World Journal of Innovation and Modern Technology, Vol. 9, Issue 6 (Jun) **2026**
ISSN 2682-5910
DOI: 10.5281/zenodo.20542020

The Working Principle of PB840 Ventilator and Maintenance Case Sharing

Qionghui Cai

The Second Affiliated Hospital of Wenzhou Medical University, Medical Engineering and Equipment Department, Wenzhou 32500, Zhejiang, China

Abstract: ***Ventilators are essential rescue equipment for large hospitals today, and are an important tool to prolong patients' lives and gain valuable time for further treatment. This paper briefly describes the basic structure of PB840 ventilator and its working principle and gives corresponding diagrams, and analyzes the common failures of this ventilator in combination with case studies. Ensure the smooth development of clinical work and better assist patient treatment.***

Keywords: Ventilators; How it works; Maintenance.

1. INTRODUCTION

Ventilators are essential life-saving equipment in large hospitals today, serving as crucial tools for prolonging patient lives and buying precious time for further treatment. Through mechanical devices, they provide respiratory support to critically ill patients with respiratory failure according to different treatment objectives. With continuous advancements in electronic and mechanical technology, ventilator performance has become increasingly sophisticated, and their applicability has expanded and become more widespread. The PB840 ventilator is suitable for ventilatory support in acute and subacute patients of all ages. This article briefly describes the basic structure and working principle of the ventilator, and analyzes common malfunctions of this ventilator using case studies. This aims to ensure smooth clinical operations and better assist patient treatment.

2. BASIC STRUCTURE AND WORKING PRINCIPLE OF THE PB840 VENTILATOR

2.1 Basic Structure

The PB840 is suitable for ventilatory support in acute and subacute patients of all ages. The main structure of the 840 ventilator consists of a graphical user interface (GUI) and a ventilation unit (BDU) each equipped with an independently operating central processing unit; optional accessories such as a backup power supply (BPS) and compressor are also available. The ventilator system composition is shown in Figure 1.

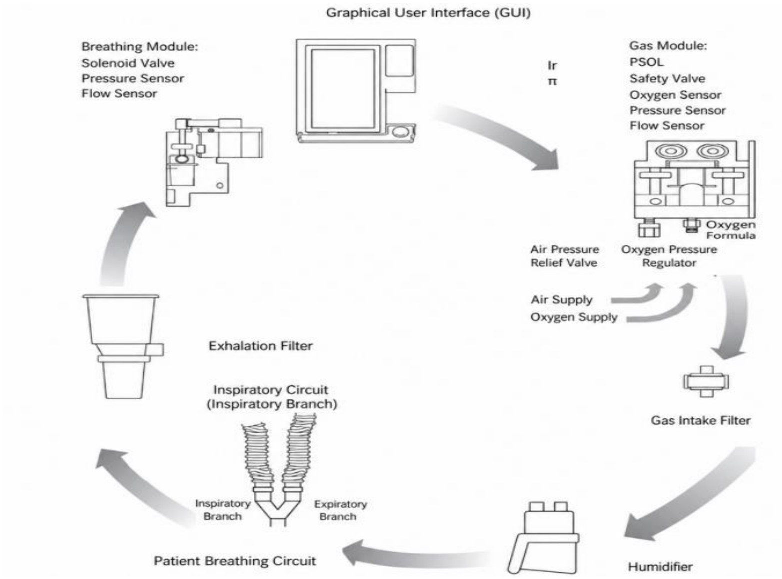

Figure 1: Composition of the ventilator system

The ventilation unit (BDU) consists of a pneumatic device and a patient circuit. The BDU CPU ventilates the patient according to the ventilation control parameters set by the operator, and at the same time, it performs comprehensive and continuous background control during the operation of the ventilator to ensure that the ventilator works normally.

The GUI CPU monitors the interaction between the ventilator and the human, and simultaneously monitors the BDU CPU to prevent a single fault from causing a simultaneous interruption of control and monitoring functions.

The compressor (optional) supplies compressed air to the BDU, replacing wall-mounted or bottled air. The compressor is connected to and powered by the BDU.

Backup power supply (BPS) can supply DC power to the BDU and GUI in the absence of AC power.

