



# Instruction Manual of Direct Pressure Tester

V2.06

## Hirays Product Manual

Focus on R&D air leakage tester equipment for 14 years

The Brand Of China The Level Of The World



## Revision of instruction manual of Direct Pressure Tester

Version	Change content	Valid Date
V1.01	First issue	2019.09.08
V2.05	Added Chapter V and Chapter VI, and corrected some errors	2020.07.04
V2.06	Modified the "warning icon", optimized pictures and layout design.	2021.10.25
V2.06	Translate the article to English.	2022.10.11

# Preface

Dear Customers:




Thank you for trusting our brand and purchasing Hirays' Direct Pressure Tester. This tester is designed to be as practical and stable as possible. We are confident that it will bring you a very satisfactory experience during many years of use.

To operate the tester better, please read the instructions carefully. This manual introduces the installation, setting, product function, operation method, maintenance, repair and operation precautions of Hirays' direct pressure tester. Please read this manual carefully before use and keep it properly.

## Safety precautions

This manual records how to use the direct pressure tester correctly and safely and describes the contents of preventing harm and property loss to the operator and others. Do not perform operations other than those described in this operation manual.

[identification description]

SIGN	Content
 WARNING	If the following warnings are ignored, mis operations may result in personal injury or death.
 CAUTION	If the following precautions are ignored, mis operations may result in injury and property damage.
 WARNING	
<ol style="list-style-type: none"><li>1) Before turning on the power supply, make sure that the power supply is grounded. If the grounding wire is not connected, it may cause an electric shock accident. The ground wire must not be connected to the natural gas pipe, otherwise it will easily cause fire and electric shock accidents.</li><li>2) Non Hirays' engineers, please do not open the case, otherwise it may cause electric shock and irreversible damage</li><li>3) When there is dust on the metal part of the power plug and its surroundings, please wipe it carefully with a dry rag, otherwise it is easy to cause fire and electric shock accidents.</li><li>4) If the direct pressure detector is dropped or damaged, turn off the power and then pull out the plug. Otherwise, it is easy to cause an electric shock accident.</li><li>5) When inflating the precision leak tester, the inflation pressure must not exceed the specified pressure, otherwise it's easy to cause equipment damage and personal injury.</li><li>6) When water, oil and other liquids enter the tester, please turn off the power and pull out the plug. It is easy to cause electric shock accident. Attention should be paid when the direct pressure detector is installed near water and oil.</li><li>7) If the following situations occur to the tester, please stop the operation immediately and contact the relevant personnel of our company:<ul style="list-style-type: none"><li>*Smoke</li><li>*Abnormal sound</li><li>*Operation failure</li></ul></li></ol>	

\*Problems occurred that were not in the instructions

\*When it is impossible to operate correctly according to the instructions



CAUTION

- 1) Do not open the back cover of the tester if you are not an engineer from Hirays. Otherwise, the tester may be damaged or injured.
- 2) Objects shall not be placed on the upper part of the tester, within 20cm around, otherwise it will cause the accuracy of the tester to decrease.
- 3) Do not place the tester near the door, window, or outlet of the air conditioner, otherwise the measurement results will be inaccurate.
- 4) Do not install or remove the trachea in the state of ventilation, otherwise it may cause injury.
- 5) Do not use the device in the environment with humidity, direct sunlight, and room temperature below 5° and above 40°, to avoid mis operation and failure.
- 6) The direct pressure tester must be placed on a platform with sufficient load. Do not install in the strong vibration, unstable place, in order to avoid falling cause work-related accidents.
- 7) The test trachea of the tester should be of appropriate length, and the excess length should be stored to avoid accidental collision, which may cause the tester to fall to the ground and cause unnecessary losses.
- 8) When carrying the tester, unplug all cables and trachea, and hold the handle on the upper part of the tester with one hand and the lower part with the other hand. Otherwise, it is easy to cause personal injury and equipment damage.
- 9) When transporting the tester, protect it with sufficient shock-resistant material to avoid damage. For long-distance transportation, please use a wooden box.
- 10) When cleaning the surface of the tester, please use a soft cloth dampened with a small amount of water or alcohol to gently wipe.
- 11) Due to the upgrade of tester functions, the contents of this manual may be modified without prior notice.
- 12) Due to easy leakage of products and molds, misjudgment may be caused; when used in an inappropriate environment such as temperature changes, it may also cause misjudgment.
- 13) If there is anything unclear about the use of this tester, please contact our sales engineering as soon as possible.

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# Chapter I、Preparation and installation

## 1 . Open

### 1.1 Preparation

- a) Stable and clean compressed gas with a pressure of 0.4mpa-0.8mpa.
- b) Stable and reliable workbench;
- c) Stable and leak-free tooling and fixture;
- d) Power requirements: AC 220V( $\pm 15\%$ ) 、50Hz;
- e) Insert the power cable of the tester, the air inlet and outlet pipes, and the 25pin cable for communication between the tester and the tooling; The connection mode is shown in Figure 1-3;

### 1.2 Accessories

When receiving our tester, please open the package and check whether the accessories are complete, and the appearance is good.

Name	Specification	QTY
$\phi 8$ trachea with quick connector	2M	1
$\phi 4$ trachea for testing	1.2M	1
Plug	$\phi 4$	1
Instruction manual	V2.06	1
Inspection report	Issued by quality control department	1
Power line	220V ( $\pm 15\%$ ) 50Hz	1

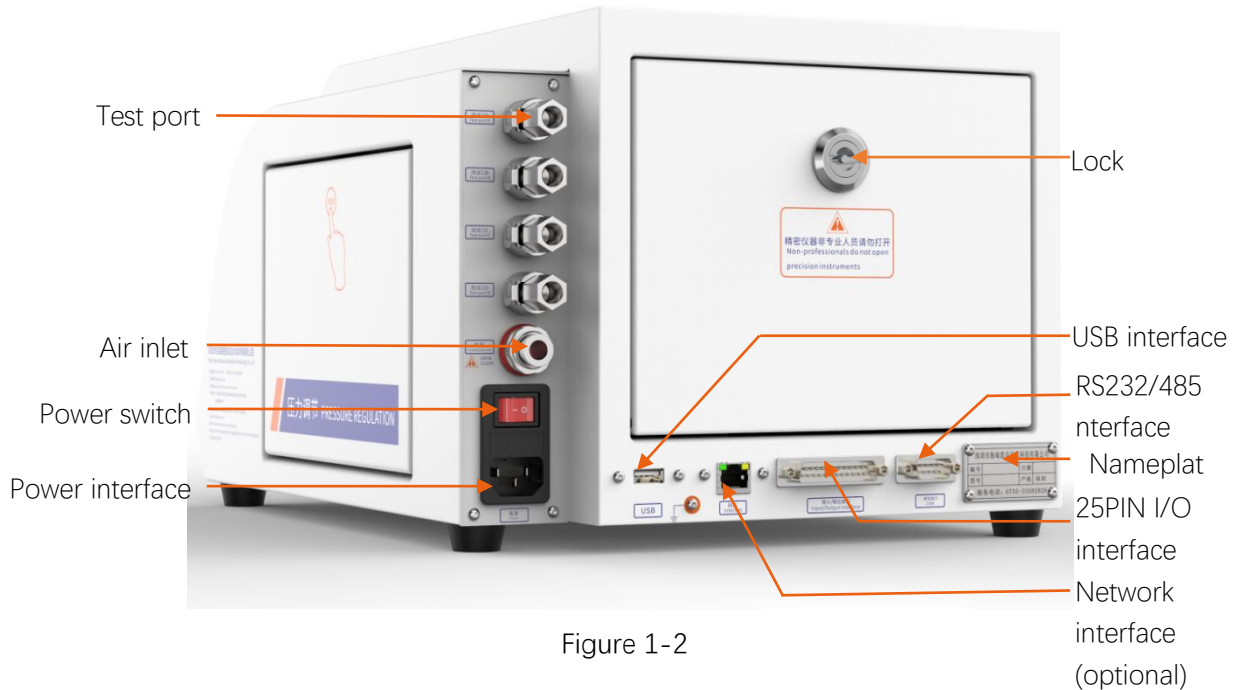
## 2. Tester composition

### 2.1 Front composition of the tester



Figure 1-1

## 2.2 Back composition of the tester



## 3. Tester installation and connection

### 3.1 Environment for installing the direct pressure tester

- Keep the working environment temperature at  $26^{\circ}\pm 1^{\circ}$ ;
- Place the tester away from the door、vent、air conditioning port etc.;
- The workbench must be stable and reliable ,no sundries around;

### 3.2 Tester air source / power connection

- As shown in Figure 1-4, first place the tester on a flat and stable desktop, insert one end of the power cable into the power interface of the tester, and the other end into the 220V/50Hz single-phase power socket.
- Connect one end of  $\phi 8$  air pipe to air inlet port of tester, and the other end to the factory air source;
- Connect the air pipe of the test interface to the fixture or mold;
- Turn on the power switch and wait for 2-3 seconds to complete the startup of the tester;

### 3.3 Connection of fixture and tester

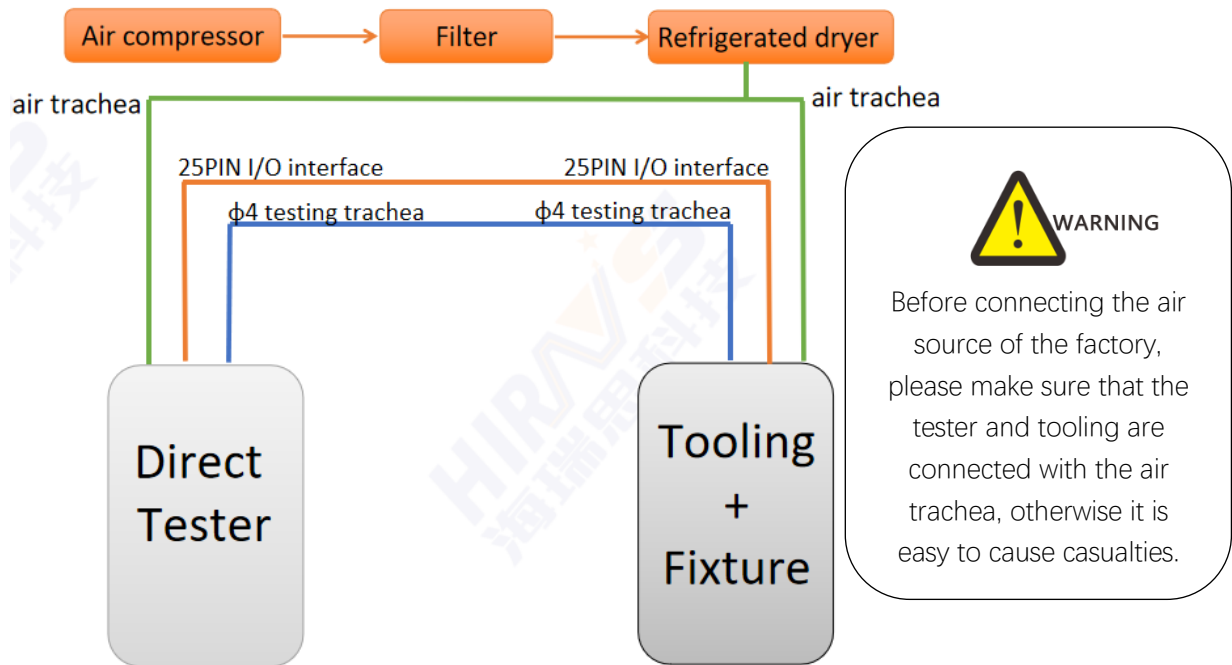


Figure1-3



Figure 1-4

Connection steps of tooling and tester:

- As shown in Figure 1-4, the filtered factory air source is divided into two channels, one for tooling and the other for tester.
- Both tooling and tester are connected by φ8 trachea;
- Connect the outlet trachea of φ4 on the tester to the air inlet of the mold;

- d) Connect the 25p cable on the tooling to the tester;
- e) The connection between tooling and tester is complete;

### 3.4 Description of control interface

- a) Ethernet interface: used to connect the computer (optional);
- b) USB interface: used to export historical data or install code scanning gun;
- c) RS485 interface: Standard communication interface, can be connected to a computer.  
If you need a communication protocol, please contact the sales engineer.
- d) 25PIN I/O interface: Special control data interface of Hirays;

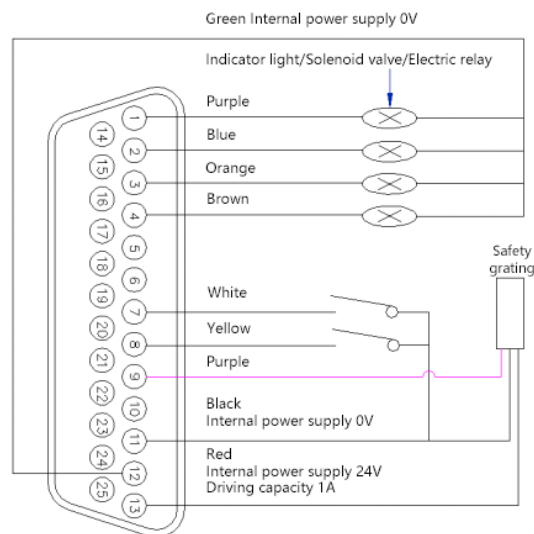


Figure1-5 25PIN external I/O interface

Pin number	Pin function	Pin number	Pin function
1	External output 1 (purple)	2	External output 2 (blue)
3	External output 3 (pink/orange)	4	External output 4 (brown)
5	External output 5	6	24V
7	External startup (white)	8	External stop (yellow)
9	Safety light curtain (grey)	10	Proximity switch (External output1)
11	GND (black)	12	GND (green)
13	Internal 24V power input (red)		

**External output:** The default is 24V DC output, maximum output current is 0.5A.

**External input:** NPN transistor input.



Figure 1-6 RS485 communication interface

Pin number	Leak tester pin function	Device port pin definition for connection to leakage meter
2	232_TX	232_RX
3	232_RX	232_TX
5	GND	GND
7	485_A	485_A
9	485_B	485_B

Remarks: For serial communication, the tester and computer are connected by straight line, 2 to 2, 3 to 3, 5 to 5.

