

# *Scientific*

## Laboratory Two-Roll Mills

### Hands Free Computerized Two Roll Mills



### Two Roll Mills for Thermoplastic



### Two Roll for Rubber Mills



### Bench Top Two Roll Mills for Thermoplastic



## *Labtech Engineering*

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# Scientific

## Manual Laboratory Two-Roll Mills

MANUAL VERSIONS TO FULLY  
AUTOMATIC COMPUTERIZED  
HANDS FREE MILLS



Our **Scientific** Two-Roll Mills have a modern and pleasing design with a compact machine body, constructed for optimum flexibility to allow for numerous optional features. The left and right side of the roll assembly is equipped with swing open cabinets, which gives easy access to the entire upper part of the Two-Roll Mill. The control cabinet is mounted on a swing arm enabling a multitude of positions for best viewing possibilities. The machine structure is built up with welded rectangular heavy-duty steel tubing and is covered with removable steel panels. The rigidity of the machine body makes it fully self supporting.

The U-shaped roll support is made from machined steel parts, which have been precision milled and assembled with heavy-duty bolts to give optimum support in all directions to the rolls. Large machined steel bearing blocks for the rolls are mounted in the U-shaped support and the front set of bearing blocks which are supported on precision brass slides to allow for Nip Gap adjustment without any lateral play. The bearing blocks are each equipped with a double set of needle bearings, (or roller bearings for LRM-S-200) which together with the precision ground roll shafts, will give a very sturdy support to the rolls with no play. The bearings are lubricated with special high temperature grease and the shaft seals ensure that there is no leak of grease to the rolls.



The rolls are machined from a solid rod of high grade tool steel and are hardened to give a roll surface hardness of over 60 Rockwell C. Further, the surface of the rolls have been hard chromed, ground and polished to a mirror surface.

The mills are available with many roll heating and cooling systems where our standard thermo-plastic two roll mills are equipped with electric roll heating. Here the center of the roll is equipped with one or several three zone electric cartridge which are mounted is a special heat conductive core to ensure optimum heat conductivity to the roll

For mills with optional oil heating and cooling systems the rolls is machined internally with spiral channels for the heating and cooling media which enables a very even temperature over the entire roll width.



The swing away control panel shown here is equipped with the optional TRUE 3-Zone electric roll heating system where three temperature controllers regulate individually the center part and the sides on each roll. This panel also covers with two digital RPM meters, which will show the speed of each roll individually at a tolerance of only 0.1 RPM. Further the roll speeds are controlled with individual potentiometers, one for each roll and one for synchronous speed control of both rolls. And thus contains two digital torque meters which shows the driving torque in (A)% to each roll individually

The self supporting mill cabinet is equipped with swing open top cabinet covers which gives easy access to all roll components. All cabinet covers, door covers to electrical cabinets, and control panel are safety locked so that the machine can not operate when opened.

The Nip Gap is centrally adjusted with a turning wheel placed in the center part of the U-shaped roll support frame. The high gear ratio allows for easy adjustments even under heavy load. All the adjustment components are made with high precision to ensure that the rolls remain absolute parallel to each other at any gap setting.

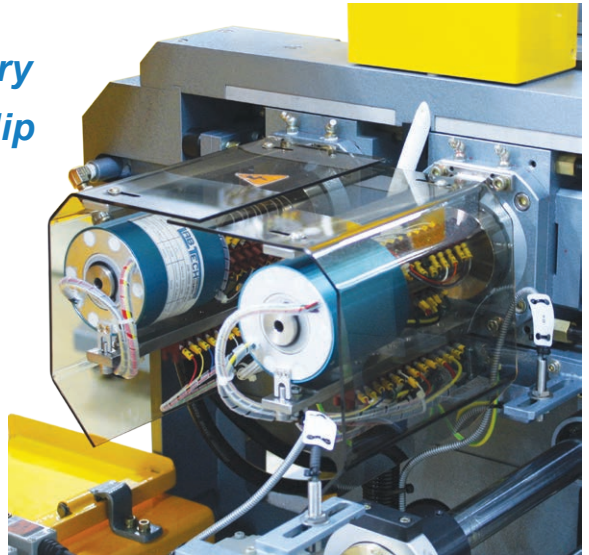


The standard **Scientific** mills are also equipped with an electronic Nip Gap sensing device, as well as a digital read out instrument on the control panel. With this advanced system, the rolls can be adjusted with a micrometric accuracy of 0,01 mm. Optionally, the mills can also be equipped with a motorized Nip Gap adjustment.



