www.microrheometer.com/>

# India's Leading Company in Rubber Testing Instruments





Since 1992

**Micro Vision**  
Rubber Testing Instruments



Ashok Sharma  
C.E.O

“ Micro Vision is a knowledge based organization with strong focus on R&D and application development. We want to give more than just products. We strive to share our knowledge in this field to others and aim at global recognition.” ”

## MESSAGE FROM THE C.E.O



With the vast experience of two decades, Micro Vision, is pioneer in the field of rubber testing machines and software development. We are known for delivering world-class equipment to serve the need of thousands of customers with the best accuracy and precision. Our story started with Microvision's Oscillating Disc Rheometer and then further to Moving Die Rheometer, Mooney Viscometer, Two-In-One (Rheo+Mooney), Ozone Test Chamber and Tensile Testing Machine. Thereafter, with the updated knowledge of advancements and changes in the field, we revolutionized the Up-Gradation of old Rheometer.

“ Our company is extensive committed to research & development, with focused complete customer's satisfaction and we always strive to deliver the highest quality with the most reliable and efficient products in the industry. ”



**Rajeev Sharma**  
Director

In 2000, Mr. Rajeev Sharma, younger brother of Mr. Ashok Sharma has joined Microvision Enterprises to take the business to new heights.



**Rajat Sharma**  
Director

In 2015, Mr. Rajat Sharma, elder son of Mr. Ashok Sharma has joined Microvision Enterprises after his Graduation in Electronics and Communication Engineering. He brings in young energy and enhanced knowledge in the field of technology and aims at taking Micro Vision to new heights.

“ I had long been thinking of eliminating the need of computer from the machine. So, after long years of research, Micro Vision launched the new running model of Oscillating Disc Rheometer & Mooney Viscometer with a touch screen panel and an onscreen Rheo & Mooney graph. ”

Our production facilities and research development lab is based in Rai Industrial Estate, Sonapat, Haryana (India).



# Industrial Application

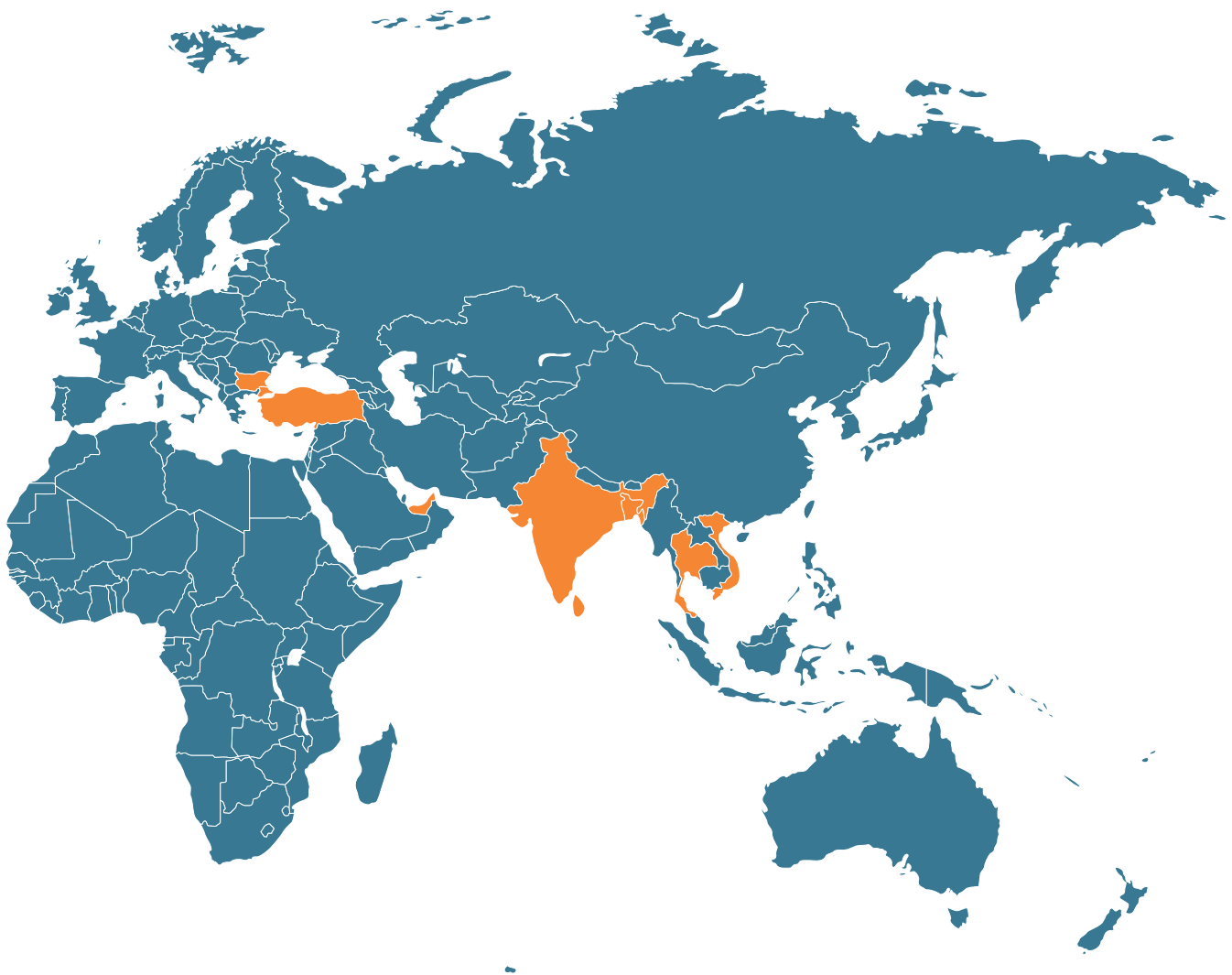
Micro Vision is not only building machines but also refining, or even engineering major key components in order to supply our customers with exceptional features.

Since we developed our first product in 1998 we have maintained an up-to-date product range which we are continuously expanding and adapting to the demanding needs of our customers



# Service

Micro Vision is a global service providing company who is designed to keep instruments operating in conformance with ASTM / ISO 3417 guidelines. Quality and customer satisfaction is our top priority. With direct support/service network in India & worldwide. Our professional field service engineers are highly trained and strategically located to offer you the most reliable calibration and preventive maintenance services for your laboratories. Our technical support team offers expert troubleshooting and application advice to maximize your testing efficiency.



# Oscillating Disc Rheometer



## Introduction

Our Micro Vision (MV) Oscillating Disc type Rheometer is an efficient, easy-to-use, and reliable testing equipment. We have designed the instrument in accordance with ASTM and ISO 3417. Our machine very effectively and precisely process the characteristics of vulcanized rubber compounds.

## How does it works ?

All of our machines work on a very simple principle.

Firstly, test piece of rubber compound is contained in a sealed test cavity under positive pressure and is maintained at a specified elevated temperature. A Rotor (bi-conical disc) is embedded in the test piece and is oscillated through specified rotary amplitude. This action exerts a shear strain on the test piece and the torque (force) required to oscillate the disc depends upon Stiffness (shear modulus) of the rubber compound. The stiffness of the specimen compound increases when cross links are formed during cure. The direct proportionality posited between the shear modulus and the cross linking density is based on the statistical theory of rubber elasticity. At a constant temperature of the test, a cross linking isotherm is the function of time of that property which serves to measure the course of the cross linking reaction.





# Principle

In the context of Rheometer, the cross linking isotherm is thus the function of time, of the oscillating shear force  $F$ , or of the Rheometer indicating proportionality to it - occurring at a given temperature as a result of vulcanization. A plot of this torque ( $F$ ) value against time gives a typical graph called "Cure Curve or Rheograph". A trained eye can monitor the initial trough i.e. processing behaviour of the compound; the slope of rise during cure phase i.e., curing characteristics and the final shape of the curve on Internationally designated parameters like MI,ML,MH, TS2, TC50, TC90 etc.

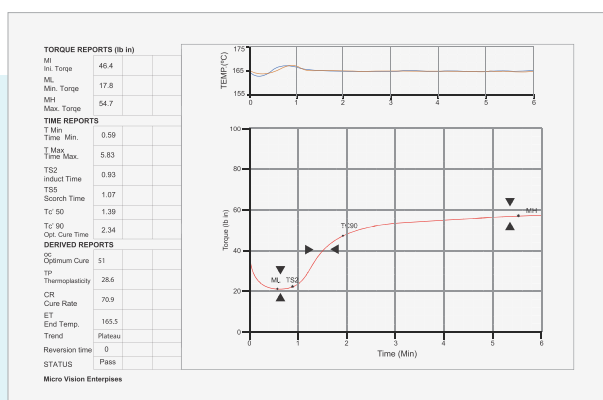
## Results:

### When ?

A complete Cure Curve is obtained when the recorded torque value either increases to an equilibrium value or the maximum value.

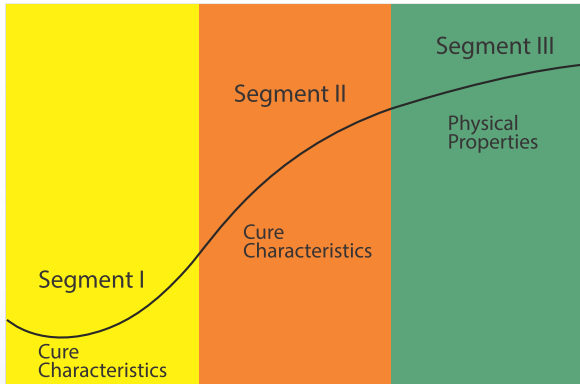
### How ?

The time required to obtain a Cure Curve is a function of the test temperature and the vulcanization characteristics of the specimen rubber compound. The signal of torque ( $F$ ) is sensed by a torque sensor mounted directly on the torque shaft bearing the rotor under stress. This torque signal is then, converted to volts and travels through ADC fed into the computer to draw torque against time curve called Rheograph. The computer then, calculates the measurements on its own.



## Reversion Time

The minimum torque is proportioned to the viscosity of the uncured compound. The scorch time is a measure of process safety. The full cured torque is a measure of shear modulus or stiffness of the compound.



## Thereafter, Rheograph is divided into three phases that describe the rubber compound

- Phase 1* - Indication of processing behavior
- Phase 2* - Describes the curing characteristics
- Phase 3* - Describes physical properties

## Results & Values

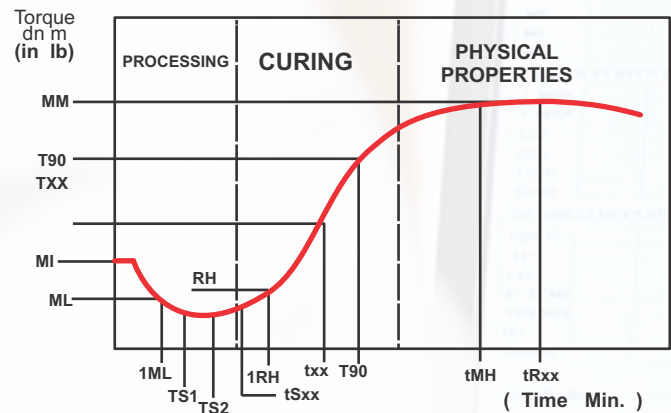
The plot of torque against time is analyzed to obtain the various results. In the Oscillating Disc Rheometer, the Rheograph is displayed in real time and at the end of test time, computer analyses the graph and results are automatically then, computed and displayed on the screen.

The results are then, categorized into three columns of which the significance is described further -



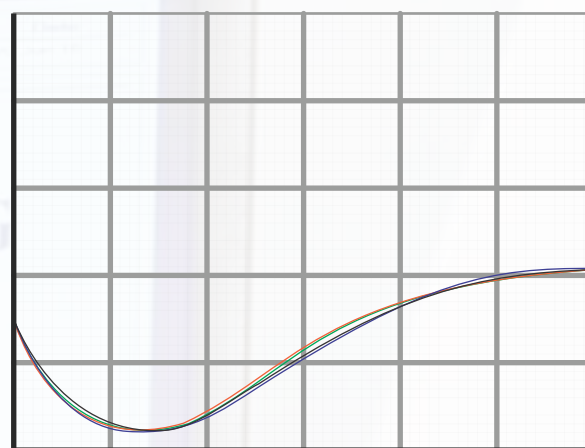
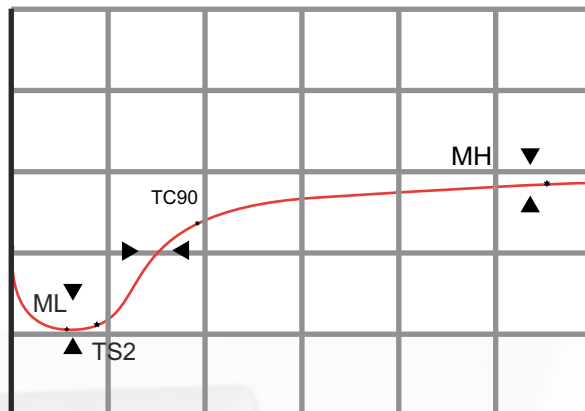
## Reversion Time In-depth Understanding of Rheograph and Computed Values RHEOGRAPH

The diagram above shows a typical Cure Curve obtained with an Oscillating Disc Rheometer. This curve of Torque V/s Cure Time depicts all the vulcanization characteristics of the Rubber Compound that can be determined directly. XY Plot of Torque(F) against real cure time is called Rheograph.



## Torque & Value

- MI (Initial Torque) - It is the torque recorded at zero time.
- ML (Minimum Torque) - As the compound gets heated under pressure, the viscosity decreases and the torque falls. The lowest value of Torque recorded is called ML, which is a measure of the stiffness and viscosity of unvulcanized compound.
- MH (Maximum Torque): As the curing starts, the torque increases proportionately. Depending upon the type of compound, the slope of rising torque varies. The torque then, attains maximum value which is displayed through Plateau Curve. If the test is carried out for enough time, the reversion of cure occurs and torque tends to fall. This type of curve with reversion is called Reverting Curve. At times, the torque shows continuous rising trend during the period of record and the curve is called Rising or Marching Curve.