# Chapter II tester interface operation instructions

## 1. Overview

### 1.1 Interface description



Figure1-1

Description:

- A: Return button
- B: Pre-Set button
- C: Program button
- D: System button
- E: Factory button
- F: About button
- G: Main button

- H: Date button
- I: History button
- J: Bar code button
- K: Internet button
- L: Test interface button
- M: User log button
- N: Support button

## 2. User login

"User login" includes login system, modify the password, new user and logout user.

### 2.1 How to login?

To use the tester, you must first log in. First click the user login button on the main interface as shown in Figure 2-1.



Figure 2-1

Figure 2-2 is showed, click User Login, as shown in Figure 2-3.



Figure 2-2

Log On

User name:

Password:

Belong to Administrator group

1	2	3	4	5	6	7	8	9	0	<-
A	B	C	D	E	F	G	H	I	J	Del
K	L	M	N	O	P	Q	R	S	T	Cap
U	V	W	X	Y	Z	OK	Cancel			

Figure 2-3

### 2.1.1 User description:

- a) Administrator: Belongs to the administrators group, can manage permission allocation.
- b) Operator: can operate the machine but cannot modify parameters.
- c) Engineer: factory engineer, can view and modify parameters.
- d) Hirays' Engineer: can operate the machine, modify parameters, add and delete users.

### 2.1.2 Password description:

- a) Administrator default password: 35689
- b) Operator default password: 8888
- c) Engineer default password: 123456



CAUTION

After the tester is delivered, please change the password as soon as possible and remember the password.

## 2.2 How to modify the password?

Click the red box in Figure 2-4, and the display is as shown in Figure 2-5



Figure 2-4



Figure 2-5

Before changing the password, you need to log into the corresponding user, enter the old



password first, then enter the new password, confirm the new password, and press the OK button to complete the password modification.

## 2.3 How to logout the user?

### 2.3.1 The function of logout the user

Log out the user, that is, logout of the currently logged in user authority.

### 2.3.2 How to logout the user?

Click the red box as shown in Figure 2-6, and then click OK to logout the user.



Figure 2-6

## 2.4 New user

When the built-in users of the system can't meet the needs, new users can be created. This function can only be used by Hirays engineers. If you need to use it, please contact the relevant personnel of our company.

## 3. Pre-Set

"Pre-Set" includes the setting of the display mode, the setting of the start mode, the selection of the system language, and the selection of the display unit and Radix point; You can check the current pressure and the Press zero.

Click the red box on Figure 2-7 to enter the Pre-Set, and then enter the following page as shown in Figure 2-8,



Figure 2-7



Figure 2-8

### 3.1 Display mode

Click the white button in the red box as shown in Figure 2-8 to switch the display mode.

- Digital display: as shown in Fig. 2-9, you can know the pressure of the current test pipeline on the test interface, and the leak of the current product after the test; The current program number can be seen on the right side, and the Fill time, Stable time test time, and Production can be seen on the lower side.
- Curve display: as shown in Fig. 2-10, based on digital display, the pressure curve from the beginning of the test to the end is added on the right side, which can more intuitively understand the pressure change trend.



Figure 2-9

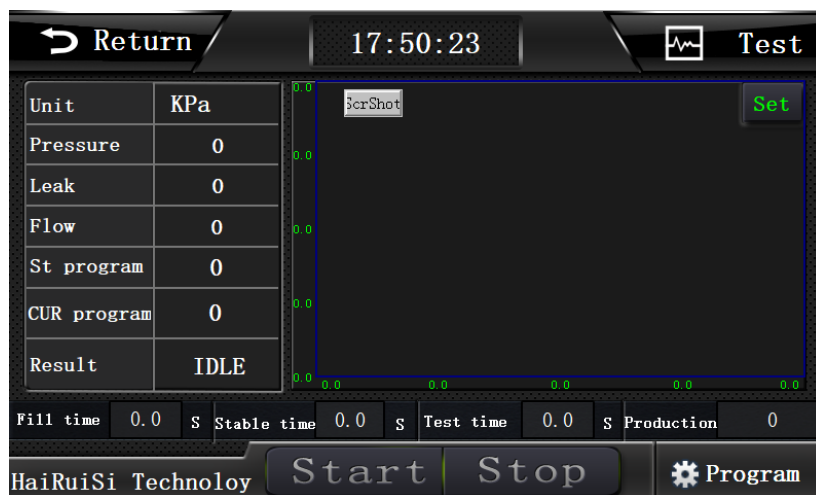


Figure 2-10

### 3.2 Start Mode:

As shown in Figure 2-11, click white button in the red box to switch the startup mode.

- Fixture start: Only the two-handed start button on the fixture can be used. At this time, the start and physical keys on the tester screen cannot be started. Fixture start is suitable for operation by the operator after commissioning, more secure.
- (INST) Tester starts: At this time, both tooling and tester can start the test program;



Figure 2-11

### 3.3 Language

As shown in Figure 2-12, click the white button in the red box to switch the language display.

- ENGLISH: Display in English.
- CHINESE: Display in Chinese.



Figure2-12

### 3.4 Unit selection

As shown in Figure 2-13, click the button in the red box to switch units.

#### 3.4.1 Unit description

- Kpa: Kilo Pascal
- Pa: Pascal
- Kgf/cm<sup>2</sup>: Kilograms force per square centimeter
- Psi: Psi/Inch<sup>2</sup>
- mmH<sub>2</sub>O: Millimeter H<sub>2</sub>O
- Bar: Bar
- Mbar: Mill bar

h) mmHg: Millimeter Hg



Figure 2-13

### 3.4.2 Unit conversion

#### 3.4.2.1 Precautions for unit conversion

The unit of this tester is automatic conversion. Once the unit is set, do not switch units quickly, otherwise the setting will be wrong.

#### 3.4.2.2 Unit conversion form

Unit	Kpa	pa	Kgf/cm <sup>2</sup>	Psi	mmH <sub>2</sub> O	Bar	Mbar	mmHg
1Kpa	1	1000	0.0101972	0.1450377	101.972	0.01	10	7.500612
1Pa	1000	1	1.02x10 <sup>-5</sup>	1.45x10 <sup>-4</sup>	0.101972	1.0x10 <sup>-5</sup>	0.01	0.007501
1Kgf/cm <sup>2</sup>	98.0665	98066.5	1	14.2233	10000.037	0.98066	980.7	735.5592
1Psi	6.89476	6894.76	0.07030	1	703.07216	0.068947	68.95	51.71493
1mmH <sub>2</sub> O	0.00981	9.80661	1.0x10 <sup>-4</sup>	0.0014223	1	9.81x10 <sup>-5</sup>	0.098	0.0735557
1Bar	100	1x10 <sup>5</sup>	1.0197162	14.503774	10197.2	1	1000	750.06168
1Mbar	0.1	100	0.00101	0.0145038	10.1972	0.001	1	0.7500617
1mmHg	0.1333	133.322	0.00135	0.01933	13.59514	0.00133	1.333	1

### 3.5 Radix point

Click the button in the red box as shown in Figure 2-14 to select the accuracy.

- 0.0000: Accurate to four decimal places
- 0.000: Accurate to three decimal places
- 0.00: Accurate to two decimal places
- 0.0: Accurate to one decimal places
- 0: Accurate to one digit



Figure 2-14

### 3.6 Current pressure

Display the current real-time pressure value.

### 3.7 Press zero

When calibrating the test pressure, be sure to connect the test air trachea to the atmosphere, and then click this button to reset the Press zero, taking the current atmospheric pressure as the standard zero.

If the pressure is incorrect due to the wrong return to zero, please connect the test air trachea with the atmospheric pressure again and click the Press zero button to recalibrate.

### 3.8 POSI

Pressure above atmospheric pressure is positive pressure. Click the button to open the inlet valve. The pressure at the test port is positive. The test pressure can be adjusted by the right pressure regulating valve knob.

### 3.9 Negative

Pressure below atmospheric pressure is negative pressure. Click the button to open the inlet valve. The pressure at the test port is negative. The test pressure can be adjusted by the right pressure regulating valve knob.

### 3.10 Pressure

It means that the current tester is pressure type, and the flow type tester will display "flow" when clicking "pressure".

## 4. Program parameters

"Program parameters" includes the settings of Test type, Test function, Test time, Pressure parameter and Output.

Click the red box as shown in Figure 2-15 to set program parameters. Figure 2-16 is the

interface after entering.



Figure 2-15



Figure 2-16

#### 4.1 Test type selection

Click the white button in the red box as shown in Figure 2-17 to switch the test type.

- a) Pressure: indicates the current program, and positive/negative pressure is used for testing.
- b) Flow: indicates the current program, and the flow is used for testing; (For this tester, the type cannot be switched to flow)





Figure 2-17

## 4.2 Test function

Click the white button in the red box as shown in Figure 2-18 to switch the test method.

- POSI(positive): Use positive pressure to inflate the product;
- Negative: Use negative pressure to evacuate the product;
- Direct: Suitable for products with air holes and semi-finished products.
- Indirect: Suitable for testing products without air holes and finished products;
- leak: Direct testing, leakage must be selected.
- Volume: as shown in Figure 2-19, when used for indirect testing, it is necessary to judge the large leakage. After selecting the volume test, you must click the orange button below, and the button will change to volume. The PRESS max on the right side will become the Volume max, and the PRESS min will become the Volume min. For example, the mold void volume standard is 30ml, then the volume upper limit is set to 32ml, the volume lower limit is set to 29ml, if the measured volume is outside 29-32ml, then the product will be judged as a big leak, if not in this outside, the tester will begin to determine whether there is a small leak.



Figure 2-18



- g) Volume: the volume will be displayed in the lower left corner of the test interface.
- h) Deff: this button of this tester cannot be selected.



Figure 2-19

### 4.3 Additional function

- a) Small Products: This function is enabled when we test extremely small products, such as medical capsules, small car cameras, electric toothbrush and so on.
- b) Pressure judgment: OK or NG use pressure to distinguish.
- c) Blasting test: During the whole testing process, the tester will record the maximum pressure value, which is the critical maximum pressure of product blasting.
- d) Block test: this function is used to test whether the product is blocked.

### 4.4 Time parameter

Click the number in the red box as shown in Figure 2-20 to change the corresponding time. The time description is as follows:

- a) Filling: in the direct mode, the air inlet time indicates the time for the tester to inflate into the product to be tested, which is generally set at 5-10 seconds. In the indirect mode, the air inlet time indicates the time for the air tank to inflate into the gap between the product and the mold.
- b) Stable: the time for the air filled into the product to stabilize the pressure, generally set as 5-10 seconds.
- c) Testing: that is, the time when the sensor starts to test the change of the leak. The longer the time is set, the larger the leak will be generally set to 5-15 seconds, depending on the product;
- d) Exhaust: generally, set to 2-5 seconds;
- e) Pre-fill: It will be used when using the indirect test; the time for the quantitative air inlet control tester to inflate the air tank is generally 5 seconds.
- f) Fixture: after setting the fixture interval time, we press the test button, and the tester will wait for the response time before starting to execute the program to inflate the product; For example, the fixture interval is set at 2 seconds. After we press the test button, the tester will wait for 2 seconds before inflating the

product.

- g) Learning: click to learn how to set parameters.



Figure 2-20

## 4.5 Pressure parameter

Directly click the number in the red box as shown in Figure 2-21 to modify the corresponding data.

- INPUT PRESS: the standard pressure when the product to be tested is pressurized, depending on different requirements.
- PRESS Max: the maximum value of the product to be tested when pressurized, generally 110% - 150% of the air inlet pressure; When it is a negative pressure test, the upper limit of air inlet is the standard to judge the large leakage of the product.
- PRESS Min: the minimum value of the product to be tested when pressurized, generally 70% - 95% of the air inlet pressure; When using the positive pressure test, the value of the lower limit of air inlet is the standard to judge the large leakage of the product.
- Leak max: the standard used to determine whether the small leakage of the product is qualified during the test.
- Leak Min: the minimum value of the leakage pressure of the product to be tested, generally - 0.1 to - 1.
- Leak rate: automatically calculated according to the input volume of the workpiece.
- Volume: the volume inside the product in the direct test, the unit is ML, and the volume between the product and the mold in the indirect test; it can be obtained by automatic volume calculation or actual measurement
- Next: used to connect the next test program. When there is only one program, the current program number is the same as the next program number. When there are two or more programs, the next program points to the next program number.



