



Kingpo Technology Development Limited

HME Moisture Loss Tester

ISO 23328-1 Conditioning Apparatus For BSF

User Manual



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1. Overview:

The HME testing equipment is developed and designed according to ISO 9360-1 and ISO 23328-1. This equipment is mainly used to test the performance of the heat and moisture exchanger that simulates the human body, mainly measuring the water loss value during the use of the HME.

2. Specifications:

- The instrument is based on the standards ISO 9360-1, ISO23328-1;
- The instrument is mainly used to test the water loss of heat and moisture exchangers (HME) used in anesthesia and respiratory systems to humidify human respiratory gases.
- Working principle: A sinusoidal gas generator is used to simulate human breathing. The test system is calibrated using a standard HME, and the tidal volume is adjusted. The weight change of the simulated respiratory system and HME is recorded by weighing, and the water mass loss of the HME during breathing is calculated to determine the performance of the HME.
- The tester consists of a sine wave generator, a test host, a moisture generator, a simulated lung, a constant temperature water bath, an insulation box, a gas constant temperature control device, a gas storage container, a gas delivery system, an automatic separation weighing system, a calibration HME and auxiliary test accessories.
- Automatic weighing, using a precision electronic scale with a measuring range of 0-15 kg and an accuracy of $\pm 0.1\text{g}$. Automatic lifting and lowering of the electronic scale, automatic separation of the test system, automatic recording of system mass changes, and automatic calculation of HME moisture loss.
- Sine wave gas generator, used to generate sine wave gas that simulates human breathing, with adjustable breathing rate from 0 to 30 times/min;
- Automatic adjustment of tidal volume, the system defaults to four levels: 250mL, 500mL, 750mL, and 1000mL.
- A constant temperature water bath ensures that the gases entering the HME from the simulated lung are fully humidified and kept at a constant temperature of 37°C . The constant temperature water bath automatically controls the temperature to a constant of 37°C with a control accuracy of 0.1°C .



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- The insulation box is filled with foamed polypropylene material to isolate the internal temperature of the test system from the external environment. A constant temperature control device is used to control the air temperature inside the insulation box at 37°C with a control accuracy of $\pm 0.5^{\circ}\text{C}$.
- Gas flow measurement uses a precision electronic flow meter with a response time of 10ms, a maximum resolution of 0.001SLPM, an output fluctuation of $\pm 0.12\%/^{\circ}\text{C}$, a flow pressure upper limit of 600Pa, and a flow upper limit of 50SLPM;
- Test time can be set to any value between 0-9999H9999 min;
- Calibration HME: The housing contains 81 polyvinyl chloride (PVC) pipes arranged in a 9×9 pattern. Each pipe has an inner diameter of 2mm, an outer diameter of 4mm, and a length of 50mm. It has 22 outer cones, 15 outer cones, and 15 inner cones;
- Simulated lung volume: 2L;
- Display: The system main interface displays real-time data such as running time, water temperature, air temperature, number of breaths, weight, tidal volume, respiratory rate, flow rate, etc.
- Touch screen control, use the touch screen to input parameters and operate the instrument;
- It can run continuously for 4800 hours; power supply: AC220, power 500W;
- Weight: The main unit weighs less than 15 kg.

3. Equipment control and operation:



- ① 2-liter anesthesia bag
- ② Postpartum dampness patient model
- ③ Control system
- ④ Flow meter (ISO9360 test)

3.1. Front page

You can choose Chinese or English on the homepage. Click the **[Enter System]** button to open the running interface.