## Time Value

- TS5 (Scorch time) - It is the time for viscosity (torque) to rise 5 units above ML. Both ts2 and ts5 are measures of initial slope of curing phase of Rheograph i.e., these are the measures of processing safety. Scorch is premature vulcanization in which the stock becomes partially vulcanized before it is in its final form and ready for vulcanization. It reduces the plastic properties of the compound so that it can no longer be processed. Scorching is the result of both - when the temperatures reach maximum during processing and the amount of time the compound is exposed to elevated temperatures. This period is generally referred to as Scorch time.

Since scorching ruins the stock, it is important that vulcanization does not start until processing is complete.

- TS2 (Induction time) - After attaining minimum torque, during cure phase, as the torque rises, ts2 is scorch time for viscosity to rise 2 units above ML.
- TS50 (Optimum Cure Time) - It is the time at which 50 per cent of cure has already taken place.
- TS90 (Optimum Cure Time) - It is the time at which 90 per cent of cure has taken place.

## Statistical Analysis

S.No.	Operator	Sp.No.	Batch	Date	Shift	MI	MH	ML	TMin	TMax	TS1	TS2	Tc50	Tc90	OC	Trend	RT	EndT	Status
1	MUTHAN	1-A	1	16/04/13	0	16	37.8	8.1	.62	5.87	.97	1.18	1.58	3.53	34.8	March	0	181.4	Pass
2	Saravana	19-A	4	16/04/13	1	16.4	38	8.1	.55	5.82	.95	1.18	1.63	3.48	35	March	0	180.5	Pass
3	MUTHAN	2-A	1	16/04/13	1	16.4	38	7.3	.53	5.98	.93	1.18	1.68	3.65	34.9	March	0	179.1	Pass
4	Saravana	20-A	4	16/04/13	1	16	38.9	7.8	.42	5.95	.92	1.15	1.63	3.68	35.8	March	0	180.5	Pass
5	MUTHAN	3-A	2	16/04/13	1	15.6	37.3	7.6	.55	5.93	.97	1.2	1.67	3.72	34.3	March	0	180.1	Pass
6	Saravana	37-A	6	17/04/13	1	17.1	38.8	8	.48	5.98	.85	1.12	1.6	3.42	35.8	March	0	181.4	Pass
7	Saravana	38-A	8	17/04/13	1	15.8	38.4	8	.52	6	.83	1.07	1.53	3.5	35.3	March	0	181	Pass
8	Saravana	39-A	8	17/04/13	1	14.9	37.9	7.6	.47	5.98	.82	1.05	1.52	3.67	34.9	March	0	180.5	Pass
9	Saravana	54-A	10	18/04/13	1	17.3	38.7	8.5	.45	5.82	.87	1.1	1.55	3.53	35.7	March	0	181.4	Pass
10	Saravana	55-A	10	18/04/13	1	14.7	37.3	7.8	.53	5.98	.9	1.15	1.58	3.62	34.4	March	0	181	Pass
11	Saravana	60-A	13	19/04/13	1	18.2	38	8.4	.53	5.98	.97	1.15	1.55	3.45	35.1	March	0	182.6	Pass
12	Saravana	61-A	14	19/04/13	1	15.6	37.1	7.4	.47	5.88	.87	1.12	1.53	3.38	34.1	March	0	181.8	Pass
13	Saravana	63-A	16	19/04/13	1	16.4	38.2	7.1	.57	6	.95	1.18	1.63	3.78	35.1	March	0	180.1	Pass
UNITS						lb in	lb in	lb in	Minute	Minute	Minute	Minute	Minute	Minute	lb in		Minute	°C	

# Advantages

## What makes MV Rheometer special ?

We all know the fact that the effects of compound variations on curing characteristics are important in compound development studies and production control. In-compound development and the composition of ingredients can vary until the desired vulcanization characteristics are achieved. Therefore, computerized Rheometer with micro-processor temperature controls is of vital importance here.

And, the Rheometer is the one and only equipment in the Rubber Industry which helps the Compounder to choose the right material and meet the requirements of the product to its end. It not only exhibits the curing characteristics of Rubber Compound but it also monitors the processing characteristics as well as the physical properties of the material.

## Let's look into the benefits of the Cure Curve

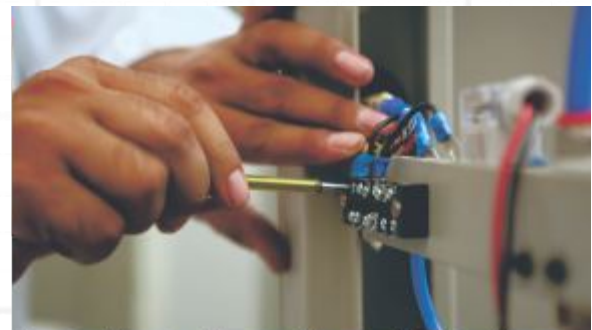
### A) Research & Development

To develop a new compound, Rheometer helps

- Defining compound's quality targets
- Designing preliminary compounds that includes selecting specific ingredients and determining each ingredient's quantity
- Costing
- Individual Testing
- Re-designing the formula till the required quality target is achieved
- Helps reducing the time taken to process and minimum wastage

### B) QUALITY CONTROL

MV Rheometer is based on internationally recognised "Statistical Quality Control" (SQC). It is of utmost importance to produce consistent quality of Rubber products and one cannot afford variations in batches. Rheometric analysis helps



### C) Process Control

MV Rheometer is widely accepted Production Control Test Equipment. It helps getting the exact and accurate processing behavior of the compound. MV Rheometer can detect the minutest of changes in the composition of rubber

### D) Effect of new Ingredients

MV Rheometer has proven to be useful to study changes in the compound and is used to study that effect.

### E) Ingredient Optimisation

The Rheometer can determine if there is any change required or done in the quantity of ingredients in the compound.

### F) Assessment of Physical Properties

MV Rheometer can also determine the physical properties of the compound.

### G) Economics

Everything said, but one may still be hesitant in investing in such instruments mainly because of its cost. Experience has shown that if Rheometer's full potential is exploited with regards to few of various advantages mentioned above, the return is quite handsome. Improved quality, minimized wastage, optimized dosage of each ingredient, choice of right ingredients, controlled process certainly makes this instrument singularly ideal for

## PERFORMANCE ANALYSIS

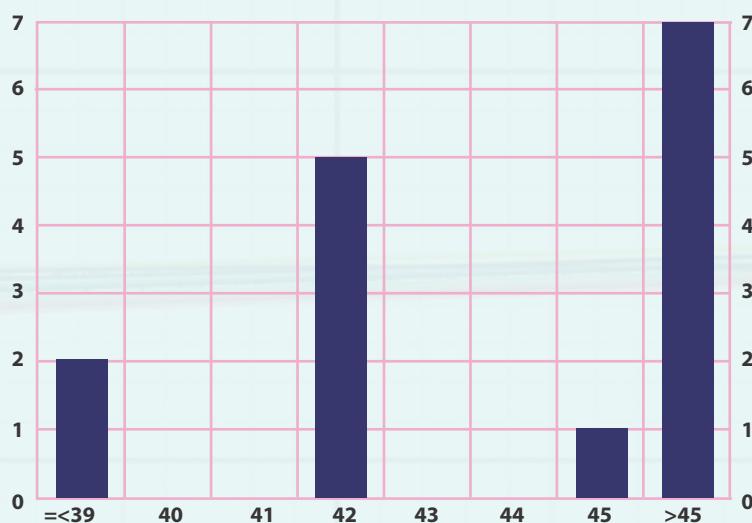
Stock - Black

Parameter - MH (lb in)

Target	42
USL	49.5
LSL	41.3
Stop	1

Value	Count
=<39	2
40	0
41	0
42	6
43	0
44	0
45	1
>45	7
<b>Total Count</b>	<b>16</b>

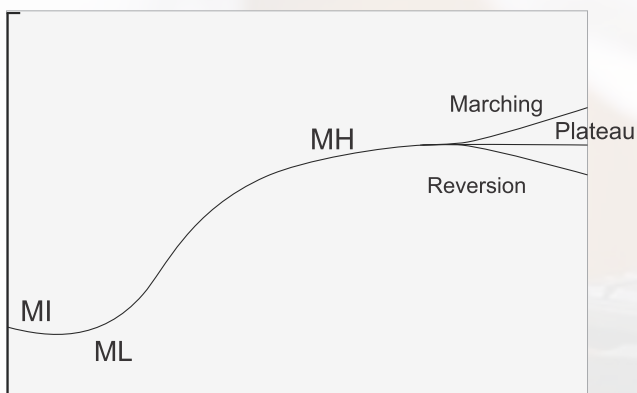
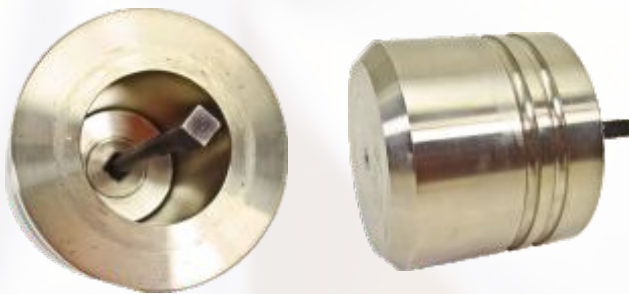
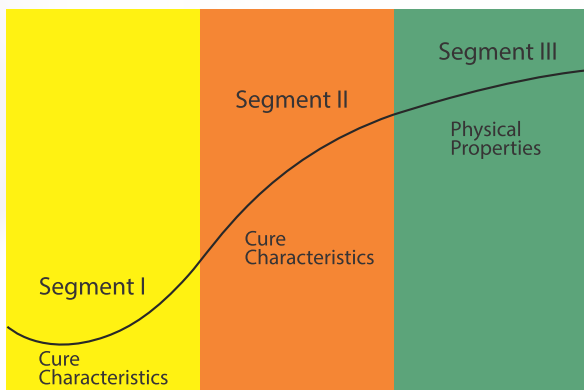
Frequency Dist. Graph



Mean	46.18	Cp	0.83
Range	8.2	CPK	0.18
Sigma	3.20	Ppk	0.39

Time<sup>3</sup> (Min) 3.5 4 4.5 5 5.5 6

# Curve segment & Cure curve types



## Curve Segment

Typically, the cure curve us shown in the fig can be divided into three segments .

**For segments I** - It to gives the information related to the processing characteristics such as the viscosity and the fluidness.

**For segments II** - It shows the characteristics of the curing rate.

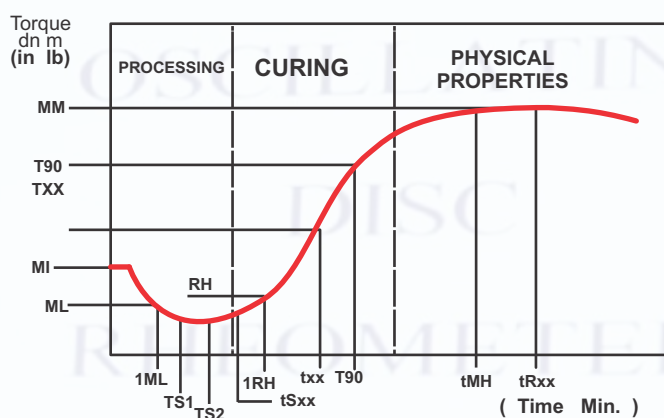
**For segment III** - It indicates the physical properties such as stiffness, hardness, strength.

## Cure Curve Types

As shown in the following picture, according to the difference of rubber compounds, the cure curve are classified typically in three types.

1. Vulcanization to equilibrium torque.
2. Vulcanization to a maximum torque with reversion.
3. Vulcanization with continuously increasing torque.

# Results Obtained with Rheometer



## The Curing Phase

During the curing phase of the curve, the cross-linking process evolves. The shape and the slope of the curve are very important because the curing curve must be designed according to the thickness of the finished part to produce and to the kind of transformation process.

Typical data that can be obtained from the curve are:

- t'10: time corresponding to 10% curing**
- t'50: time corresponding to 50% curing**
- t'90: time corresponding to 90% curing.**

This result is considered the '**optimum vulcanization time**'

**Note:** More data about the slope of the curve can be obtained.

## The Processing Curve

During which the viscous (plastic) behaviour of the compound is dominating shows rubber processability and therefore furnish useful indications about the fluency in the moulds. Meaningful results are: ML, (least torque) tS1, tS2: Scorch time: time required for the increase of 1 (ts1) or 2 (ts2) points from Minimum Torque. This number is an indication of the time required for the beginning of the process of cross linking.

## The Physical Properties Phase

The last part of the curve is an indication of the physical properties of the compound.

The maximum value of torque obtained is related with:

- **the final level of cross-linking,**
- **The quality of the polymer used**
- **The filler used**
- **The compounding process.**
- The typical result is: **MH: Maximum Torque**

After the Maximum Torque has been reached the degradation of the compound can be measured: the reversion is an indication of the resistance of the compound at high temperature and can be useful for the design of the transformation process.

**TR\_x:** Time for the torque reduction of x points

# Specification

<b>Main Power Supply</b>	AC 175-275 V, 50 Hz, 20 Amp. maximum
<b>Compressed Air</b>	60 psi (4.2 Kg./Sq. Cm.) minimum. Operating pressure controlled by Integral Regulator with Gauge.
<b>Frequency of Oscillating Disk</b>	100 cycles/min. (1.66 Hz)
<b>Oscillating Amplitude</b>	$\pm 1^\circ, 3^\circ, 5^\circ$ (Half Cycle)
<b>Temperature Control</b>	Microprocessor Controlled Calibrated Range: 100-200 Degree C Independent Upper & Lower Platen Control
<b>Temperature Sensor</b>	PT-100, Platinum Resistant
<b>Torque Transducer</b>	Directly shaft mounted in line with Oscillating Disk (Reaction Torque Sensor).
<b>Recording &amp; Display</b>	Directly On-Line Display on VGA Monitor memory Storage Data
<b>Environment</b>	Free from Dust & Humidity
<b>Panel</b>	Main Panel 1420 x 610 x 610 mm



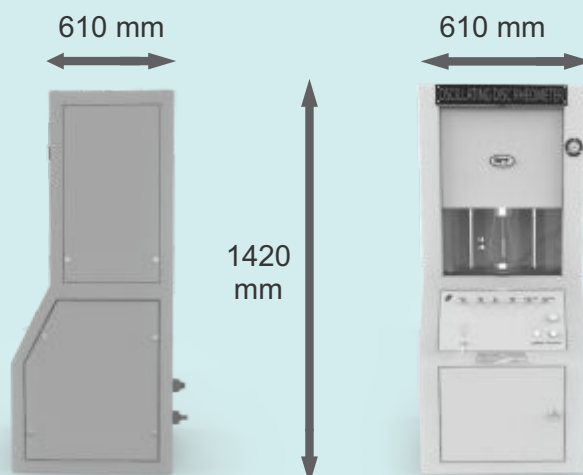
# Comparison Between MDR + ODR

## MDR

## ODR

In MDR You will get Three Graphs S', S'', Tan Delta. with TS1, TS2, TS5, TS10, TS50, TS90	In ODR you will get only one Graph.
MDR is <b>Rotor less</b> , less maintenance.	ODR is universal for all Rubber manufacturer.
Heat Recovery is very fast.	Acts as "Heat Sink-Lenghtens Temp. Recovery.
Latest Software window based.	Measuring Torque through Rotor Shaft causes problems in measuring dynamic properties.
No need of Teflon O Rings	Time required to remove sample from Rotor after completed.

