Labotronics



USER MANUAL

Oxygen Bomb Calorimeter

LB-100BC

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Oxygen Bomb Calorimeter LB-10OBC

1. Introduction

Oxygen Bomb Calorimeter LB-10OBC is adopted with single chip machine technology and windows system. Features sealed oxygen bomb with double container external water jacket. Designed with stainless steel structure and touch screen user interface, performs automatic test procedure without any manual interface and provides test results in short time.

2. Features

- Designed as per ASTMD24 configuration standard
- Single chip machine technology for efficient operation
- Windows system for convenient and easy operation
- Sealed oxygen bomb with 20 MPa of pressure endurance
- Double container external water jacket for constant temperature
- Stainless steel structure, low maintenance and long service life
- Touch screen user interface for convenient usage and operation
- Electric stirrer to ensure uniform temperature in water bath
- High-efficient, stable and reliable unit for quick and accurate results

3. Specifications

Model No.	**LB-10OBC**
Heat capacity	14000 to 15000 J/K
Resolution	0.001 K
Measurement accuracy	≤ 60 J/g
Measuring range	10 to 35°C
Repeatability error	≤ 0.2% (Grade C)
Bomb pressure endurance	20 MPa
Temperature measurement range	15 to 28°C
Relative humidity	≤ 85%
Display	Touch screen display
Power supply	AC 220 V± 5% , 50 Hz
Power	≤ 150 W
Dimension (W×D×H)	600×480×460 mm
01 Box packaging dimension (W×D×H)	740×600×570 mm
02 Box packaging dimension (W×D×H)	500×410×300 mm
01 Box gross weight	46 kg
02 Box gross weight	12 kg

4. Applications

Oxygen Bomb Calorimeter is used to measure the heat emitted by a sample across animal feed research, coal analysis, explosives analysis, fuel analysis, food & nutrition, oil analysis, universities, waste product analysis, cement manufacturing etc.

5. Operations

5.1 System Functionality

0.5-2.0 g: Put the material to be examined in a crucible that can withstand both heat and corrosion. After being placed within an oxygen bomb that contains oxygen at 2.8-3.2 MPa, the crucible is put into the calorimeter's inner cylinder. A specific volume of distilled water is contained in the inner cylinder. Heat is released when the combustible ignites, and this heat then evaporatively enters the water. The specific heat value of the combustible can be found by calculating the water's temperature rise and applying the calorimeter system's heat capacity.

5.2 Preparations before use

1) **Opening the box:** After opening the box, check whether there is any damage to the appearance of the instrument and whether all accessories are complete.
   Note: The calorimeter should be installed in a room without strong air convection, not exposed to direct sunlight, and the temperature change should not exceed 1°C. The room temperature should be in the range of 15-30°C.
2) Place the calorimeter on a horizontal ground or work table and connect the power supply. Add distilled water with a temperature equivalent to the room temperature until water overflows from the overflow.

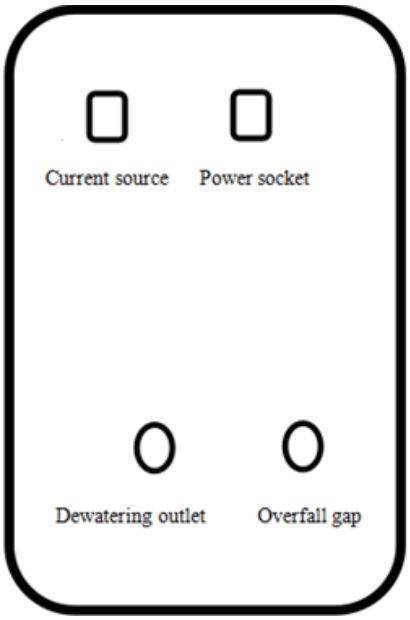


Figure-1 Instrument view

5.3 Instrument Instructions

The main interface of the instrument is as follows:

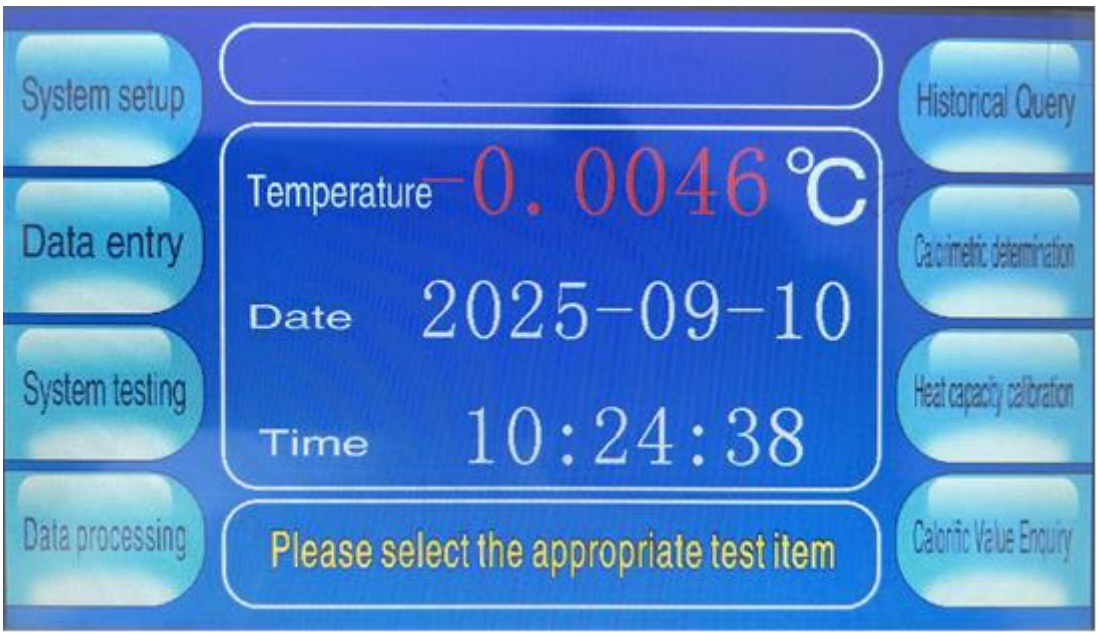


Figure-2

5.3.1 System

[System]: Click **"System Settings"** to enter the system Settings menu, as shown in the figure below.

