INSTRUCTION MANUAL

Chapter 1: Introduction of HX-Ⅱ Respirator Examination Instrument

1.1 Overview

HX-Ⅱ Respirator Examination Instrument is automatic and controlled by computer to test the comprehensive functions of air respirators and breathing protection apparatus in other types. It's widely used in respirator maintaining stations in fire army, breathing protection products examining institutes and respirator manufactories to make comprehensive examination and assessment for respirators functions.

The examination processes of HX-Ⅱ respirator examination Instrument are set by computer programs and operators can work using mouse button according to the computer window prompts. Choose the test parameters according to State Standards to control artificial lungs and simulate different breathing situations to make dynamic examinations and results automatically occur. The dynamic respiratory resistance curves and all examination results can be displayed on computers or printed, or saved in the database for use at any time.

1.2 Structure and Working Principle

HX-Ⅱ Respirator Examination Instrument consists of examination heading die, artificial lung, computer, printer and high pressure main.

1.2.1 Heading Die

Heading die, used to test the examined respirator mask. It is set on the cover of artificial lung and its mouth connects the gaps of ripple tubes of artificial lung. There is a pressure sampling hole at the left eye of heading die to connect the low pressure sensor in the artificial lung, therefore test the pressure in masks and transmit data to computer.

HX-Ⅱ Respirator examination Instrument can only be used to test the whole-mask respirators and can not be directly used to test the half-mask respirators, which can not cover the sampling hole in the left eye of examination heading die and pressure in masks while breathing can not be confirmed.

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1.2.2 Artificial lung

Artificial lung consists of electric motor, ripples tube and control electric circuit. There is a gap on the top of ripple tube connects the mouth of examination heading die, the instructions from computer controls the running of motor, which inhales and exhales by compressing connecting role or extending ripple tubes. The front panel of enclosure of artificial lung has a power indicator and a switch to connect the power inside. The back panel of enclose has a power interface to connect power 220V. The data put-in/put-out interface is for date transmission between artificial

and computer, while the sensor interface is to transmit date from low pressure sensor and high pressure sensor to computer. A high pressure interface is available at the left of enclosure to transfer the pressure of air tank to high pressure sensor through high-pressure main.

Warning: When the artificial lung is working, please do not block the mouth of examination heading die! Otherwise, the pressure in ripple tubes is increasing and maybe damages machine.

1.2.3 Computer

A special subdirectory in the computer of HX-Ⅱ Respirator Examination Instrument saves the special operation software and examination results database for the instrument. Users are not allowed to amend or cancel the content or documents in the content. Computer can be used as usual if no examination.

Attention: The computer for HX-Ⅱ Respirator Examination Instrument is used for special purpose and can no be replaced by other computers. Please don't try to open the database documents or amend the computer setting freely. Operation system update or set up other application software will make the software abnormal running.

1.2.4 Printer

Printer is used for typing test reports, the printer connects computer by USB interface and the test result of HX-Ⅱ Respirator Examination Instrument can be typed by printer.

1.2.5 High Pressure Main

High Pressure Main is used in the SCBA mode, one end of high pressure main is connected to the high pressure interface in the back of instrument, the other end is connected to the pressure regulator input of respirator tested, and another end is connected to gas sources, which can be the gas cylinders or other gas sources.

Attention: Length and instruction of High Pressure Main can not be changed.

1.3 Work rate

Air quantity of exhaling or inhaling is controlled by the compressed or extended distance of ripple tube in artificial lung. For example: At the work rate of 30 liter/minute and 20 times/minute, 2 liters air can be inhaled according the distance for ripple tube downwards and almost the same volume air can be exhaled according the distance for ripple tube upwards. Work rate is controlled by air volume of exhaling or inhaling and breathing times per minute. According to Standard GA-124, there are three different work rates available for HX-Ⅱ Respirator Examination Instrument:

（1）30 liters/minute, 20 times/minute: The work rate for self-rescue respirators

（2）50 liters/minute, 25 times/minute: The work rate for positive self-contained breathing respirators under extreme conditions.

（3）100 liters/minute, 40 times/minute: The work rate for positive self-contained breathing respirators under general conditions.

Above-mentioned three kinds of work rate are listed in the menu of operation software, operator can choose work rate accordingly and artificial lung will work with it.

In the meantime, as requested by items 6.6 and 6.7 according to Public Security Industrial Standard of P.R.C. (GA141-2001), the options of "Normal Temperature and High Temperature Test" & " Low Temperature and Low Pressure Test" are added in the menu.

1.4 Main Technical Parameters:

Pressure Test Accuracy: ±1%
Breathing Volume Accuracy: ±5%
Breathing Frequency Accuracy: ±5%
Dimension: 400 ×400 ×400 (head die is not included)
Weight: 25KG

1.5 Application Environment Conditions

Environment temperature: 0℃～40℃
Relative humidity: ＜85%
Power supply voltage: 200 V ～ 240 V 50 HZ Single phase <1 A

Chapter 2 Preparation before Using HX-II Respirator Examination Instrument

2.1 Installation

The examination heading die of HX-Ⅱ Respirator Examination Instrument is installed on the top cover of artificial lung, screwed 4 stud bolts into 4 screws while installing, therefore uninstall the plastic hose adhered on the top cover and plug it into the copper tube under the heading die, put the rubber gasket in the middle of the cover and make heading face the machine case panel, the four holes of heading die should set with the four bolts. Attention: Don't enwind or fold the plastic hose in case of difficult ventilation and therefore the test result will be affected. Put four gaskets on bolts and respectively screw four plastic knobs and tighten to avoid leakage, then test results are guaranteed.

2.2 Access to Power

After checking all circuits correctly connected, power on computer and start. Turn on the power on the panel of computer case and the power indicator is on.

2.3 Open the Operation Software

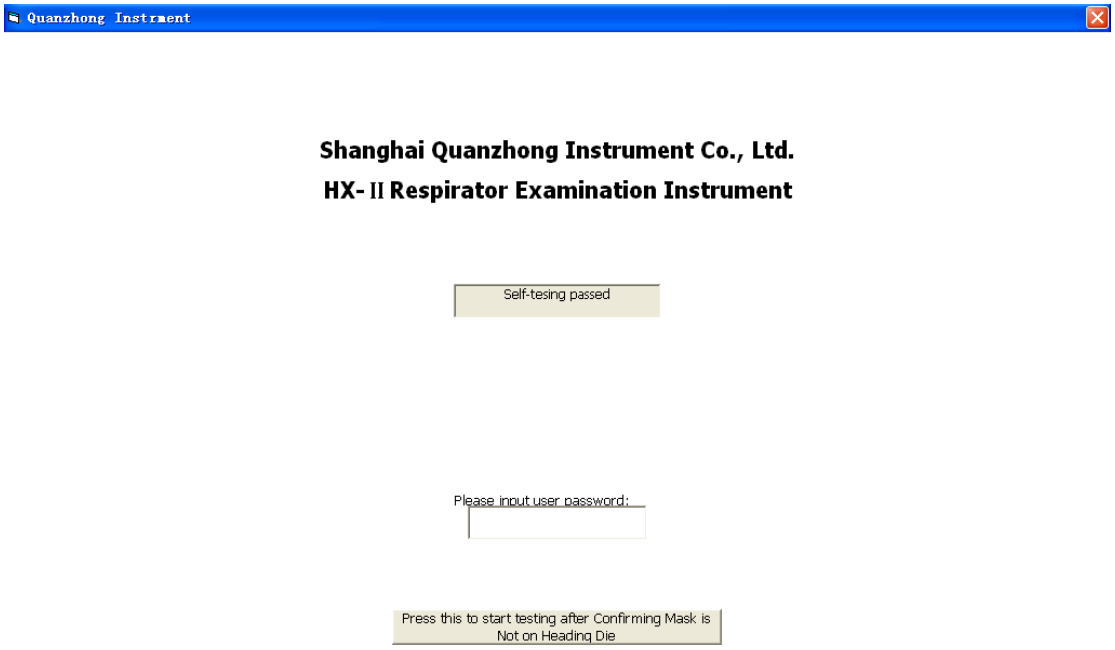
Start a computer under the WINDOS XP environment, double click the shortcut key of the main window "Respirator Comprehensive Examination" and enter into the test program of HX-Ⅱ Respirator Examination Instrument. Or click the key "START" to enter the start menu - "Program"- "Shanghai Quanzhong Instrument" – "Respirator Comprehensive Examination", and finally enter into the test program of HX-Ⅱ Respirator Examination Instrument.

Picture 2.4 will show up while entering the test program of HX-Ⅱ Respirator

Comprehensive Examination. First, HX-Ⅱ Respirator Examination Instrument will make serial self-check and related data will appear, ATTENTION: self-check result will be affected if mask on the heading die, and causes fault check, therefore, no any mask on heading die before checking. Related information will be displayed no matter pass or fail the self-check.

2.4 Enter Operation Password

After enter the respirator examination program and pass the self-check, the screen prompts: “Please Enter Operator Password”. Before operate on HX-Ⅱ Respirator Examination Instrument, operator needs to enter a preset password, which has two functions: One function is to avoid incorrect operation from unauthorized persons, and the other is that the computer can identify operator and transfer the related information into test report.