**Note: ODR Value and MDR Value will not match, You have to maintain your own quality parameter because ODR Rotor Rotate at 3 degree, MDR at .5 degree.**



# Touch Screen Model

## Features

Automatic Temperature Setting Through Pc

No Need Of Temp. Controller

Temp. Controller On Screen

Latest Model With Hmi, Touch Screen

No Need Of Pc, Machine Will Run Error Free

Graph With Data On Hmi Screen

Elimination Of Pc & Temp. Controller

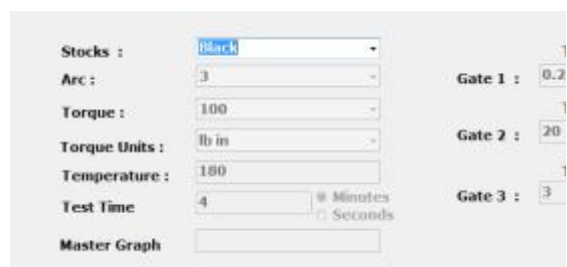
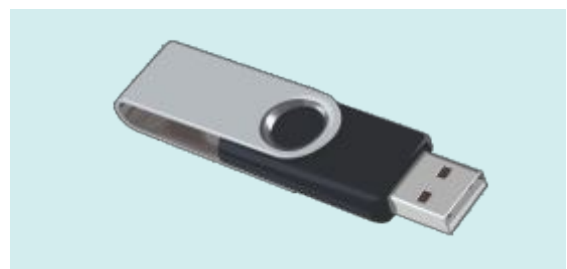
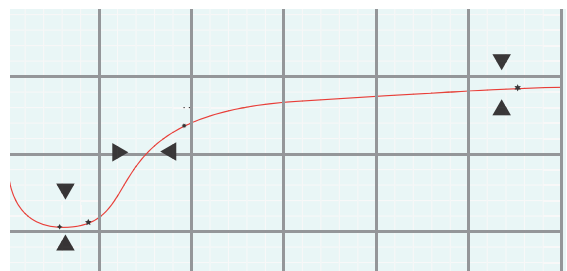
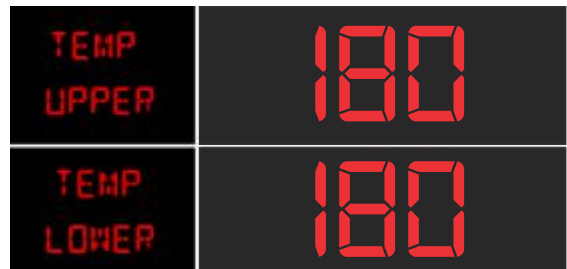
No Breakdown Due To Temp. Controller Or Pc System

Through Hmi You Can Store Data On Pen Drive And Transfer Data Any Pc

New Software User Friendly compatible With Window 8, Window X And Laptop

Machine Only Start When Desired Temperature Achieved

Temp. Recovery Very Fast



# MVO Model

## Statistical quality control

- The results are marked on the graph during display
- Each user is identified and can be given a Passwords
- 3 quality control gates (3 QC Gates)
- User can define Master graph
- Choices of selecting any parameter as pass fail criteria
- Extensive statistical analytical parameters such as CP, Cpk, Cof. of Variation, MI, MH, ML, T.MIN, T.MAX, TS2, TS1, TC50, TC90, TP, Opt. Cure Rate, End Temp., Trend, Reversion Time, Value (Bar Graph).
- User can add own comments for future references for each stock

## Printing Options

- The report can be sent to printer

## Calibration

- User friendly calibration routine for quick and easy calibration

## International quality design

- Machine design in compliance with ISO 3417
- Powder coated to withstand industrial harsh environment

## Precision torque sensor

- NPL lab certified sensor in compliance with ISO requirements
- Display of torque to manually record torque values
- Class A high temperature resistant strain gage used

## Accurate temperature control

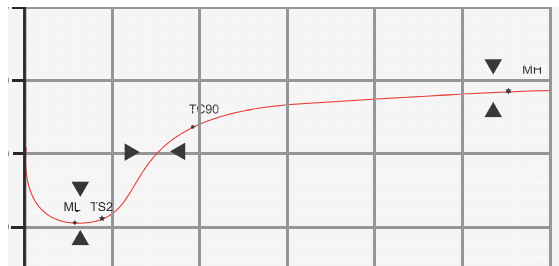
- Low wattage heater for energy conservation
- Teflon insulated rod insulator for high temperature usage

## Pneumatic system

- Precise machined pneumatic cylinders for long life.
- Machine fitted with FRL for trouble free operation
- International standard pneumatic valves for accurate control of Airline pressure
- Pressure gage for checking airline pressure

## Electrical

- Earth leakage circuit breaker incorporated in the circuit for safety.
- CE compliant electrical component used
- Long life relay
- User friendly design of electrical panels for quick maintenance
- Each circuit is incorporates separate fuse/MCB for



ISO 3417



# Mooney Viscometer

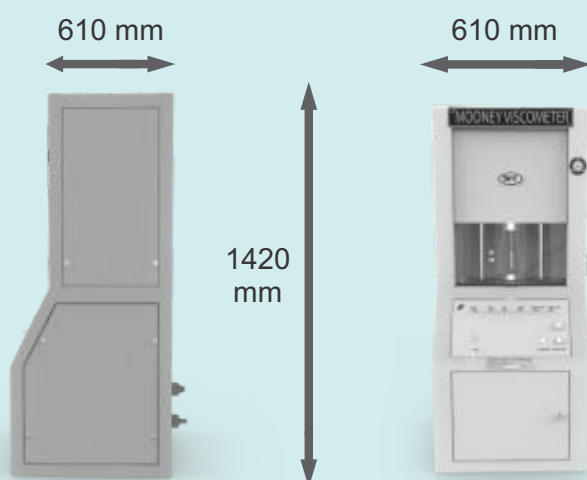


## Introduction

It is an instrument consisting of a motor driven disk within a die cavity formed by two dies maintained at specified conditions of temperature and die closure force. It measures the effect of temperature and time on viscosity of rubber or compound.

**MOONEY VISCOSITY:** It is a measure of the viscosity of a rubber or compound determined in a Mooney shearing disk viscometer. It is indicated by the torque required to rotate the disk embedded in a rubber/compound specimen and enclosed in the die cavity under specified conditions.

Viscosity of rubber or compound plays vital role in deciding its processing behaviour. In Rubber Industry rubber or compound have to undergo various processing before it can be vulcanized into its final form. Deviation in viscosity of the compound will critically alter its processibility specially in terms of calendaring, extruding or injection moulding. It is necessary that viscosity parameter be maintained within specified limits. To do this Mooney Viscometer is of vital importance. In fact viscometer has manifold advantages.



# Principle

MV's Mooney Viscometer's process includes rotation of a flat, cylindrical disk, embedded in an elastomeric specimen which is confined in a heated die cavity and exerts a shear strain on the specimen. The resistance to rotation offered by the elastomer is shearing viscosity which is proportional to mean absolute viscosity of the



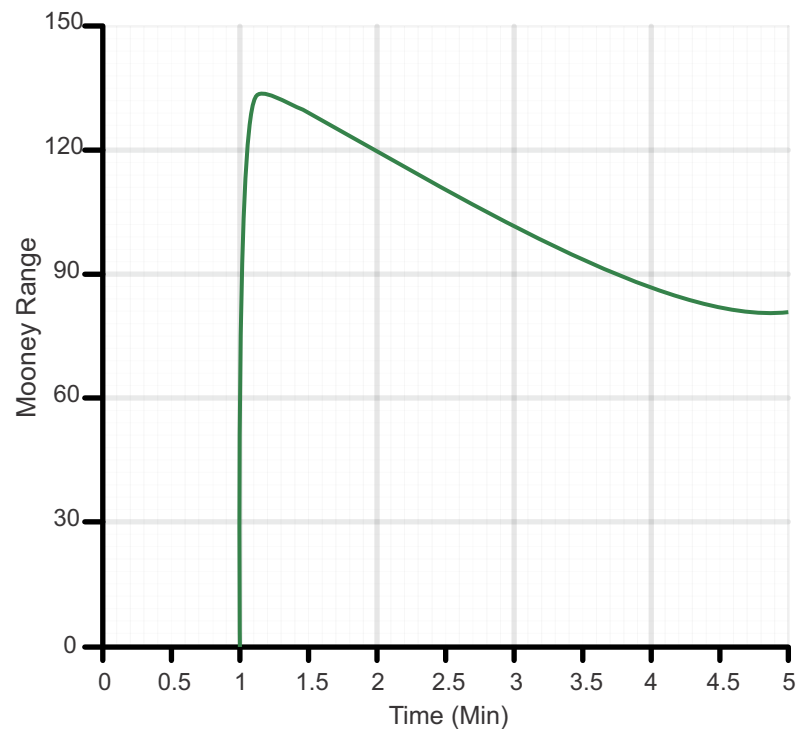
Generally, a pre-heat period is given to the elastomers, followed by which the disk starts to rotate. An initial high viscosity is recorded and the viscosity decreases to a minimum value. Viscosity that is obtained with large rotors is approximately twice those of small rotors. The complete calibration can be performed directly by Micro Vision's software.

## MOONEY REPORTS

VI	135.61		
VM	80.08		
ML(1+4)	80.08		
ML(1+8)	---		

## TIME REPORTS

T5	---		
T35	---		
$\Delta T30$	---		
Stop Time	5		
End Time.	100.4		
Status	Pass		



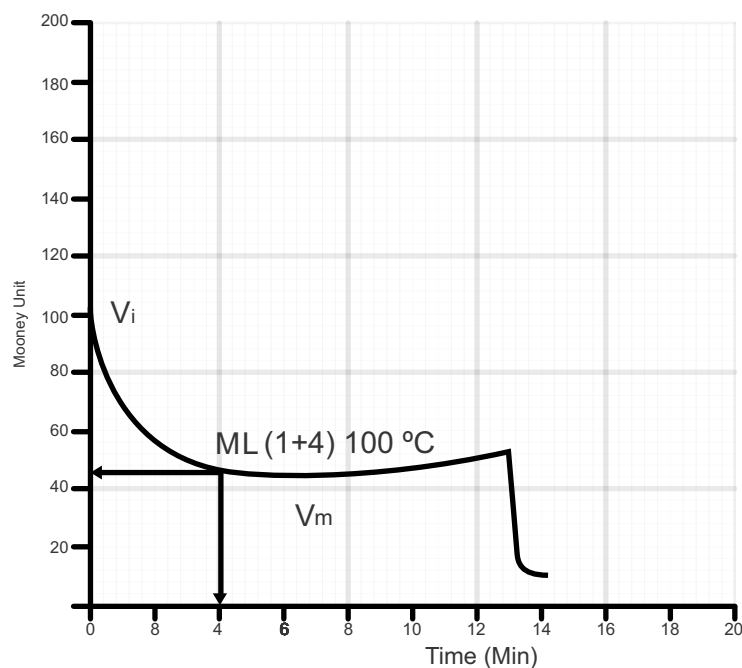
## The viscosity is reported as under:

1. Method of sample preparation
2. Mooney viscosity number
3. Rotor size
4. Preheat time.
5. Time interval to viscosity reading
6. Temperature of test

## Typical test results are stated as under :

= 50ML(I+4)100°C  
 where  
**50 M** = Viscosity in mooney units.  
**L** = Large rotor (for small replace it with 'S')  
**I** = Preheat time in minutes.  
**4** = Time in minutes after starting the motor at which the reading is taken.  
**100°C** = Test temperature.

