

ООО «ПОЛИМЕРМАШ ГРУПП»

**Вискозиметр по Муни с компьютером и принтером
MZ-4016B1. Китай.**

ПАСПОРТ

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MZ-4016B₁ Mooney Viscometer Operation instruction

1. Summary

MZ-4016B₁ Mooney Viscometer analysis system is a kind of Rubber-measurement of rubber viscosity and curing index with advanced technique and high automation.

MZ-4016B₁ applies to the model of main set & computer & printer. It uses windows system operating platform and it turns graph into picture, making figure more accurate, using simpler, faster, and more convenient. Adopting the import intelligent and digital temperature controller, MZ-4016B₁ has simple adjusting set, wide range of temperature controlling, and high accuracy of controlling. Having original structure, MZ-4016B₁ adopts computer controlling to cope with the data and print the testing result. MZ-4016B₁ also has the function of data inquiry, data comparison and curve enlargement.



2. Hardware part

2.1 Features

2.1.1 This machine is characterized by high-precision and wide range (within $\pm 0.1^{\circ}\text{C}$) of temperature controlling, easy calibration and setting because of the adoption of the intelligent and digital temperature controller. Generally speaking, it takes 10 minutes to rise to 200°C from the room temperature. Therefore, after the tested sample is put into the Mooney viscometer, it usually takes about 1 minute to rise to the temperature set point with the complete elimination of the influence brought by the rotor.

2.1.2 High-quality chips are used for the purpose of a well-functioning microprocessor. On the one hand, the microprocessor can sample the signals from the torque sensors, and then convert and process them and record the torque-time curve later. On the other hand, the microprocessor can communicate with the interface of the intelligent and digital temperature controller. Subsequently, the figure shown on the temperature controller will be recorded and printed as a temperature-time curve. The users will get a clear idea from the two temperature-time curves and one torque-time curve printed on the same figure.

2.1.3 It is designed with a set of concatenate functions, successively including closing the Plexiglas door, closing the dies, starting the microprocessor, and running the motor. If the door is not closed, the whole system will not work. The designing means the safe operating and the consistency of the testing results.

2.2 Controlling Functions and Technical Parameters

2.2.1 Functions introduction for controlling button (refer to Appendix 1,)

Controlling buttons are shown as the Figure 1. The following introduction will make the users have a detailed understanding about the controlling function.

OPENING button:

If the **OPENING** button is pressed, the door will be opened automatically at first. When the door is opened at the limit position, the upper die will rise automatically away from the lower mould.

CLOSING button:

When the button is pressed, the door will be closed automatically, and then the upper die will move downwards until the two dies closed.

POWER button:

If **POWER** button is pressed, the indicating light will be on, this means that the main power of the instrument is turned on. If you press it a second time, the light will be off, which means that the instrument is cut off the main power supply.

HEATING:

HEATING button is especially designed for upper and lower die heaters. When **HEATING** button is pressed, power supply is provided for heating system. If **Heat** button is pressed again, the heaters will be cut off the electricity supply. Such a design brings convenience for operation and maintenance. But the **Heat** button doesn't work until the **Power** button is pressed.

Motor button:

If the **Motor** button is pressed, the motor will run. When the Motor button is pressed again and sprung out, the motor will stop running. This button is used for the trial working of the instrument. During the normal testing, the Motor button should be the state of springing out because the motor is started by microprocessor.

Test button:

We may press this button to start the motor after the operator putting the rubber into the mould, the function is the same as **next** in menu of testing.

2.2.2 Technical parameters

Range of controlled temperature: Room temperature to 200°C

Period of increasing temperature: ≤10 min

Rate of describing temperature: 0.1°C

Variation of temperature: ≤±0.3□ (after feeding stability)

Set accuracy: 100±0.5 Mooney value

Rotary speed of rotator: 2 rpm ±0.02 rpm

Range of torque: 0 ~200 Mooney value

Dimensions: 645mm×720mm×1300mm

Weight: 210kg

Power: AC220V±10% 50Hz 1kW

Mould room, and rotators (large and small) shall all be designed and manufactured as per ISO 289 and GB/T1232.

2.3 Machine Installation

This machine should be installed on a solid steel or cement platform (size: ≥1200mm×800mm, height; 650-700mm, bearing weight: ≥300kg)

Enough space should be left for repairing after the instrument is fixed on the platform. It is suggested that the four feet of the instrument should be separately equipped with four rubber pads so as to the user may adjust the level. Each pad is about 10mm of thickness for the stability of the instrument.