Figure 2-21

## 4.6 Output status

- Directly click the numbers in the red box in Figure 2-22 to modify the corresponding data. The tester can control 4 groups of external outputs by default, after the start button is pressed, the tester does not start the test for a period, by controlling the on-off sequence of the solenoid valve to complete the corresponding action, and then control the fixture to complete the corresponding action, down or up.
- The output state is divided into two states: ON/OFF. ON means the fixture performs part of the action, OFF means the fixture resets.
- If the external output 1 is connected to a solenoid valve that controls the cylinder, change the first group of OFF to ON for 3S before the test, which means that the external output 1 will be turned on with a delay of 3 seconds after pressing the test button. Shown in the fixture, after the start button is pressed, the clamp delays for 3 seconds and then presses down;
- If the external output 1 is connected to a control cylinder solenoid valve, the first group of OFF 4S after the test, means: the external output 1 after the end of the test, delay 4 seconds to open, as shown in the fixture, after the test is completed, the cylinder delay 4 seconds to rise.



Figure 2-22

# 4.7 Description of button above

As shown in the red box in Figure 2-23

- a) Return: click this button to return to the main interface;
- b) NO.0: Indicates that the current used program number is 0;
- c) Program0: Click this button to modify the program name, as shown in Figure 2-24, click the blue box to switch the input mode: uppercase, lowercase, symbols, pinyin. Finally, click OK to save the program name.
- d) Search: Click the button, the page shown in the red box in Figure 2-25 will appear, click the program name to jump to the corresponding program; click the button shown in the black box to switch the number of pages displayed; there are 100 programs in total.
- e) Test: click to return to the test interface;



Figure 2-23



Figure 2-24

Program total: 100			
NO.	Name	NO.	Name
0	program0	10	program10
1	program1	11	program11
2	program2	12	program12
3	program3	13	program13
4	program4	14	program14
5	program5	15	program15
6	program6	16	program16
7	program7	17	program17
8	program8	18	program18
9	program9	19	program19

Page: 1

Figure 2-25

#### 4.8 Description of button below

As shown in red box in Figure 2-26

- Last/Next: click to go to the last/next program.
- Super reset: Click to reset the current program.
- Save: Click to save the current program. If you modify the program, be sure to click Save, otherwise the program will malfunction.
- Save as: click and the display as shown in Figure 2-27. You can copy the current program to another program and automatically add the program name as: current program name\_ copy.

Return NO. 0 program0 Search Test

Test type: Pressure

Test function: POSI, Direct, Leak, Deff

Additional function: Small Pressure, Blasting Block

Time parameter: Filling 3 S, Stable 5 S, Testing 5 S, Exhaust 1 S, Pre-fill 0 S, Fixture 0 S

Pressure parameter: Input PRESS 20 KPa, PRESS max 25 KPa, PRESS min 15 KPa, Leak max 0.2 KPa, Leak min -1 KPa, Leak min 0.00 SCCM, Volume 0 ML, Next 0

Output: Before Test, After Test (OFF, 0, S)

Learning

Last Super reset Save Save as Next

Figure2-26



Figure 2-27

## 5. System settings

"System Settings" includes input/output control, bar code parameter, and advanced parameter settings and others.

### 5.1 How to enter system settings?

Click the red box as shown in Figure 2-28 to enter the system settings, and Figure 2-29 is the page after entering.



Figure 2-28

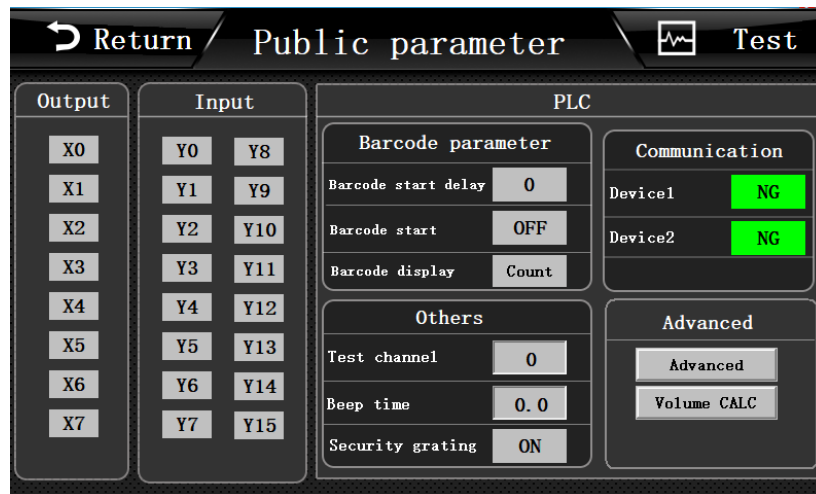


Figure 2-29

## 5.2 Output

- a) Y11: External Output 1
- b) Y12: External Output 2
- c) Y13: External Output 3
- d) Y14: External Output 4
- e) Y15: Reserved for non-standard use, this tester is not used

## 5.3 Bar code parameters

- a) Bar code start delay: after setting the scan bar code, the time to start the tester is 0s, the test will start immediately after scanning the bar code, and if it is changed to 3s, the test will be started 3 seconds after the bar code is scanned.
- b) Bar code start OFF: Bar code start is prohibited, and the tester needs to be manually started after scanning the code
- c) Bar code start ON: allow bar code start, after scanning the bar code, the tester will start automatically;
- d) Bar code display --count: that is, the code starts from 1.
- e) Bar code display --scan: that is, the bar code is scanned.

## 5.4 Other parameters setting

- a) Test channel: The system defaults to 1, modification is prohibited.
- b) Beep time: adjust the buzzer sounding time, generally set to 1 second.
- c) Security grating ON: when the safety grating is installed, turn on this button and install the safety grating. When there is no foreign object blocking between the gratings, it can be started normally, otherwise it cannot be started.
- d) Security grating OFF: turn off the safety grating detection function.

## 5.5 Communication status

- a) Device 1 OK: the default is OK; if it is NG, all program parameters become 0, adjust the inlet pressure, no pressure display
- b) Device 2 OK: the default is OK; if it is NG, all program parameters become 0,



adjust the intake pressure, no pressure display;

## 5.6 Advanced parameters

5.6.1 Advanced parameter setting (not to modify at will, please consult the corresponding engineer if necessary)

Figure 2-30 shows the first page of advanced parameter settings.

- a) Auto test: After this function is turned on, the tester starts to run the current program automatically, unless the current function is turned off or the power is cut off, the auto test will not stop! During operation, if you press the stop button, it will pause for 15 seconds, after 15 seconds, the tester will automatically start the test.
- b) One Step: when this function is applied to multiple program tests, the results will be displayed after each program test is completed. If you want to continue the test, press the start button again.
- c) Pressure zero: This function is to automatically reset the Press zero before each test to enhance the reliability of data.
- d) Safety grating on: When this function is turned on, the grating is valid during the whole test process; if this function is not turned on, the grating is only valid during the tool pressing time.
- e) History program NO.: The first column of history record shows the program number.
- f) History product model: The first column of history record shows the product model (set program name).
- g) Show all result of OK/NG: when multiple programs are in progress, if there is a program test result NG, the tester will display NG, if not, it will not display.
- h) Continue after test NG: When multiple programs are connected to test, the test will be stopped after NG by default. After this function is turned on, when the product has a large leak, the inlet pressure exceeds the upper limit, or exceeds the upper limit of leakage, the next program will continue automatically after NG occurs.
- i) Pressure pre-judge: judge whether the air pressure is qualified at the inflation stage, and if not, judge NG in advance.
- j) Leak pre-judge: judge whether the leakage pressure value is qualified or not in the test stage, if not qualified, judge NG in advance, and do not test of the remaining time;
- k) Quantify pre-fill: When used in indirect mode, put the time of quantitative air inlet after the test. Skip the quantitative air inlet directly during the test to save time. This function is only limited to HC and HL series products.
- l) Low alarm on: When the inlet pressure is lower than the set inlet lower limit, after the test is over, a pop-up window will warn.
- m) Low alarm off: to block the lower limit pop-up window.
- n) High alarm on: when the air inlet pressure is higher than the upper limit of air inlet, a window will pop up for warning after the test is completed;



- o) High alarm off: block upper limit pop-up window.

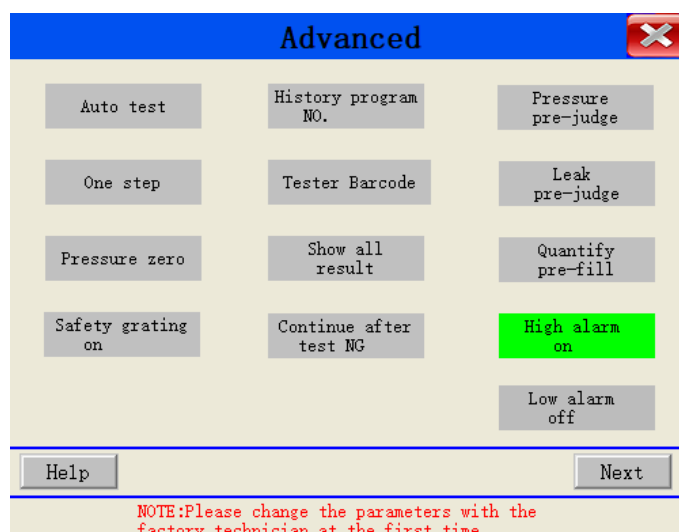


Figure 2-30

## 5.6.2 Advanced parameter setting 2

As shown Figure 2-31

- Flow unit: SCCM by default, which cannot be easily changed.
- Atmospheric coefficient: the default value is 1013, which cannot be easily changed;
- Stop at current program number: for multiple programs, during the test, press emergency stop, or STOP, the tester executes the current program;
- Stop reset program and cycle last program: Stop reset or safety grating reset, the tester is executed the last program;
- Stop reset specify program: when stop reset or emergency stop reset, the tester executes the specified program;
- Check after NG : After testing the product NG, the operator must press the reset button to take out the NG product for the next test, otherwise the test mold will not be opened and the product cannot be taken out; when setting, please consult the Hirays' engineer.
- No indicator lamp mapping: the indicator is not mapped to the external output;
- No 1-2 indicator lamp mapping: map OK NG signal to Y11, Y12, which is used when adding signal lamps externally
- No 3-4 indicator lamp mapping: map OK NG signal to Y11, Y12, which is used when adding signal lamps externally;
- Flashing indicator light: When this function is turned on, the indicator light will keep flashing, strongly reminding the operator;

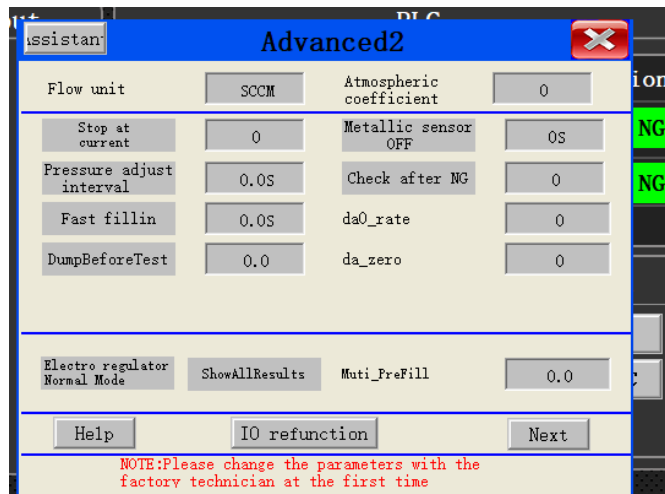


Figure 2-31

### 5.6.3 Automatic volume calculation

As shown in Figure 2-32, how to use this function?

- Switch program to No. 99 program;
- Change the input press in the program to the current input press;
- Save current program;
- Input the current test pressure into "Output Press", click to start the calculation, the tester starts to calculate the volume, and the volume result is the volume between the product and the mold gap + the volume from the mold to the test port of the tester;

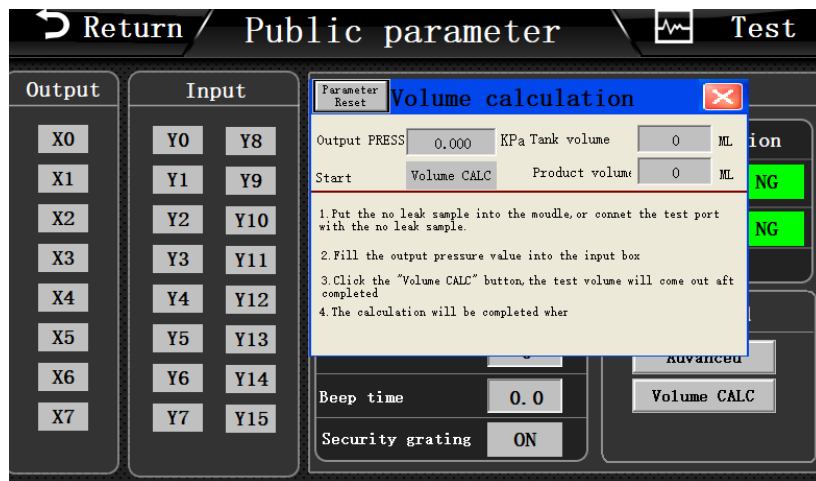


Figure 2-32

## 6. Test interface

### 6.1 Digital test interface

Click the Hirays' LOGO on the boot interface or the "Test" button in the upper right corner of any interface to enter the test interface.