*All electric heated rolls now have a new very efficient and totally encapsulated rotary slip ring systems where all connections are made with gold plated slip rings for both the high current to the cartridge heaters inside the rolls as well as the low current to the thermocouples.*

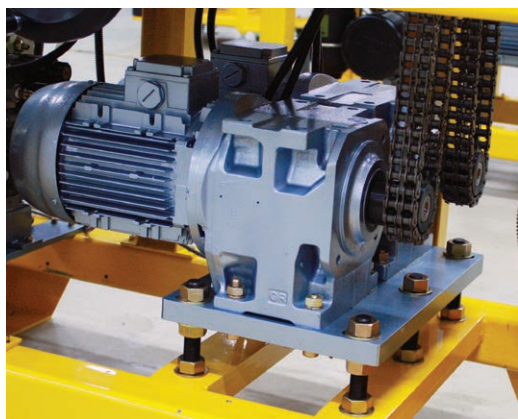
*This ensures a very accurate temperature control and heating of the rolls at all times*



All our two-roll mills except the bench top version are equipped as standard with infinite variable speed drives, one for each roll. The drives utilities AC gear motors connected to AC frequency inverters with high torque at low RPM.

The roll speeds are regulated with individual potentiometers on the control panel and the roll RPM is clearly shown with digital panel instruments one for each roll. In addition the control panel has a third potentiometer which will change the speed on both rolls synchronously, so that it is possible to maintain same friction ration regardless of the roll speed.

The “free hanging” heavy duty chain drive system we use on all our two-roll mills enables movement of the front roll for Nip-Gap adjustments without any negative effect on the drives which you otherwise would encounter on traditional two-roll mills using connecting gears on the roll shafts.



The picture show the standard **Individual Infinite Variable Speed drive** of each roll, by means of two AC Frequency Inverters and two AC motors, which are flange mounted to a large totally enclosed helical gearbox.

The Inverters are programmed to give a very high starting torque so that it is possible to start the mill with a full load of even the most heavy polymer type.



## Bronze And Teflon Side Guides



The New standard tilting side platens supplied with our **Scientific** Two Rolls mills are made of bronze which are mounted on hinged holders so that they can be tilted inwards to enable easy cleaning of the underside of the platens.

Optionally, the Two-Roll mill can be equipped with other types of side guides such as:

### New Tilttable bronze and teflon sideguides.



**Tilttable Split Type Non Touching bronze sideguides.** This type of side guides are the same as the standard version, except that they have been made tilttable so that by means of a quick lock handle, they can easily be tilted or flipped side ways to allow for easy cleaning of the underside.

### Adjustable working width of the side guides.

The side guides are the same as the standard Non Touching Split Type or the Teflon type, but they are assembled on two sliding bars over the rolls so that they can be adjusted inwards to reduce the working width of the Roll Mill by up to 50 %. This feature is used for running smaller batches.

**Teflon side guides,** which are made to touch the roll. With this, it is possible to run extremely thin films on the mill, avoiding that the very thin wrap around layer on the front roll will creep under the side platen. The Teflon side guides are supplied tilttable.

**Sideways adjustable** Non Touching Split Type Bronze platens (to enable running with smaller batches).

All **Scientific** Two Roll Mills are supplied with a special Material Scraper Knife with a thick bronze blade. There are two sets of support brackets with one set each for the front and the back of the roll assembly. The Scraper knife can easily be inserted and removed from the support brackets when the mill is running.

## ROLL HEATING SYSTEMS

All roll-heating systems on our manual **Scientific** Two-Roll Mills are controlled by Programmable Digital Electronic PID controllers with self-tuning function. The thermocouple which measures the roll temperatures are placed very close to the surface of the rolls and are connected to the controllers via hermetically enclosed maintenance free rotary contacts. On the computerized mills, the roll temperatures are controlled with the large capacity PLC which set and display values shown on a colour touch screen.

### TRUE 3-Zone Electric Roll Heating

Here the center and the end parts of the roll are heated and controlled with individual zones which enables a precise compensation for heat that is lost at roll ends due to the heat conducted out to the roll shafts and bearings. The temperature of the roll center and each end part are regulated individually with three controllers which gives a minimum temperature deviation over the entire roll surface.

### Heating And Cooling With Circulating Oil Media

With these versions, the rolls have been machined with internal spiral channels near the roll surface, covering the entire working width.

A thermocouple is placed in the center of the roll, very near the surface, enabling a very accurate temperature readout.

Two oil heating/cooling units supplies each roll individually with a high flow of tempered oil, which results in an extremely precise temperature control over the entire roll surface.



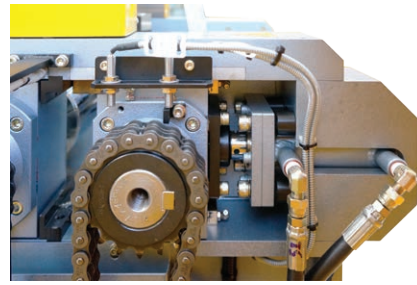
The temperature variance from the roll center to the ends is lower than  $\pm 1^{\circ}\text{C}$  at a set temperature of  $150^{\circ}\text{C}$ .