2.3.1 Pneumatic Connection

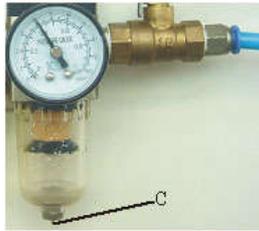
The triple valve, which are used for supplying testing pressure, are installed on the back of the instrument, including a gas-water separator, a pressure regulator, and an oil sprayer. You'd better equip oilless compressor to supply the air. The air pressure should be no less than 0.4MPa (4kg/cm²), otherwise, stability of up and down movement of mould cavities and the comparability of the test results will be affected. Usage as follow Figure:

Installation of air tube and Adjustment of pressure



we only need insert it into sliding set when install the air tube .In order to pull out air tube ,at first, valve will be turned until it run parallel to air tube and exhaust a tube of air .Then press the sliding set toward the front, at last, pull out the air tube. Refer to left chart.

If air pressure is less than 0.4MPa,pull adjusting valve for pressure (A) ,Turn It clockwise, when indicated testing pressure reach 0.4MPa then press down it tightly .



We need check weather the pressure is 0.4MPa during the testing, if it is over the range we must adjust the pressure.Otherwise,it will affect the testing result .

the user need check the device after a long time. And press up C to exhaust out water from air and water separator , to avoid wobble with cylinder.

2.3.2 Electrical Connection

Firstly insert the main plug of the main power into the relevant socket, and then connect one end of the signal cable with the relevant socket of the main unit and connect the other end with COM 1 on the computer. Before opening the power, ensure that the correct connection and proper contact.

Attentions:

It is required that the power supply of AC220V must have a good grounding to realize the normal running of the instrument and safety of the operators.

2.4 Structures & Principles

2.4.1 Structure

As an integrated intelligent instrument, this instrument is composed of the following parts.

- (1) Machinery parts: case, the upper mould and the lower mould, the oscillating mechanism, the force measuring sensor and the transmission mechanism.
- (2) Pneumatic control system: cylinders for opening and closing moulds, electromagnetic valve, triple valve of air passage, etc.
- (3) Electrical control system: temperature control systems for upper and lower moulds, control set for lift gate.
- (4) The measurement and control system, based on the microprocessor, used for collecting data, processing data, control of motor, control of opening and closing mould, and output of printed report.

2.4.2 Design Principle

Mooney viscometer has two test conditions.

A Mooney Test

Increase temperature to the set value. Select the test period depending on the different types of rubber, open the mould and quickly put the sample, during the period of pressing the key of "Closing mould", press the Mooney key to enter into the conditions of Mooney test, when the signal of closing mould reached, the preheatment for 1 min., after 1 min. preheat, the motor automatically starts, the Mooney test starts. Under the condition of the test temperature, the viscosity of the sample rubber, through torque driving mechanism, shall be passed to the measuring system, the computer will select and process, then show off the on-site curve

and data of viscosity of rubber sample changing with the time.

B Scorch Test

The procedures of the scorch test are basically same as those of the Mooney test. When the temperature setting stable, quickly put the rubber materials into the mould cavity, press the key of “closing mould” and the key of “scorch” at the same time, enter into the conditions of the scorch test. The curing index selected from T_{35} to T_5 for large rotator, and selected from T_{18} to T_3 for small rotator. In the case of the test time reaching T_{40} , the unit stops automatically.

C Relax Test

First, do Mooney viscosity testing. After abruptly stopping the rotor at the end of the Mooney viscosity measurement, and the torque turns decreasing. The relax curve and relevant data will be recorded.

2.5 Printed Curve and Symbol

Vertical cursor – Mooney value: 1 unit means 1 Mooney value;

Horizontal cursor – Time (minute);

ML: Min Mooney value of the test;

M (A+X): A means preheating time, X means record point;

T_5 : Time relevant to minimum over 5 units Mooney values;

T_{35} : Time relevant to minimum for over 35 units Mooney values;

@ T_{30} : $T_{35} - T_5$, that is the curing index of the sample;

T_3 : Time relevant to minimum over 3 units Mooney values;

T_{18} : Time relevant to minimum over 18 units Mooney values;

@ T_{15} : $T_{18} - T_3$, that is the curing index of the sample;

Notes: T_5 , T_{35} , @ T_{30} are sample data of large rotator;

T_3 , T_{18} , @ T_{15} are sample data of small rotator.

k: is a constant equal to the torque in Mooney units 1 s after the rotor is stopped;

α : is an exponent that determines the rate of stress relaxation.

3. Software part

3.1 Configure、installation and start of software

The software is used for measuring characteristics of un-vulcanized rubber samples with some characteristics, such as flexible and easy operation. All the technique indexes conform to the determination standard of GB/T 1232.