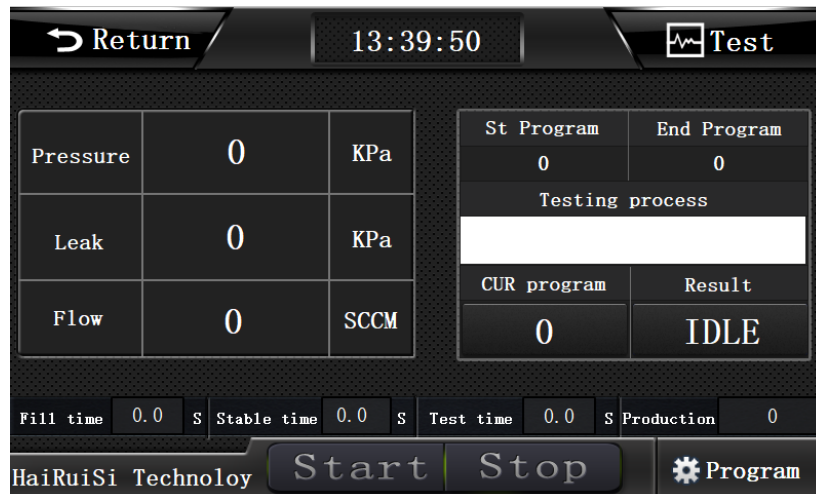



Figure 2-33

- a) Pressure: record the change of pressure during the whole test process, with the default unit of KPA;
- b) Leak : the pressure P1 at the end of pressure stabilization, minus the pressure P2 at the end of test time,  $\Delta P = P1 - P2$  is the leakage value;
- c) Flow: This value is not required for pressure type testers, here is the special display area for flow;
- d) St program: which program to start from;
- e) End program: which program to run to the end;
- f) Testing progress: Display the test progress with a progress bar;
- g) CUR program: which program is currently being tested;
- h) Results: divided into fixture installation, inflation, voltage stabilization, testing, OK, NG, standby and other states;
- i) Fill time; Real time display of current inflation time;
- j) Stable time: display the current voltage stabilization time in real time;
- k) Test time: display the current test time in real time;
- l) Production: count how many times the tester has been tested since the first test;



**CAUTION**

If there is only one program, the starting program number and the ending program number should be the same number. To switch from the No. 0 program to the No. 1 program, you only need to change the starting program number and the ending program number of the test interface.

## 6.2 Curve test interface

The curve test interface is equivalent to adding a curve graph of the pressure change during the test process in the digital test interface. Compared with the digital interface, the test progress bar is deleted.



Figure 2-34

- a) X axis/horizontal axis: defines the length of time, which is set according to the overall test time;
- b) Y axis/vertical axis: defines the displayed pressure, which depends on the test pressure;

**CAUTION**

The values of X axis and Y axis are set in the settings in the interface. The curve test interface is only suitable for testing a single program. After one test is over, the curve will automatically return to zero in the next test. Curves cannot be exported or edited;

## 7. History

"History" contains the necessary data of all test results, a total of 100,000 records can be stored, if it exceeds, it will be automatically overwritten from front to back.

As shown in Figure 2-35, click the history, and enter the page as shown in Figure 2-36.



Figure 2-35

[illegible]

Figure 2-36

- c) Production: record the total number of products tested. For each test, the total number of products will automatically increase by 1;
- d) OK product: record the number of qualified products tested, it will be automatically increased by 1 after each test;
- e) OK rate: equal to qualified number/output statistics x100%
- f) Time: the time of recording test results;
- g) Program: program number/program name to run during the test;
- h) NO./Bar code: When there is no bar code scanning, the product code is displayed; when there is a bar code input, the product bar code is displayed;
- i) Pressure: the test air pressure sampled during product testing;
- j) Leak: the product leakage pressure value calculated during product testing;
- k) Result: if the test air pressure and leakage value are within the parameter range set in the test procedure, the test result is OK, otherwise it is NG;
- l) View: click "view" to pop up the picture shown in Figure 2-37. After making the corresponding settings, you can quickly find and browse the test history data of a certain time period you want to view;

**Search history**

**Set Time Range**

☒ All stored data  
☐ Recent 10 minutes  
☐ Fixed time today

Time slice 0

☐ Appoint the time of the data stored  
 2022 Year 9 Mon 27 Day  
 10 Hour 18 Min 7 Sec

☒ Year ☒ Min  
☒ Mon ☒ Sec  
☒ Day  
☒ Hour

OK Cancel

Figure 2-37

- m) Delete history : After clicking, the page shown in Figure 2-38 will appear, click "OK" to delete history ;

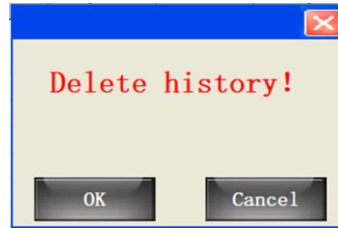


Figure 2-38

- n) Data to U disk: click it and the page shown in Figure 2-39 will appear. At this time, insert the USB flash disk into the USB interface, click Export History Record to the USB flash disk, and then wait 3 minutes to pull out the USB flash disk. At this time, the data export is completed, and the data can be opened for viewing and editing with EXCEL;

Note: USB flash disk only supports FAT32 format.

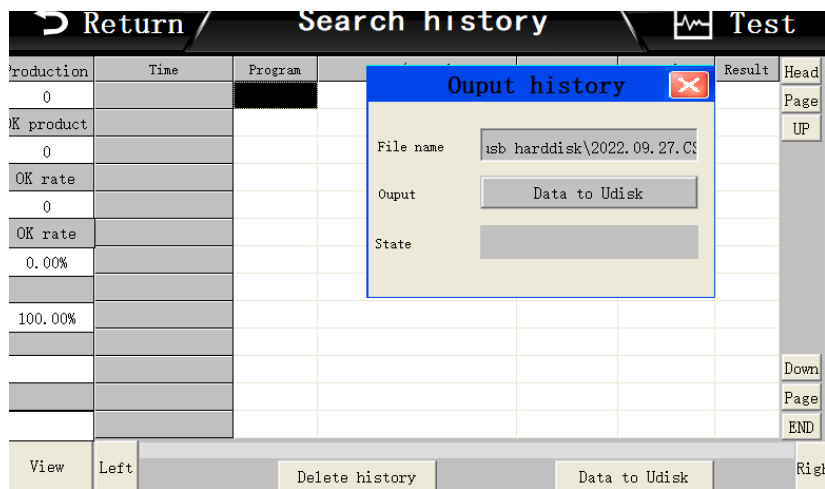


Figure 2-39

## 8. Bar code

As shown in Figure 2-40, it is the default screen after clicking bar code. The bar code function is not standard. If necessary, please contact our engineers.



Figure 2-40

## 9. Internet

Internet is suitable for communicating with computers.

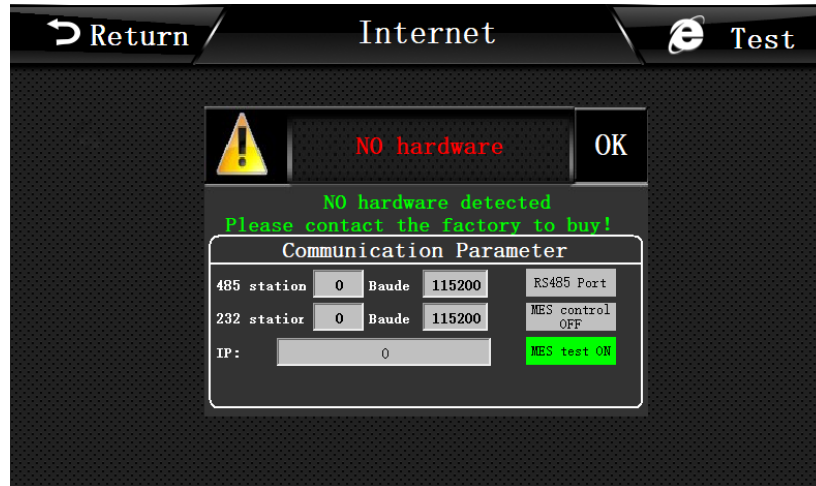


Figure 2-41

### 9.1 485modbus station

Modbus in the communication protocol, the communication station number of the equipment is set based on the upper computer.

### 9.2 232modbus station

Modbus in the communication protocol, the communication station number of the equipment is set based on the upper computer.

### 9.3 Result upload

When this function is turned on, after the test is completed, the tester will send the corresponding test results through the serial port.

### 9.4 RS485 Port/communication network port

To select the communication method and network port communication, you need to communicate with the sales engineer of Hirays in advance to purchase the corresponding module.

### 9.5 MES control OFF/MES control ON

When the MES control is ON, the tester cannot be started, and the upper computer needs to give a start signal. This function needs to be controlled by the corresponding upper computer software.

### 9.6 IP address

When the device is configured with a network interface, this IP address is used to set the network port IP of the tester;

## 10. Factory mode

This mode can only be accessed by Hirays' engineers.

## Chapter III、Maintenance and repair

### 1 About tester maintenance

#### 1.1 Test items every day

##### 1.1.1 Check whether the power supply is abnormal after work

- a) Check whether the two ends of the power cord are firmly plugged in, otherwise the tester cannot be turned on. To prevent electric shock, resulting in personal accident.
- b) Press the power switch to check whether the power indicator light is on (red if it is on), it means that the power supply of the tester has been connected and the connection is correct. If it does not light up, please confirm whether the power cord is plugged in tightly, or the fuse is over current and burned out.

##### 1.1.2 Check whether the air inlet pressure of the tester is normal

- a) Whether the air trachea of the air source and the connector of the tester are well connected, and whether there is air leakage between the air pipe of the air source and the air inlet connector of the tester
- b) After connecting the air inlet trachea, check whether the pointer of the air pressure gauge on the tester is greater than 0.4MPa. If it is not above 0.4MPa, adjust the three-element pressure regulating valve of the tester and turn it clockwise. At the same time, observe whether the displayed value on the air pressure gauge is increasing. Adjust the air pressure to above 0.4MPa. If it is adjusted to the maximum, the air pressure still cannot be adjusted, please confirm the factory air source.
- c) Check whether there is water, oil or other foreign matters in the filter. If yes, please drain and clean them.

##### 1.1.3 Check whether the test air pressure is normal

- a) The test air pressure is the air pressure inflated into the product or on the surface. The following assumes that the test method is direct testing, and the test pressure is positive pressure.
- b) Click the "Pre-Set" button on the touch screen, and the tester should be automatically entered the "Pre-Set" interface. On the "Pre-set" interface, click the "Tester display reset to zero" button (before clicking the button, confirm whether the air outlet is in contact with the outside atmospheric pressure), and observe whether the "current pressure" is zeroed. (If it is not reset to zero, please turn off the tester, wait for 20 seconds, and then restart to see if there is any fault).



- c) After the Press zero, plug the air outlet trachea of the Tester with a plug, clicking the "POSI" button in the "Pre-Set Interface" and observe whether the air pressure value displayed in the " Pressure" column is the test air pressure of the product.
- d) If the air pressure displayed in the "Pressure" column is correct, click the "POSI" Button in the "Pre-Set" interface again, and the tester will automatically stop inflating.
- e) If the air pressure value displayed in the "Pressure" column is not the test air pressure of the product, please manually open the 'Tester Side Door', manually twist the pressure regulating valve slightly, and observe the air pressure change in the " Pressure" column until the air pressure value displayed in the " Pressure" is the same as or slightly larger than the test air pressure required by the product.
- f) Close the "tester side door".

#### 1.1.4 Check whether the inspection items can be detected

- a) The OK samples and NG samples will be tested separately to see if the test results correspond one by one.
- b) If the results do not match, please contact Hirays' engineers.

## 2 Abnormal faults and Countermeasures

The tester has its own troubleshooting function, which can be entered and eliminated in the following ways.

Step 1: Return to the main interface and click the "Support" button shown in the red box in Figure 3-1.