The oil roll tempering units are placed next to the two roll mill and they are connected to the rolls with stainless steel flexible hoses. The required roll temperature is set on the unit and since they are independent from each other, it is also possible to set different temperatures on each roll.

### Combined Electric TRUE 3-zone Heating And Water Cooling

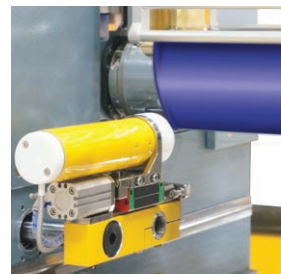
Here the rolls are both electric heated from the center and water cooled through spiral channels near the roll surface. The center and the two side zones of each roll are regulated individually with three controllers. This new TRUE 3-zone heating system gives an accurate temperature control with minimum deviation over the entire roll surface. The water circulation near the surface enables a very rapid cooling of the rolls.

### Hydraulic Quick Opening Of Rear Roll For Emergency.



This option will enable an emergency opening of the rear roll which will be activated when touching any of the emergency stops, i.e. the emergency bar over the rolls, or the knee activated front and rear panels, or the emergency stop on top of the control panel. The hydraulic system is equipped with an accumulator which keeps the system at full pressure at all times so that the emergency cylinders can be immediately activated without waiting for the pump to build up pressure. The mill will stop automatically in the unlikely event of hydraulic failure, and the rolls will also open in case the electric main supply is cut off.

### Automatic Rollover Device



The optional rollover device allows fully automatic mixing of the mill batch. The device comprises of a geared DC Motor driven Teflon Roller which moves parallel to the front roll and will turn over the batch from one side to another and vice versa. With this a very uniform mixing of the batch is achieved and the process can be repeated exactly from one batch to another



The stroke of the Rollover Device is regulated by easy to adjust sliders mounted on the left front panel of the mill.

All running parameters such as starting time, cycles and speed are set on a digital instrument shown to the right, which also will show on the LCD screen the status of the Rollover device during operation



### Motorized take off roll with water cooling of the roll



The unit is made on a practical sliding rail arrangement. When not in use, the unit is resting on the right side, away from the working area of the rolls. When needed, it is slid to the left in front of the rolls and tilted forward so that the take

off roll is positioned close to the front roll. The RPM of the take off roll is regulated on the touch screen and set so that its peripheral speed is slightly higher than the peripheral



speed of the front roll. When a sheet is cut off on the front roll, it is pulled gently by the Take Off roll and with this it is possible to pull out an even sheet or film from the roll with minimum variations in thickness. The take off roll has internal water cooling to prevent the sheet or film to stick. The drive of the roll is synchronized with the front roll so it will automatically follow any variation of the RPM

### Other Options

- **Motorized Nip-Gap adjustment** where the Nip-Gap is adjusted with push buttons. Here the Nip-Gap distance is set on a digital instrument on the control panel and a PLC coupled to the digital encoder on the Nip-Gap drive will ensure that exact Nip-Gap distance is achieved.

### Summary Of Standard And Optional Equipment

#### STANDARD VERSIONS

- Modern designed steel cabinet with swing away control panel. Heavy duty machined U-shaped frame for the roll assembly. Rolls are machined from high grade tool steel, surface hardened to >60 RC, chromed, precision ground and polished to a mirror surface.
- Central Nip Gap Adjustment with Digital Electronic Nip Gap instrument on the Control Panel for readouts in increments of 0.1 mm.
- 3-Zone heating of the rolls with Programmable self-tuning Digital Electronic PID temperature controllers and electronic proportional relays.
- Individual infinite variable speed drive of each roll with a large variety of roll friction ratio with digital read out of roll RPM on control panel.
- Swing open left and right side top cabinets with swing away control cabinet.
- Non Touching Split Type Bronze Side Platens.
- Bronze Scraping Knife with holders at front and rear part of the rolls.
- Safety features according to European CE and other International Standards comprising of:

Protection cage over the rolls with interlocked swing open front and rear parts that stop the rolls when opened.

Stop bar over the rolls which, when activated, will instantly stop the rolls. Alternatively, the safety stops can also be made to both stop and reverse the rolls.

Knee activated front and rear panels on the mills lower part, which instantly stops and alternatively reverse the rolls.

Interlocked Swing Open left and right top panels which stops the rolls and cuts of the electric supply when opened. Interlocked rear cover to control panel, which cuts of the electric supply if the cover is removed.

Safety switch handle on the door to the electric cabinet, which cuts off the main supply when the door is opened.

Self-locking Emergency Switch on top of control cabinet that will stop the rolls instantly and which will also cut off all electric supply to the mill.

## Laboratory Bench top Two Roll Mill



The MicroScientific Bench Top Two roll mill type LRM-M-100 is intended mainly for learning institutes and for laboratories where a smaller batch size is preferred compared to our range of floor mills.