2.4 Program Initial Menu

After enter password, which is not displayed on screen but using asterisk (*) in case of revealing password to others. For incorrect password, prompt “Please ask for Administrator” will show up. But if operator temporarily has no password, pelase quickly enter the special password “9999” to the next operation menu. For correct password, prompt “Press Button after Confirming Mask is Not on Heading Die” (Operator can move the mouse to make the arrow at the box, then press the left button of the mouse to confirm. Same to the following operations)

2.5 Data input

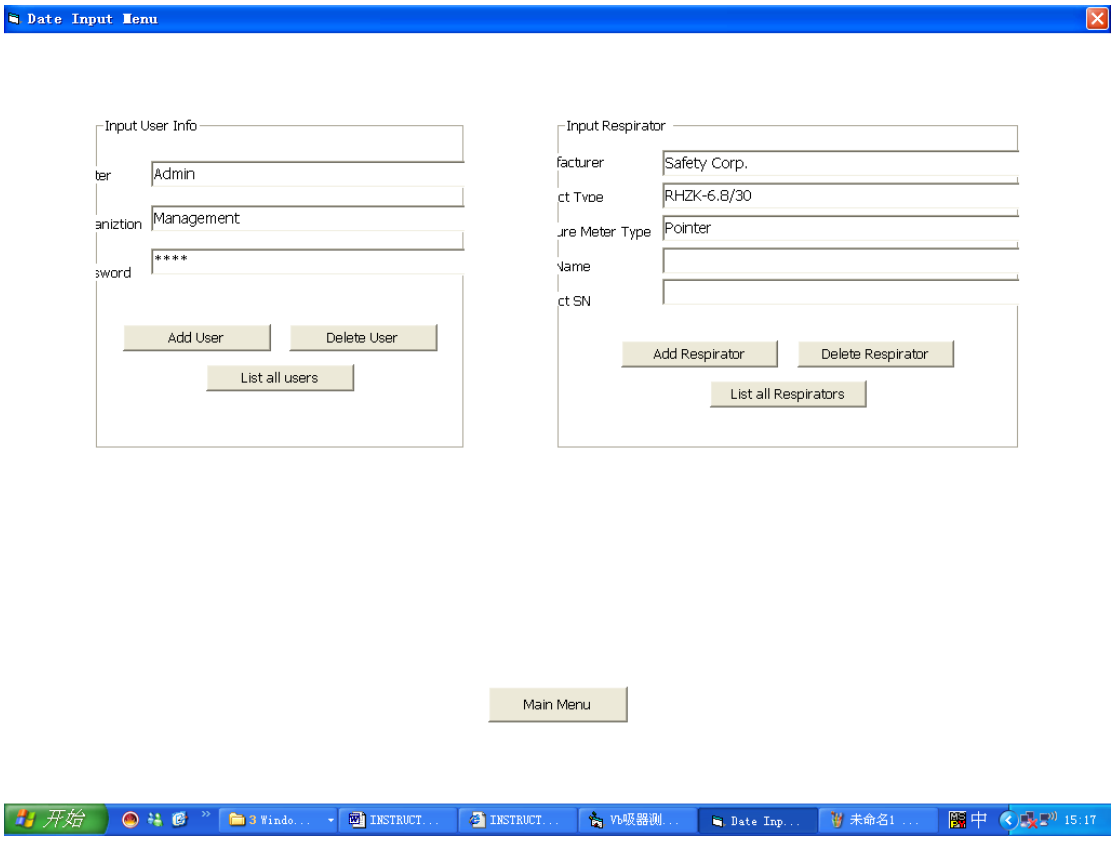
If password is right, the procedure enters "Data Input Menu" automatically. Please refer to 2.5. Operator details and type, serial number with manufacturer information of tested respirators can be input into Data Input Menu, which must be choose or entered because they will be typed out in the test report automatically.

Six options are available while entering data into menu:

2.5.1 List all operators: Click this button, all the authorized operators details saved in the computer at present will be listed at the following table

Attention: The password of operator is not displayed because of confidentiality.

2.5.2 Add new operators: Click this button to add new operators. Choose “Add New Operator” and the box items for operator data is blank, enter data as prompts in the left of the box and a prompt says “Press this Button after Confirmation”, press this button to finish operation. If the data is wrong, modify it and press this button again.



2.5.3 Cancel an operator: All the authorized operators details saved in the computer at present will be listed at the bottom of the screen by choosing this option, and you can cancel the chosen operator details line by pressing the mouse, screen prompts: Press this button to cancel the operator. If you don’t want to cancel, just press “Enter Main Menu” and the operation data line you choose will not be cancelled.

Please enter the special password “9999” as administrator while operating 2.5.1, 2.5.2 and 2.5.3 to make modification accordingly.

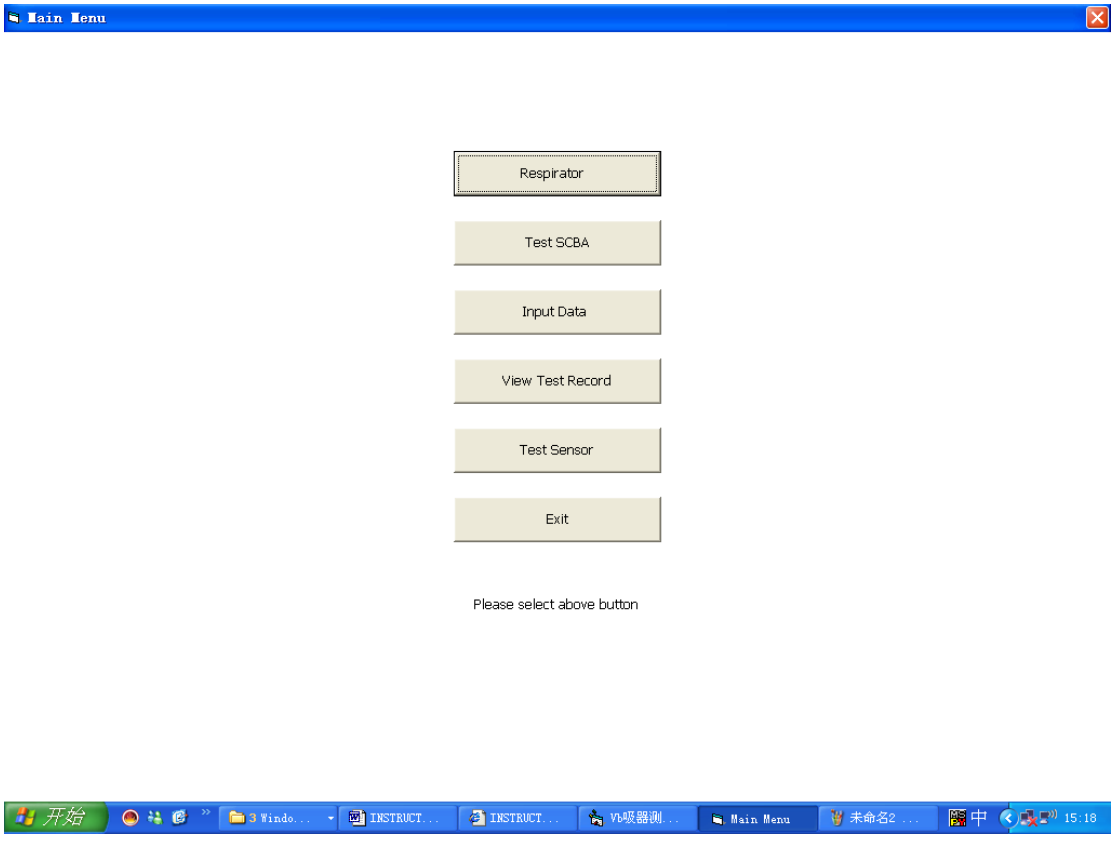
2.5.4 List all Respirators: All respirators saved in the computer at present will be listed at the bottom of the screen by choosing this option.

2.5.5 Add New Respirator: Choose this option to add new respirator into computer. Choose “Add New Respirator” and the box items for respirator data is blank, enter data as prompts in the left of the box and a prompt says “Press this Button after Confirmation”, press this button to finish adding new respirator. If the data is wrong, modify it and press this button again.

2.5.6 Cancel a respirator: All respirators saved in the computer at present will be listed at the bottom of the screen by choosing this option, and you can cancel the chosen respirator data line by pressing the mouse, screen prompts: Press this button to cancel the respirator. If you don’t want to cancel, just press “Enter Main Menu” and the respirator data line you choose will not be cancelled.

2.6 Enter Main Menu

After completion of data input, Choose: “Enter Main Menu” and the procedure enters into the main menu as Picture 2.6. Six options are available in main menu, and two examination modes are provided in HX-Ⅱ Respirator Examination Instrument: Respirator Mode & SCBA Examination Mode.



Picture 2.6 Main Menu

2.6.1 Respirator: While choosing "Respirator" mode, HX-Ⅱ Respirator Examination Instrument will offer dynamic checking to the mask pressure by using time as parameter and complete machine air tight checking is also offered. Various whole-mask respirators can be checked in the respirator mode, including positive (negative) pressure air respirator, full-mask fume respirator, ASR, flow air-line respirator and escape respirator.