## The test temperature and duration of test are specified in international standards

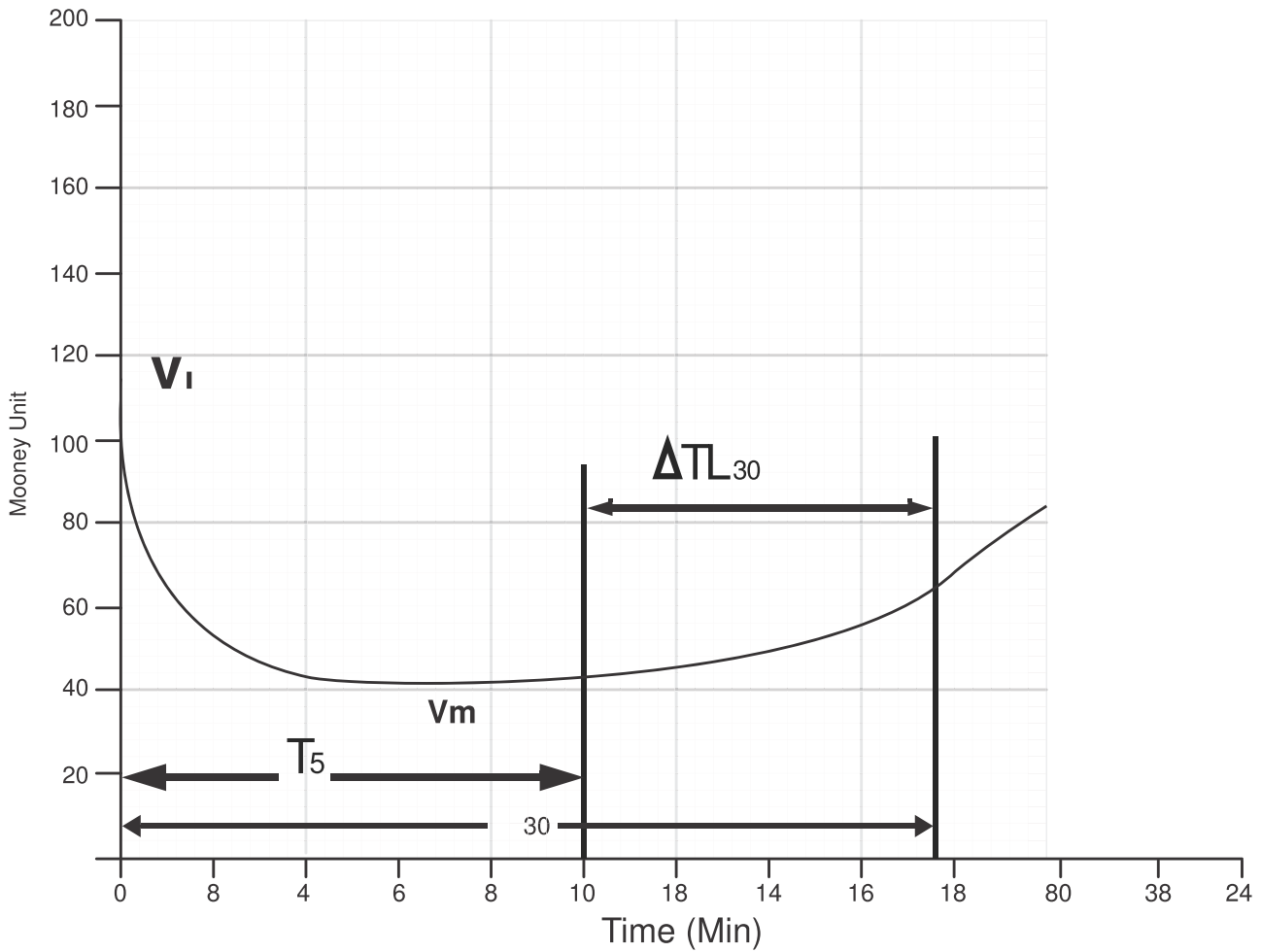


Type of Rubber	Running time (°C)	Test Temperature of rotor (Min.)
NR (Natural Rubber)	100 ± 0.5	4
IIR, BIIR, CIIR	100 ± 0.5 125 ± 0.5 *	8
EPDM, EPM	125 ± 0.5	4
Other Synthetic rubbers black master batches, compounder rubber and reclaimed material	100 ± 0.5	4

\* Temperature of 125°C should be used whenever the specimen has viscosity higher than 60ML(I+8)100°C.

## Mooney Scorch Test:

Elastomers which vulcanize at the experimental temperature the viscosity will increase from minimum value at the induction or scorch point. The rate of increase in viscosity with time is a measure of cure rate of elastomer. This cure characteristics may be determined from plot of viscosity v/s time graph.



The following information is obtained from the plot:

$V_i$	Initial viscosity
$V_M$	Minimum viscosity
$T_5$	Time to five point rise from $V_m$ (time to scorch)
$T_{35}$	Time to thirty five point rise from $V_m$
$DTL_{30}$	$T_{35} - T_5$ Rate of cure or cure Index - for large rotor
$DTS_{15}$	$T_{18} - T_3$ Rate of cure or cure Index for small rotor

## Sample Preparation

The Mooney Viscosity is affected by the manner in which the rubber is prepared and the condition of storage prior to test. Accordingly, the prescribed procedure should be followed rigorously as given below in the chart.

The test piece consists of two disks of elastomer of 50mm diameter and approximately 6mm thickness sufficient to fill completely the cavity of the viscometer. The specimen should be free from air and from pockets that may trap air against the rotor and die surfaces. A hole is pierced through the centre of one disk for insertion of rotor stem. The specimen be allowed to rest at least 30 minutes at standard laboratory temperature before the test and tested not later than 24 hours after homogenisation.



### Method of sample preparation for Mooney Viscosity test : (as per ISO 1796)

Type of rubber	Mill roll Temp. (°C)	Nip width (mm)	No. of Passes
NR (Natural Rubber)	70 ± 5	1.3 ± 0.15	10
IIR, BIIR or CIIR	No milling	-	-
BR	35 ± 5	1.4 ± 0.15	10
CR	20 ± 5	0.4 ± 0.05	2
EPDM, EPM	35 ± 5	1.4 ± 0.15	10
Black Master-batch	50 ± 5	1.4 ± 0.15	10
Compounded rubber & reclaimed material	No milling	-	-
Other synthetic	50 ± 5	1.4 ± 0.15	10

When Butyl rubber (IIR, BIIR, CIIR) are tested in crumb form they must be massed as “other synthetic rubber”)



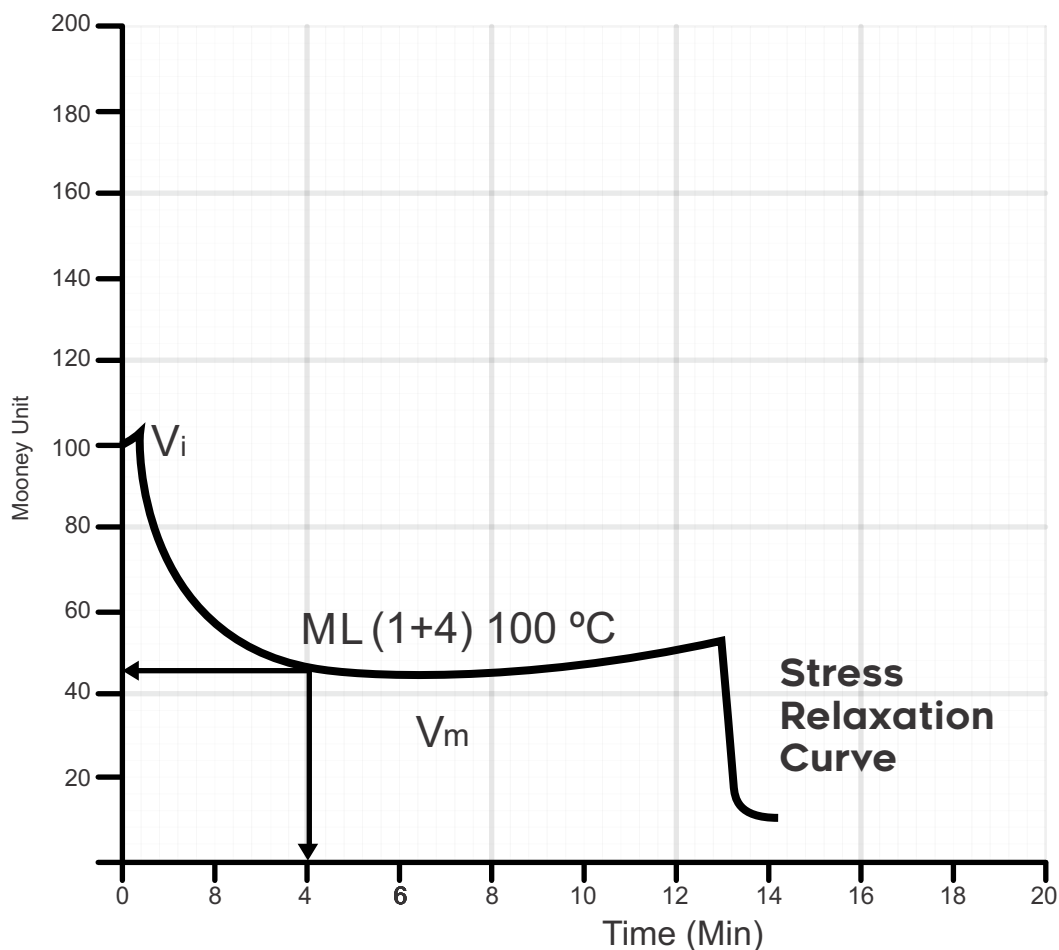
## Delta Mooney

It is the difference between Mooney viscosity at 1.5 and 15 minutes. It reflects the ratio of breakdown to buildup. It is taken as a measure of processibility of the rubber, a higher value being indicative of good processing behaviour.

## Stress Relaxation Test:

Extension of the basic Mooney viscosity test to include relaxation can generate information on both raw polymer and compounded green stock rheological behavior. The measured stress relaxation data obeys the power law

$$ML = Kt^{-a}$$



where ML is the decaying Mooney stress, t is the relaxation time and K and a are characteristic parameters of the relaxation curve. K is a measure of stiffness of the rubber and is proportional to Mooney viscosity ML 1 + 4 or ML 1 + 8. The value "a" is a measure of speed of relaxation, which is a combination of viscous and elastic response of the material (the slope of the log ML vs. log time plot). Parameter "a" correlates with compound processing behavior (milling, extrusion, die swell) and raw polymer molecular weight distribution.

This test helps us to study co-relation between Viscosity and Elasticity of a batch of rubber. It is performed at the end of Mooney Viscosity Test when the rotor is stopped suddenly and the torque is continued to be monitored over a given period of time. This can be calculated as the % torque drop (Mu) achieved after a given period of relaxation.

# Advantages

## **A) Processing Behaviour:**

The invention of new polymers and rubber chemicals compounder is faced within problem of choosing the right ingredient and its dose, specially with respect to its processing behaviour during calendering, extruding or injection moulding. As the processing behaviour of the compound changes with respect to its temperature, one has to predict how it is going to behave during processing. With the help of Mooney Viscometer one can predict its behaviour with respect to temperature and time during processing.

## **B) Research & Development:**

The most tedious part in compounding is to develop a new compound to meet the desired results.

It involves:

- a) Defining required quality targets
- b) Designing preliminary compounds, selecting specific ingredients and determination of dosage of each ingredient. Checking the cost factor.
- d) Testing each compound.
- e) Re-designing the formulation till quality target is achieved. The process involves enormous work which is time consuming, expensive and requires skill. With the help of Mooney Viscometer, one can do all this exercise quickly with minimum wastage of materials.

## **C) Quality Control:**

In order to produce consistent quality of Rubber products, it is of vital importance that compounded rubber is of consistent quality. As the compound is mixed in batches, batch to batch variation, if any, needs attention in controlling quality of each batch. If randomly selected batches are subjected to Viscosity analysis, one could in a large sample size, workout upper and lower control limits, range, mean and standard deviation, with reference to Viscosity parameters. Each batch on testing can be classified on Pass/Fail criteria depending upon the quality control limits. Based on this, the internationally acceptable control called "Statistical Quality Control" (SQC) can be designed. Computerized data analysis system of Mooney Viscometer viz. "Viscosoft" is ideal in this

## **D) Grading of Rubbers:**

Mooney Viscosity of the rubber is one of the important parameter in grading the quality of rubber. And it is also important parameter in choosing the rubber quality for application.

## E) Choosing the Correct Polymer:

While developing new compound one has to choose the right polymer for the end use. Each polymer again is sub divided into various types depending upon their physical and chemical properties. Viscosity is of paramount importance before selecting its acceptability in the formulation. A high viscosity polymer can be selected where high filler loading is desired and a lower viscosity polymer is selected if other properties are important.

## F) Economics:

Everything said, but one may still be hesitant in investing in such instruments mainly because of its cost. Experience has shown that if Mooney Viscometer's full potential is exploited with regards to few of various advantages mentioned above, the return is quite handsome. Improved quality, minimized wastage, optimized dosage of each ingredient, choice of right ingredients, controlled process certainly makes this instrument singularly ideal for any Rubber Industry.

## Principle

The viscosity of rubbers can vary dramatically with deformation rate, and thus their rheological properties can not be defined by measuring viscosity at one rate. One of the most important instruments in the rubber industry is the Sharing Disc Viscometer. A knurled disc within a serrated cavity and measurement of combined effect of shear rate and shear stress are recorded as a function of time. The shear rate is expressed as :

$$y = \frac{r_1 \Omega}{h} \quad \left| \quad \sigma = \frac{c}{3 + \frac{1}{\eta}} + \frac{4\pi \eta b r_1 h}{1 - \left(\frac{r_1}{r_2}\right)^{2\eta}}$$

and shear stress is expressed as

Where

$r_1$	=	rotor radius
$r_2$	=	stator radius
$b$	=	rotor thickness
$h$	=	clearance, top & bottom between rotor and stator
$\Omega$	=	angular velocity of the rotor
$c$	=	driving torque
$\eta$	=	material constant

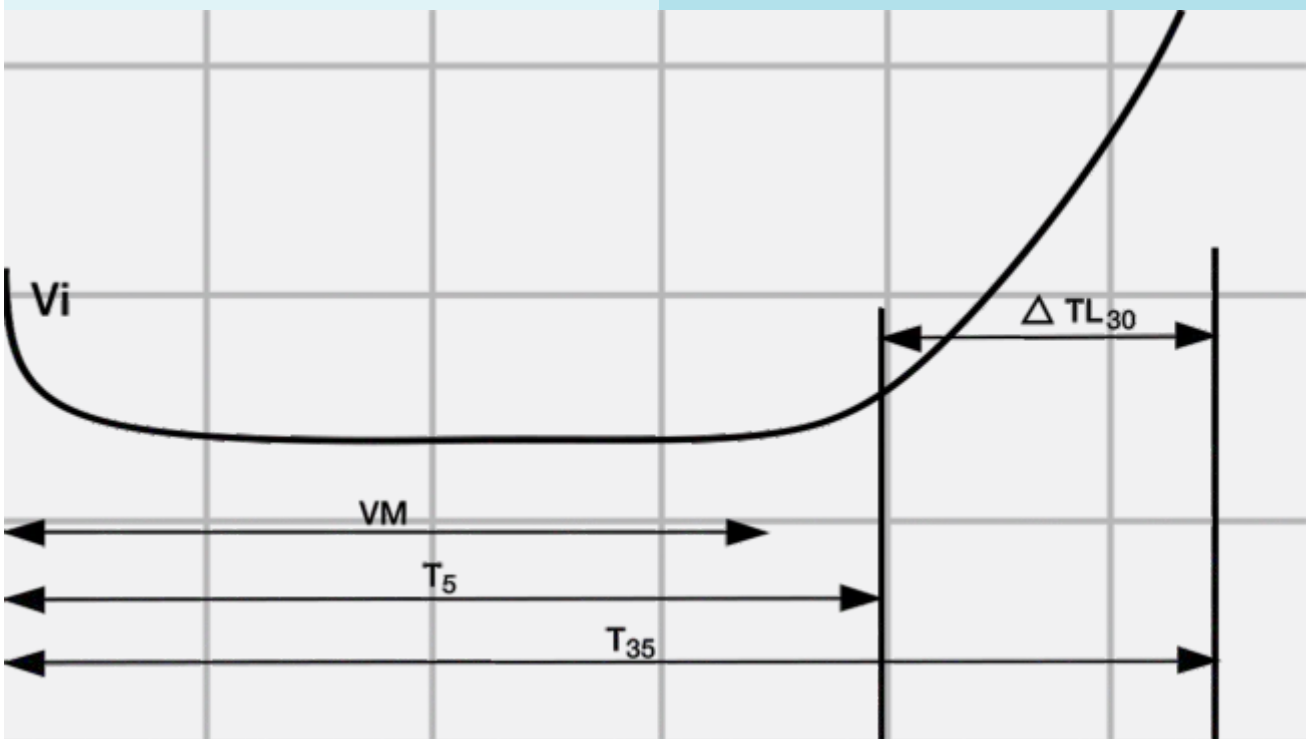
The combined relation is converted into mooney number with the help of standard torque  $84.6 \text{ Kg cm} = 100$  Mooneys.