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进入系统

HME水份损失测量仪

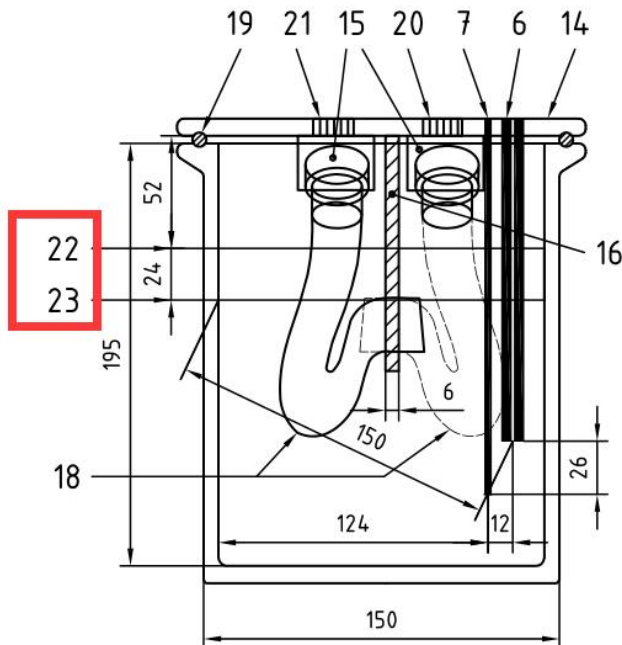
3.2. Run interface

1. Heating switch: ON, the heater starts heating, PID control, OFF turns off heating;
2. Humidity PV: humidity value in the water tank;
3. Water tank temperature SV: set the water tank temperature;
4. Water tank temperature PV: real-time display value of water tank temperature;
5. Box temperature SV: set the box temperature;
6. Box temperature PV: real-time display value of box temperature;
7. Time setting: set the breathing operation time, and it will stop automatically when the time is up;
8. Time display: display breathing running time;
9. [TIMER] button: white, timer stop, yellow, timer start;
10. Breathing volume: Click the input box to select 1000ml, 750ml, 500ml, 250ml;

11. Respiratory frequency: automatically selected after selecting respiratory volume;
12. **[Breathing Start]** button: start breathing after selecting the breathing volume;
13. **[Return to origin]** button: After the device is powered on, it will return to the origin before starting breathing;
14. Current weight: When weighing, it displays the weight of the breathing device, which is used to calculate the loss of water during breathing;
15. **[Reset]** button: used to clear the scale before weighing, so that the current weight is zero;
16. **[Record Clear]** button: clear the recorded weight value;
17. **[Weight]** button: used for weighing;
18. **[Record]** button: used to record the weight during weighing;

4. Test steps:

- (1) Open the water inlet on the sink and fill the sink with water to the standard water level (119-143mm).



- (2) Connect the external power supply and turn the power switch to the "open" position.
- (3) Connect the test sample to the port on the right side of the device.
- (4) Set the heating temperature to 37°C. Click the water tank and box heating button to start heating, and wait for the temperature to stabilize for at least 1 hour.



- (5) Set the test time to 25 ± 1 H
- (6) Set up a test Tidal volume and start it.

Table A.1 — Patient model parameters for conditioning BSF

BSF intended use	Tidal volume V_t^a ml	Frequency f min^{-1}	Ventilation rate $\text{l} \cdot \text{min}^{-1}$	I:E ratio (inspiration: expiration)
Paediatric	250	20	5	1:1
Adult	500	15	7,5	1:1
^a Tidal volume is the volume of gas entering or leaving the lungs of the patient in a breath.				

- (7) The device stops automatically when the test time is reached

5. Notes:

Please test the samples according to ISO23328-1 standard test requirements;

Please read this manual carefully before operating this machine, and do not operate it in violation of regulations.

6. Common troubleshooting

Serial number	Fault phenomenon	Cause of failure	Treatment method
1	The touch screen does not light up when the power switch is turned on	External power supply is not working	Reconnect the power supply
		The device circuit breaker is disconnected	Close the circuit breaker
2	Pressing the start button does nothing	The test time is not reset	Reset the time to zero
		Emergency stop switch not reset	Reset the emergency stop switch
3	Large temperature fluctuations	Thermocouple Connection Problems	Reconnect the thermocouple plug
4	Unstable weighing	Other items touch HG	Remove the left and right pipes inside the box