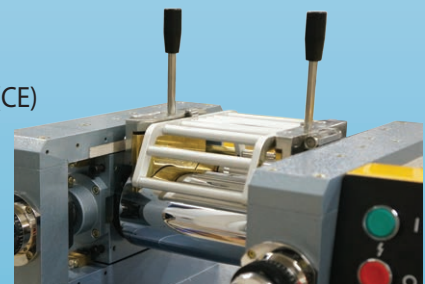
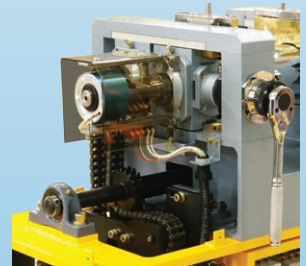
It is supplied as standard with variable speed roll drive as well as electric roll heating system. The mill features:

- Modern designed steel cabinet built up with welded rectangular steel tubes and hand shaped steel sheets. Heavy duty machined U-shaped frame for the roll assembly. The rolls are machined from high-grade tool steel, which has been treated to a hardness of over 60 Rockwell C and hard chromed, precision ground as well as polished to a mirror surface. The rolls are mounted with heavy-duty needle bearings on each shaft and resting in machined bearing blocks. The grease lubricated bearing assemblies are built with special heat resistant seals on the roll sides to prevent leakage and to ensure a long bearing life at high temperature.
- Control panel mounted on the right side of the mill body containing self adjusting fuzzy logic digital PID temperature controllers for the rolls as well as digital roll RPM meter with scroll buttons for regulating the roll speed.
- Ratchet type individual Nip-Gap adjustment with micrometric scales
- Electric Roll Heating with high wattage cartridges mounted in the roll core and with higher heat density at roll ends to ensure an even temperature over the entire working area of the rolls.
- Slip Rings on the roll shafts supplies the high power electric current to the heating cartridges while the low current from the thermocouple near the roll surface is connected with miniature hermetically enclosed capsuled with internal gold plated slip rings for trouble free temperature control with very long life time.
- Supplied as standard with 1.5 kW variable speed drive for the rolls with a fixed roll friction of 1:1.2. The drive is equipped with an enclosed helical gear transmission connected to the rolls with chains for a smooth and very quiet run even at high RPM and high load
- Swing open left and right side top cabinets with swing away control cabinet.
- Non-Touching Bronze Side Platens.
- Safety features according to European and other international Safety Norms (CE) comprising of:

**Protection cage over the rolls which stop the rolls when opened**

**Self-locking Emergency Switch below the control panel, which stops the rolls instantly and cuts off all electric supply to the mill**

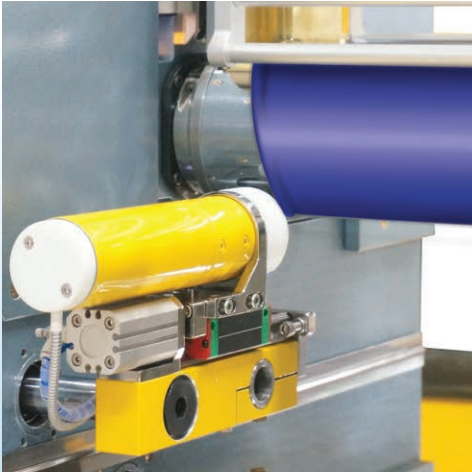
**Safety main electric switch handle on the door to the electric cabinet, which cuts off the main supply when the door is opened**





# Scientific

## Hands Free Computerized Two-Roll Mills



**FULLY  
AUTOMATIC  
MIXING WITH THE  
ROLL OVER  
DEVICE**



**Enables complete standardizations of quality controls, colour matchings and additive evaluations, as well as control of incoming pigment or other raw materials.**

The computerized Scientific two-roll mills are equipped with the Rollover device, which enables fully automatic "hands free" mixing of the mill batch, where all the mill parameters can be pre-programmed on the colour touch screen so that the mill will run exactly under the same condition from one batch to another, a new batch just after the first batch or a batch produced months or years thereafter. This enables complete standardizations of Quality Control, Colour Matching, and Research etc. of pigments, additives, fillers and other components added to thermoplastics.

*All operations are operated from an LCD colour touch screen with an extremely user-friendly software design, which allows for ease of operation and programming.*