# Specification

Standards	According to International Standards ----- ASTM D1646, ISO289
Rotor Speed	2.0 ±0.02 RPM
Mooney measurements	Choice of 3 readings
Temperature	PT 100 Platinum resistor microprocessor controlled Calibrated range 50° to 200° C. Independent Upper and Lower Platen Control
Torque transducer	Reaction torque sensor. Four Arm temperature compensated semi-conductor strain gage bridge.
Recording & Display	Computer Controlled testing. At the end of the test the computer calculates the result automatically and display it.
Printed Data	Color Inkjet Printer
compressed air supply	60psi (4.2 kg/sq.cm) minium operating pressure.
Enviroment	Dust free reasonably controlled ambient temperature and humidity
Net Weight	Main machine 200 kg

# Features

Provision Quality gates (Pass/fail criteria)	Flexible Testing timings On line display of Mooney vs Time graph
Statistical Analysis. (Sigma, Range, Mean, Standard deviation)	Easy to operate and calibrate
Output data reports- VI, VM,ML, (1+4),ML(1+8), T5, T35, T30, Stop Time, End Time and Status, Sp, Spk, Values (Bar Graphs)	Precision torque sensor
Temperature graph will appear along with Mooney graph	Accurate temperature control
High capacity of data storage and Retrieval.	Pneumatic system



# Moving Die Rheometer

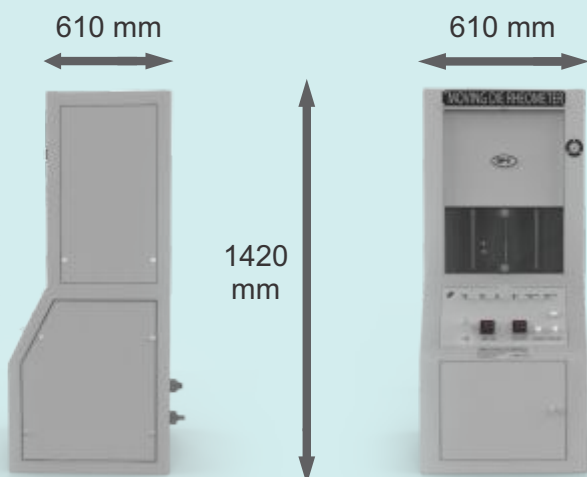


## Introduction

Micro Vision's high precision instrument – Moving Die Rheometer offers sensitivity and reliability of measurement for the evaluation of Vulcanization properties of rubber.

Using world-class technology, it has been developed to determine the elasticity of vulcanization, the cure rate, cure speed and examine the behavior of rubber mixture post-vulcanization. All the more, with MV's Moving Die Rheometer, it is also now possible to now determine the viscous and elastic fraction of the rubber mixture.

With the help of our product, an expert can easily monitor the initial trough i.e. processing behavior of the compound and the final shape of the curve.



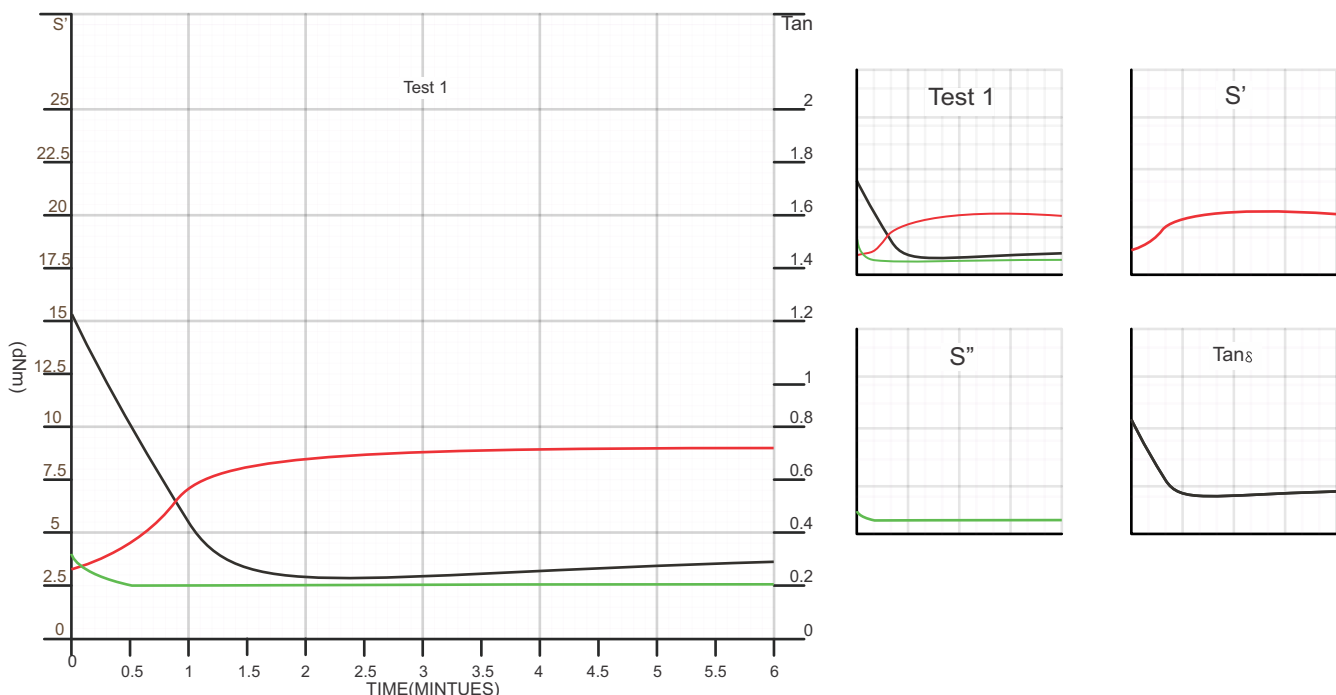
# Principle

## How does it works ?

The rubber test piece is contained in a unique designed bi-conical die capacity and also maintained at a stable die temperature. Through the oscillating lower die at small rotary amplitude, a precise transducer will measure the reaction torque of vulcanizing rubber. MV's accurate temperature control and torque measurement ensures the faster temperature response, greater repeatability and reproducibility of test results. Resulting in measurement of accurate scorch time and cure time, it can accurately measure and analyze the viscous and elastic properties of vulcanizing rubber.

## Definition of $S'$ and $S''$

$S'$  is called the storage modulus, elastic modulus or in-phase modulus.  $S''$  is called the loss modulus, viscous modulus, or out-of-phase modulus. All of these terms have been used to mean the same thing. The units of  $S'$  and  $S''$  in the product family instruments are in-lbs. these are units of torque. They can also be in dNm which are also torque units. These are scientific instruments on the market which also provide a storage and loss modulus but they use the label  $G'$  and  $G''$  or  $E'$  and  $E''$ . The letter G is used to refer to the shear modulus if a material in modulus units such as Pascal's or pounds per square inch. The letter E refers to the tensile modulus.



## Results Variation:

The minimum torque is proportioned to the viscosity of the uncured compound. The scorch time is a measure of process safety. The full curved torque is a measure of shear modulus or stiffness of the compound.

As per "Rubber World" 1990 January article "New Rheometer and Money Technology" by Patrik J.DiMauro, Monsanto Company, and J. Derudder and J.P.Etienne, Monsanto-Europe, one can appreciate that the results variation between original model and later models is quite substantial especially the times values. This is purely because of better temperature control and recovery Tests conducted on a SBR compound at 177 C in 50 new machines of each type i.e. ODR and MDR, the difference can be summarized as follows:

### 1. Torque Values:

ML is lower in ODR 2000 then R100S, MH is slightly higher in ODR 2000 then R100S. ML & MI-1 are much lower in MDR due to different design of machine and the dies.

### 2. Time Values:

Time values are faster in MDR then ODR

### 3. Sensitivity:

The sensitivity of the machines with respect to variation in ingredient was also assessed and it was found that the difference between R-100S, ODR and MDR was insignificant. Any difference noticed was purely due to better temperature control and recovery.





## Reduced Operation Time:

In MDR Directly heated dies reduce testing time and allow 25-50% more tests than conventional ODR

Easy sample removal from the die.

Self-calibrating temperature setting.

## Operation:

"MV" Moving Die Rheometer (MDR) measures the cure characteristics of compounded rubber by using a sealed rotor less moving die system. At the start of a test sample is loaded between the heated dies which are closed pneumatically after the protective shield has been automatically lowered. The lower die is then oscillated through a preset angle (0.5 C). The lower die oscillates at 1.66 HZ. The reaction torque measurement system of the MDR eliminates mechanical friction to provide precise values for elastic modulus  $S'$  (torque) and viscous modulus  $S''$ . The reaction torque transducer measures the torque through the sample from the lower die.

The signal of force (torque) is sensed by the sensor, converted volts and then through ADC fed into the computer to draw torque against time cure. The Moving Die Rheometer sealed, rotor less, moving die system has improved capability to detect compound differences. It minimizes the sample slippage at high strains as compared with unsealed system.

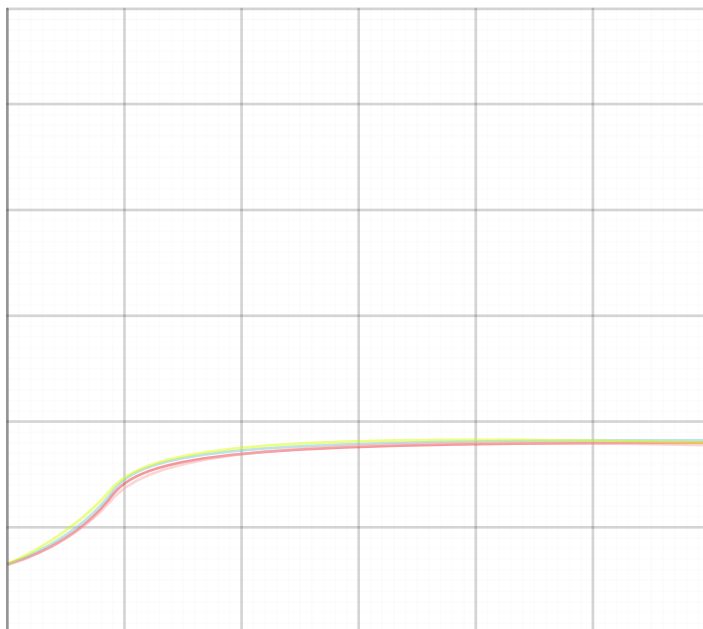


# Specification

Oscillation Frequency	100 cycles per minute( 1.66HZ)
Oscillating Amplitude	±/- 0.5, 1, 3 (half cycle)
Sample Volume	Approximately 6 cm
Temperature	Microprocessor Controlled, Calibrated Range100-200 Degree Independent Upper & Lower Platen Control
Electrical	220 Volts AC 60HZ, Single Phase
Air Pressure	60psi minimum
Printed Data	Torque S', @ML, S''@ML, Tan Delta@ML, S'@MH, S''@MH, Tan Delta@MH, Ts1, Ts2, Ts5, Tc10, Tc50, Tc90
Computer Specification	( PC) any Dual Core
Wt.	200 KG
Panel	1420 x 610 x 610 mm

# Features

<p>Unique Die Structure and Accurate Torque measurement system provides</p>	<p>Our Unique designed die structure provides simple and easy sample piece loading and removing</p>	<p>It makes sure that the test specimen in the die cavity are held firmly for accurate measurement</p>	
<p>better sensibility</p>	<p>The new improved rotor less cavity moving system ensures the stable cavity pressure during the test and provides accurate viscoelastic properties of rubber compound at vulcanization stage</p>		
<p>Elastic torque curve</p>	<p>Viscous torque curve</p>	<p>Upper/Lower die's temperature curve</p>	<p>Tan delta curve</p>



Multiple Graphs

# 2017

**Micro Vision Enterprises is launching new models of ODR, Mooney & MDR in 2017 with Touch Screen Panel .**



## USP's

- ★ Latest Model With Hmi, Touch Screen
- ★ On Screen Temp. Controller
- ★ No Need Of Pc, Machine Will Run Error Free
- ★ Graph With Data On Hmi Screen
- ★ No Breakdown Due To Temp.
- ★ Controller Or Pc System
- ★ Through Hmi You Can Store Data On Pen Drive
- ★ Faster Temperature Recovery