Attention: High-pressure main is not needed in the respirator mode.

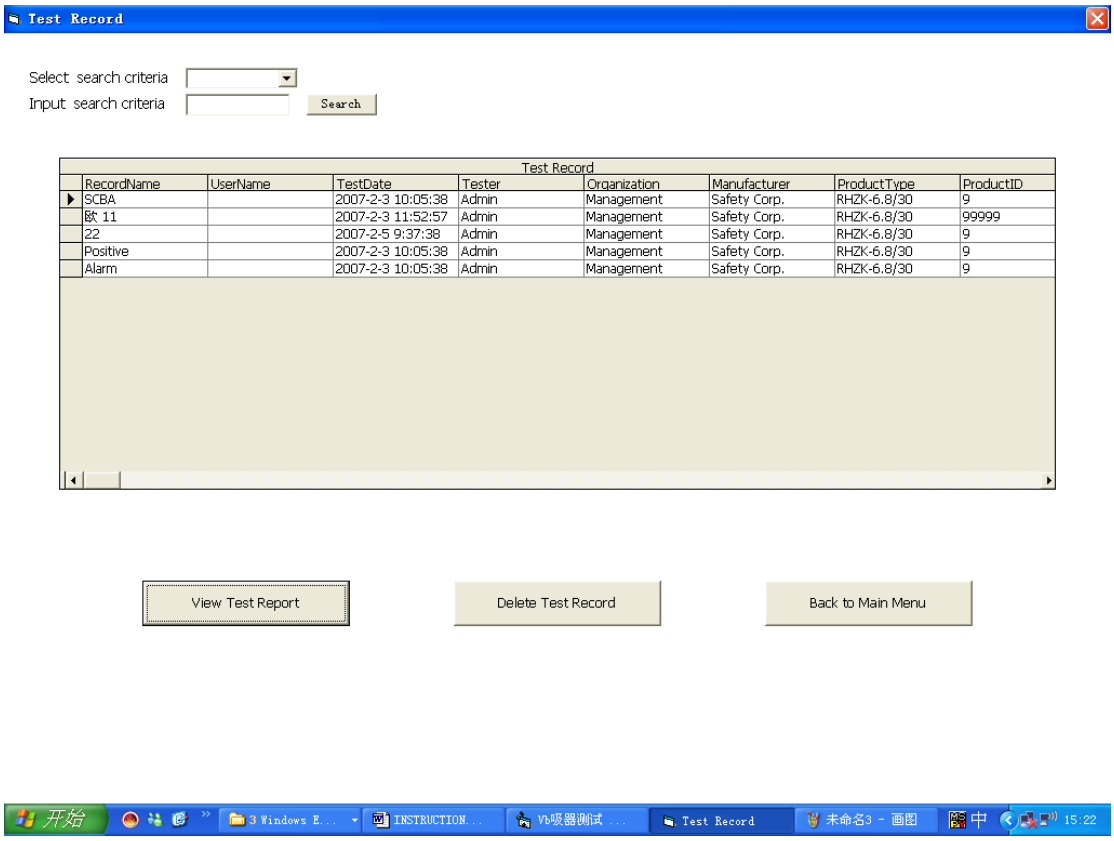
2.6.2 Test SCBA: Select “Test SCBA” to assess the complete machine function of self-contained breathing apparatus (SCBA in short as follow). In the SCBA mode, high-pressure main is needed for HX-II Respirator Examination Instrument so as to carry out dynamic test to the pressure in respirator mask while using pressure in high-pressure main as parameter. While checking, simulate the whole working progresses from filling rated pressure air to using up air. Various checking items are offered to test the complete machine application function of SCBA, including mask leakage test, setup/static-press test, high-pressure leakage test, pressure accuracy inspection, alarm test and respirator resistance test.

2.6.3 Data Input: Select “Data Input” option and HX-IIRespirator Examination Instrument allows data to be entered from main menu to procedure. After input data to procedure from main menu, the operation method is the same to that of 2.5 reads.

2.6.4 View Test Record: Select “View Test Record” option, and the program enters into a table (Please refer to Picture 2.6A to review the test result menu). Users can read the tested respirators’ test results data from this table. Three options listed at the bottom of the table: Review Test Record, Cancel a Test Record, Back to Main Menu.

Select the respirator line you want to review by using mouse and the line will be lightened, then select “View Test Result” option, the corresponding test report will be showed up and you can modify or type the test report; if select “Cancel a Test Record” option, the test result selected will be cancelled from database. Select “Back to Main Menu” option and the program will back to main menu.

The function of searching test record is available in the program in order to give convenience to users. At first, users can select search-conditions using drop-down option and enter the search-condition, click the search button, and all matching records will show up. For instance, if search the test record made by tester Zhao Yun, first select “Tester” in the search-condition, and enter “Zhao Yun” into search-condition, then all the test record tested by Zhao Yun will show up.



Picture 2.6A Review Test Record Menu

2.6.5 Sensor Test Program: This option is a special program which is specially used to test sensor for special instruments in manufactories.

2.6.6 End Task: Select “End Task” option, and close program.

Chapter 3 Usage of HX-Ⅱ Respirator Examination Instrument

3.1 Wearing Full-Mask

Ensure mask and test heading die is well sealed together, or mask leakage may occur, no any clearance allowed between the sealed space and test heading die while wearing mask, the mask place can be adjusted by frapping or slacking the string on the mask.

Attention: Leakage will occur if the string is over tightened or slacked.

3. 2 Respirator Mode

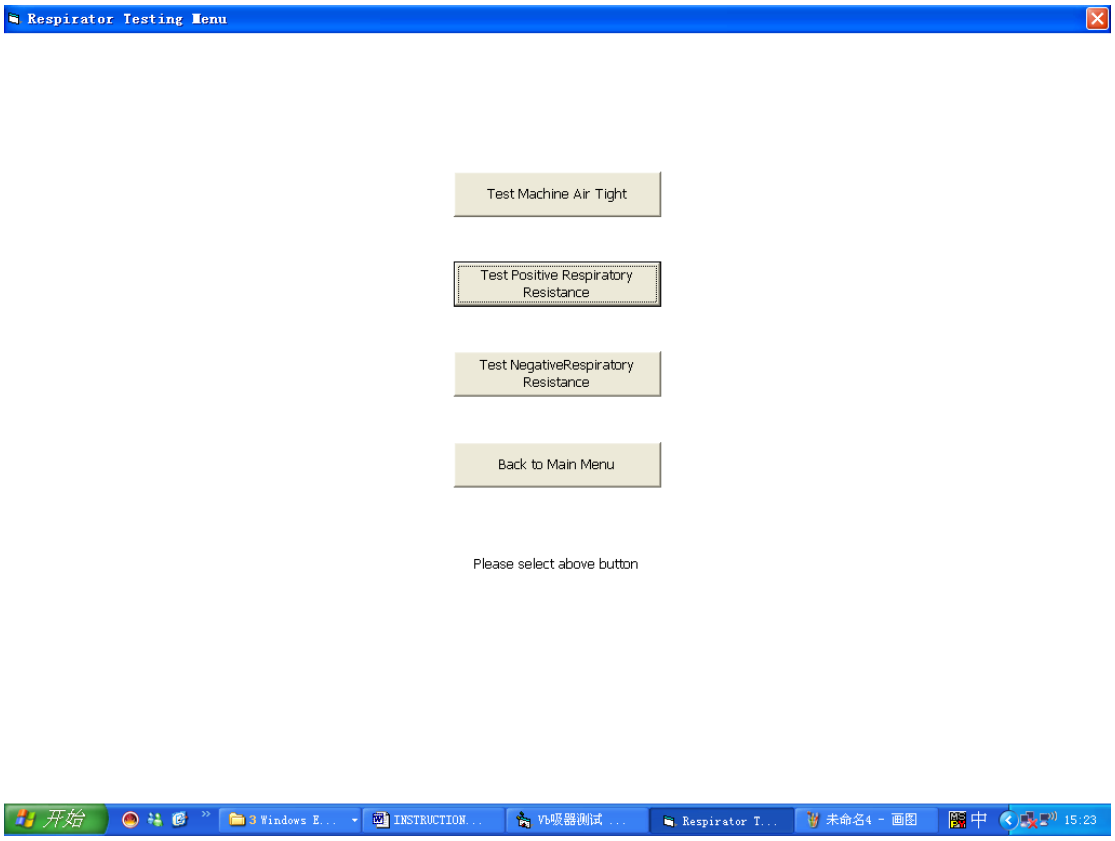
Select “Respirator” in the main menu and enter into respirator menu, refer to Picture 3.2. Four options are available at respirator menu:

（1）Positive Pressure Respirator: To test the dynamic respiratory resistance capabilities of positive pressure respirator.

（2）Negative Pressure Respirator: To test the dynamic respiratory resistance capabilities of negative pressure respirator.

（3）Complete Machine Air Tight Test: To test the mask covering on the test heading die correctly and if there is possible damages to masks.