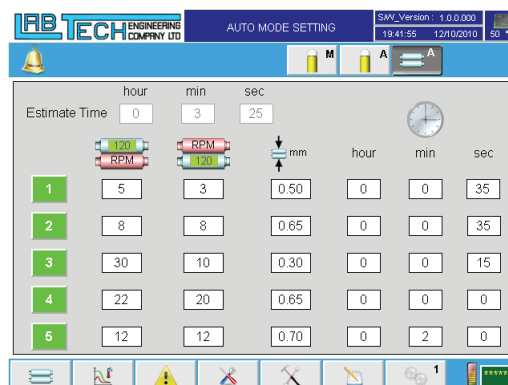
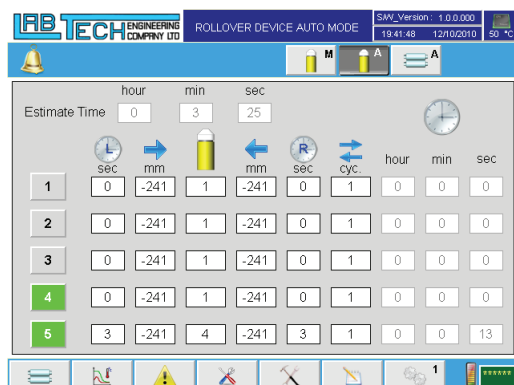
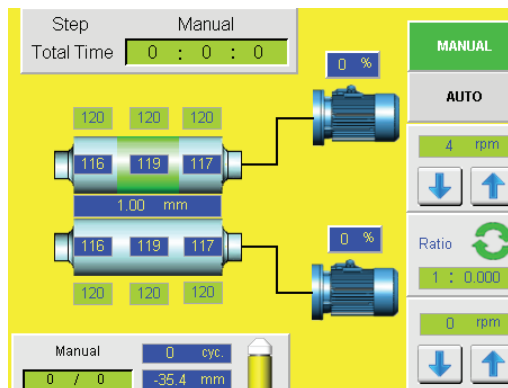
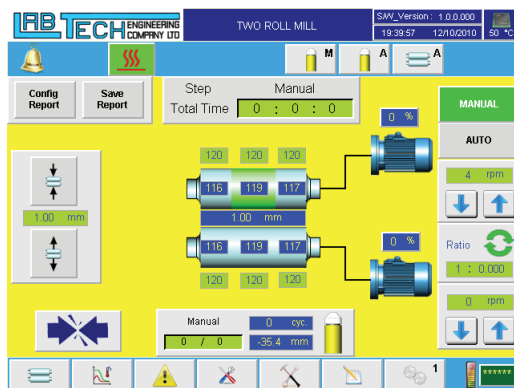
### **General Description Of The Mills.**

The Computerized Scientific two-roll mills are built up in the same way as our standard mills. However, all mill parameters are set and controlled on a large 10-inch colour LCD touch screen coupled to a high capacity PLC. The mills are also equipped with infinite variable speed drive of each roll, as well as motorized Nip-Gap Adjustment and tiltable side platens.

The mills are available with the same roll heating system as our standard mills, described on page 4-5. The Rollover device is comprised of a conical shaped Teflon roll, driven by a strong DC-motor mounted on oscillating shafts parallel to the front roll. The position of the Rollover device is determined by a digital encoder, and all movements are commanded from the PLC over the touch screen.

## MILL CONTROLS AND PROGRAMMING

The touch screen control is based on in house designed software with a user-friendly programming system. The Main Screen below to the left shows clearly all mill parameters in running mode so that only a glance is needed to identify the status of the mill. The extremely easy programming of the mill can be done by simply touching the buttons in sequence, as shown below and then key in your required parameters.



## Touch Screen Functions And Controls

The Main Screen have buttons for two running modes, Manual or Automatic.

In Manual Mode, Nip-Gap and each roll speed, as well as synchronous speed of both rolls are adjusted with easy up/down buttons on the touch screen. The Nip-Gap distance is shown on the screen with accuracy of 0.01 mm (10 microns). The roll RPM for each roll is also shown on the screen as well as the Friction Ratio between the rolls (for instance 1: 1.20). Further the torque of each roll is shown digitally in (A) %.

The temperature of the rolls are set by pressing the MANUAL SETPOINT button and then by keying in required temperature for each of the three zones for respective front and back roll.

In Automatic mode the rolls can also be set for full temperature control, either with the standard TRUE 3-zone roll heating system or with the optional oil heating/cooling of the rolls. Here each of the 8 programs can be set at any desired roll temperature. When this program is selected, the rolls will be heated to the exact pre-selected temperature. When pressing the START button, a signal will be heard and the start button will flash until the set temperature on both rolls have reached their equilibrium. The mill will not start until the set temperatures have been reached. This ensures that the specific batch will be processed at exactly the same temperature as before.

Front and rear roll speeds and friction can be pre-set in 5 different steps for each of the 8 programs. The roll speeds are infinite adjustable at any speed setting of each roll from 0 to 50 RPM. The accuracy of the roll speed is less than 0.1 RPM which means that each batch will be subjected to exactly the same kneading and shear forces at all times.

The Nip-Gap is also infinite adjustable from 0.10 mm to 5.00 mm. with an accuracy of 10 microns. Each of the 5 running steps can be individually set with any Nip-Gap desired.

Each of the steps is programmable against time so that the mill will run each step at exactly the same duration. When the time has elapsed from the first step, the mill will automatically switch over to the next step and will run this step at the pre-set time with roll speeds and Nip-Gap in accordance to parameters set for that second step.