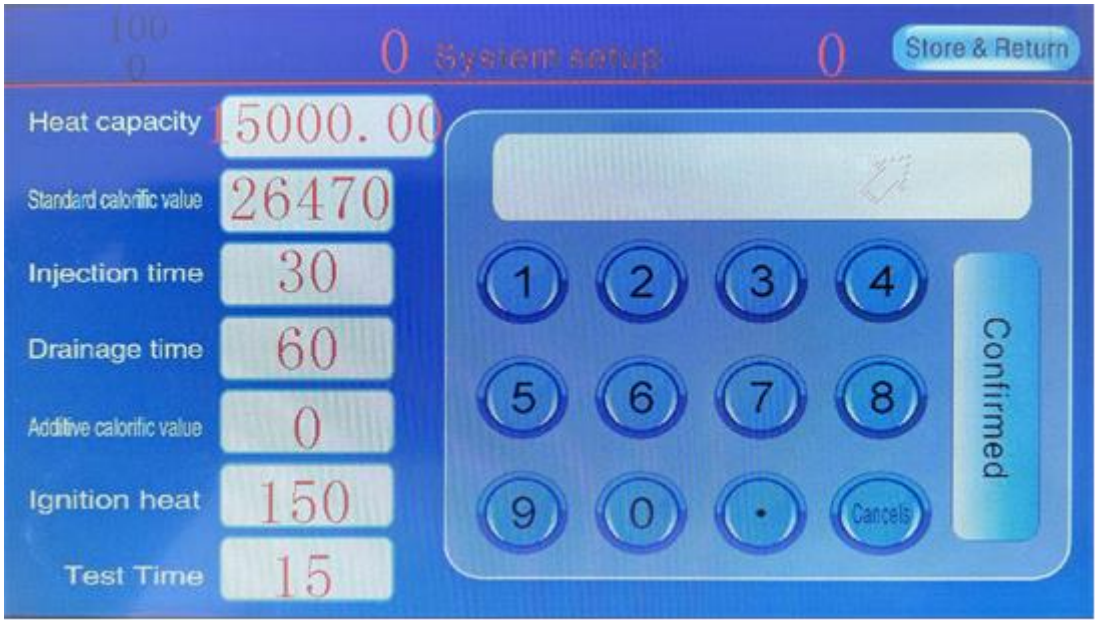


Figure-3

[Heat Capacity]: Click the white box labeled "**Heat Capacity**," and a keyboard will appear to enter the heat capacity value.
The system heat capacity is proportional to the measured heat value. manually calculate and calibrate the average heat capacity, then input the average heat capacity, click **store** and return, save, and return to the main interface of the system.
[Standard Calorific value]: Click the white box behind the standard calorific value, and a keyboard will pop up to input the standard calorific value.
The calorific value of the standard substance used in the calibration instrument is directly input according to the data on the package of the standard substance used. Click return, save, and return to the main interface of the system.
[Watering time]: Click the white box behind watering time, and a keyboard will pop up to input watering time.
The water injection timing for the inner cylinder is crucial for experimental accuracy. The optimal setting should submerge the oxygen bomb. Based on the oxygen bomb's volume and voltage level, input appropriate values, then click "**Save & Return**" to save the settings and return to the parent menu.
[Drain time]: Click the white box behind the drain time, and a keyboard will pop up to input the drain time. Set the appropriate drainage time and drain the test water from the inner cylinder.
[Hotspot]: Click the white box behind the hotspot, and a keyboard will pop up to input the hotspot.
The heat generated by ignition is set to 150J at the factory. If the length of the ignition wire and cotton wire is not changed, it generally does not need to be changed. If you want to change it, input a new value, click store & return, save, and return to the superior menu.
[Additive value]: Click the white box behind the additive value to pop up a keyboard to enter the additive value.
For low-calorific-value coal or other combustible materials, auxiliary combustion substances need to be added to ensure that the measured sample can be fully burned. Enter the calorific value of the additive (unit: J/g), click **Save & Return**, and save and return to the superior menu.
[Experiment time]: Click the experiment time, and the white display box will pop up. The keyboard can set the experiment time range to 13-18 minutes.
[Data Processing]: Click data processing to enter **Figure 4**.
Note: Sulfur-hydrogen water directly affects both higher and lower heating values. When sulfur-hydrogen water is input, the heat output (unit: J/g) can be calculated through the system. Clicking "**Calculate**" allows users to determine the heat values in different units, including kcal, joules per gram, and megajoules per kilogram. This feature enables preliminary heat value measurement before sulfur-hydrogen water is fully generated. Once the sulfur-hydrogen water data is finalized, users can utilize this function too.
Perform data processing: Click the unit conversion button in the top-right corner to switch between heat units: kilocalorie/gram, joule/gram, or megajoule/kg, to obtain your desired results. Enter the barrel heat value (in joules), click Start Calculation, and the corresponding result will appear in the calculation results box. Return to the main interface and click Print to generate your processed data.