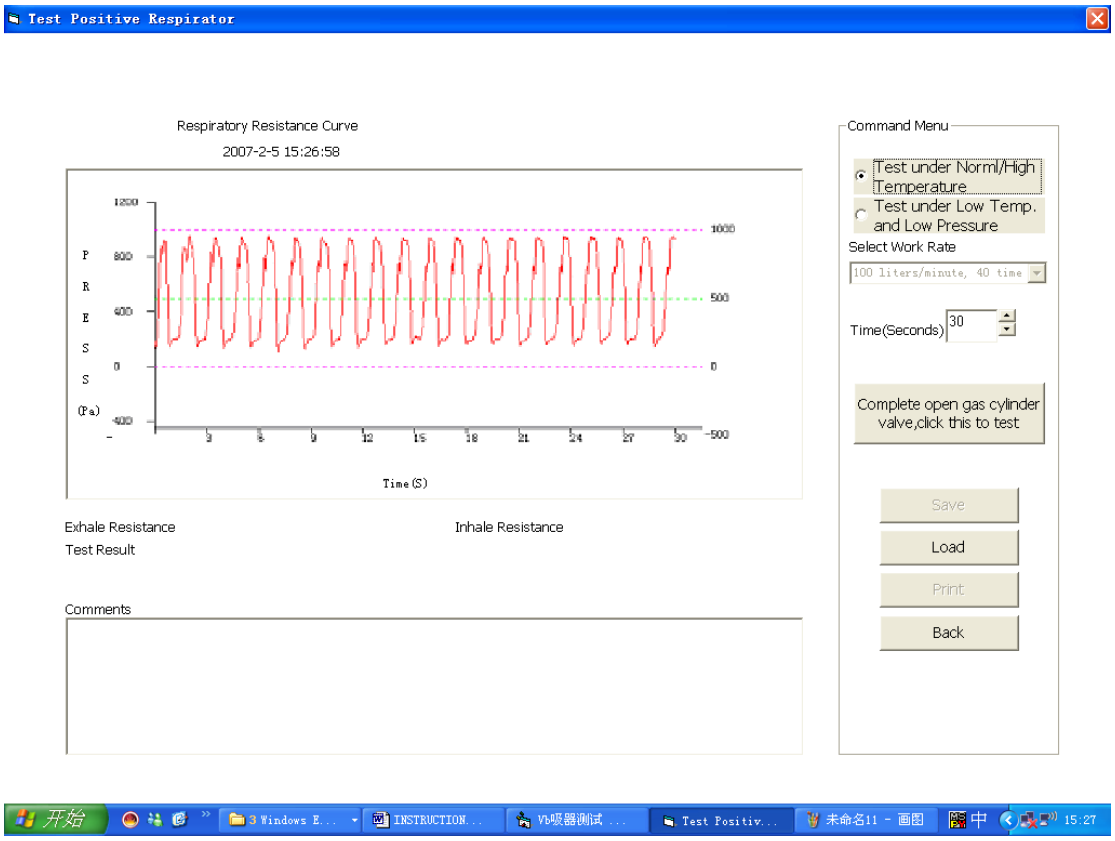
(4) Back to Main Menu: To end respirator mode and back to main menu



Picture 3.2 Respirator Menu

3.2.1 Positive Press Respirator

Most respiratory resistance test is carried out in the program of “Positive Respirator”. Pressure should be kept positive in all stages in breathing circle of positive pressure respirator. No any negative pressure is allowed at any time for a high-performance positive pressure respirator. Select “Positive Respirator” and the screen enters into “Positive Pressure Respiratory resistance Curve”, refer to Picture 3.2.1.1 for menu, and the respiratory resistance curve consists of three parts: Command Menu, Respiratory resistance Curve and Comments.



Picture 3.2.1.1 Positive Pressure Respiratory resistance Cure Menu

3.2.1.1 Command Menu

Command Menu consists of ten options: Normal-temperature and high-temperature test, low-temperature and low-voltage test, work rate, test time, start test, comment, save and load files, print test report and Back.

(a) Normal-temperature and High-temperature Test: it is in conformity with the technology requirements item 6.6 in Public Security Industrial Standard of P.R.C. <<GA141-2004>> and test the high-temperature resistance to positive pressure type air breathing apparatus for fire fighter.

(b) Low-temperature and low-voltage test: it is in conformity with the technology requirements item 6.7 in Public Security Industrial Standard of P.R.C << GA141-2004>> and test the low-temperature resistance to positive pressure type air breathing apparatus for fire fighter.

(c) **Work rate Option: Work rate must be selected before test, otherwise, the screen prompts: Please select work rate. Four different work rates are optional, please refer to item 1.3 <<Work rate>> for working option details.**

Attention: it is best that no any international maximum work rate test for respirators with small air supply because low air supply will cause mask pressure increasing, which will damage the instrument.

(d) Test Time Option: Defaulted value of test time option is 30 seconds, and the least test time of respirator should not be less than 10 seconds, within which breath three times at least, generally three breathing can completely test the

respirator performance. Using mouse to press up/down button beside test time box to select different test time if applicable, or entering numbers into the text box directly beside cursor.

(e) Start Test: Select work rate and test time, press button “Start Test” and test begins. Start static-pressure test inside of mask and later respiratory resistance test, the real-time respiratory resistance curve will be drawn on screen, maximum and minimum values will be listed at the bottom of curve after test completed.

(f) Save File: Screen prompts while saving files: Please enter the name of test record. After confirming the user test name, present test result can be saved for record.

Attention: The test record name should not be as same as the previous used test record name, if so, the system will prompt that cancel the former test record or cancel this test record.

(g) Load File: You can load the test result, which saved in Database, if needed. After clicking the button, test results are shown on the screen for your selection. The testing graph of the result will be shown after it’s selected.

(h) Print Test Report: The report shown on the screen will be printed by clicking this button.

(i) Back：Clicking this button will back to the menu for Respirator Testing.

3.2.1.2 Respiratory resistance Curve

Respiratory resistance Curve sets time (second) as x-coordinate, and sets pressure (Pa) in the mask as y-coordinate, the upper limit in the mask is 1000Pa, and the lower limit is -500Pa, real-time respiratory resistance curve will be drawn along with testing. The maximum and minimum value of pressures will be listed at the bottom after test ends. According to the Standard GA124-2004 required, qualified positive respirator should meet with the following requirements at the normal-temperature and high-temperature test: Positive pressure should be kept in the mask (Curve is located at 0Pa dotted line), inhaling resistance should be less than 500Pa (the bottom of the curve should not over 500Pa dotted line), exhaling resistance should be less than 1000Pa (the bottom of the curve should not over 1000Pa dotted line). While qualified positive respirator should meet with the following requirements at the low-temperature and low-voltage test: Positive pressure should be kept in the mask (Curve is located at 0Pa dotted line), inhaling resistance should be less than 500Pa (the bottom of the curve should not over 500Pa dotted line), exhaling resistance should be less than 700Pa (the bottom of the curve should not over 700Pa dotted line)

3.2.1.3 Comment

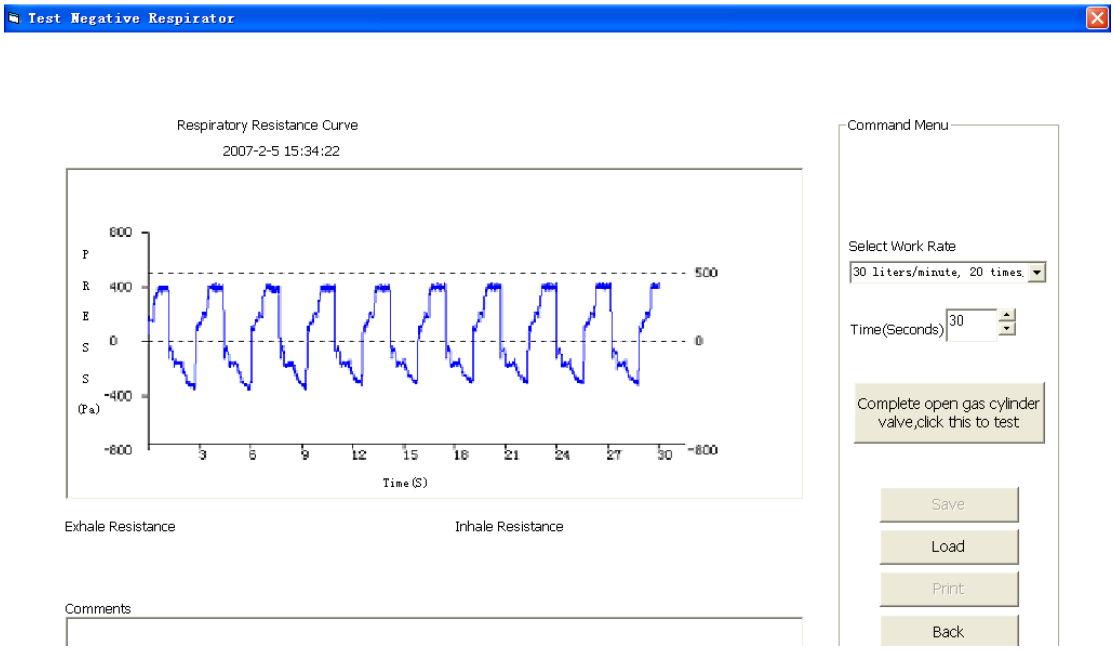
If test ends, enter your comments on test or other information into the comment box at the bottom before saving files and print test reports. Comments will be printed in test reports.