3.1.1 Configure of hardware and software

A. EMS Memory PIIC300/64M, display :Colorful VGA (supporting resolution of 800×600 or above).

B. Colorful inkjet printer.

C. Windows XP Operating system.

3.1.2 Installation

Insert the disc, open the software, double click”  , follow the prompts of installation program, in turn install the operation, the installation was successful until the installation program prompts. After installation, desktop will automatically generate a quick icon.

3.1.3 Start software

There are two start ways as follows:

A. Double click the icon of system in system table, and start the operation.

B. Click **【start】** → **【program】** → **【Mooney analysis system】** →  **MOONEY】** .

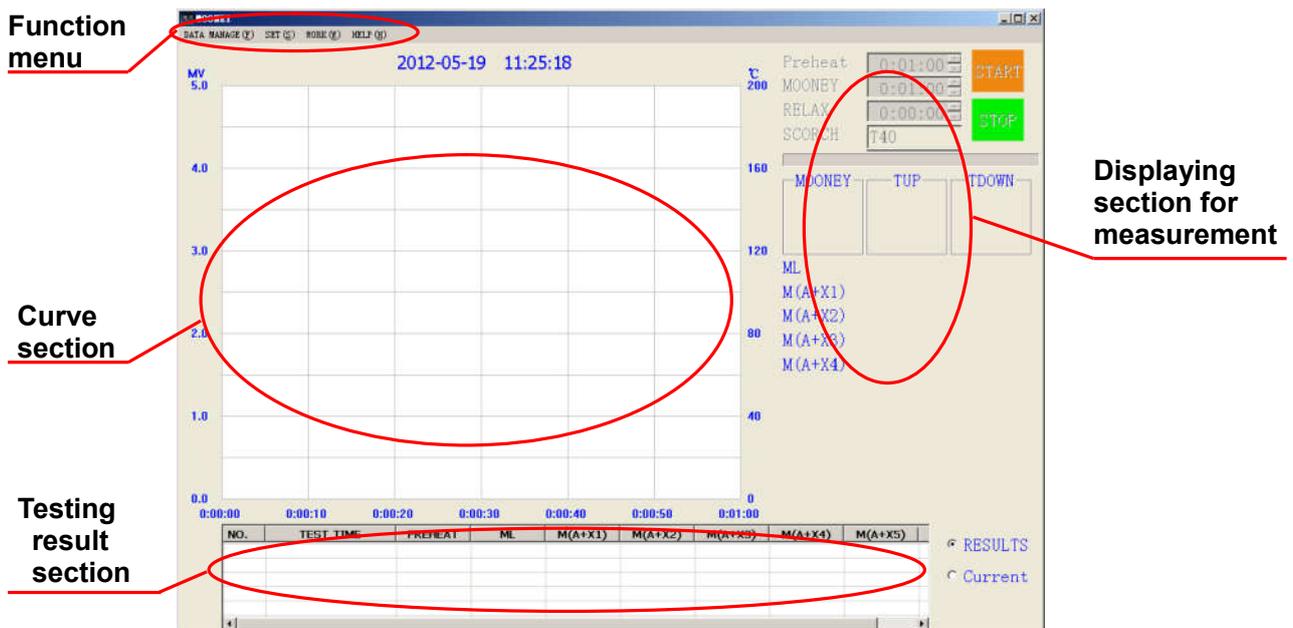


Figure 1

3.2 Main windows of software

Main windows of software is the center of controlling program, it is in charge of witching all windows and displaying testing status information during testing. (as follows Figure 1)

- A. Function menu: Switch from one menu to another.
- B. Displaying section for measurement: Display Mooney value, temperature of upper and lower die.
- C. Curve section: Real-timely display curve of Mooney value-time and temperature-time.
- D. Testing result section: display every sample testing result.

3.3 System menu functions

3.3.1 Data management

Click "**Mooney data management**" or "**Scorch data management**" or "**Relax data management**" on the figure 2, appear figure 3 interface.

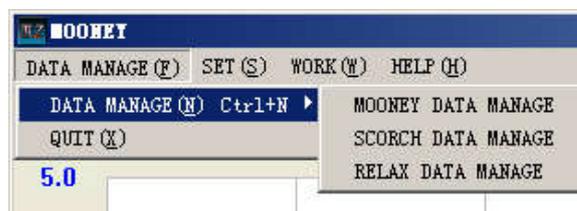


Figure 2

the empty boxes that in 'test material option' column. Behind the blank box to fill the record you want to view point, it will appear M(A+X) Mooney value.)

3.3.2 Parameter settings

3.3.2.1 Initial Setting

Click "**SET**" button, select "**Initialization**", appear figure 5 interface.

Figure 5

SET: In the column of the test is the parameters set.

[TESTNAME]: The name of rubber of the test.

[ProcDate]: The production date of the test.

[B/N]: The batch number of the sample

[Preheat Time]: Before the start of the test, sample need to preheat too long, the longest for 10 minutes, the shortest for 1 second.