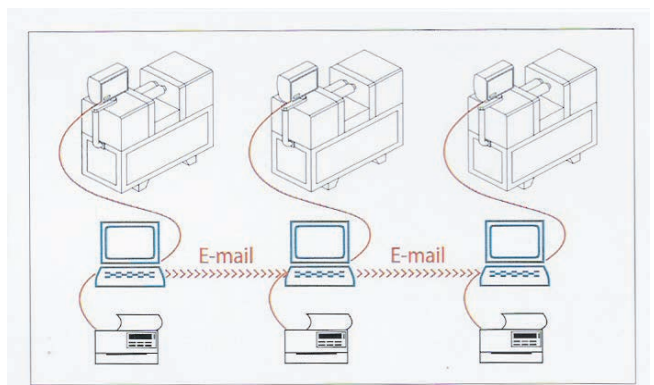
The Rollover device is also programmable on the LCD touch screen and can be individually set for each of the 8 programs so that it runs in a pre-set mode through each of the 5 milling steps. The device can be programmed with the following parameters:

- Time to start and in which step the Rollover device should start. (Normally the Rollover device will not be used in STEP 1 since this step is used for melting the plastic).
- Time to rest after completing each stroke, i.e. the time the Rollover device should pause on both sides before next mixing stroke. This is done in order to allow the batch sufficient time to spread out on the entire front roll before it is caught by the Rollover device and "rolled over" again from one side to the other.
- Length of travel from left to right and back from right to left side of the roll. For instance, the device can be set to "Rollover" the batch only 2/3 of the roll length so that there is not too much resin moved over to one side.
- Speed of movement from left to right and vice versa. Adjustable with 5 different speeds.
- Amount of repeated strokes, i.e. how many times it will mix the batch for each step.

The rollover device will catch the batch wrapped around the front roll and move it from one side to the other, thus replicating the mixing method normally done by hand. By turning over the batch, several times from left to right and vice versa, the batch will get a very efficient mixing in a short time.

The roll over device, coupled with the pre-programmed mill parameters enables a complete reproduction of the test batch from time to time.

### COMMUNICATION WITH OTHER MILLS IN OTHER LOCATIONS



The **Scientific** computerized automatic two-roll Mills with (or without) Rollover device are equipped with PC connection and with this it is possible to record and store all programmes and all running parameters of the mill, using Microsoft Excel. In addition, various processing curves and graphics can easily be done with this software.

The mill programmes can be saved on a hard or floppy disc etc. and mailed or e-mailed to another location using the same computerized mill. Here exactly the same mill programmes can be entered and with this a full standardization is made, where every mill on every location is running with exactly the same parameters. In other words the mills will run with:

- Exactly the same roll temperatures
- Exactly the same roll speeds in each step
- Exactly the same friction in each step
- Exactly the same Nip-Gap distance in each step
- Exactly the same time for each step
- Exactly the same batch mixing if equipped with the Rollover device



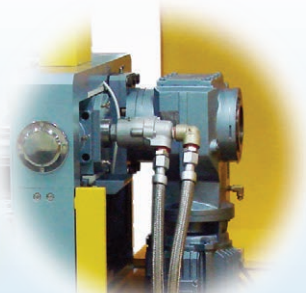
# Scientific

## Rubber Mills

*Our rubber mills are distinguished from our other polymer mills by a more heavy duty build up of the rolls, bearings and Nip-Gap adjustment, as well as a significantly larger drives where the rolls are directly coupled to heavy-duty helical bevel gears. This enables trouble free processing of even the toughest rubber compounds. The design and appearance of these rubber mills are the same as our other Scientific mills.*



**HEAVY DUTY  
DIRECT DRIVES TO  
THE ROLLS**



**INFINITE  
VARIABLE ROLL  
SPEEDS AS  
STANDARD**

The **Scientific** range of rubber mills have a modern and pleasing design based on a steel cabinet built up with welded rectangular steel tubes and equipped with a swing away control panel mounted on a tubular steel arm.

The rolls are machined from high-grade tool steel, which has been treated to a hardness of over 60 Rockwell C with a hard chromed, precision ground, and polished to a mirror surface. The rolls are mounted with dual heavy-duty bearings on each shaft and resting in machined bearing blocks. The grease lubricated bearing assemblies are built with special heat resistant seals on the roll sides to prevent leakage and to ensure a long bearing life.

**Central Nip Gap Adjustment** with Digital Electronic Nip Gap instrument on the Control Panel for readouts in increments of 0.1 mm. Nip-Gap adjustable from 0.2 to 10.0 mm. Safety stops to avoid that the rolls touch each other. A hand wheel placed centrally below the roll U-frame adjusts the Nip-Gap. The hand wheel is linked to the front roll via heavy-duty gears so that the nip-gap can be easily adjusted even while running a heavy compound.