Program will automatically judge the respirator qualified or not according to Standard GA124. Test result “Qualified Test ” or “Unqualified Test” will be shown at the bottom of screen, which will also be added in test report. Retest according to above-mentioned steps if needed, or press

Exit button back to Respirator Menu.

3.2.2 Negative Pressure Respirator

The characteristics of negative pressure respirator is that air can enter into mask only when the pressure inside mask is smaller than that outside mask, i.e., pressure inside mask is smaller than that outside mask while inhaling, and pressure inside mask is larger than that outside mask while exhaling. Screen will display positive pressure or negative pressure in mask. Select “Negative Respirator”.



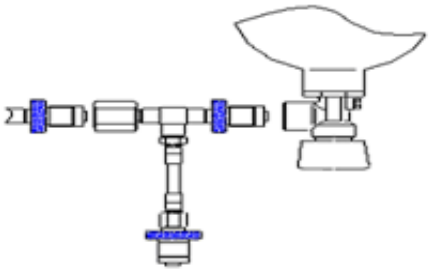
Picture 3.2.2 Negative Pressure Respiratory resistance Test Menu

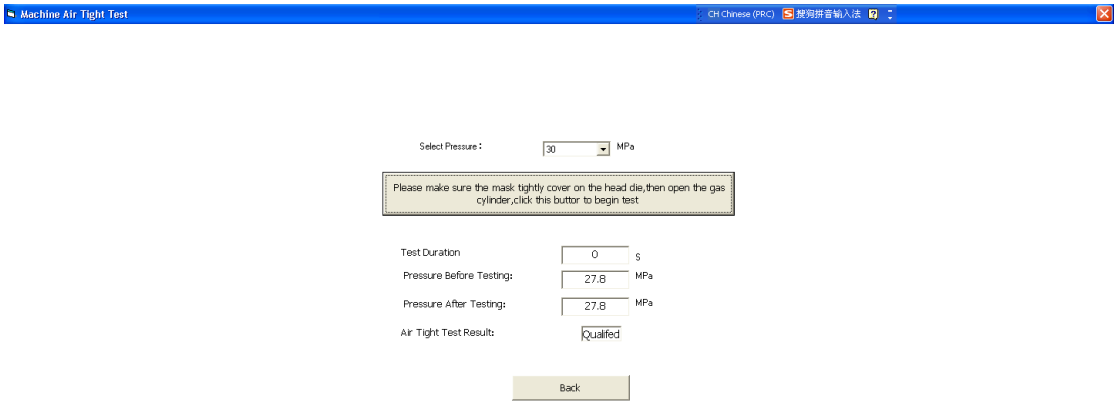
Pressure’s upper limit +727Pa and lower limit -747Pa inside mask will be shown on screen at negative pressure respiratory resistance test menu, referring to Picture 3.2.2. Operation method of testing respiratory resistance test menu for negative pressure respirator is the same to that of positive pressure respirator, the difference is the pressure’s upper limit and lower limit.

3.2.3 ASR

While ASR is working, air flows to wearer at constant flux, which will no vary along with wearers’ requirements. Positive pressure will be kept in the mask in the whole breathing circle so long as constant flux is more than work rate of wearer. If the constant flux is less than work rate, negative pressure will occur in the breathing mask, less constant flux than work rate, more negative pressure, it is better to select positive pressure respirator for ASR to carry out respiratory resistance test.

3.2.4.Machine Air Tight Test





Picture 3.2.4 Machine Air Tight Test Menu

3.3 Test SCBA Mode

Select “Test SCBA” in the main menu, screen displays “Test SCBA” menu (see picture 3.3), in order to assess the complete machine function, seven test items are set to test SCBA program. High pressure Main is needed to test SCBA, it should be set between the first-level redactor and cylinder valve so that SCBA test can be carried out at the range from full-gas cylinder pressure to the gas cylinder pressure which causes alarm.

Eight options are available for testing SCBA menu:

(1) Machine Air Tight Test: To ensure SCBA mask covering test heading die correctly and no any leakage with light negative pressure inside of mask.

(2) Start / Static-pressure / Inhaling Valve Test: To ensure certain positive pressure kept in “Static” situation inside of mask when respirator stops breathing, and gas supply valve opens, exhaling valve starts pressure.

(3) High-pressure Leakage Test: To check obvious leakage in the high-pressure parts of high-pressure main and respirator.

(4) Test Pressure Meter: To check the pressure indication on pressure meter right or not.

(5) Alarm Test: Check alarm start pressure, average alarm decibel, average quantity of spend gas and confirm alarm qualified.

(6) Respirator Resistance Test: To confirm the air positive in the whole breathing process in the respirator mask in the breathing circle.

(7) Back to Main Menu: To end Test SCBA program and back to main menu.

Picture: Test SCBA Menu

It is better to carry out SCBA test according to the sequence of listed items in the SCBA menu, if

one item is not tested, it will be blank or “Not Tested” written in the test result.

3.3.1 Test SCBA

High-pressure main is needed when taking experiment in the Test SCBA Mode. Please refer to Picture 3.3.1 for installation of high-pressure main, take the first-level reductor apart from gas cylinder valve, and connect high-pressure main according to the picture, and the other end is connected to the high-pressure interface back of artificial lung.

3.3.1.1 Usage of High Pressure Main under Test SCBA Mode

Attention: High-pressure main can only be used under Test SCBA Mode.

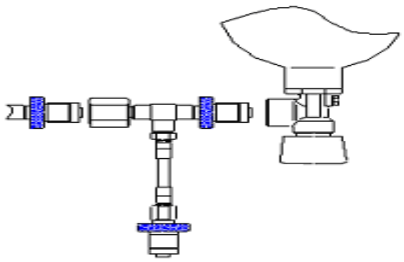
Only when the high-pressure main is correctly connected to HX-Ⅱ Respirator Examination Instrument, respirator tested and gas sources, and the respirator tested covers the test heading die correctly, then the gas source valve can be opened and inflate the high-pressure main. After inflating the high-pressure main, gas source valve should be closed and all the air for respiratory resistance test is from high-pressure main. Comparing with gas cylinder, the volume of high-pressure main is smaller and just can breath for several times and small air quantity is needed for the whole experiment.

The pressure in the high-pressure main for every breathings will fall and after several breathings, the initial high-pressure falls to the alarm pressure with sound. It takes a short time to fulfill the assessment for the whole process from full gas cylinder pressure to air used up. Due to the connection between high-pressure main and high-pressure sensor in the artificial lung, high-pressure sensor can transfer the pressure change in the high-pressure main to the computer, which will draw the curve describing the pressure change inside of mask along with the pressure change of high-pressure main.

Attention: Please confirm that every ends of high-pressure main tightly connected before open the gas cylinder valve, otherwise the connection will fall and hurt persons or damage equipments.

For experiment under Test SCBA Mode, respirator gas cylinder or gas sources should be filled with enough pressure in all items except for mask leakage test, and for air respirator with working pressure 30 MPa, the gas cylinder pressure should be less than 25 MPa.

Before testing, open gas cylinder valve and computer will check the gas cylinder pressure which should meet with the requirement, and then decide



to carry out test or not. If the pressure is not up to 15MPa, computer prompts: Low Gas Cylinder Pressure, Please Replace Gas Cylinder and Retest.

Attention: Gas cylinder valve should be opened or closed according to the computer prompts before testing, otherwise, computer prompts error information “Low Gas Cylinder Pressure”

3.3.1.2 Machine Air Tight Test

Select "Machine Air Tight Test" in the Test SCBA Menu and screen prompts "Machine Air Tight Test", which will confirm that the respirator mask covers on the test heading die correctly and set up light positive pressure. Test method is same to that under Respirator Mode.

After entering Machine Air Tight Test menu, picture 3.2.4 is displayed on screen, and it prompts: Please cover mask and seal mask air inlet, press this button to start test". Mask and test heading die should be well sealed together, otherwise it will cause machine air tight test unqualified.

Attention: If test self-contained breathing respirators or long-tube air respirators, gas sources valve covers mask and don’t let gas sources valve is open, otherwise, negative pressure will no be kept in the mask and will make respirator unqualified in the machine air tight test.

When the test is in process, ripple tube will slowly exhale until light positive pressure formed in the mask. Screen will prompt “Unqualified” if negative pressure fails to form at the beginning stage of test.