Figure 3-1

Step 2: Click the "Troubleshooting" button shown in the red box in Figure 3-2

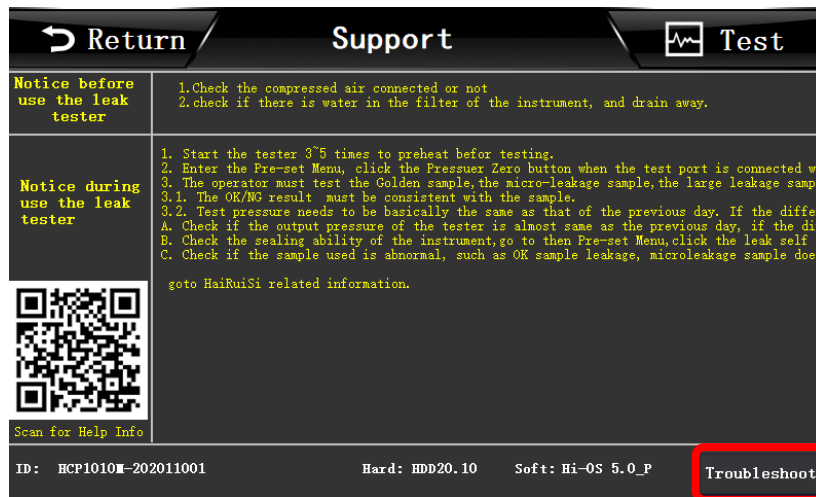


Figure 3-2

Step 3: Click the relevant fault detection button in Figure 3-3 to get the corresponding processing method;



Figure 3-3

## 2.1 When NG occurs frequently in the test

Please determine the causes in the following order and then implement the countermeasures.

### 2.1.1 No leak testing

Please test the tester for no leak after tying the test trachea. If there is no leak, it belongs to the reasons other than the differential pressure detector. Please confirm the following reasons.

### 2.1.2 Check the status of the fixture

Reason	countermeasure
Leakage of piping joints	Apply soap to the piping joint and pressurize it (keep it pressurized state) to confirm that there is no leakage. If there is a leak, replace the fitting and reconnect the piping.
Piping deformation	Replace the air trachea with material.
※ If the above reasons are eliminated or the countermeasures are invalid, please confirm the next item.	

### 2.1.3 Check the state of the mold seal

Reason	countermeasure
Missing silicone seal	Replenish the new seal ring
Dirt or foreign matters on the surface	clean
The sealing material is damaged	Replace the seal ring
When the seal is unstable	<p>Please confirm the following items and improve them if necessary.</p> <ul style="list-style-type: none"> <li>•whether the size and hardness of sealing materials is proper</li> <li>•whether gap between sealing material and the mold assembly is sufficient</li> <li>•Wear and tear of sealing materials</li> <li>•Whether the clamping force of the cylinder is too high or too low</li> </ul>
※If the above reasons are excluded, or the countermeasures are invalid, please contact our sales engineer.	

### 2.1.4 Check environmental changes

Reason	countermeasure
Insufficient compressor power	Replace the high-power compressor.
Other pneumatic tools are used on the air source, resulting in unstable air pressure	Do not connect pneumatic tools such as air guns and pneumatic screwdrivers during the test, to supply stable air pressure.
The influence of the air from the air conditioner and fan blowing directly to the test product	Move the equipment to a place with relatively stable pressure and temperature
※ If the above reasons are excluded, or the countermeasures are invalid, please contact our sales engineer.	

### 2.1.5 Check the state of the product to be tested

Reason	countermeasure
The temperature of the test product is higher or lower than the room temperature	The buffer station is added on the production line to make the temperature of the test article reach room temperature.
Product deformation during pressurization	Set blocks to prevent product deformation.
Air hole leakage or internal leakage	Check for leaks with soapy water or a water test If the leakage part cannot be found, it may be internal leakage. If leakage is confirmed, the production process needs to be improved.
Test product is wet	Improve drying process or add drying process
When the finished product was tested, the product structure resulted in the formation of the second and third cavities	Remove the second and third cavities that affect the test by improving the assembly process
※ If the above reasons are excluded, or the countermeasures are invalid, please contact our sales engineer.	

## 2.2 History can't be derived

Please check whether the format of the U disk is correct, the direct pressure tester only supports the U disk of FAT32.

## 2.3 Test result don't correspond to actual soaking test result

- Check whether the test pressure corresponds to the actual soaking depth and time;
- Check whether the mold and the product are completely sealed. If the product structure affects the sealing, please consider replacing the sealing method;
- Check whether the procedures and pressures used are those of the current product
- Other questions, please contact our sales engineer.

## Chapter IV、 Quick programming


### 1. Introduction of waterproof level and corresponding air pressure

#### 1.1 IP waterproof level

The protection grade adopts the IPXX grade standard recommended by the International Electro technical Commission (IEC). Different installation places have different grades. For details, please refer to the table below. In the grade standard, XX is a two-digit number, the first one indicates the protection level of the product against solids, and the second one indicates the protection level against liquids. The solid protection level has 7 levels, which are represented by 0-6; the liquid protection level has 9 levels, which are represented by 0-8 respectively.

Dust proof level	Protection standards	waterproof level	Protection standards
0 level	unprotected	0 level	unprotected
1 level	Prevent large solids from entering	1 level	Water droplets falling vertically have no harmful effect on the product
2 level	Prevent medium sized solids from entering	2 level	When the product is tilted 15°, water droplets drip onto the product, and the product has no effect
3 level	Prevent small solids from entering	3 level	Water or rain falls on the product at 60°angle from the vertical, and the product has no effect
4 level	Prevent solids larger than 1mm from entering	4 level	The liquid splashes on the product from any direction, and the product has no effect
5 level	Prevent harmful dust from entering	5 level	The product is sprayed with water in any direction, without any damage
6 level	Completely prevent dust from entering	6 level	The product is directly sprayed by water in any direction, and the water will not enter the product
		7 level	Can be soaked in water in a short time (1m,30min)
		8 level	This standard is more stringent than IPX7, and the water depth is deeper

## 1.2 IPXX waterproof level reference corresponding air pressure

waterproof level	Reference corresponding air pressure	Reference test air pressure
IPX5	≈ 3-5kpa	3-5kpa
IPX6	≈ 5-8kpa	5-8kpa
IPX7	≈ 10kpa	12-15kpa
IPX8	≈ 20-500kpa	20-500kpa
<div style="text-align: center;"><b>CAUTION</b></div> <p>The above air pressure is the reference air pressure and does not represent the actual test air pressure. For the actual test pressure, please consult our engineers.</p>		

## 2. How to quickly set the required air pressure

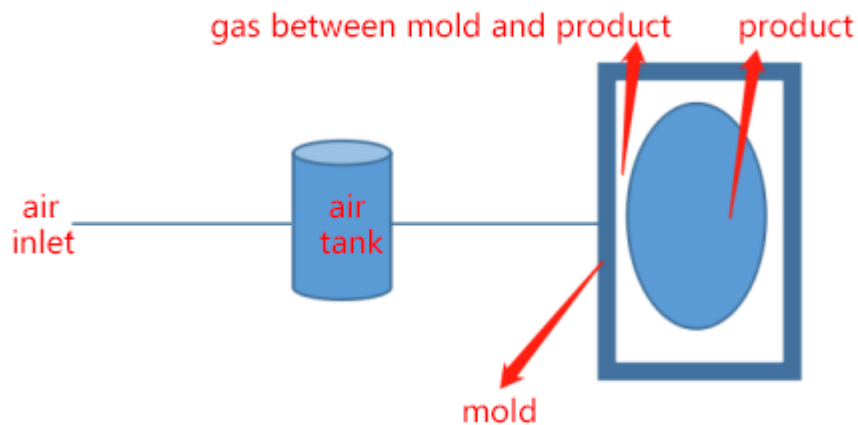
### 2.1 The product to be tested has air filling hole

- a) Enter Pre-set
- b) Open the test air trachea and connect it to atmospheric pressure
- c) Click "Press zero"
- d) Fully fold or plug the test air trachea
- e) Click the "POSI" and open the positive pressure air inlet switch
- f) Adjust the pressure regulating valve on the right to the proper air pressure
- g) Close the "POSI" air inlet
- h) Test pressure adjustment completed

**Note: If there is a clear pressure requirement, please set it according to the clear pressure, if not, please set it according to the reference pressure.**

### 2.2 The product to be tested has no air filling hole

- a) Enter Pre-set
- b) Connect the test port to atmospheric pressure, or press the STOP button once;
- c) Click "Press zero"
- d) Click the "POSI" and open the positive pressure air inlet switch
- e) Adjust the pressure regulating valve on the right to the proper air pressure
- f) Close the "POSI" air inlet
- g) Test pressure adjustment completed
- h) Put the OK product into the mold, and test it to see if the test pressure meets the requirements, otherwise repeat steps e and f



In the indirect test mode, the output air pressure adjusted by the Pre-set is the air pressure entering the air tank. When the air pressure in the tank reaches the set. The mold is inflated by the air tank. If the product is completely sealed. The gas in the gas tank can only enter the gap between the mold and the product. Assume that the air pressure charged into the air tank is 10Kpa. Gas tank 114ML.

The air between the mold and the product is also 114ML. At this time, the air pressure formed by the gap between the mold and the product is 5Kpa. (The influence of pipeline is not considered)



When the product to be tested has no air hole, the test method used is indirect test, and the specific air inlet pressure should be adjusted according to the actual situation until the test pressure is the required air pressure.

### 3. How to quickly choose the test method

- a) Enter the program parameter;
- b) Select the test type, there are two types of tests, pressure and flow. This tester selection, pressure.
- c) The test function has the following options:

Test type	Test function	judgment standard	Status of the product to be tested
POSI	direct	leak	Semi- finished products or with air filling holes
		volume	No such test plan
	indirect	leak	Fully sealed product, the judgment standard is the air pressure
		volume	Fully sealed product, the judgment standard is the volume
Negative	direct	leak	Semi -finished products or with air filling holes
		volume	No such test plan

	indirect	leak	Fully sealed product, the judgment standard is the air pressure
		volume	Fully sealed product, the judgment standard is the volume

## 4. How to quickly set up a test program

### 4.1 Direct test

- Choose the test type: Pressure
- Choose the test function: POSI, Direct, Leak, Deff
- Set test time parameters according to the product
- Set test pressure parameters according to the product
- Set Output according to product

### 4.2 Indirect test

- Choose the test type: Pressure
- Choose the test function: POSI, Indirect, Leak, Deff
- Select whether to open "Small" according to the product size
- Set test time parameters according to the product
- Set test pressure parameters according to the product
- Set Output according to product

### 4.3 Case description

4.3.1 How to set the test program for semi-finished bracelet with waterproof requirement of IP68. The test pressure is 20kpa; The program used is program 2.

Test type	Test function	judgment standard	Time parameter		Pressure parameter		external output parameter	
POSI✔	direct✔	leak✔	item	time	item	time	Output	time
		volume	Filling	3s	Input press	20kpa	Before test 1	0.1s
	indirect	leak	Stable	5s	Press max	25kpa	Before test 2	3s
		volume	Testing	5s	Press Min	15kpa	Before test 3	0s
Negative	direct	leak	Exhaust	1s	Leak max	0.2kpa	Before test 4	0s
		volume	Pre-fill	0s	Leak Min	-1kpa	After test 1	0s
	indirect	leak	Fixture	0s	Leak min	0.00SCCM	After test 2	0s
		volume			Volu me	0ML	After test 3	0s
Showed: ✔Indicates that the current mode is choose;					Next	2	After test 4	0s



	Indicates external output is on;				
--	----------------------------------	--	--	--	--

Note: The selection procedure for the semi-finished product of the test bracelet is: POSI, direct, leak ; time parameters and pressure parameter are as shown in the table above; output parameters are turned on, the output 1 and 2 before the test, the time is 0.1s and 3s respectively, indicating the situation is: after pressing the start button, the external output 1 starts to act after 0.1s (if the cylinder is connected, it starts to press down), and the safety light grid is valid within 3s;

The actual program settings are shown in Figure 4-1.



Figure 4-1

#### 4.3.2 Whole Bracelet test

The test pressure is 20kpa; the program used is program 3.

Test type	Test function	judgement standard	Time parameter		Pressure parameter		external output parameter	
POSI✔	direct	leak✔	item	time	item	time	output	time
		volume	Filling	3s	Input press	20kpa	Before test 1	0.1s
	indirect✔	leak	Stable	5s	Press max	25kpa	Before test 2	2s
		volume	Testing	5s	Press Min	15kpa	Before test 3	0s
Negative	direct	leak	Exhaust	1s	Leak max	0.2kpa	Before test 4	0s
		volume	Pre-fill	5s	Leak Min	-1kpa	After test 1	0s
	indirect	leak	Fixture	0s	Leak min	0.00SCCM	After test 2	0s
		volume			Volume	0ML	After test 3	0s
Showed: ✔Indicates that the current mode is choose;					Next	3	After test 4	0s
	Indicates external output is on;							

Note: The selection program for the finished product of the test bracelet is: POSI, indirect, leak, time parameters and pressure parameters are as shown in the table above; output parameters are turned on, the output 1 and 2 before the test, the time is 0.1s and 2s respectively, indicating the situation is: after pressing the start button, the output 1 starts to act after 0.1s (if the cylinder is connected, it starts to press down), the external output 2 starts to act after 2s (if the cylinder is connected, it starts to work) and the safety light grid is valid within 2s;

The actual program settings are shown in Figure 4-2.