[TESTTIME]: The testing time, the longest for 2 hours.

[TUP]: The temperature setting of upper mold temperature of this time.

[TDOWN]: The temperature setting of lower mold temperature of this time.

[Max Mooney]: This experiment shows the largest Mooney value, the maximum can be set to 200 MV.

[TEST UNIT]: The sample provide unit.

[ROTOR TYPE]: Big rotor or small rotor.

TEST TYPE: Select the testing type.

A. Mooney: Select the Mooney Test, there are five types to choose, can choose within five test record point M(A+M), among them A means preheating, X means record point. For example, the diagram chose two records points, the record four minutes and five minutes. The Record point can also choose to the second to

decimal form input, such as 7.2 minutes record as points.

B. Scorch: Select scorch, there are two testing type. As shown blow:

TX1 mean the first choice of scorch record point, example for T32. TX2 mean the second choice of scorch record point, example for T38. The Max value is T40.when choose the big rotor in rotor type within setting, the system will automatically show T5, T35 and T30; when choose small rotor, it will show T3, T18, and @T15.

C. RELAX: Select relax, there are two parts, Mooney and relax. As shown blow:

Setting up of Operation:

A. TESTER: Name of the person doing this test.

B. TEST DATE: Date of doing this test.

C. USE UNIT: company owning the equipment.

After completing all the setting up, click **"INS"** button in Figure 5, the setting of this testing will be saved. If doing the data-setting test later, double click the saved setting, it will be used directly into the current test. If the saved setting needs being deleted, click **"DEL"** button.

After completing the initial setting, click **"OK"** button, enter the main interface.

3.3.2.2 Elimination of friction force

Click **"SET"** button, choose **"Calibration Set"** button of pull-down menu, appear figure 6 interface.

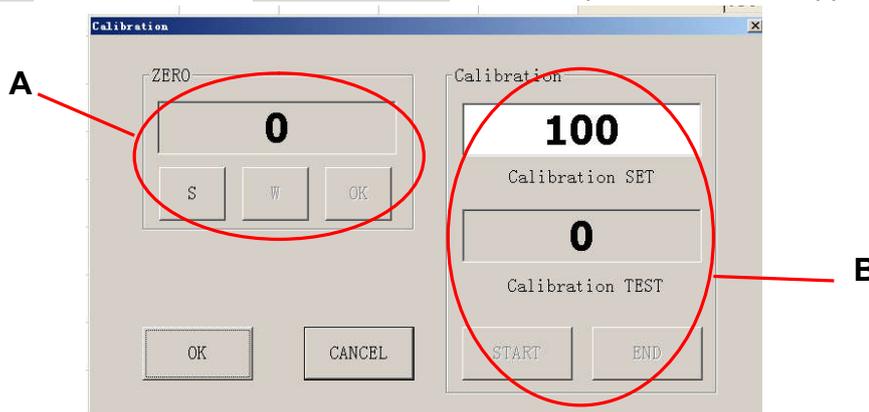


Figure 6

In the following part, process of system calibration will be introduced specifically:

Please don't put rubber sample into lower mould cavity when you eliminate this friction force, and you only need to set testing temperature, for example 150 degree (refer to Appendix 8). When the temperature of the Sp window accord with the temperature value of the PV window. You can operate as follows.

(1) Elimination of friction force

Step 1: Hang the 25MV basis weight on the screw of the swinging arm, then move around the pulley, at last hang

under the swinging axis. Click "SET" button, choose "Calibration Set" button of pull-down menu, appear figure 6 interface.

Step 2: Click the button of "S" and "W" in section A, at this time upper mould will move downwards until touch the lower mould, and indicating light of the motor will be on and system begin to count. when the figure is steady, click the button of "OK" in section A to finish the removing of friction force. Then we must begin doing the working of Torque Calibration as follows.

(2) Calibration of torque sensor

First put the four 25MV weight on the basis weight. click "Start" in section B, at this time system upper die will move downwards. The motor light is on. System start measuring, when software system prompt the value is "100" in section B after 20 seconds, click "END" button.

Attention: You must take away the four 25MV weight after calibration without basis weight.

3.3.2.3 System set

It has been set up before out factory, please don't amend arbitrarily, or it may influence the result of testing.

3.3.3 Operation of testing

3.3.3.1 Start testing

Click the button of "START TEST" under the menu "WORK", then the right button "START" takes effect. At this time, the operator prepared sample into the die cavity of the equipment, then click the button "START" or "TEST" on the faceplate of the equipment, the upper die cavity will move down, dies will be combined, and the equipment start testing. After completing the testing, the testing data will be saved automatically.