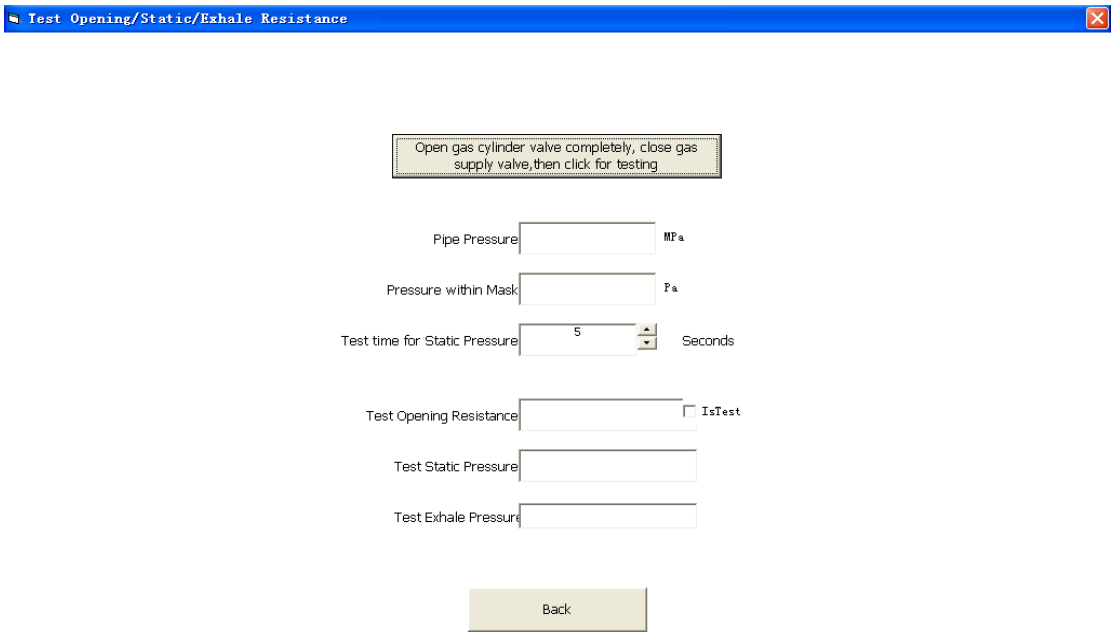
Instrument will inhale if the negative pressure can be formed at the beginning of test until pressure is up to -250Pa in the mask, then instrument will test the pressure loss in the mask in 5 seconds,

during which period if the pressure in the mask is less than -25Pa, screen will prompt: Qualified Machine Air Tight Test. If not, screen will prompt: Unqualified Machine Air Tight Test. Retest according to the above-mentioned steps if needed, otherwise, press Back button to Test SCBA Menu. Instrument will add the information of unqualified machine air tight test in the test report. Attention: For retest, mask air inlet must be open, i.e. make the pressure inside and outside of mask equal.

3.3.1.3 Start/Static/Exhale Valve Resistance Test

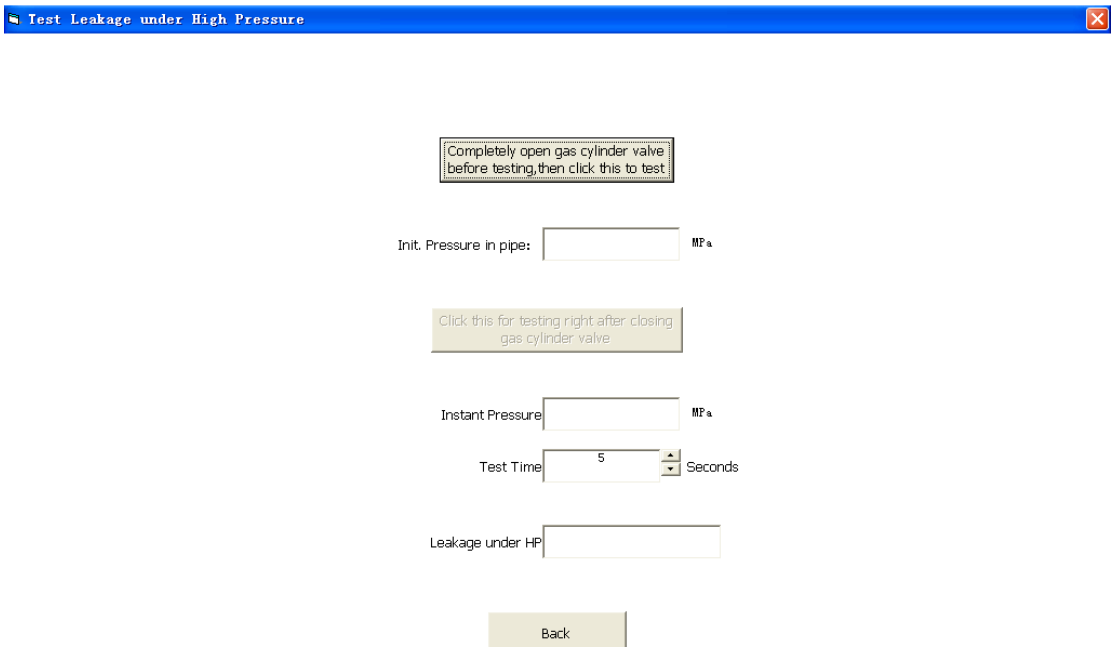
If select “Start/Static/Exhale Valve Resistance Test” on the Test SCBA Menu, screen prompts: Start/Static/Exhale Valve Resistance Test Menu (See Picture 3.3.1.3), mask should be covered on the test heading die according to the leakage requirement and gas sources valve should be closed. Screen prompts: “Press this button to start test after completely open the gas cylinder valve”, open the gas cylinder valve completely and inflate high-pressure main, screen will display the pressure in the high-pressure main and mask, instrument will test automatically after inflating the high-pressure main: make slow breathing for several times and stop breathing, pressure in the mask is monitored by computer and record the maximum pressure when gas sources valve is open and record the average pressure of exhaling valve. Pressure should be more than 0Pa and less than 500Pa or less than exhaling valve starting pressure if test ends in 5 seconds

If the test qualified, screen prompts “start pressure test qualified, exhaling valve qualified and static-pressure test qualified”, which will be added in the test report. If test unqualified, screen prompts “ start pressure test unqualified, exhaling valve unqualified and static-pressure test unqualified”. Retest according to above-mentioned steps if needed, otherwise press Back button return to Test SCBA Menu. The unqualified information about start pressure test, exhaling valve and static-pressure test will be added in the test report.



Picture 3.3.1.3 Start/Static-pressure Test Menu

3.3.1.4 High-pressure Leakage Test



picture 3.3.1.4. High-pressure Leakage test

Select “High-pressure Leakage Test” on Test SCBA Menu and the “High-pressure Leakage Test” menu will show up (see picture 3.3.1.4). High-pressure Leakage test is carried out to confirm that no obvious high-pressure leakage in high-pressure main and SCBA. High-pressure main and gas cylinder and instrument must be tightly connected with good sealing. Mask covers test heading die correctly. Screen Prompts: Before test, Press this button after completely opening gas cylinder. Inflate high-pressure main by completely opening gas cylinder valve, initial pressure of main will be displayed on screen while inflating. After inflating, screen prompts: Press this button to start test after closing gas cylinder valve.

In the 5 seconds of test, the relation of high-pressure main with time will be displayed on screen. The falling pressure of high-pressure main should not be less than 0.69MPa. If test qualified, screen prompts: Qualified High-pressure Leakage Test, which will be added in the test report. If test unqualified, screen prompts: Unqualified High-pressure Leakage. According to above-mentioned steps for retest, or press Back button to return to Test SCBA Menu, and the failed high-pressure leakage test will be added in the test report.

3.3.1.5 Pressure Meter Test

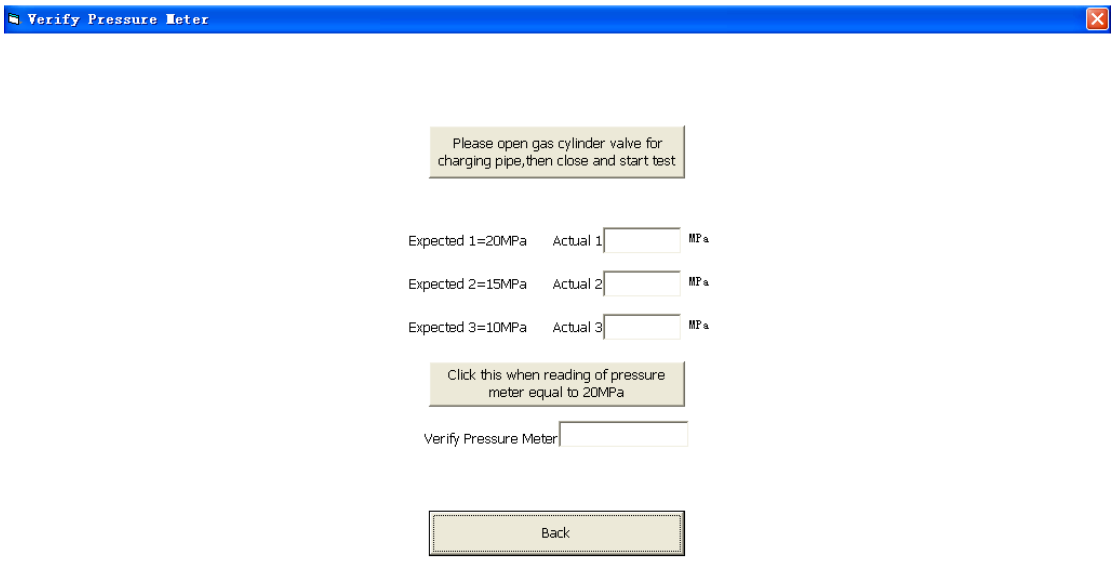
Select “Pressure Meter Test” on Test SCBA Menu and “Pressure Meter Test” menu will show up (see picture 3.3.1.4). Pressure meter is used to check the pressure direction in the pressure meter on the respirator. High-pressure main and gas cylinder with the respirator should be connected tightly before test, and the mask covers the test heading die correctly. Computer prompts: “Please open the gas cylinder valve and pressure button to start test”. Then the dialog box is displayed in the interface and prompts: “Please open the bypass valve slowly”. When the reading on the SCBA pressure meter is falling to the fist target value, press the prompt button on the screen. The real value will be displayed on screen and computer will compare the real value of main with the reading (target value) on pressure meter, the error should not more than 10% in order to pass this test.