Figure 4-2

## 5. How to determine OK and NG standards from history records?

### 5.1 No standard leakage value and unknown whether product is OK or NG

When there is no standard for product leakage, scientific analysis method must be used for judgment. That is, enough samples are selected for air leakage test and water soaking test. According to the data and phenomena of the two, the data of product OK and NG are obtained.

The specific method is as follows:

- Confirm the waterproof level of the product;
- Select 100 suitable products (To appropriately increase if 100 can't be determined);
- Number each product from No. 1 to No. 100;
- Use our air leakage detector to test each product and clear the history before testing.
- According to the leak and the test air pressure, the test data are divided into three groups: group A with small leak, group B with medium leak, and group C with large leak.
- The products of group A are soaked in water, and the judgment standard is obtained according to the test results;
- If all the products in group A pass the water soaking test, then the products in group B are also subjected to the soaking test to find the critical values of OK and NG;

### 5.2 Known product OK and NG, but do not know leakage value

- Repeatedly test the OK products and NG products ten times, and find out the value A

- with the largest leak among the OK products according to the historical records;
- b) Repeatedly test the OK products and NG products ten times, and find out the value B with the smallest leak among the OK products according to the historical records.
- c) Take the value C as the judgment standard,  $c = \frac{a+b}{2}$ ;



1. When looking for the judgment standard, the air leakage test and the water soaking test, the state of the product should be the same, otherwise there will be a misjudgment!

**Common errors:**

- 1.1 No attention was paid to the waterproof breathable membrane. During the water soaking test, the product was pasted with a waterproof and breathable film, but during the air leakage test, the product was not sealed with the waterproof breathable film, resulting in misjudgment;
- 1.2 The order of precedence was not noted. First do the soaking test, then do the air leakage test. This will cause the tester to fail to test when the product has a slight leak. Because the water has tension, it will block the product gap.
- 1.3 Not meeting the corresponding standards. During the soaking test, the required time and depth were not reached. For example, IPX7 requires 1M water depth, soaking for 30 minutes, but only 2 minutes and 0.4M. This will cause inaccurate experimental data and misjudgment of the product!
- 1.4 Proper water temperature is not used. When soaking in water, the water temperature must be 20-25° at room temperature.
- 1.5 Not use the same program and inlet pressure. When the inlet pressure is changed during the test, it will have a great impact on the results. At the same time, the inlet time, voltage stabilization time and test time cannot be changed. It is necessary to ensure that all products are in the same state during the test!

### 5.2.1 Determination of leakage standard for semi-finished bracelets

The following items should be prepared before the experiment:

- 1) One air leakage tester
  - 2) A set of suitable tooling and fixtures
  - 3) Proper depth of water
  - 4) 100 pieces of semi-finished bracelets
  - 5) Paper and pen Start the experiment
- a) Number semi-finished bracelets from 1 to 100, and write on each bracelet with a marker pen to ensure that they will not disappear due to wear and soaking;
- b) Connect the tester and tooling, ensure that the tester and tooling work well, and clear the history record;

c) Test the semi-finished products from No.1 to No.100 and record the test pressure and leak of each with paper and notes.

d) The following table shows the recorded data

No.	Test pressure	Leak (kpa)	No.	Test pressure	Leak (kpa)	No.	Test pressure	Leak (kpa)
1	10.180	0.026	35	10.424	0.013	69	10.405	0.017
2	10.452	0.051	36	10.424	0.014	70	10.235	0.018
3	9.035	0.039	37	10.425	0.012	71	10.454	-0.012
4	10.001	0.142	38	10.425	0.019	72	10.098	0.072
5	10.394	0.036	39	10.428	0.013	73	10.415	0.016
6	10.477	0.032	40	10.228	0.318	74	10.414	0.015
7	10.477	0.031	41	10.435	0.014	75	10.419	0.013
8	10.492	0.038	42	10.408	0.032	76	10.423	0.015
9	10.473	0.026	43	8.046	0.048	77	10.421	0.016
10	10.317	0.013	44	0.234	0.008	78	10.414	0.013
11	10.366	0.031	45	10.134	0.146	79	10.402	0.014
12	10.355	0.019	46	10.409	0.056	80	10.435	0.014
13	10.347	0.020	47	10.381	0.015	81	10.426	0.013
14	10.351	0.018	48	10.443	0.010	82	10.413	0.014
15	10.364	0.020	49	10.435	0.060	83	10.408	0.015
16	10.377	0.016	50	10.387	0.014	84	10.412	0.026
17	10.379	0.011	51	10.396	0.007	85	10.412	0.017
18	10.387	0.015	52	10.421	0.016	86	10.411	0.015
19	10.392	0.014	53	10.416	0.016	87	10.416	0.016
20	10.397	0.017	54	10.416	0.013	88	10.421	0.015
21	10.393	0.018	55	10.414	0.013	89	10.422	0.013
22	10.374	0.016	56	10.415	0.016	90	10.420	0.012
23	10.364	0.016	57	10.413	0.015	91	10.430	0.016
24	10.395	0.014	58	10.408	0.012	92	10.427	0.015
25	10.405	0.017	59	10.406	0.017	93	10.413	0.005
26	10.397	0.020	60	10.410	0.016	94	10.411	0.018
27	10.402	0.013	61	10.415	0.016	95	10.256	0.232
28	10.406	0.019	62	10.414	0.015	96	10.389	0.026
29	10.404	0.015	63	10.419	0.013	97	10.411	0.015
30	10.412	0.013	64	10.423	0.015	98	10.421	0.014
31	10.413	0.014	65	10.421	0.016	99	10.440	-0.010
32	10.418	0.012	66	10.414	0.013	100	10.410	0.021
33	10.427	0.016	67	10.435	0.014			
34	10.428	0.015	68	10.204	0.189			

e) From the above table, we can clearly see that No. 3, No. 43, and No. 44 semi-finished products are large leak, and No. 71 and No. 99 products have become negative due to the shrinkage of the sealing ring. Therefore, these five data should be excluded when we conduct data analysis;

- f) There are 95 items of data in total, which are grouped and sorted according to the large or small of the leak, as follows

Leak	QTY	Leak	QTY
0.005	1	0.026	4
0.006	1	0.031	2
0.007	1	0.032	2
0.01	1	0.036	1
0.011	1	0.038	1
0.012	4	0.051	1
0.013	13	0.056	1
0.014	11	0.060	1
0.015	14	0.072	1
0.016	13	0.142	1
0.017	5	0.146	1
0.018	4	0.189	1
0.019	3	0.232	1
0.020	3	0.318	1
0.021	1		

- g) We divided the leak 0.005-0.017kpa into Group A, 0.018-0.038kpa into Group B and 0.051-0.318kpa into Group C;
- h) 100 semi-finished products were soaked in water;
- i) The results obtained by Group A are all no leak, and the results obtained by Group B are that the products with a leak of 0.032kpa and below is no leak. When the leak is  $\geq 0.036$ kpa, the products leak slightly; The results of water soaking experiment in group C were all of them had water leakage.
- j) It can be obtained that the judgment standard is 0.030kpa; when the leak is less than 0.030kpa, the product is judged as OK, and when the leak is greater than 0.030kpa, the product is judged as NG;
- k) Set the judgment standard value of large leak: this value needs to meet two conditions: ① less than the test pressure of no leak products; ② greater than the test pressure of large leak products. From the above table, the leak max can be set as 10kpa;

# Chapter V、 Waterproof testing and air leakage testing knowledge

## 1. Definition of various pressures

### 1.1 Relative pressure and absolute pressure

Relative pressure: the difference from the current atmospheric pressure

Absolute pressure: the pressure value calculated from the absolute vacuum;

Standard atmospheric pressure :it is the pressure at sea level under standard atmospheric conditions, which is 101.325kpa;

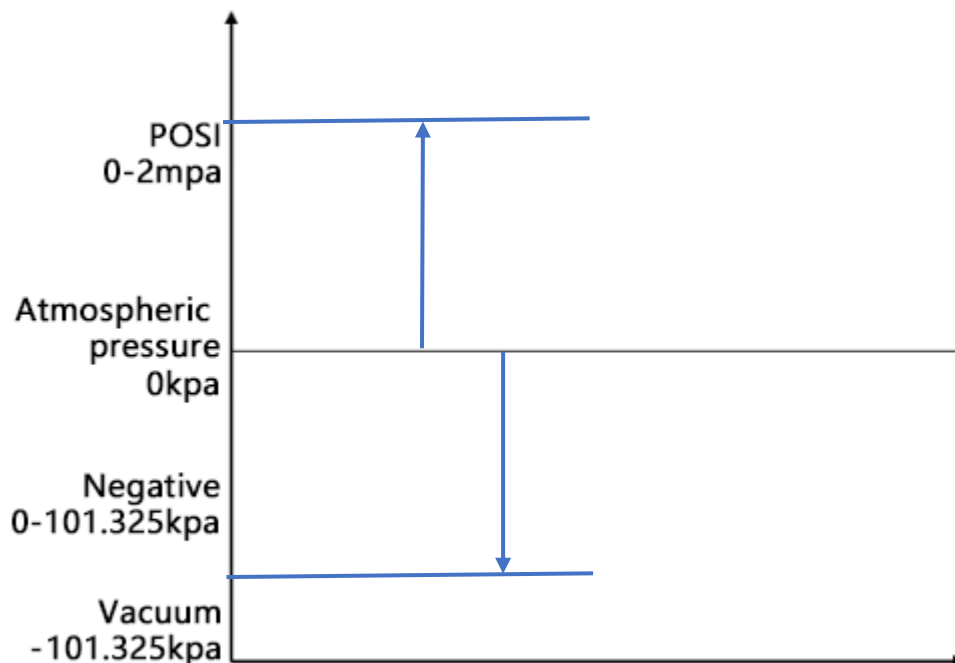


Figure 5-1

**Atmospheric pressure:** pressure formed due to irregular movement of air;

**Characteristics of atmospheric pressure:** with the increase of altitude, the atmospheric pressure will gradually decrease; The atmospheric pressure decreases by 100pa for every 10m above sea level, and the difference between the atmospheric pressure in Shenzhen by the sea and that in Guiyang Mountain area in Guizhou is 10kpa;

As shown in Figure 5-2, it is the characteristic diagram of atmospheric pressure.

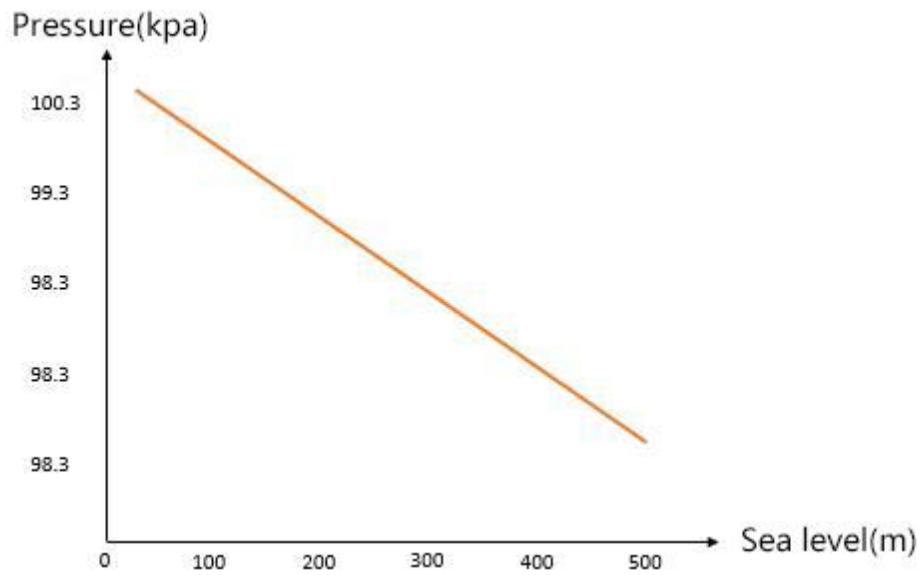


Figure 5-2

## 1.2 Positive pressure、 negative pressure、 engineering atmospheric pressure, standard atmospheric pressure

**Positive pressure:** The pressure higher than the current atmospheric pressure is positive pressure;

**Negative pressure:** The negative pressure is lower than the current atmospheric pressure and higher than the absolute vacuum, and the maximum negative pressure is -101.325Kpa;

**Engineering atmospheric pressure:** One kilogram of force per square centimeter is an engineering atmospheric pressure, and  $1\text{kg/cm}^2=98.0655\text{Kpa}$  is an engineering atmospheric pressure;