3.3.3.2 End this testing

During the process of testing, if the operator wants to stop, click the button of "STOP THE TEST" under the menu "WORK", or click the button "STOP" in the interface.

3.3.3.3 End testing

After doing a group of testing, print report can be previewed only by clicking the button "EXIT TEST" under the menu "WORK". After clicking the button "EXIT TEST", if wanting to do next testing, the operator have to set up the parameter again.

4. Testing process

4.1 Open the system: double click the icon of "MZ" on the computer desk.



4.2 Parameter setting: check the heating button lightened or not. Set up the wanted temperature for the test. Complete the input of Parameter by click the menu, and 3.3.2.1 Initial Setting to for rules and types of inputting data .

4.3 Removing of friction force and torque of calibration. (Take 3.3.2.2 Elimination of friction force)

If the software is used for the first time, do this step, or skip it. Because the system has preserved the former figure of friction and calibration, it will be loaded automatically when doing test.

4.4 Click the button of "WORK", then click the button of "START TEST". The system will load the Parameter setup.

4.5 Start testing

After putting into the sample, click "START" or "TEST" on the faceplate of the equipment. At the moment, the class door moves downwards, and mould cavities close and the motor starts. We can observe the curve changing in curve section. If preheating or testing time needs to be changed, click the small triangle.

During the process of testing, if the operator wants to stop, click the button of "STOP THE TEST" under the



menu "**WORK**", or click the button " " in the interface. Results will be saved automatically after completing the testing. After doing a group of testing, print report can be previewed only by clicking the button "**EXIT TEST**" under the menu "**WORK**". After clicking the button "**EXIT TEST**", if wanting to do next testing, the operator have to set up the parameter again.

4.6 File printing

Click "**Data management**" button, then click "**Mooney data management**" or "**Scorch data management**" or "**Relax data management**", select "**NAME**" or select "**DATE**" or both, then click the "**HISTORY**" button the eligible historical data will be popped. Chose one or more data, click "**LOAD**" button, then the curve of the picked data will show up. If you need to print the report, click the "**PRINT**" button.

4.7 Close the system

Click the button of "**QUIT**" under the menu "**Data management**".

5. Maintenance

This instrument is an easily operated integrated automatic control system on the base of a microprocessor. Since its complex and fine inside structure, the customer shall make daily maintenance properly.

5.1 Always keep the inside and outside of the instrument clean, don't rub its surface with corrosive organic solvent and gasoline.

5.2 Make lubrication and oil adding as follows.

5.2.1 Regularly clean the stud with soft silk filled with machine oil (one time every 2 –3 weeks)

5.2.2 Regularly drop few machine oil at the joint bearing at the two ends of the link (one time per month)

5.2.3 For long stop of operation, cover little machine oil on the surface of the cavities of upper and down moulds so as to prevent rusting.

5.3 For triple valve, mind timely draining water and adding oil with correct types of oil, keep close watch on the mist conditions of the oil mister (adjustment general after 2 –3 times of consecutive close and open of the mould), there are one or two drops of oil, clean the filter every 3 months to prevent block and malfunction of the magnetic valve.

5.4 Check the pressure meter one time every year.

5.5 At the completion of each test, thoroughly clean out the adhered rubber inside the mould room so as to avoid slippery, which will affect the result of the test of sample?

5.6 If the date of the test unstable, the customer shall check if the screws fixing the sensor are loosen, and tighten them if necessary.

6. Attentions

6.1 Periodically check the seal between rotator and down mould gravity. Seal's failure will lead to the rubber's going between the mould gravity and axle and then affect the precision of instrument and testing error. If so, loosen the two bolts in the cover of the down mould gravity, take off the cover and then clear rubber sample in the mould gravity.

If the rubber sample enters main axle hole through down mould gravity resulting in the rotator not completely inserting into it, clear the rubber: Pull the cylinder ahead off the center of withstanding pole, loosen off the screw cap (refer to Appendix 6), take out the withstanding pole in the main axle and then clear the rubber.

Attentions: While installing the withstanding pole, firstly insert the rotator, then install the withstanding pole and adjust limited pole's position so as to control the height of rotator out of the mould gravity half of the thickness of itself and finally tighten the screw cap.

6.2 The Mooney shall be installed far away from the electrical with large capacity, especially those frequently

started.

6.3 At the completion of removal of abrasive forces and calibration of torque, in the case of unstable Mooney value or with difference, please repeat operation of calibrating torque.