Test the second and third target value by the same method.

If pass the test, it will show “Pressure Meter test qualified” on the screen, also this result can be shown on the test result. Otherwise, it will show “Pressure Meter test unqualified”. You can re-test following the same step mentioned above or press “Back” to return to “SCBA Test” menu, then on the test report, it will shows “Pressure Meter test unqualified”.

The default pressure for testing is 20, 15 and 10MPa. When the pressure under pipe is below 20MPa, the system will prompt user for inputting the pressure for testing

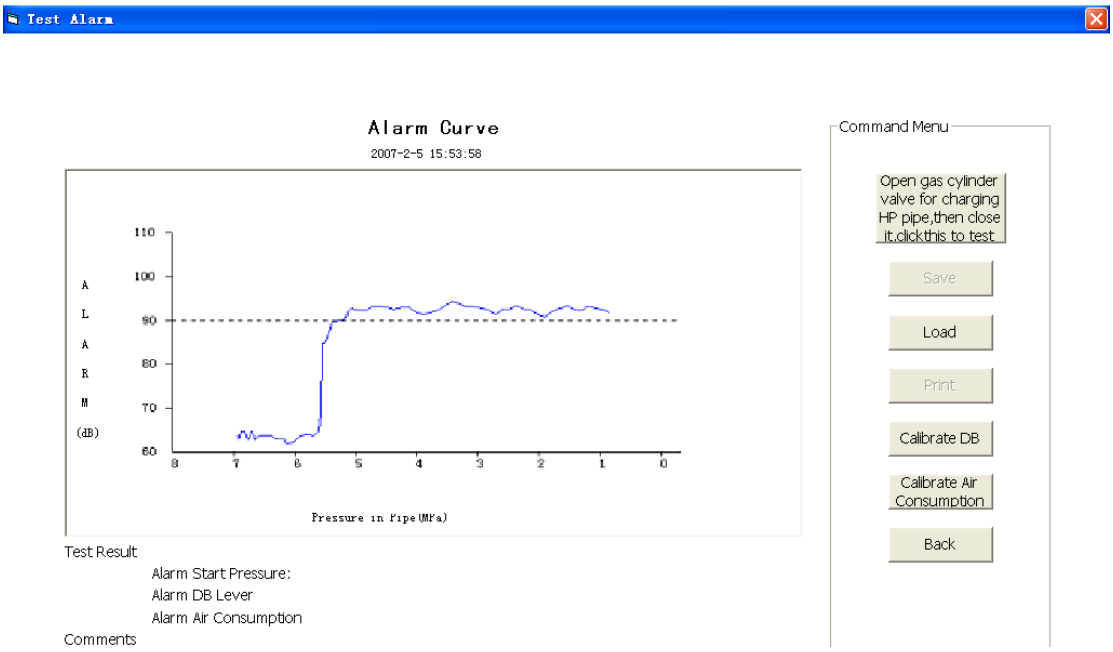
.



Graph 3.3.1.5 Verify Pressure Meter Menu

3.3.1.6 Alarm Test

Select “Alarm Test” in the Test SCBA Menu and “Alarm Test” menu is displayed on the screen (see picture 3.3.1.6). Alarm test is carried out to check alarm function and alarm starting pressure value, average alarm decibel and average gas consumption of alarm will be displayed. (Average alarm decibel and average gas consumption of alarm are average values for pressures of high-pressure main falling from 4MPa to 1MPa).



Picture 3.3.1.6 Alarm Test Menu

The high-pressure main and gas cylinder with instrument should be tightly connected, and mask covers the test heading die correctly, confirm the alarm decibel and average gas consumption have been calibrated. For detail calibrating operation, please refer to (5) and (6) in this section.

（1）Test Steps are listed below:

(a) Screen prompts: “Please open gas cylinder valve and inflate high-pressure main, then close gas cylinder valve, press this button to start test”. Inflating pressure should be more than 8Mpa.

(b) The real-time changed value of high-pressure main pressure will be displayed on screen. A new window is displayed and prompts “Please open bypass valve and deflate slowly”. This window will automatically close with 4 seconds and then open bypass valve to deflate slowly.

(c) Inspecting screen, when high-pressure main’s pressure value is up to 7Mpa, a new window is displayed and prompts: “Please deflate, when alarm sounds, stop deflating and close bypass valve.” (This window will automatically close in 2 seconds). And please close the bypass valve immediately according to prompt.

(d) Pressure of main will fall slowly, the pressure is set as x-coordinate and voice is set as y-coordinate, the corresponding curve will be drawn on screen. Keep silence in the testing room in case of high surrounding noise and the test accuracy of alarm will be affected. When the pressure of main is falling to 0.8 Mpa, test ends. In this process, computer will automatically calculate the alarm starting decibel, average alarm decibel at pressure range 4MPa to

1MPa for main and average gas consumption, and computer will judge qualified or not.

Note: Please restart computer for test if sound card sampling is wrong.

（2）Save: Screen prompts “Please enter file name” when select save file. When you enter file name and confirm, the test result will be saved for future usage.

（3）Load: You can click this for load the saved result for viewing. The prompt of saved result name will be shown on the screen.. You can select it by result name of time of saving, then open the test result and can view the graph of alarm test on the screen

(4)Print: You can click this to print the test result shown on the screen.

(5)Calibrate DB: The alarm DB level should be done before testing SCAB. Typically this step has been done before shipping to end users.

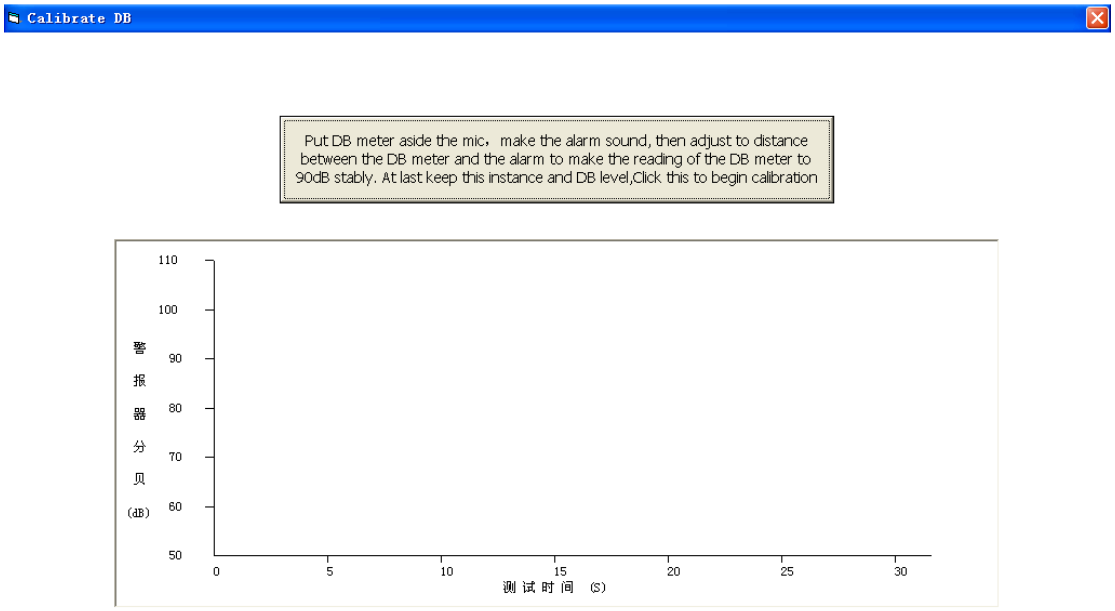
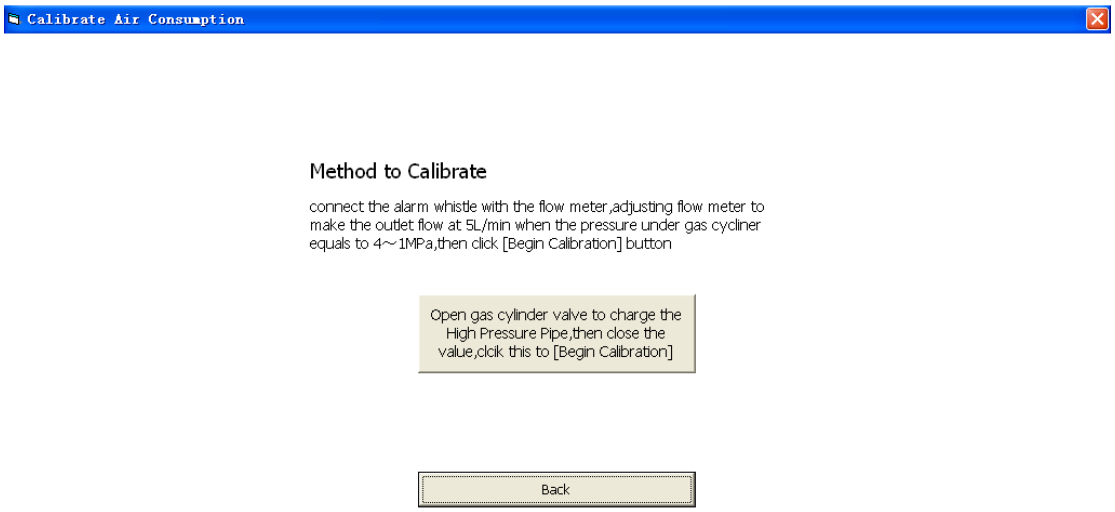