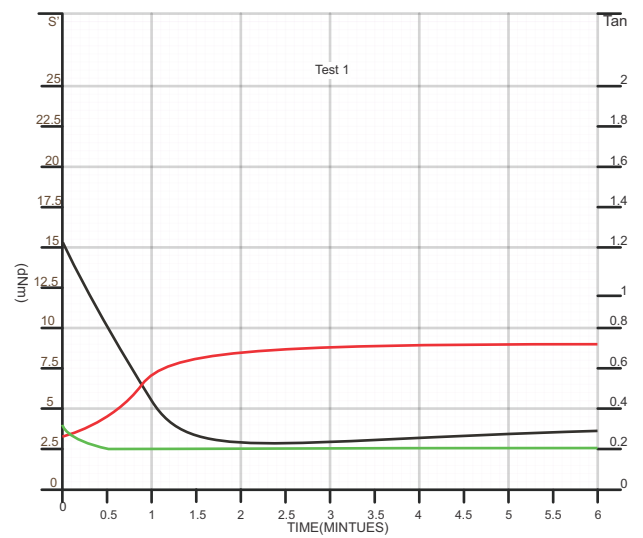
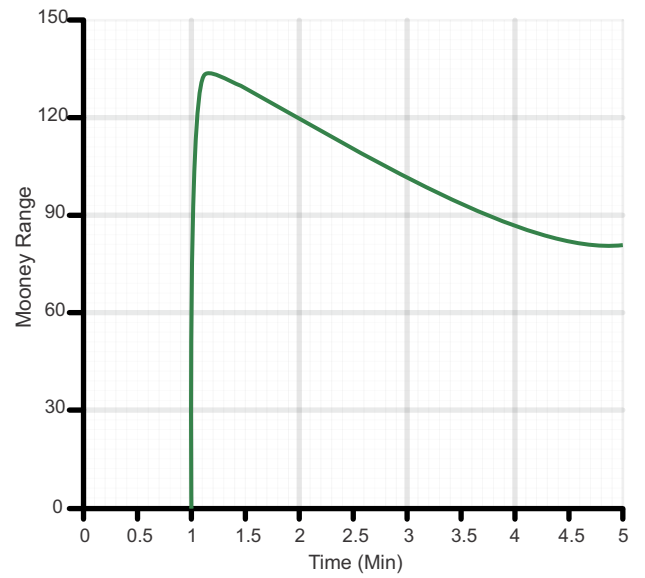
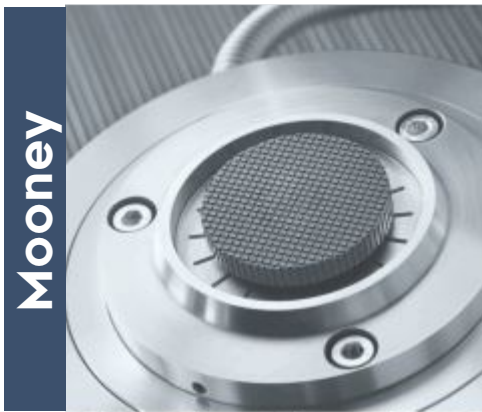
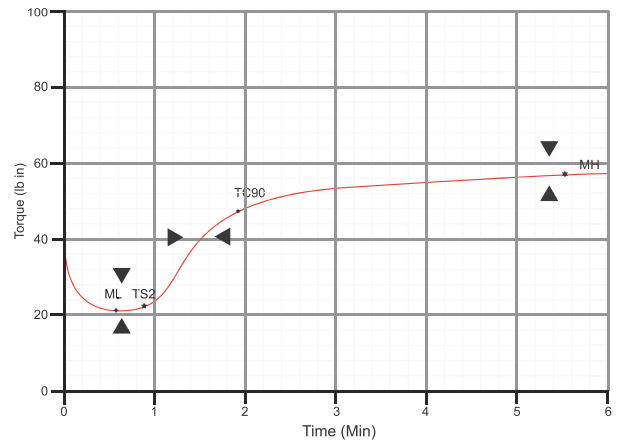
OSCILLATING DISC RHEOMETER



MOONEY VISCOMETER



MOVING DIE RHEOMETER



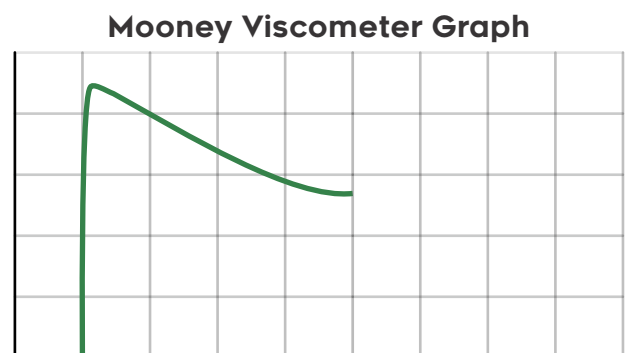
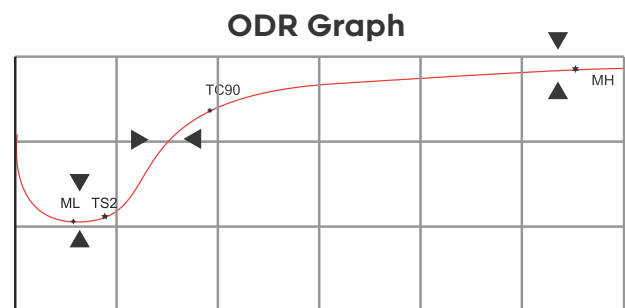
# Two-in-One Rheo + Mooney



## Introduction

Micro Vision's Two-In-One is the first Indian Rheometer plus Mooney Viscometer machine introduced in India. It is efficient, reliable and convenient rubber testing machine that is used to extract the exact information and analysis of unvulcanized rubber compound.

Moreover, it serves a dual purpose by interchanging a few key components. There is no denying to the fact that Rheometer and Mooney Viscometer are very similar in operations but have different ways to measure the rubber specimen properties.



730 mm

660 mm

1665 mm



# SPECIFICATION

Oscillating Disc Rheometer			Mooney Viscometer		
A.	Sample Volume	Approximately 8 Cm	A.	Mooney measuring range	2 to 200mu
B.	Oscillating Disc frequency	100 cycles/min.(1.66Hz).	B.	Pre-Heat Time	0 to 60 sec.
C.	Oscillating Amplitude	+1°, 3°, 5° (Half Cycle).	C.	Rotor Size	Large and Small
D.	Temperature control	microprocessor. Controlled Calibrated Range: 100-200°C Independent Upper & lower Platen control	D.	Rotot Speed	2.0 + 0.02r.p.m.
E.	Temp. (Sensor)	PT-100	E.	Drive motor	Synchronous geared motor
F.	Torque transducer	Directly Shaft mounted in line with Oscillating disk (Reaction Torque Sensor)	F.	Temperature	PT-100 Microprocessor Controlled Calibrated Range 5° to 200° C. Independent Upper and Lower Platen Control.
G.	Recording & Display	Directly On-line Display on VGA Monitor Memory Storage Data Automatic Computation Results.	G.	Temperature Control	PID temp. Control. + .05°C
H.	Printed Data	Color Inkjet Printer	H.	Torque Transducer	Reaction Torque sensor.
I.	Main power supply	AC175/275V, 50Hz, 20Amp. Maximum.	I.	Recording & Display	Computer controlled tersting VGA Monitor, Memory data. Automatic computation of results multiple display of graphs.
J.	Air Pressure	60psi (4.2 kg/sq.cm) minium operating pressure controlled by Integral Regulator With gauge	J.	Printed Data	Color Inkjet Printer
K.	Enviroment	Free from dust & humidity.	K.	Main power supply	220 Volts, 50Hz
L.	panel	(72/24/24) Inches 1830/610/610 mm	L.	Air Pressure	60Psi (4.2 kg/sq.cm.) Minimum. Operating Pressure controlled by Regulator with gauge.
M.	Net Weight	300 kg	M.	Enviroment	300 kg

# Upgradation of old Rheometer



Micro Vision has its own homegrown software in Visual Basic that runs in Windows 10.

Our software is designed keeping in mind its compact unit along with hardware (Interface Unit). Old Rheometer is upgraded by installing our software and hardware. Torque Sensor cable which is attached with old Rheometer is now connected with our Interface unit which is in a small box (Length 14", width 7", Height 6").

**Old Version Rheometer**



**Upgraded Version Rheometer**







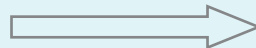
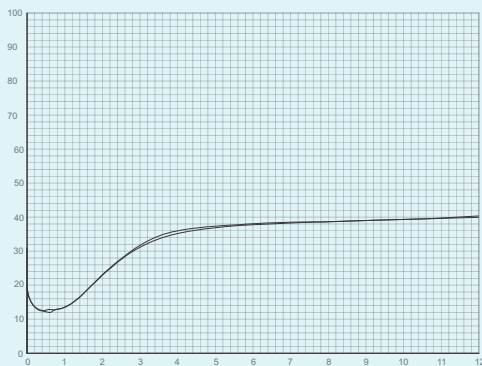
Another cable (Serial Port RS232) is connected from the small box to one's computer. After the successful Up-gradation of R-100 Rheometer with computer connectivity, the results are obtained in the form of Online Rheograph.

With MV's upgraded Rheometer comes a CD which you can install in any system but will run with our interfacing unit.

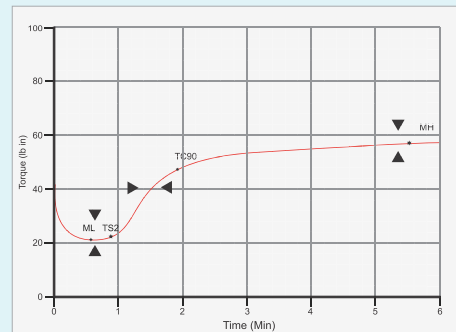
Our working Upgraded-Rheometer includes the following in perfect order:

- i) Motor, Torque Sensor and electric connections
- ii) Rotor (Oscillating Disc) and Lower & Upper Die.
- iii) Pneumatic Air Line, Valves.
- iv) Aluminum Platen attached with Pneumatic Cylinder.

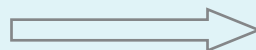
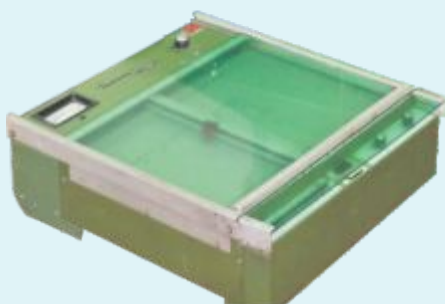
### OLD Rheometer Graph



### Upgraded Rheometer Graph



### Old Thermologer for Graph creation



### Pc for graph Creation



# Ozone Test Chamber



## Introduction

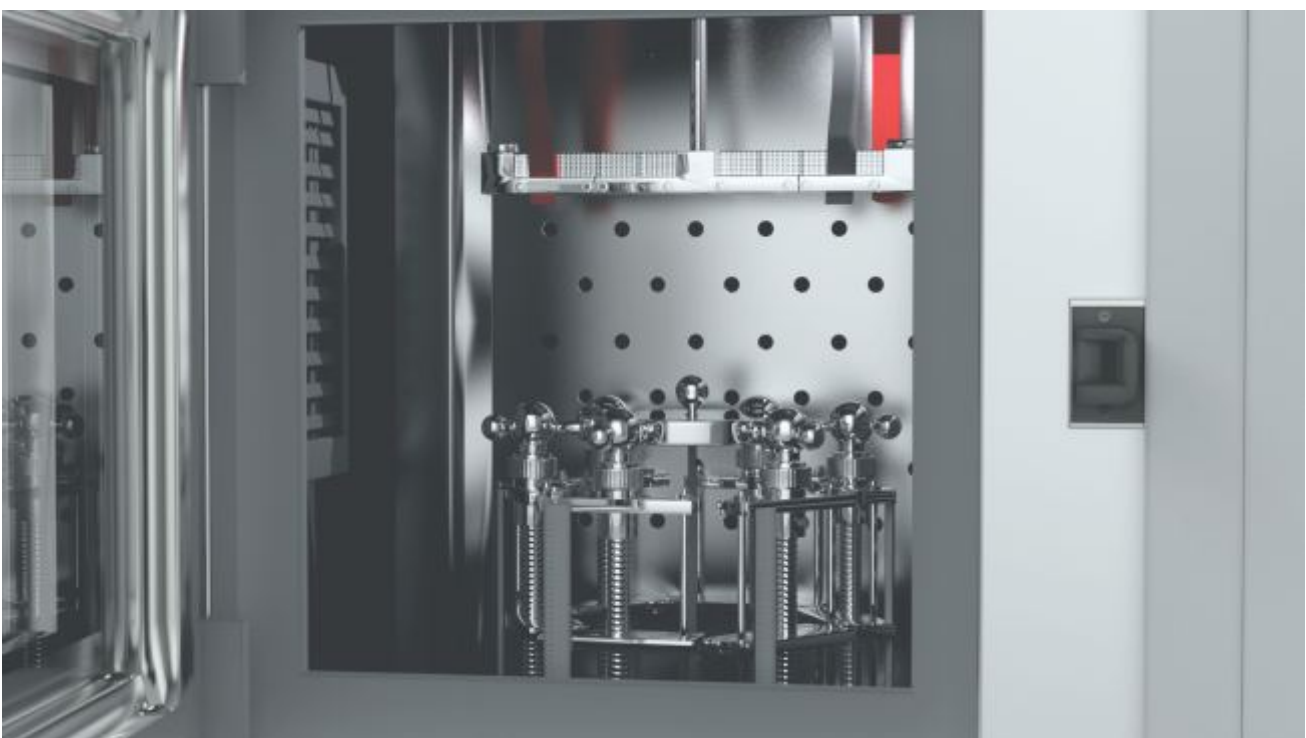
The chamber housing is manufactured with 16 gauge heavy duty steel and is completely welded for strength and reliability. The Siemens grey powder coated finish provides long lasting corrosion protection. Type SS-316 stainless steel interior provides excellent corrosion resistance to ozone. The chamber has compact fiberglass insulation to maintain uniform temperature and minimize heat loss. Front door is provided with a silicone seal for positive sealing and has AIR FLOW SYSTEM.