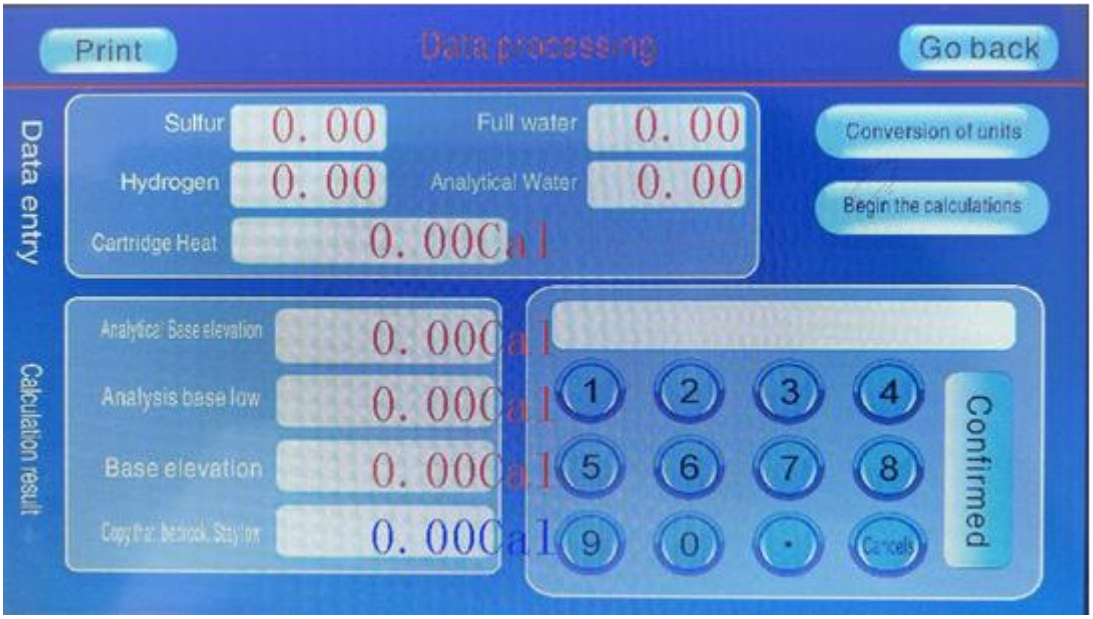


Figure-4

[System Test]: Click the system test to enter the test interface, as shown in **Figure 5**.

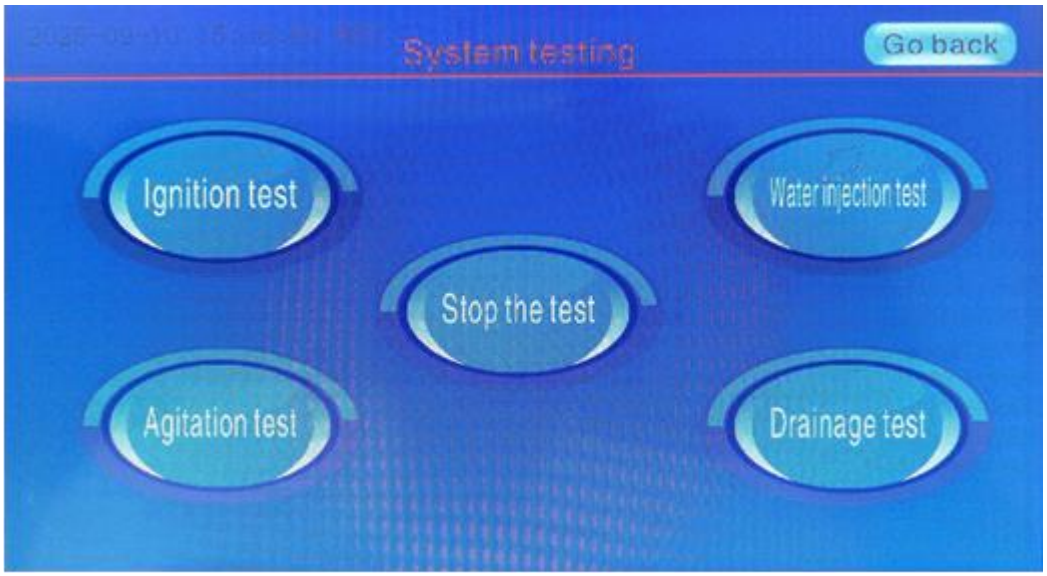


Figure-5

Click the **ignition test**, MCU sends the ignition command, and turns on the ignition circuit. It is used to detect the ignition circuit.
Click the **mixing test**, the MCU sends the mixing command, and the mixing is connected. It is used to detect the mixing circuit.
Click the **water injection test**, MCU sends the water injection command, and drives the water pump to work.
Click the **drainage test** MCU to issue a drainage command and drive the drainage pump to work. It can be used for filling the outer cylinder of the instrument.
Click **Stop Test** to end all functional tests.

5.3.2 [Calorific value determination]

Click the **calorific value measurement** button to start the calorific value test, and switch the interface to the following:



Figure-6

Click on the **caloric input**, as follows:

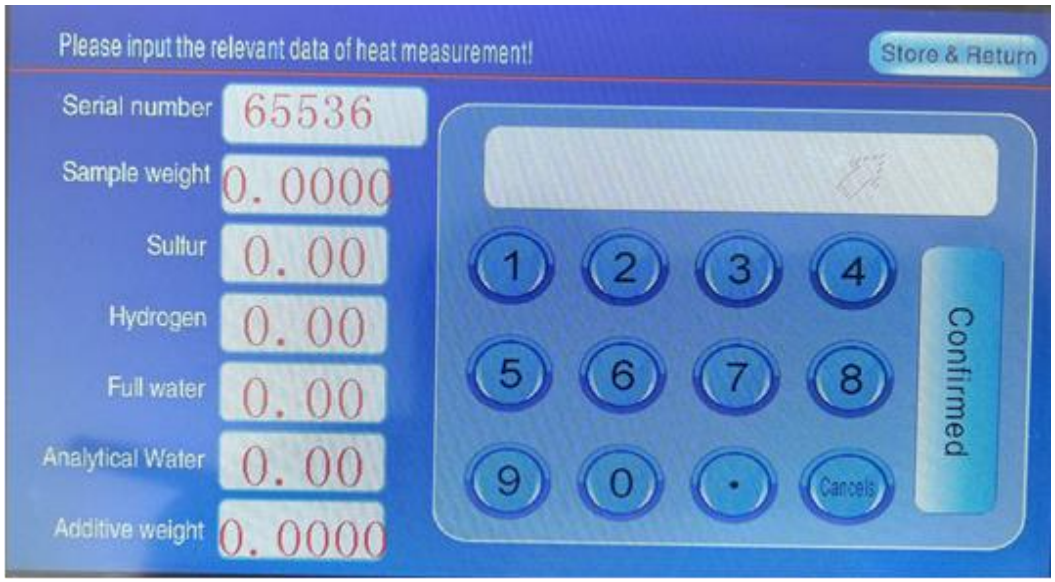


Figure-7

Enter the weight of the so-called sample (if no additive is used, you can enter 0), the number, sulfur, hydrogen, water, and other experimental data. Click **Return** to return to the calorific value measurement interface.

5.3.3 [Demarcate]

Click **calibration**, the calibration test starts, and the interface is switched to the following:



Figure-8

Click **calibration** input as follows:

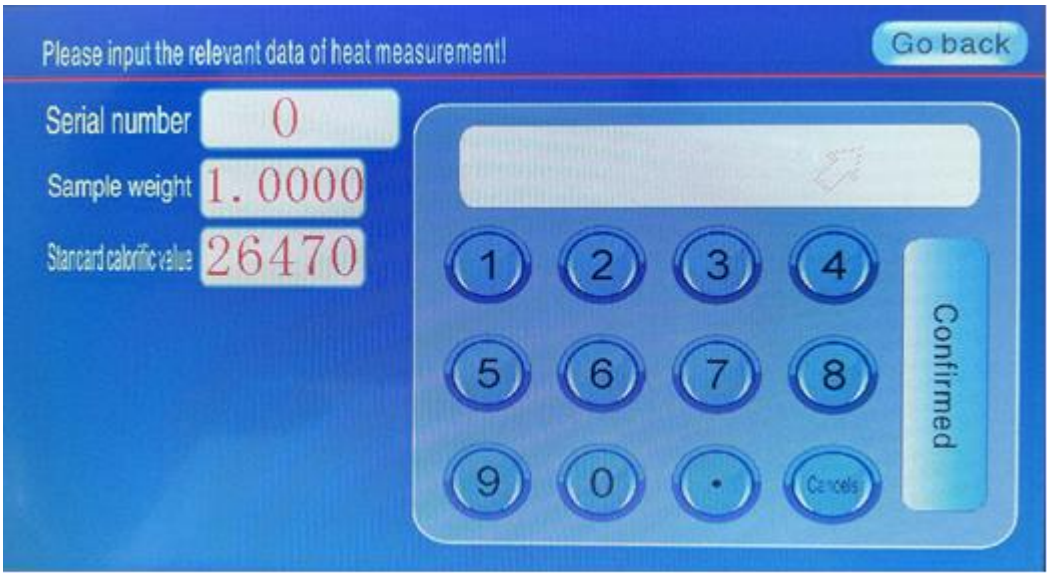


Figure-9

Enter the test data, such as sample weight and number, and click **Return** to return to the heat capacity measurement interface.