图 3.3.1.6.5 Calibrate DB

Way to Calibrate DB: Following to the prompt ” Put DB meter aside the MIC，make the alarm sound, then adjust to distance between the DB meter and the alarm to make the reading of the DB meter to 90dB stably. At last keep this instance and DB level, Click this to begin calibration”, you can see the voice sample DB level on the screen, which will last 30 seconds by default. However, you can stop this by clicking “Stop” button, and then the system will remove the noise vale ,calculate the average result, the get the sample level in the 90DB.

Warning: The wrong or inaccurate calibration may impact the alarm testing result.

(6)Calibrate Air Consumption: The Air Consumption Calibration should be done before testing SCAB. Typically this step has been done before shipping to end users.



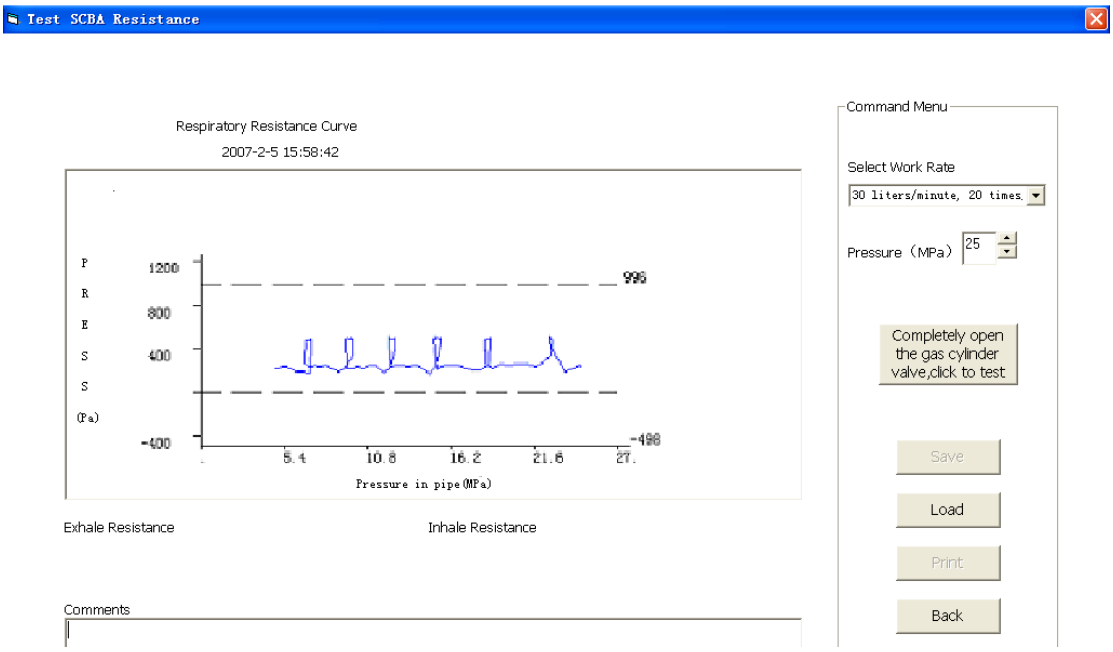
Graph 3.3.1.6.6 Calibrate Air Consumption

Way to Calibrate DB: Follow to the prompt “connect the alarm whistle with the flow meter, adjusting flow meter to make the outlet flow at 5L/min when the pressure under gas cylinder equals to 4～1MPa,then click [Begin Calibration] button” and make sure the pressure in pipe is more than 8MPa, then click this button. The system will prompt you to “Please open bypass valve, deflate slowly until the pressure falls to 4.5Mpa, then close the value immediately”. After prompting for inputting the reading of flex meter, the system will calculate the average air consumption and save it in database automatically.

Warning: The wrong or inaccurate calibration may impact the alarm testing result.

3.3.1.7 Test Respiratory Resistance

Select “Test Respiratory Resistance” on the SCBA menu, the menu for testing respiratory resistance will be shown (See graph 3.3.1.7). This will testing if the pressure in the mask is always positive during the breath cycle.



Graph 3.3.1.7 Test Respiratory Resistance

The Respiratory Resistance testing screen includes Command menu, Respiratory Resistance graph and comment.

(1) Command Menu: includes Work rate selection, begin test, save, load print and back

（a） Work rate selection: This step must be done before testing. Otherwise the system will prompt you to “Please select work rate”. There are 4 type of different work rate can be selected, for detailed info, please refer to section 1.3. When testing Respiratory Resistance, you should charge the pipe and then close the gas cylinder value. Compares to the gas cylinder, there’s only a litter gas in the pipe, which can only support several breathing cycle. So the pressure will fall with each breath. The pressure can vary from current to alarm starting pressure within several breathing cycle　The pip is connect with the sensor in the artificial lung, the system can draw the graph of the pressure in the mask, which varying form Full to Empty along with the pressure varying in the pipe.

（b） Begin Test: Click this button to start test after selecting the work rate. The static pressure in the mask will be get firstly, then it will shown the instantly graph of Respiratory Resistance on the screen. At last the Maximum and minimum pressure in the mask can be shown below the graph.

（c） Save: Screen prompts “Please enter file name” when select save file. When you enter file name and confirm, the test result will be saved for future usage.

（d） Load: You can click this for loading the saved result for viewing. The prompt of saved result name will be shown on the screen. You can select it by result name of time of saving, then open the test result and can view the graph of Respiratory Resistance test on the screen

（e） Print: You can click this to print the test result shown on the screen.

（f） Back: will lead you to the SCBA menu.

(2) Respiratory Resistance Graph; The X coordinator bases on pressure in the pipe, and the Y coordinator bases on the pressure in the mask. Also the maximum pressuring in the mask is +996Pa and minimum is -448 is shown on graph, which is drawn during the testing. The qualified inhale Resistance for positive respirator should be great than zero and the exhale inhale Resistance should be less than 996Pa

(3) Comments: You can add other comment for this test, which will be available on the printed result.

If pass the test, it will prompt “Test Qualified” which is also available on the printed result. Otherwise, the screen shows “Test Unqualified”. You can retest following the same step mentioned above or back to SCAB menu by clicking “Back” button. Then on the test result, it will shows “Respiratory Resistance Test Qualified”

Chapter 4 Maintenance of HX-Ⅱ Respirator Examination Instrument

4.1 Maintenance of HX-Ⅱ Respirator Examination Instrument

HX-Ⅱ Respirator Examination Instrument is highly automatized and no maintenance is needed inside. If the indicator is not on, please check the power fuse in the back panel is burned break or not, if yes, replace a new 2A fuse. Fuse current should not more than 2A, otherwise, the inside electronic units inside of instrument will be burned. Please don’t take apart instrument freely in case of bad contact between electronic units or leakage in the ventilation pipeline.

In order to ensure the good seal between test heading die and mask, the cleanliness of test heading die should be guaranteed, and don’t scratch or damage the test heading die in case of leakage while it is working. And if the test heading die is not used, cover a mask on it to protect the sealed part from damage.

4.2 Regular Calibration for HX-Ⅱ Respirator Examination Instrument

HX-Ⅱ Respirator Examination Instrument is specially used to check the breathing apparatus, which has closely relationship with the health and lives for people, therefore, Shanghai Quanzhong Instrument Co.Ltd would like to ask for users’ attention that HX-Ⅱ Respirator Examination Instrument should be calibrated every year. Since the special test equipment and skills are necessary for calibration, which is generally carried out in manufactory.

If send back HX-Ⅱ Respirator Examination Instrument to Shanghai Quanzhong Instrument Co., Ltd for calibration, it is not necessary to send back computer and heading die, just take apart heading die and send back the square machine case only.

4.3 Package and transportation of HX-Ⅱ Respirator Examination Instrument

If send back HX-Ⅱ Respirator Examination Instrument to Shanghai Quanzhong Instrument Co., Ltd for calibration, please use the original package material or make package box as the primary package requirement. Package should be shockproof, dampproof, against pressure and be well labeled accordingly.

Attached Equipment List:

1. A set of HX-Ⅱ Respirator Examination Instrument
2. A computer
3. A printer
4. Three power lines.
5. Two cable connection lines

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