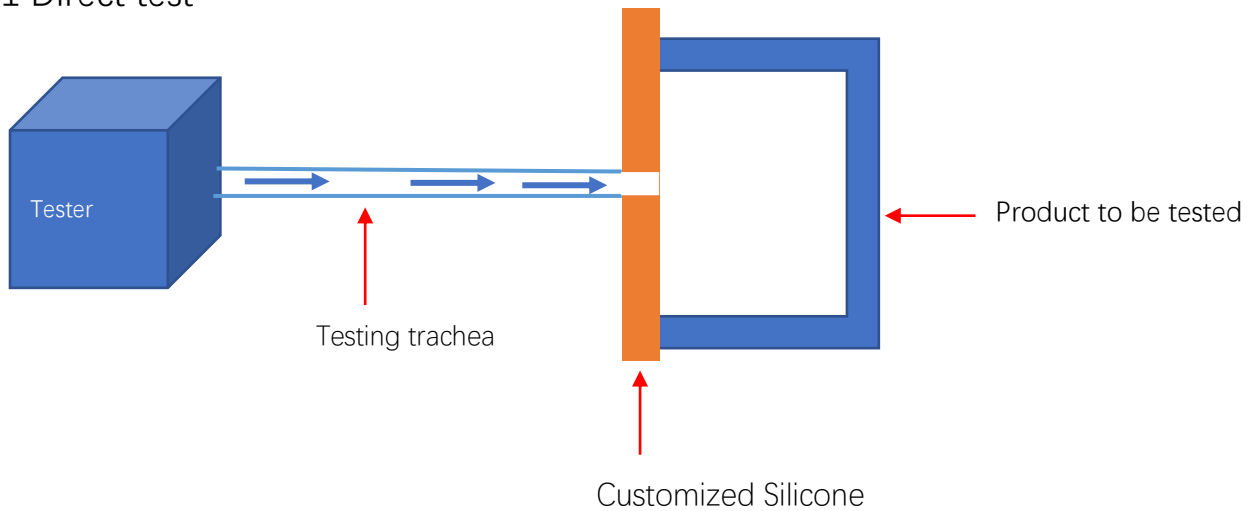
**Standard atmospheric pressure:** symbol is atm,  $1\text{atm}=101.325\text{kpa}$ ;

## 1.3 Mechanism of leakage

Leakage occurs in parts such as loose material organization, cracks, fissures, stress concentration, bending, and disassembly. Most of them are caused by factors such as unreasonable processing, unreasonable structure, and unreasonable installation. Generally, an allowable leakage value is given according to the specific application environment or state of the workpiece. If it is less than this value, it is qualified, and if it is greater than this value, it is not qualified.

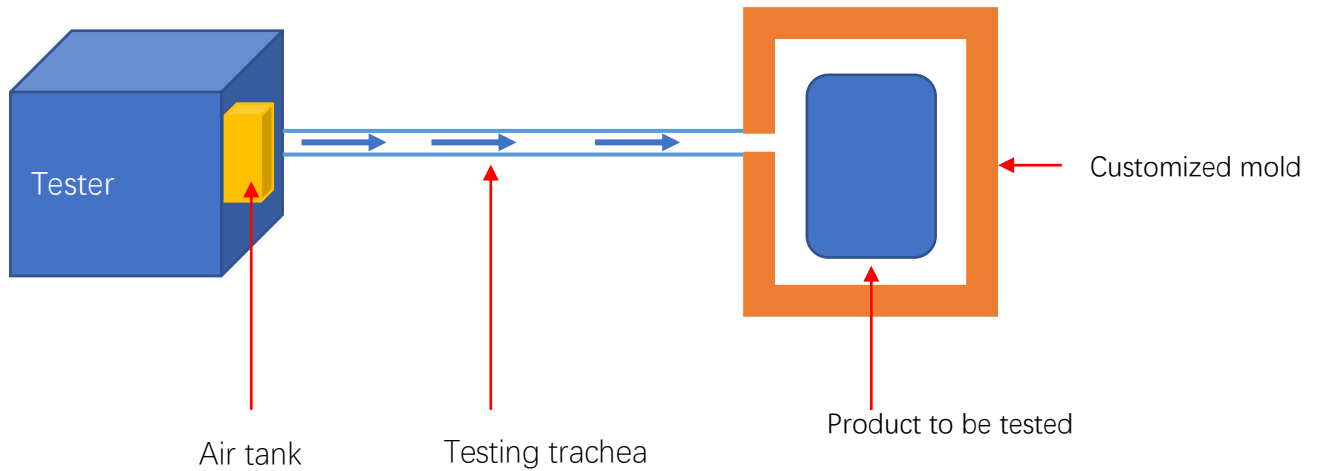
## 2. Test Principle

### 2.1 Direct test



Use customized silica gel to completely seal the opening of the product, and the set air pressure will fill the product through the tester. Judge whether the product is qualified by monitoring the change of pressure.

### 2.2 Indirect test

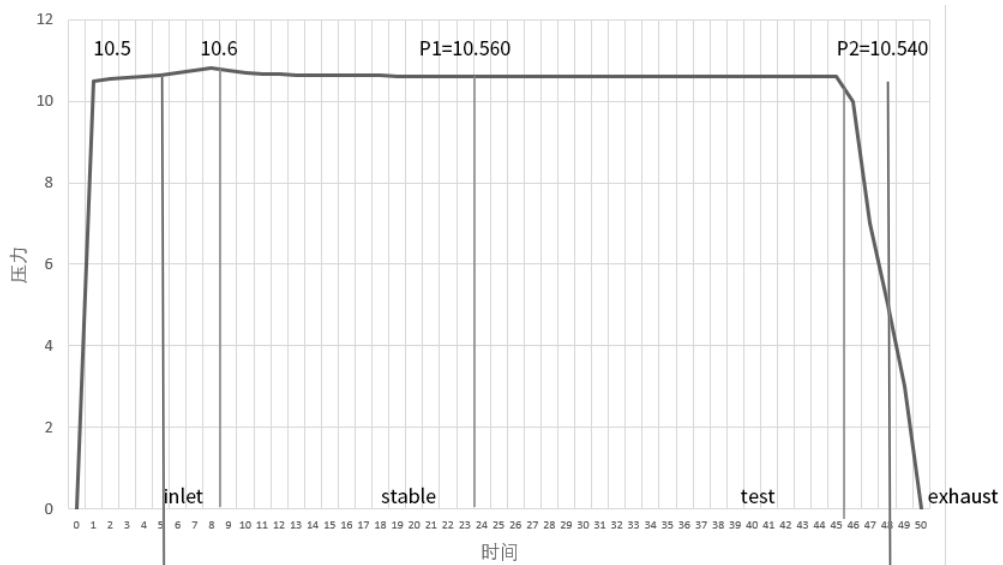


A custom profiling mold is used, and the product is placed in it. First, a certain air pressure is filled into the internal air storage tank of the tester, and then the air is filled into the cavity between the product to be tested and the mold. By monitoring the change of pressure, it is judged whether the product is qualified or not.

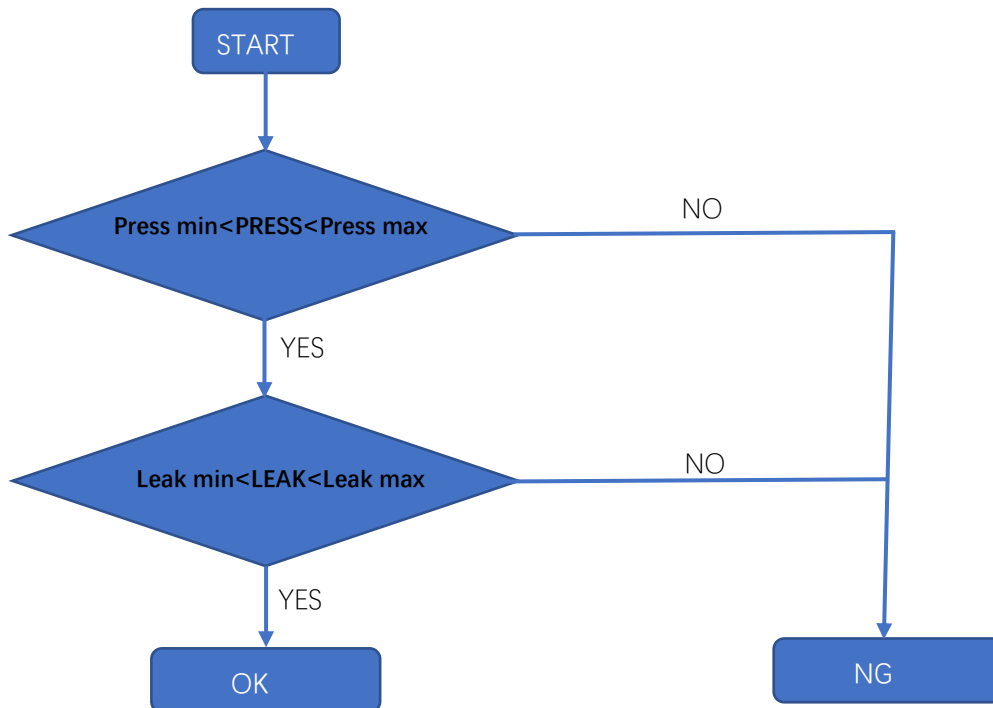
Why fill the air tank with air first? If the product leaks greatly and inflates directly, the pressure will instantly fill the cavity between the product and the mold, resulting in undetectable.



### 3. Test process and judgment logic



Leakage value  $\Delta P = P1 - P2$ , P1 is the test pressure value in the history.



Description:

When the test pressure  $P1 > \text{PRESS min}$ , and  $P1 < \text{PRESS max}$ , the leak  $\Delta P < \text{LEAK min}$ , and  $\Delta P > \text{LEAK max}$ ; The tester output is OK, and the light is green.

When the test pressure  $P1 < \text{PRESS min}$  or  $P1 > \text{PRESS max}$ , the leak  $\Delta P > \text{LEAK max}$ , or  $\Delta P < \text{LEAK min}$ ; The tester output is NG, and the light is red.

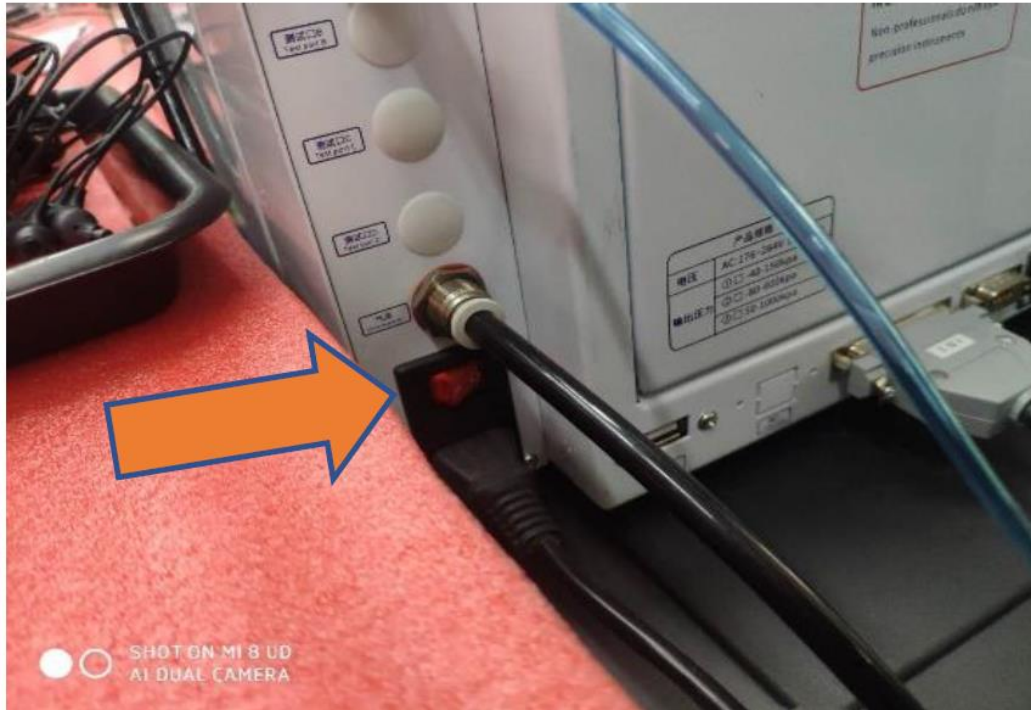
## Chapter VI some suggestions on SOP

### 1. What is SOP?

SOP is the capital of the first letter of the three words Standard Operating Procedure, that is, standard operating procedure, which refers to the description of the standard operating procedures and requirements of an event in a unified format, which is used to guide and standardize daily work. SOP is to refine and quantify the key control points in a program.