5.3.4 [Return]

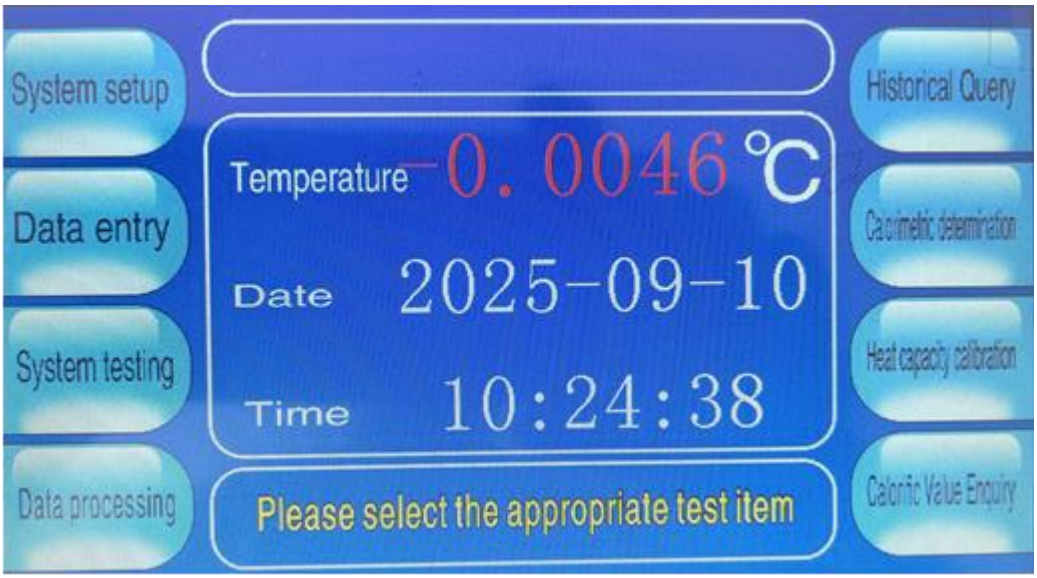


Figure-10

When the test is finished and ignition fails, press this key to clear the test information and curve, and return to the standby state.
Note: After using the data processing, click the **stop reset** button.

5.3.5 [Reset]

Press this key, and the instrument returns to the startup state.

5.3.6 Heat capacity calibration

The apparatus (0.9-1.1g) is loaded with an oxygen bomb, and oxygen is supplied for 15-45 seconds at 2.8-3.0MPa pressure. After inserting it into the inner cylinder, click "**Heat Capacity Measurement**" and input the weight of the benzoic acid sample. The instrument will print out the calibrated heat capacity E within ten minutes. Repeat this process 5-6 times, manually calculate the average value, and save it in the system. Then perform 1-2 calorific value tests on the benzoic acid samples. Compare the calorific value of the bomb with the standard value. If the error is less than 120J, the calibration is successful.

5.3.7 Calorific value determination

Weigh the sample (0.5-2.0g), load it into the oxygen bomb, and oxygenate for 15-45 seconds at 2.8-3.0MPa pressure. Place it in the inner cylinder and click "**Heat Release Test**" to start the measurement. Enter the sample weight and additive quantity (0 if none added). Subsequently, input the coal sample's total moisture content, analytical moisture content, sulfur content, and hydrogen content in sequence. The system will automatically display and print the heat release results after the test.

6. Troubleshooting

Phenomenon	Cause	Solution
Oxygen bomb leakage	Rubber seal aging or wear	Check and replace the seals
Ignition failure	The circuit is not connected, or the ignition wire is in poor contact	Check whether the connection is good, whether the oxygen bomb head and the fuse are in contact, and whether the oxygen bomb is well placed
	The sample is moist	The sample is moistened by excessive oxygenation
	The ignition wire or cotton thread is not in good contact with the sample	Re-sample it
	The electrodes are too dirty	Grind the electrode with sandpaper
	Ignition cap oxidation	Grind oxide on the ignition cap with sandpaper
	The two electrodes are short-circuited with the crucible (it is easy to burn the crucible and electrodes)	Replace the electrode or crucible and repackage the sample
Incomplete combustion of samples	The sample is not flammable. Insufficient oxygen or insufficient oxygen pressure	Wrap the sample with a piece of paper to prolong the oxygenation time, and replace the oxygen cylinder
The temperature rises too high, and the calorific value is too high after ignition	The stirrer does not turn	The mixing shaft is stuck, and the circuit is blocked
	Blade detachment	Insert a cotton into the nylon rod connected to the stirring shaft and reinsert it
The test does not end for a long time	The ambient temperature is too high	The water temperature of the adjustment sleeve is basically the same as the room temperature, or the indoor temperature is low
The oxygenator is leaking	The oxygenation instrument seal is aging or worn	Replacement of seals

7. Accessories

Standard Accessories

S. No	Accessory Name
1	Oxygen Pressure Reducer