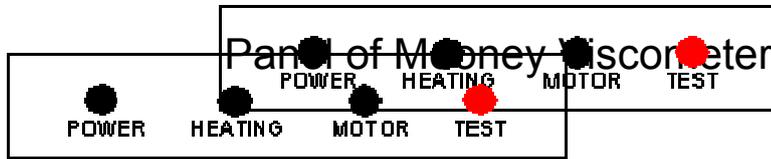
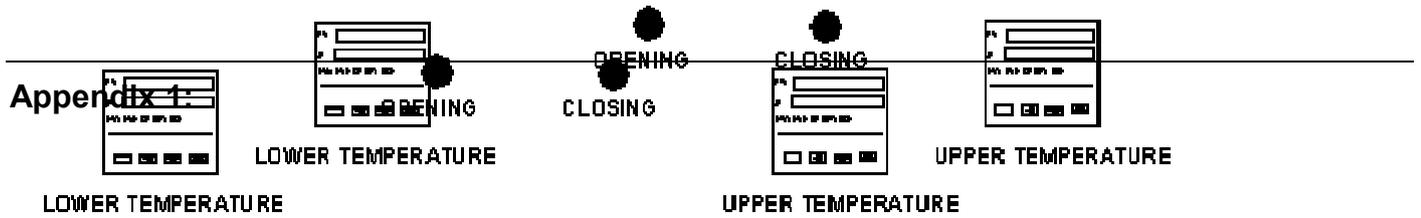
6.4 The instrument shall have good grounding to keep safety of the instrument and operators.

6.5 Because of have not connect a dependable ground that the temperature controller, the mainboard etc. damage, the duty all by customer.

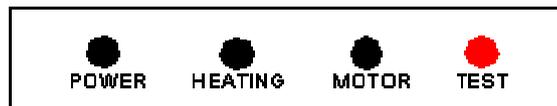
6.6 If the rubber have bigger viscosity, it must add high temperature paper when testing.

7. Common Faults and Remedies:

Faults	Possible Causes	Remedies
Without indications, the lighter doesn't light up	<ol style="list-style-type: none"> 1. The plug of the main power NOT placed. 2. Burn of the total fuse wires. 	<ol style="list-style-type: none"> 1. Carefully check plugs at the two ends of the power cable. 2. The replacement of fuse wires shall be operated by a technician. Contact our factory for consecutive burning.
Without actions	The compressed air NOT delivered.	The air pressure shall in conformity with the regulated.
Stop of the instrument during test	<ol style="list-style-type: none"> 1. Power fluctuated. 2. Interference of electro-magnetic field. 	<ol style="list-style-type: none"> 1. Check if there is a powerful motor frequently starting. 2. Casing shall be grounded reliably.
No heating of heating plate of mould cavity.	<ol style="list-style-type: none"> 1. The key of "heating" not pressed, the heater is off power. 2. Burn of fuse wires of the heating plate. 3. The solid-state relay burned. 	<ol style="list-style-type: none"> 1. Press the key of "heating", power the heater. 2. The two ends of the heating plate shall have some hundred Ohm resistances through measurement with X10 Grade of Multimeter. 3. Check if the lighter of the relay lights up, the relay generally will not be damaged.
Malfunction of actions of opening and closing mould.	<ol style="list-style-type: none"> 1. Air pressure NOT acted. 2. The gate moving mechanism works interruptedly or doesn't work. 	<ol style="list-style-type: none"> 1. Act proper air pressure. 2. Check if the stroke switch moved or damaged. 3. Check the power of the reversible motor.
Fluctuated curve	Some spare rubbers enter into main axle or check sealing washer.	Sealing washer need be replace or take spare rubber out main axle.
exceptional measurement value		We must do the removal of unloaded abrasive forces and calibrate torque