**Water Cooling or optional oil heating / cooling** of the Rolls where the water or oil flows in spiral channels near the roll surface which gives an extremely efficient cooling/heating of the rolls and the compound being milled. The cooling/heating media is connected to the rolls through rotary joints with ball bearing and carbon seals for a leak free operation.

**Direct drive to the rolls with heavy-duty helical bevel gears** where the output shaft is directly coupled to the roll shaft.

**Individual infinite variable speed drive of each rolls** with AC-motors coupled to programmable frequency inverters.

**Digital readout on control panel of roll torque in (A)%. Speed variation of each roll** by means of two potentiometers on the control cabinet.

**Synchronous speed variations of both rolls** by means of a potentiometer on the control panel, which will regulate speed of both rolls simultaneously without changing the friction ratio between the rolls.

**Swing open left and right side top cabinets with swing away control cabinet**

**Non Touching and tiltable Side Platens made of Bronze.** The standard feature of tiltable side platens allows for fast and easy cleaning of the area facing the rolls.

**Bronze Scraping Knife with holders at front and rear part of the rolls**

**Safety features according to European (CE) Safety Norms and other world standards as described on page 6 for standard mills.**

### Other Options

- **Hydraulic quick opening of rear roll for emergency.**

This option will enable an emergency opening of the rear roll which will be activated when touching any of the emergency stops, i.e. the emergency bar over the rolls or the knee activated front and rear panels or the emergency stop on top of the control panel. The hydraulic system is equipped with an accumulator which keeps the system at full pressure at all times so that the emergency cylinders can be immediately activated without waiting for the pump to build up pressure. The mill will stop automatically in the unlikely event of hydraulic failure.

### Side Platens

- **Sideways Adjustable Non-touching Bronze platens.** The side platens are attached to two sliding holders with quick locks and mounted on two steel bars over the rolls so they can be moved inwards to reduce the working area.

- **Sideplatens in Nylon instead of Bronze.** These side platens are made in one piece covering both front and rear roll

### Option Roll Heating System

Oil Heating and Cooling where the rolls are heated and cooled by two separate free standing oil heating and cooling units. They are placed next to the two roll mill (usually on the left side) and connected to the mill with stainless steel hoses at floor level with an insulating cover

The units contain two individual oil-circulating systems, one for each roll and each with a large circulating pump as well as high capacity electric heaters and oil cooling units.

Both oil heating and cooling systems are individually regulated with programmable electronic digital PID temperature controllers and the control panel on the mill is also equipped with digital temperature instruments for each roll. The rolls are made with internal machined spiral channels placed near to the surface, which, coupled to the rapid circulating oil heating media, gives a very even temperature over

the entire roll surface. At a set temperature of 150 °C, the actual temperature variance between center and end part is less than +/- 1.0 °C. Max roll temperature is here 220 °C, optional 250 °C.



## COMPUTERIZED RUBBER TWO-ROLL MILLS WITH LARGE LCD TOUCH SCREEN CONTROL

The Computerized **Scientific** two-roll rubber mills are built up in the same way as our standard rubber mills. However, all mill parameters are set and controlled on a large 10-inch color LCD touch screen coupled to a high capacity PLC. The mills are also, equipped with Infinite variable speed drive of each roll as well as motorized Nip-Gap Adjustment and tiltable side platens. The rolls are heated and cooled with internal oil units as described on previous page.

### These mills have the following features:

1. Two running modes selectable on the control panel, Manual and Automatic
2. In Manual Mode, Nip-Gap and each roll speed as well as synchronous speed of both roll is adjusted with easy up/down buttons on the touch screen. The Nip-Gap distance is shown on the screen with readout in two decimals (0,00). The roll RPM for each roll is also shown on the screen as well as the Friction Ratio between the rolls (For instance 1:1.20).
3. In Automatic Mode, the mill parameters can be pre-programmed with up to 8 different programs
4. Display and control on the touch screen of Front and Rear roll temperatures. The temperature is controlled only with water cooling of the rolls, so that when the rolls are reaching a set max temperature, the controllers will switch on the cooling water and if temperature reaches below the set minimum, the cooling water will be turned off.
5. 5 Steps with different RPM on Front and Rear rolls, as well as Nip-Gap and time duration for each step. With this, the mill will run fully automatic through all 5 steps (or less if time for one or more steps is set at zero). For example, when compounding rubber, the mill can start in Step 1 with a small Nip-Gap setting say 0.50 and a high RPM and friction during 1 minute. This will enable to homogenize the batch completely and the small Nip-Gap will prevent the material to fall down on the underlying tray. At Step 2, the Nip-Gap and the roll speeds can be increased for normal running condition. Or the mill can stop at this step and sound an alarm for adding further ingredients to the batch. The parameters on the last 3 Steps can be set in accordance to the required test procedure for that specific batch.
6. Dual geared heavy duty motor drives to each spindle, driven by two programmable inverters which are controlled by the PLC with set and read out Nip-Gap distance on the touch screen. The heavy duty drive enables adjustments of Nip-Gap distance while running even under maximum load.
7. The Nip-Gap accuracy on these computerized rubber mills is 0.05 mm and contains automatic compensations for the thermal expansions of the rolls. Thus, when the rolls is heated up, the front roll will automatically move outwards so that the Nip-Gap remains the same as the set value at all times
8. The PLC also has a maintenance schedule programmed where a symbol will be shown on the screen when it is time for lubrication of the various machine components. Bank temperatures during the entire milling process.
9. The touch screen also shows the torque for each roll, measured in Nm.
10. The backside of the control panel is equipped with two ports. One parallel port for direct connection of a printer and the other serial port for connection of a PC. With the direct printer connection, it is possible to print out all running parameters of the mill. The PC connection also enables collection of all data to be either printed out or stored to the PC memory, floppy disk etc. The data can also be transferred to Microsoft Excel program and with this it is possible to produce a great variety of graphic illustrations covering all the parameters, i.e. Nip-Gaps, Roll Speeds, Frictions, torque as well as the optional rolling bank temperature