### 2. SOP writing model

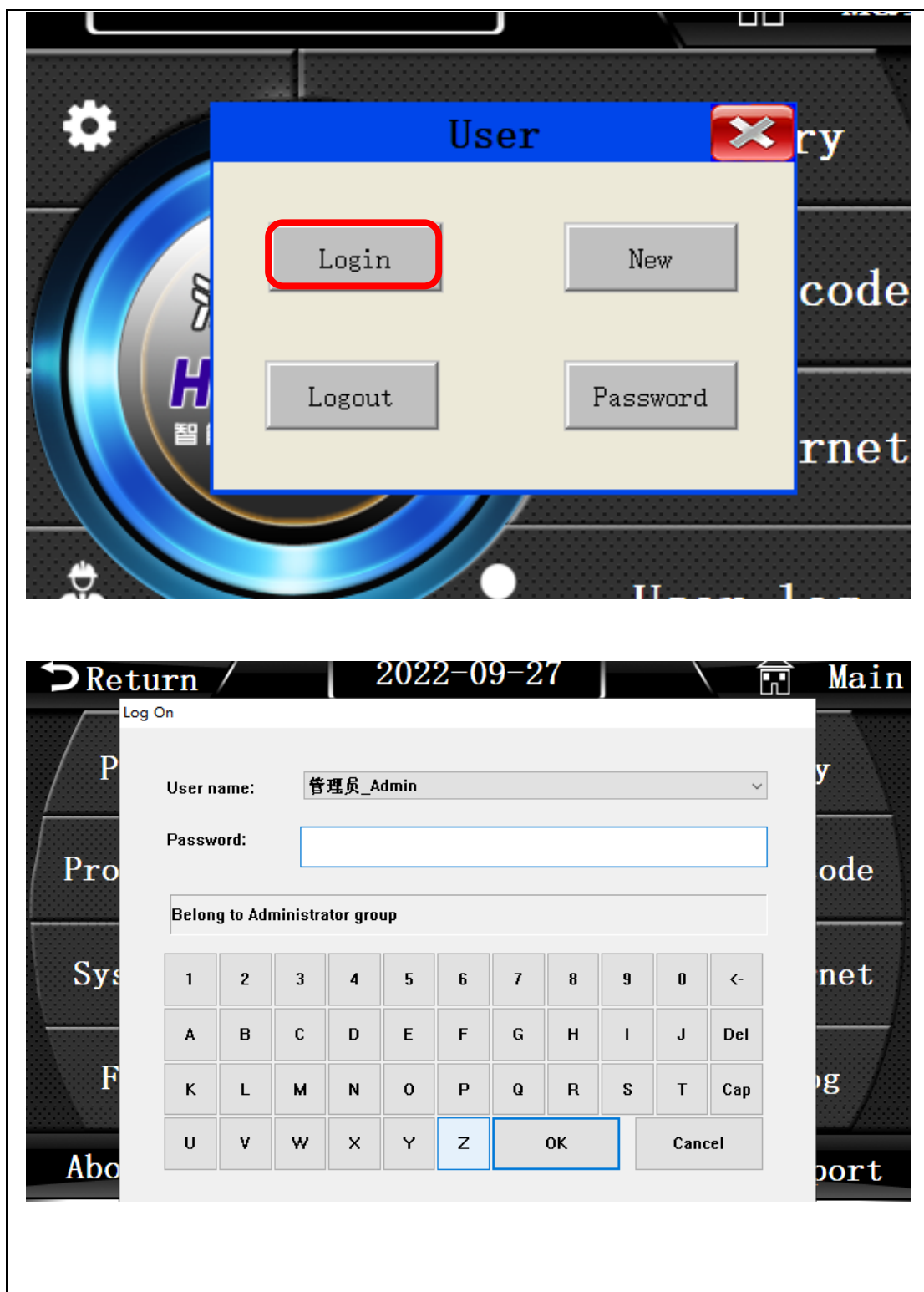
<b>XXX Project</b>	
<b>Standard Operating Procedure</b>	
<b>Process name:</b> test the air leakage of XX <b>Effective date:</b> May 11, 2020 <b>Version No.:</b> V1.10.2	<b>Written by (modifier):</b> XXX <b>Pages:</b> 8 in total
<b>1.0 Purpose</b> It is intended to assist the operator in correctly operating the air leakage tester to accurately measure the qualified and unqualified products.	
<b>2.0 Responsibilities</b> 2.1 The writer is responsible for the effectiveness of the program. 2.2 The operator is responsible for the correctness of the daily operating procedures.	
<b>3.0 Scope</b> Applicable to the air leakage test of XXX project and XXX station.	
<b>4.0 Procedure;</b> 4.1 Start up As shown in the figure, turn on the power switch of the tester.	

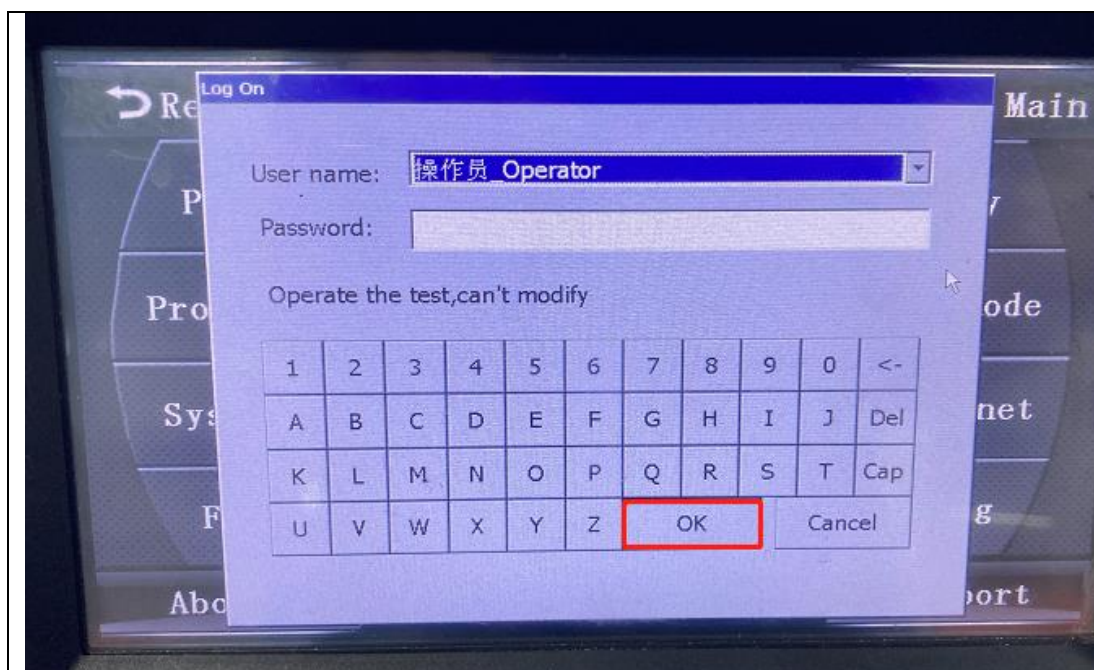


#### 4.2 User Log

As shown in the figure, click "User Log" (the operation screen of this tester is a resistance screen, please click with your fingernail), select the user name as "Operator", enter the password "8888" and click OK, that is, the tester is logged in.







### 4.3 Calibration test pressure

#### 4.3.1 The tester back to zero

Click "Pre-Set ", press the "STOP/Reset" button of the tester, and after hearing the "click" sound produced by the action of the tester's solenoid valve, press the tester zero button on the "Pre-Set" interface, and the zero return is completed.

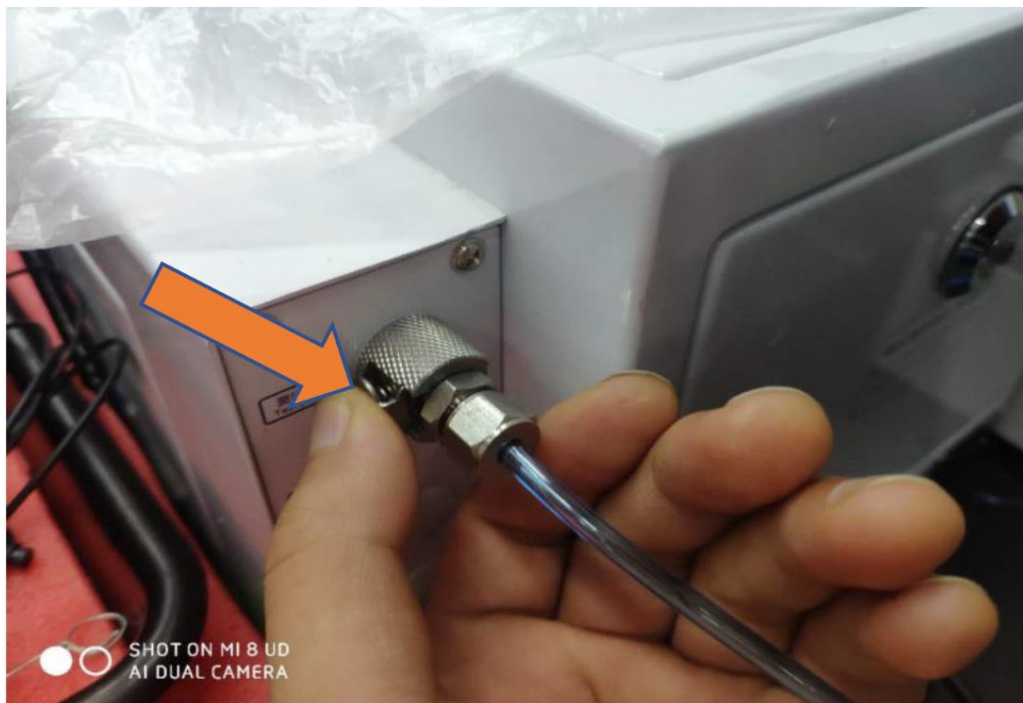






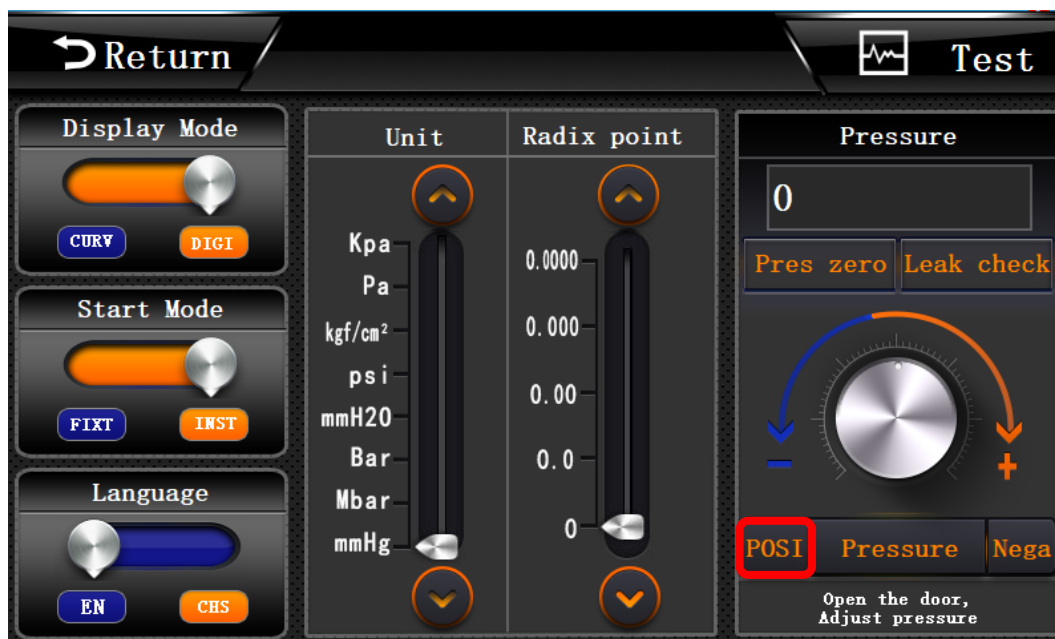
#### 4.3.2 Adjust pressure

- Go to the back of the tester, press the spring pin of the quick connector with the left/right thumb, and pop out the test air trachea



- Click the POSI/Negative button at the lower right corner of "Pre -Set", and adjust the pressure to 12.5-12.6KPA by adjusting the pressure regulating valve of the pressure

regulating chamber on the right side.



- c) Click the positive/negative pressure again, then turn off the air source
- d) Close the pressure regulating chamber, hold down the spring pin of the quick connector, and insert the test air trachea into the tester to adjust the pressure;



#### 4.4 Check product before test

Check products before test are used to confirm that the whole test system has no problems. The specific spot check methods are as follows:

##### 4.4.1

- a) Put the qualified products with green marks into the mold for normal testing, the output result of the tester is OK and the green light is on.
- b) Put the yellow marked micro leak/small leak products into the mold for normal testing, the output of the tester is NG, and the red light is on.
- c) Put the large leakage product marked in red into the mold for normal testing, the output result of the tester is NG, and the red light is displayed.
- d) In the check before test of the above three products, the judgment result of the tester corresponds to the actual result one by one, and the test can be started normally. If not, please contact the relevant personnel immediately

#### 4.5 Placement of OK and NG items after normal testing

Put OK products on the green tray and NG products on the red tray.

### 5.0 Maintenance



5.1 Before going to work every day, carefully clean the blue sealing silica gel or orange sealing rubber ring with alcohol until there is no dust or dirt on the surface;

5.2 Equipment maintenance man should check whether the pressure of the tooling is within the set range every day, and whether there is too much water in the filter of the tooling and the tester.

## 6.0 Accessories

Materials required	QTY
Products without leakage and with green label	1PCS
Products with slight leakage and yellow label	1PCS
Products with large leakage and red label	1PCS

Quality Department (approval): XXX

Date: 2020.5.18

Project Manager (Approval): XXX

Date: 2020.5.19



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