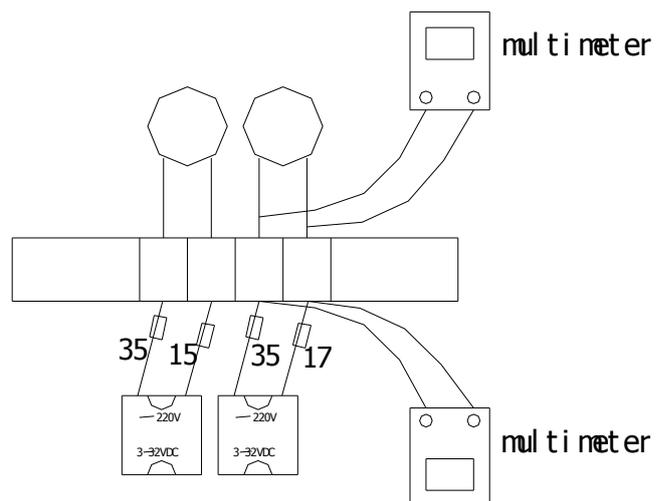
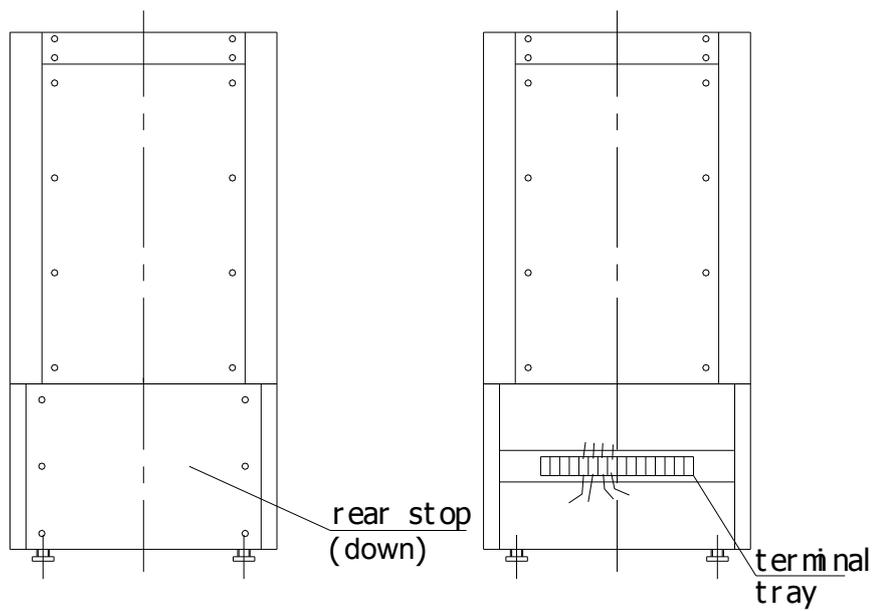


MZ-4016B₁ MOONEY VISCOMETER



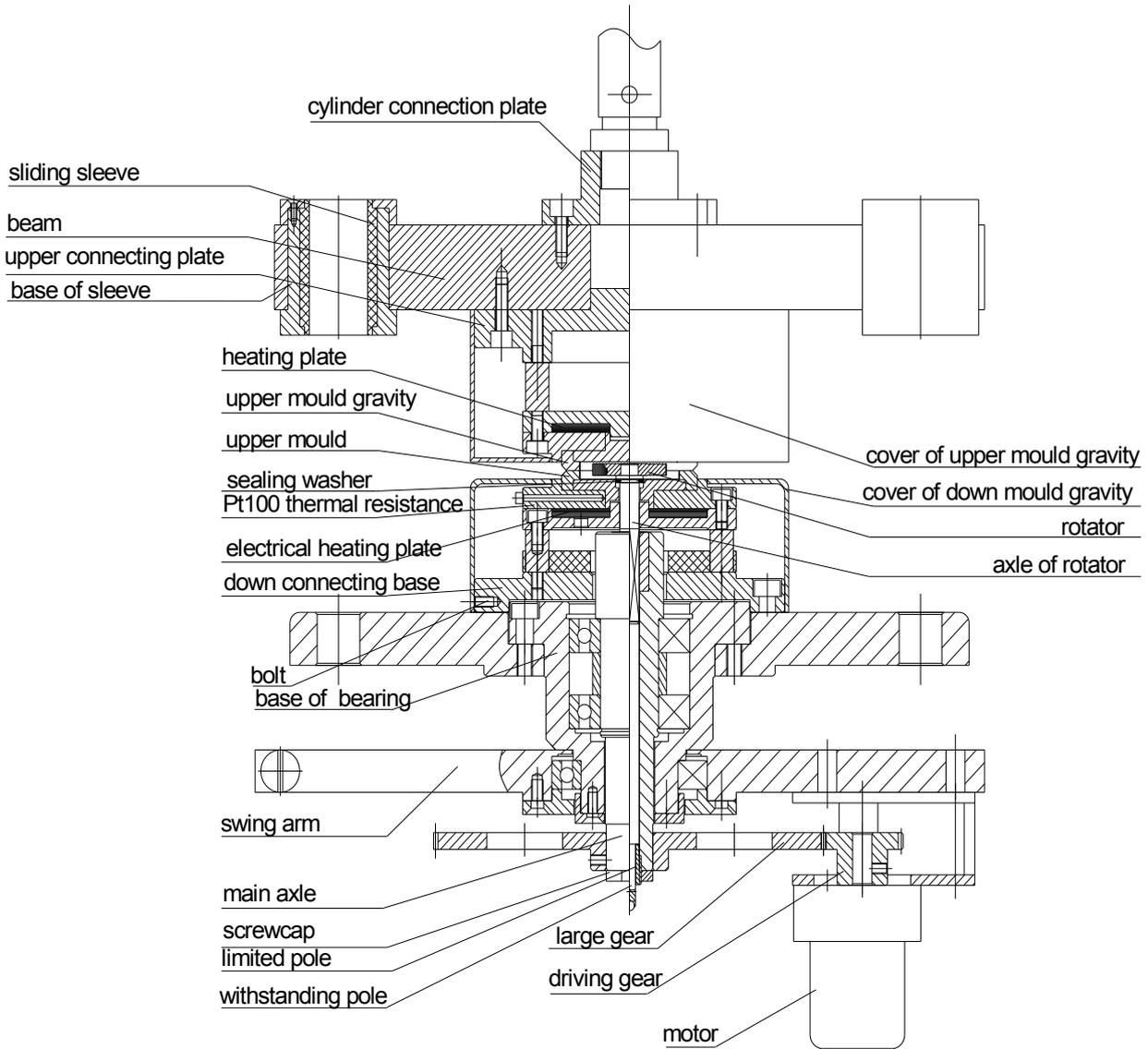
Appendix 2:

Inspection methods of the Solid State Relay and the electrical heating plate



Appendix 3:

Diagram of structure of
mould gravity



Appendix 4:

Inspection Methods for Mould Cavity of Mooney Viscometer NOT Heating

If upper and lower mould cavities of Mooney Viscometer cannot heat, generally owing to damage of electrical heating plate or damage of solid state relay, especially damage of the heating plate.

1. Inspection methods of the electrical heating plate

Open the rear stop (refer to Appendix 2), you can see the terminals (codes marked on the cables), you will find No.35, No.15 for cables of the heater of upper mould, and No.35, No.17 for cables of the heater of down mould. Adopt a millimeter, measuring No.35, No.15 or No.35, No.17 (both disconnection to the solid state relay), check the resistance of the heater of upper or down moulds. If the resistance is $135\Omega\sim 200\Omega$, the heater is normal. If the resistance is indefinite, the heater is bad. If the heater is normal, Press the heating key, measure No.35, No.15 or No.35, No.17 to see if there is a 220 voltage.

2. Inspection of the Solid State Relay

Open the front gate, there is an installation plate at the left side, there are two black blocks at the left bottom corner of the installation plate, that is, the solid state relay with the type of GJ10-W. The inspection procedures as follows.

Power "on", press the switch of "heating", adopt the voltage grade of a millimeter, measuring No.35, No.15 or No.35, No.17 to see there is a 220V. Otherwise, the relay has some faults.

During normal operation, mind the correct procedures, connect with the power, and then press the switch of power. For stop of the instrument, firstly open the switch of power, and then cut off the power. At the completion of operation, stop the instrument; avoid keeping the conditions of heating.

3. Change Methods of Heating Plate

Loosen two screws at the back of the cover of mould cavity with a small driver, remove the cover.

Loosen three M6 socket head cap screws at upper and down mould cavities with socket spanner, take out the upper and down mould cavities, you will see the round heating plate.

Remove the bands between the heating plate and the terminals, discharge the heating plate.

Load a new heating plate, in the course of inserting it into the upper and down mould cavities, mind to keep parallel of upper and down mould cavities, and press firmly the heating plate. If there is a space between the upper and down mould cavities, unstable heating will occur. You may spray a heat induction layer of glue between the plate and the mould cavity, and between mould cavities. You may also add a lay of rock wool between the heating plates, (but NOT at the space between the plate and the mould cavity).

After installing the heating plate, install the mould cavities, and then install the cover.

Appendix 5:

Parameters set and Procedures of self-tuning Temperature Controller

This instrument adopts 2 temperature controllers, and their parameters are set properly before delivery to ensure high accuracy. If there is a big difference between rubbers, or change of electrical heating plate, etc. the controlling accuracy will decrease. In case of a large curve fluctuation, you can set the temperature as follows.

Press the key of “Power”, press the key of “heating”, press the keys of “ ” or “√” at the controller to get the required setting of temperature. When the PV value of the controller is close to SP value, please operate as follows:

Step 1: Press the key of **【Para】** at the controller, 3 seconds later, appears “A--ā” on the PV screen, appears “AU₁0” on the SP screen.

Step 2: Press the key of **【Para】** again, appears “A₁” on the PV screen, SP screen will indicate “ ”, change it to “ ”, there is a dot flashing besides 1, meaning that the controller enters into the condition of self-tuning setting.

1 minute later, the controller returns to the original, and the bright dot at the PV screen will continue to flash, until the dot disappear, the setting will be finished. The controller may be put into normal operation.

. Appendix 6:

Environment setup for measurement software

When you firstly use this measurement software, you must do follows environment setup (refer to follows) so as to use the normal software, and then install the Rheometer measurement software.

As follows the menus: click **【start】** → **【settings】** → **【control panel】** → **【data,time.....】** → **【regional and language options】** you will see the item and change its settings.