# Principle

First, fresh air is drawn into the system with a rotary vane type Gast oil less air Blower. Felt filters on both the intake and exhaust sides of the blower remove particulate contamination. The rate of airflow is observed on a Rotameter and set with the air flow Control, a valve in the Blower by-pass line. Air leaving the Rotameter then, passes in small parts through the computer controlled regulator over the ultra-violet lamp and in large parts, through a lamp bypass line. The Ozonized air from the lamp is remixed with the bypassed air and enters the test compartment circulation system. A freshly Ozonized airflow replenishes the air in the test compartment approximately once a minute at the recommended flow rate of six cubic feet per minute. Only fresh air is passed over the ozone source as recommended by ASTM. Air in the test compartment is exhausted outside and is not re circulated over the ozone source.

Plenum chambers located on the bottom of the stainless steel test compartment direct the Ozonized air through it. A wheel-type blower in the plenum chamber provides two-feet/air recirculation velocity over the test samples. The blower wheel is shaft-mounted with the drive motor mounted outside the test compartment, as required for the ASTM tests a glass observation panel. MV's Ozone Test chamber is available at very competitive prices and is known widely for their easy handling, operation and lesser maintenance cost.



# Specification

Consisting of : Chamber Size :	500x500x500MM (SS-316L)
Ozone Concentration	(50 to 100 PPHM)
Temperature	(Ambient to =50 degree C)
Concentration sensing system	50-100 pphm
Measurement accuracy in standard models	$\pm 2$ % resolution : 0.1 pphm
Humidity sensor	HS series capacitive sensor
Warm up time	96 hours(first time) 1 hour(optional)
Range	50- 100 pphm
Power supply	(220VAC/110VAC selectable)
Required flow Rate	1 LPM

# Features

PLC Controlled	Static Deformation Testing	U.V. Based Ozone
Semiconductor Ozone Monitor & Controller (50-500 PPHM)	Computerized Data Logging	Chemical Concentration Ozone Monitoring for calibration
PID Controlled		



OZONE

# Carbon Black Dispersion Analyser

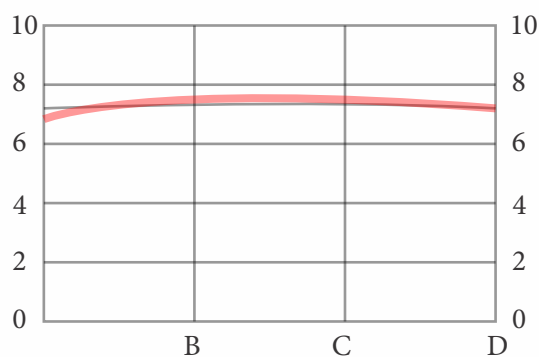


## Introduction

The New Millennium brings new challenges and new parameter this to meet the same, accurate testing methods have become an essential prerequisite to meet the enhanced quality challenges. Micro vision Enterprises presents you the DISPERSION ANALYZER. The internationally accepted technology is totally computerized controlled and is the only one of its kind in the rubber industries which helps you to identify the perfect mix of material and doze to suit the end product and its parameter .Since Dispersion of Carbon black in rubber is directly related to quality, it is important that the best possible dispersion be obtained. Agglomerates of black in the range of 10 mm or greater are of the most damaging. A visual photograph can easily pickup this poor dispersion of black in the compound.

## Principle

A test piece of approximately 30×15×2mm out of a 2mm thick rubber slab is cut with the help of a sample cutter provided with the system. This sample is mounted on the sample-holder and positioned under the microscope for inspection. To achieve a magnification of 30× a Japanese CCD Camera with lenses is provided with the system. The photograph is captured by the customized software supplied along with the system. In the software, the standard photographs for Comparison with the sample are also available to make a quick decision of the rating of the dispersion.



Dispersion Analyzer Graphical Data

Sp.No.	Rating	Status
13-A	6.9	
13-B	7.3	
13-C	7.4	
13-D	7.2	
Mean	7.2	

Dispersion Analyzer Data

# Specification

<b>Standard reference:</b>	ISO 11345	<b>Weight (Approx):</b>	15 kg
<b>Sample Cutter:</b>	Provided with spare blades	<b>Magnification Interface:</b>	30x
<b>Focus Setting:</b>	Automatic	<b>Power Requirement:</b>	240, 50Hz
<b>Computerized Dispersion Rating:</b>	<b>Dispersion Classification:</b>		<p><b>Text picture:</b> Put the specimen on the measuring platform. By using 45° light to illuminate the specimen and to enlarge the captured image displayed along with reference standard image</p> <p><b>Reports:</b> The Dispersion Analyzer performs “Statistical Analysis of result” and can represent the data in graphical form if controlling within set limits.</p>
9-10	Excellent		
7-8	Good		
5-6	Acceptable		
3-4	Poor		
1-2	Very Poor		

ISO11345 B  
Rating - 7



Test Sample - C  
Rating - 7.4

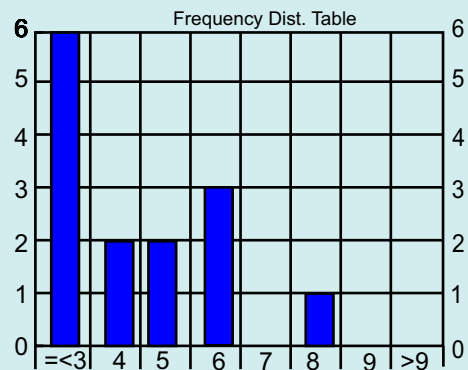


Target	6
USL	7.2
LSL	1
Step	1

Frequency Dist. Table	
Value	Count
=<3	6
4	1
5	1
6	2
7	0
8	1
9	0
>9	0
<b>Total Count</b>	<b>11</b>

Meanu	3.14	Cp	0.89
Range	6.2	Cpk	0.07
Sigma	2.33	Ppk	0.31

## PERFORMANCE ANALYSIS



# Tensile Testing Machine

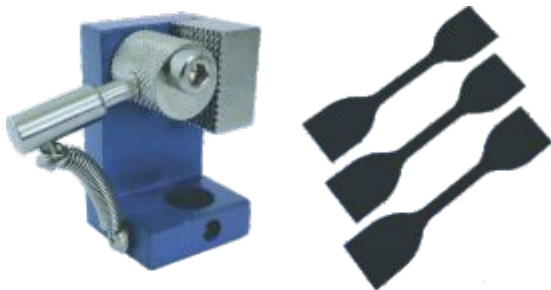
## U.T.M



## Introduction

Micro Vision's tensile testing is one of the most fundamental science test in which a sample is subjected to a controlled tension until failure. The results from the test are commonly used to select a material for an application, for quality control, and to predict how a material will react under other types of forces.

Our highly researched machine enables you to directly measure the ultimate tensile strength, maximum elongation and reduction in area.

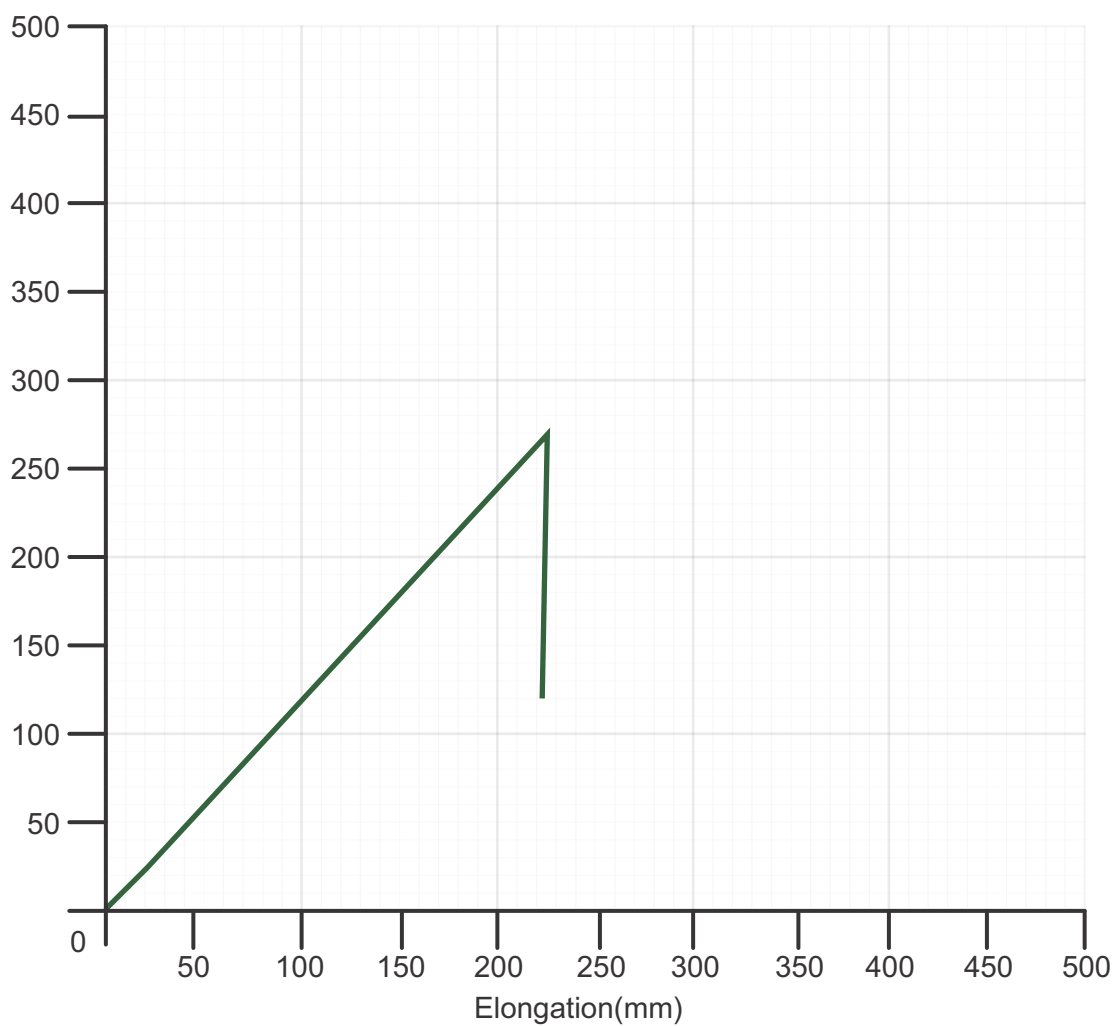




# Principle

The test is made by gripping the ends of a suitably prepared standardized test piece in MV's tensile test machine and then, applying a continually increasing load. Our highly customized software will help you show the real time load versus elongation graphs.

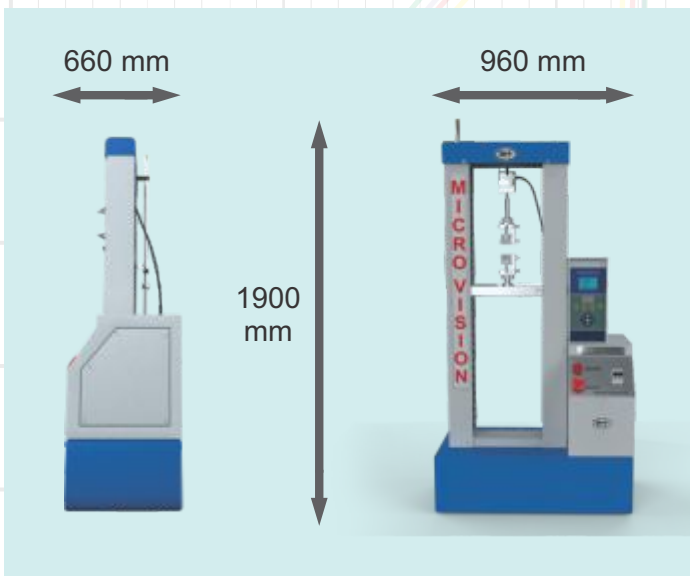
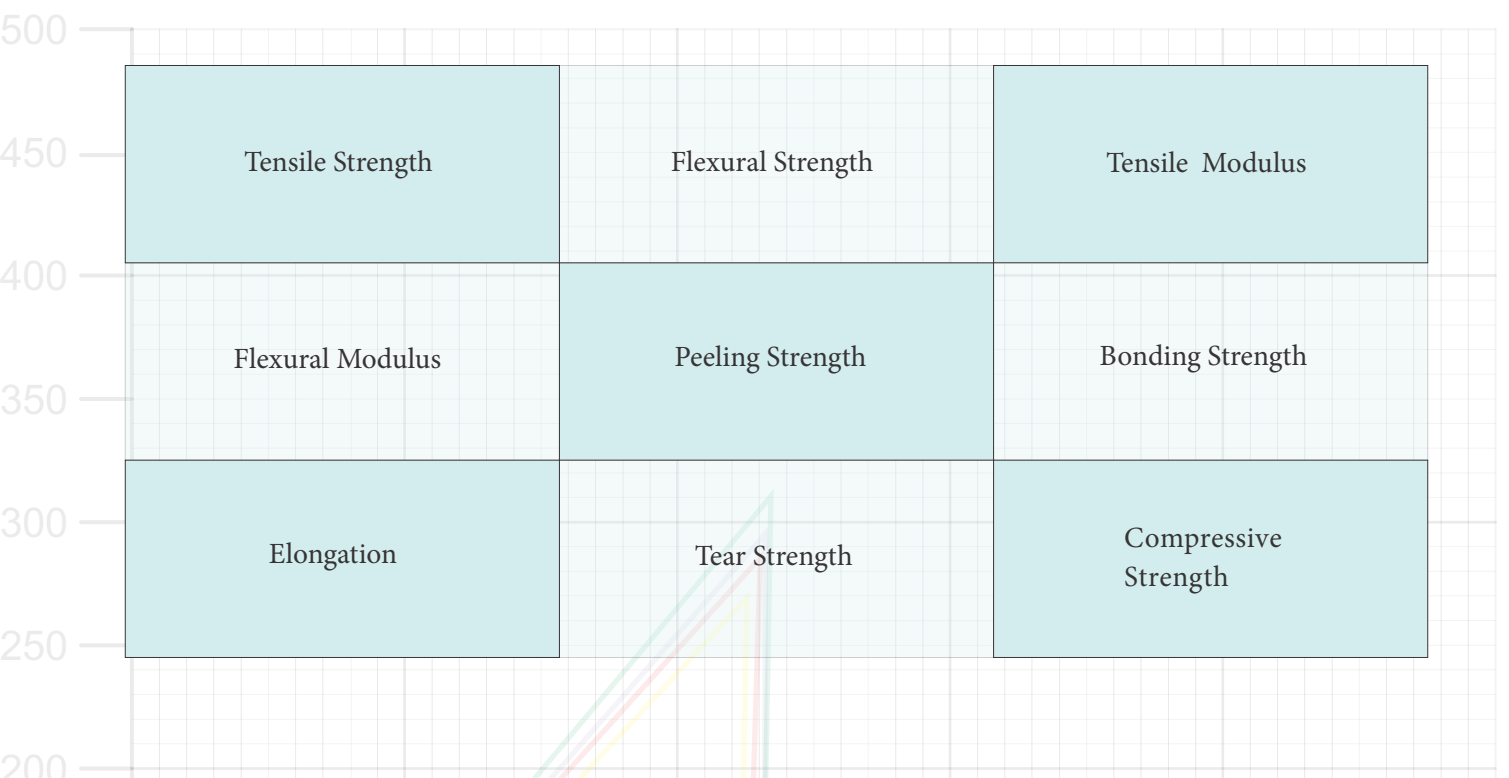
Tensile Graph