## THE COMPUTERIZED TWO-ROLL MILLS ARE ALSO AVAILABLE WITHOUT THE ROLL OVER DEVICE

The features are otherwise the same, except that the mixing of the batch of course has to be done by hand. This version is useful for those instances where the specific polymer has a tendency to stick to the rolls and thus cannot be moved by a Rollover device.

### Available Options

(For further details please see description on pages 4 - 6)

- Oil Heating and Cooling of the rolls
- Tilttable Side Platens
- Teflon Side Platens
- Sideways adjustable side platens (only for mills with rollover device).
- Infrared temperature measuring of rolling bank.
- Hydraulic emergency quick opening rear roll.
- Dual Nip-Gap motor drive, one for each roll side. For producing extremely accurate thin films.
- Emergency Nip Gap sensors with a 30 microns thin steel tape placed on each roll side. Useful when producing very thin films where the standard Nip-Gap stoppers are not sufficient.

## TECHNICAL DATA FOR *Scientific* Two-Roll Mills

TWO-ROLL MILL TYPES		LRM-M-100	LRM-S-110	LRM-S-150	LRM-S-200
<b>Mechanical data, plastic mills</b>					
Roll diameters	mm.	100	110	150	200
Roll Widths	mm.	210	280	400	450
Working widths	mm.	150	220	320	370
Approx. capacity with a compound density of 1,0	gram	30-50	100-150	200-400	500-1000
Nip-Gap distance adjustment	mm.	0.1 to 10.0	0.1 to 5.0	0.1 to 5.0	0.1 to 5.0
Individual variable speed drive of each roll. (Other RPM's on request)	Front	rpm	2-25	0-50	0-30
	Rear	rpm	2-25	0-50	0-30
	Motor Power	kW	1.5	2x1.5	2x4.0
Fixed friction ratio		1 : 1.2	-	-	-
Mill sizes ( width x depth x height)	cm.	89 x 67 x 50	150 x 70 x 170	160 x 80 x 175	180x90x185
<b>Roll heating and Cooling system</b>					
True 3-Zone Electric Roll heating system	kW	(1zone) 2x2.5	2 x 3	2 x 6	2x9
True 3-Zone electric heating and water-cooling of the rolls	kW	-	2 x 3	2 x 6	2x9
Max temperature with electric heating	°C	300	300	300	300
Oil Heating and Cooling	kW	-	2 x 9	2 x 9	2x9
Max temperature with oil heating	°C	-	220 (option : 250)	220 (option : 250)	220 (option : 250)

TWO-ROLL RUBBER MILL TYPES			LRMR-S-110	LRMR-S-150	LRMR-S-200
Roll diameters		mm.	110	150	200
Roll Widths		mm.	280	400	450
Working widths		mm.	220	320	370
Approx. capacity with a compound density of 1,0		gram	100-150	200-400	500-1000
Nip-Gap distance adjustment		mm.	0.2 to 10	0.2 to 20	0.2 to 20
Individual variable speed drive of each roll. (Other RPM's on request)	Front	rpm	0-50	0-40	0-30
	Rear	rpm	0-50	0-40	0-30
	Motor Power	kW	2x2.2	2x4.0	2x5.5
Water Cooling ( Controlled )			Yes	Yes	Yes
Optional oil heating/cooling			Yes	Yes	Yes
<b>Roll heating</b>					
Oil heating/cooling, heating power		kW	2 x 9	2 x 9	2 x 9
Oil circulating pump power		kW	2 x 0.5	2 x 0.5	2 x 0.5
Max temperature with oil heating		°c	220 (option : 250)	220 (option : 250)	220 (option : 250)

# MANUFACTURING OF LABORATORY MACHINES SINCE 1983

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