# Specification

Load Capacity	Different Capacity model from 10kg (100N) to 20 tonnes (200kN)
Load accuracy	Load accuracy as per depend on to capacity of load cell
Mechanical structure	High grade steel gives unmatched accuracy and precision High axil stiffness reduces machine
cross head driven	Cross head driven by conventional screw and guided & supported by hardened, ground finished and hard chrome plate tie rods. Gliding on linear bearing allowing the cross head motion. Ball screw driven mechanism is also available on demand.
Travelling length	Maximum travel from grip to grip is 800mm a extension least count of 0.01mm.Higer length is also available on demand (optional).
Force Range	1 N to kN
Crosshead Speed	0.1 to 1000 mm/min (0.004 to 40 in/min)
Speed Precision	+/- 0.5% from 0.1 to 500 mm/min (0.004 to 20 in/min) +/- 1.0% from 500 to 1000 mm/min (20 to 40 in/min)
High speed return	1000 mm/min (40 in/min) maximum

# Features



# Other Machines



## Digital Specific Gravity Balance Machine

Remove any hanging sample

Press “Test” button : Display will give message “Hang Sample”.

Hang sample and wait to be stable.

Press “Test button : Display will give message “Dip in water”.

Dip your sample in water now and wait to be stable.

Press “Test” button : Display will give the Specific Gravity value of the sample.

## Slab Mould Press Machine

MV Lab Slab Mould Press is specially designed to prepare slabs for laboratory purpose only. It is a Bonsai Model of Press which have two platens directly heated by pencils type heaters of **500watts** each and a ram beneath attached with hydraulic pressure pump which **manually operated** for user friendly operation of this equipment between two platen(7”x7”) a book type mould (150x150mm) is placed with rubber compound in it .A steady lead screw on the top to maintain hydraulic pressure. An electric panel is placed on the press which have switches **digital temperature controller** with **digital display** on front. Glow sign indicators are also provided. There is a large Round shape Pressure Gauge displays the hydraulic pressure maintained during slab curing process time.





## Compression Set Apparatus @ Stress

Compression set tests is intended to measure the ability of rubber compounds to retain elastic properties after prolonged action of a known compressive stress under static loading.

## Lab Two Roll Mill Machine

MV Two Roll Mill Machine is used For preparing test sample from two or more materials, they have to be mixed homogeneously. The Two - Roll Mill with its two heated rollers, rotating in different directions, at slightly different speeds is an ideal machine for such a work. Using Hydraulic Hot Press, Dumbbell Dies etc, can then obtain the test samples from the sheet. Two - Roll Mill is available in two models - one for PVC Compounds and other for PVC/Rubber Compounds with heavy-duty motor & water-cooling arrangement.



## Din Abrasion Machine



The method conforms to ASTM D5963 / ISO 4649. This method enables comparative tests for the control of the uniformity of a specific material. The achieved test results provide important parameters in respect to the wear of elastomers in practical use.

TECHNICAL DATA	
Diameter of test specimen	16 mm± 0.2 mm
Height of test specimen	6 to 10 mm
Diameter of rotating drum	150 mm
Length of rotating drum	470 mm
Speed of rotation of cylinder	40 rpm± 2 RPM
Lateral movement of test specimen holder	4.2 mm per revolution of drum
Load on test specimen	10 N / 5 N

## Cutting Dies Dumbbell Shaped



1	115 x 6 mm	IS 3400 (Part - I) 1987
2	75 x 4 mm	IS 3400 (Part - I) 1987
3	35 x 2 mm	IS 3400 (Part - I) 1987

## Hydraulic Cutting Press

Hydraulic type specimen cutting press is suitable for Quick and accurate cutting of specimen. It can accommodate various types for cutting die and the pressure can be released quickly to remove the specimen.

Capacity: 5Ton



## Muffle Furnace

Rectangular horizontal electrical muffle furnace working temperature 900 C complete with control gears. Bulb Mains, leadwire, thermocouple and thermal fuse working on 230 V AC single phase.

Muffle Size: 9"x4"x4"

Rating Watts: 1600

Temp. 1050 C Maximum

with Digital Display Control Indicator.





## Aging Oven

Made of Outer M.S. Material & Inner Stainless Steel Material

Duly powder coated, Two Shelves, Temperature

Range: 0 - 250 C

Temperature Regulator

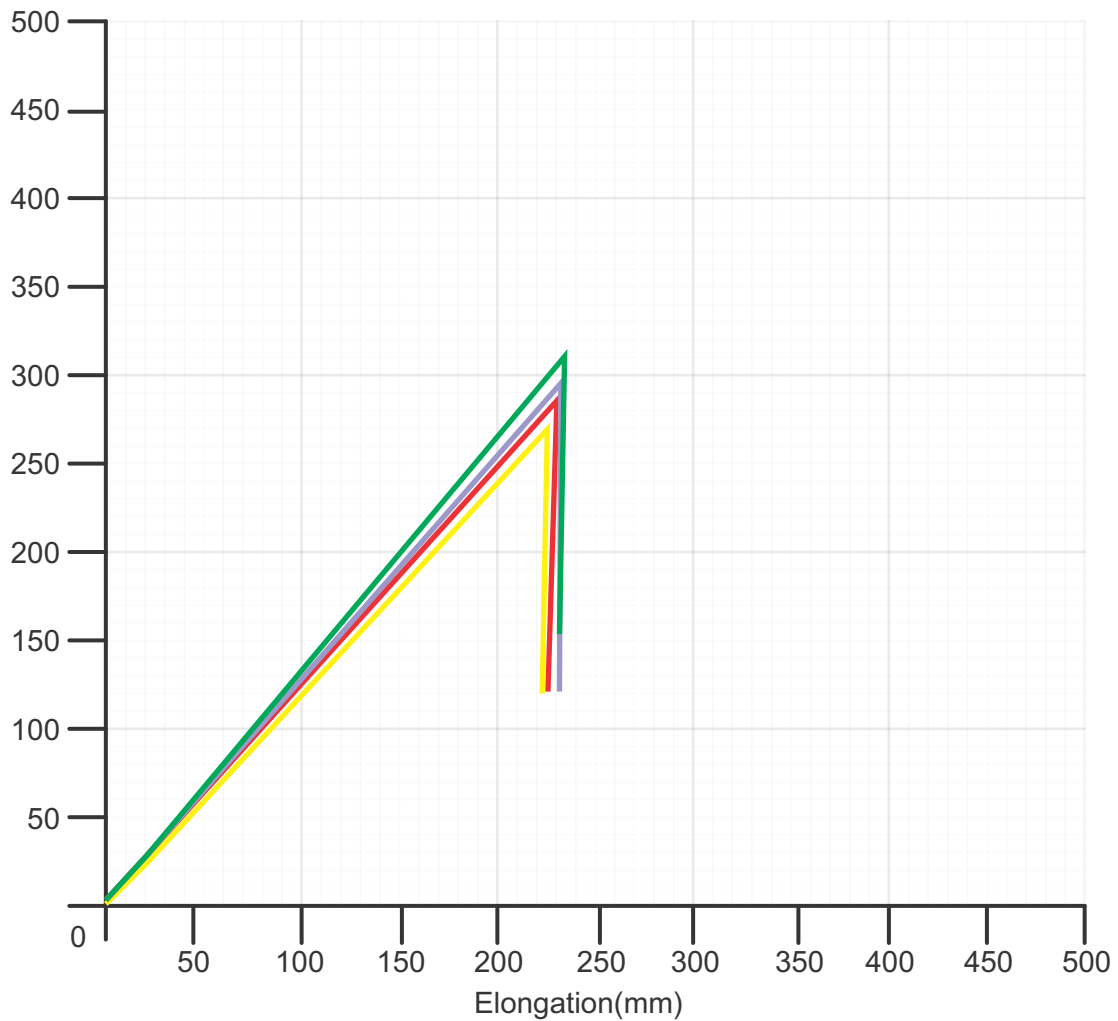
Model : 1 (Size: 14"x 14"x 14")

With Above Specifications

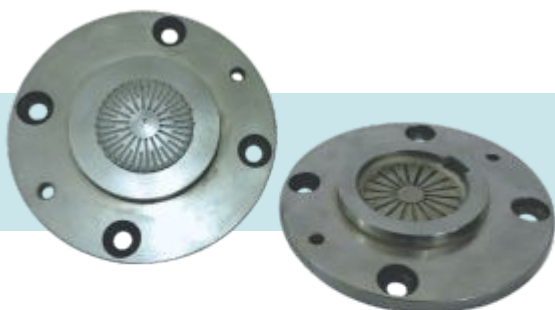
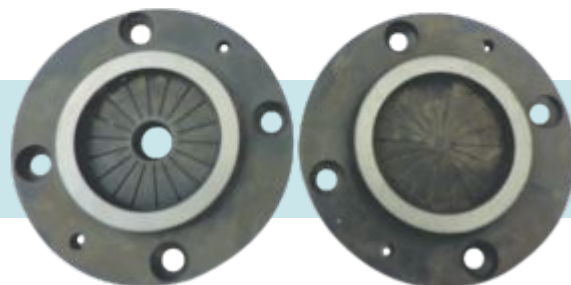
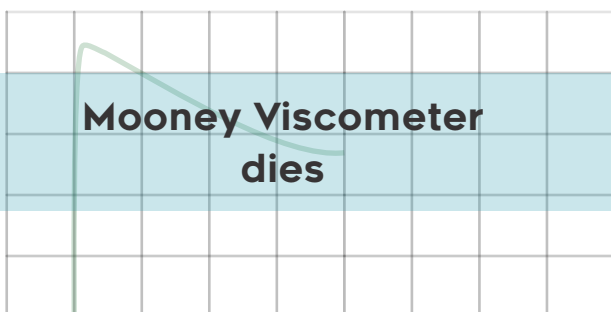
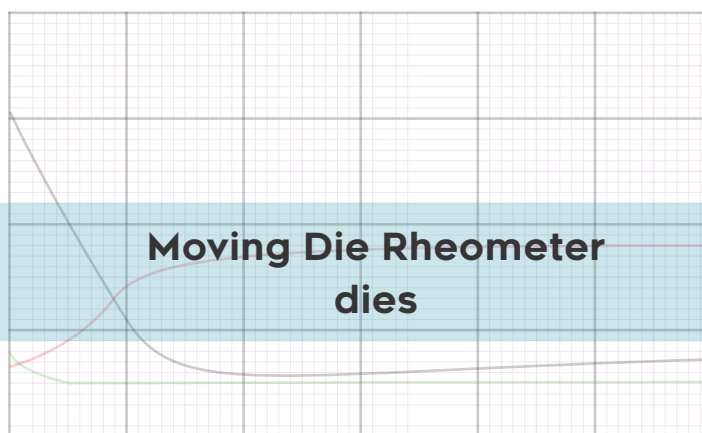
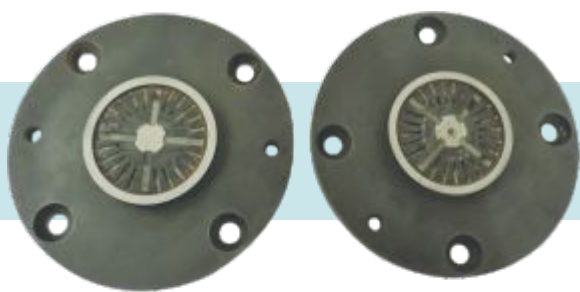
Made of Outer M.S. Material & Inner Stainless Steel Material

Digital Temperature Indicator cum Sensor for above mode

## Tensile Multiple Graph



# Consumables & Spare Parts



**Mooney / ODR Rotors**







**Teflon Ring**

**Sensor**



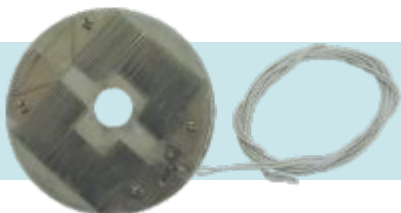
**SSR | Torque Standard**

**Pneumatic Cylinder**



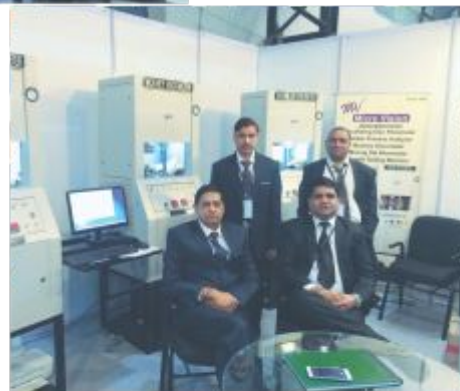
**Bearing Housing Assembly**

**Temperature Sensor**



**Heater**

# Image Gallery



## AWARDS & CERTIFICATES





**Scan to download E-Catalogue**

**<http://www.microrheometer.com/>**

The content of this brochure has been compiled with meticulous care and to the best of our knowledge. However, we cannot assume any liability for the up-to-dateness, completeness or accuracy of any information. Specifications and other contents mentioned in this book may be changed subject to the improvement requirement without advance notice.



S C A N



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Rubber Testing Instruments

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