The operator selects ventilator parameters and inputs data via the GUI touchscreen, off-screen buttons, and GUI knobs. The GUI CPU processes the information and stores it in the ventilator's memory. The BDU CPU uses the stored information to control and monitor the patient's inhaled and exhaled gas flow rates. The two CPUs transmit and verify new ventilator parameters or alarm limits to each other. Then, each CPU continuously performs background checks for operational and data integrity.

2.2 Working Principle

The ventilator uses pressure or flow triggering to confirm the patient’s inspiratory effort.

When pressure triggering is used, the ventilator monitors pressure changes in the patient circuit. When the patient inhales, causing the airway pressure to drop and reach the pressure trigger sensitivity setting, the ventilator performs a ventilation.

When flow triggering is used, the ventilator monitors the difference between the inspiratory and expiratory flow sensor readings. Since the ventilator delivers a constant baseline flow rate, it detects a decrease in expiratory flow rate during patient inspiration, meaning the difference between inspiratory and expiratory flow rates increases. When this difference reaches the set value for the flow trigger sensitivity, the ventilator initiates a ventilation.

If the patient is not inhaling, the increased flow rate difference between the inspiratory and expiratory ends may be due to sensor malfunction or leakage at the patient end. To compensate for leakage at the patient end and avoid false triggering, the operator should increase the flow trigger sensitivity setting.

As a backup to flow-triggered triggering, pressure-triggered triggering is also effective, with a default trigger sensitivity of 2 cmH_2O. This value is the most sensitive setting that is sufficient to avoid false triggering while also allowing for confirmation of patient-triggered triggering.

3. A CASE STUDY OF PB840 VENTILATOR REPAIR.

3.1 Fault Description

During routine self-inspection, the department discovered that the second step of the EST test, the "Flow sensors cross-check Test," failed. Upon reviewing the test data, significant discrepancies were found between the baseline and measured air and oxygen flow rates. For example, the measured flow rate was only 63.09 L/min when the baseline oxygen flow rate was 120 L/min, and only 64.79 L/min when the baseline air flow rate was 120 L/min (see Figure 2).

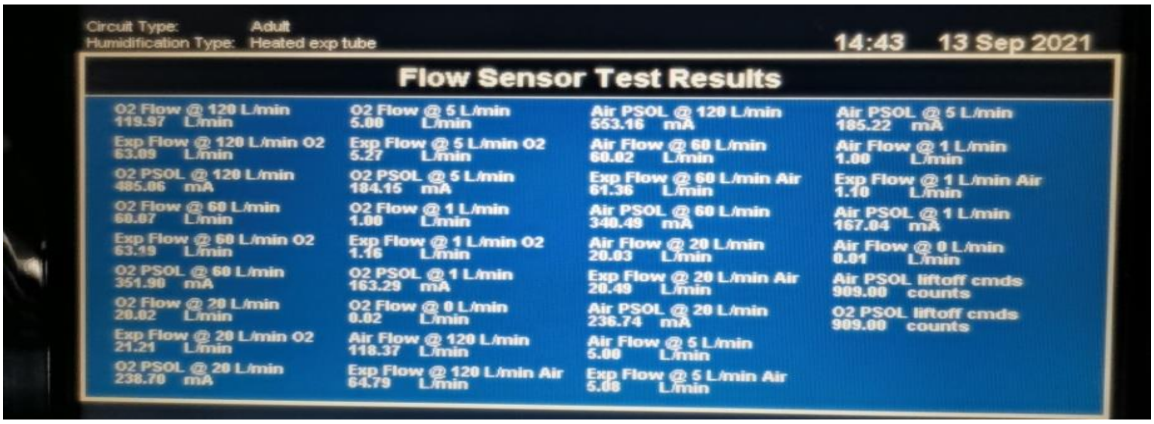

Figure 2: Flow Sensors Detection Results

3.2 Troubleshooting and Analysis

Upon disassembling the expiratory airway, water accumulation and a cloudy color were found at the exhalation end, while the inhalation end showed no such issue. Inquiries with the department suggested that a nurse may have improperly used this model for nebulization, causing medication to enter the expiratory airway. Disassembly of the flow sensor revealed significant rust and blackening of the needle pins, making cleaning impossible (Figure 3). Dark water droplets remained on the inner tubing. Disassembly and cleaning were performed (Figure 4). A replacement flow sensor was ordered from the manufacturer, and the ventilator passed the EST test, allowing for normal operation. The head nurse was informed that nebulization of this model is strictly prohibited, as it causes significant damage to the machine.

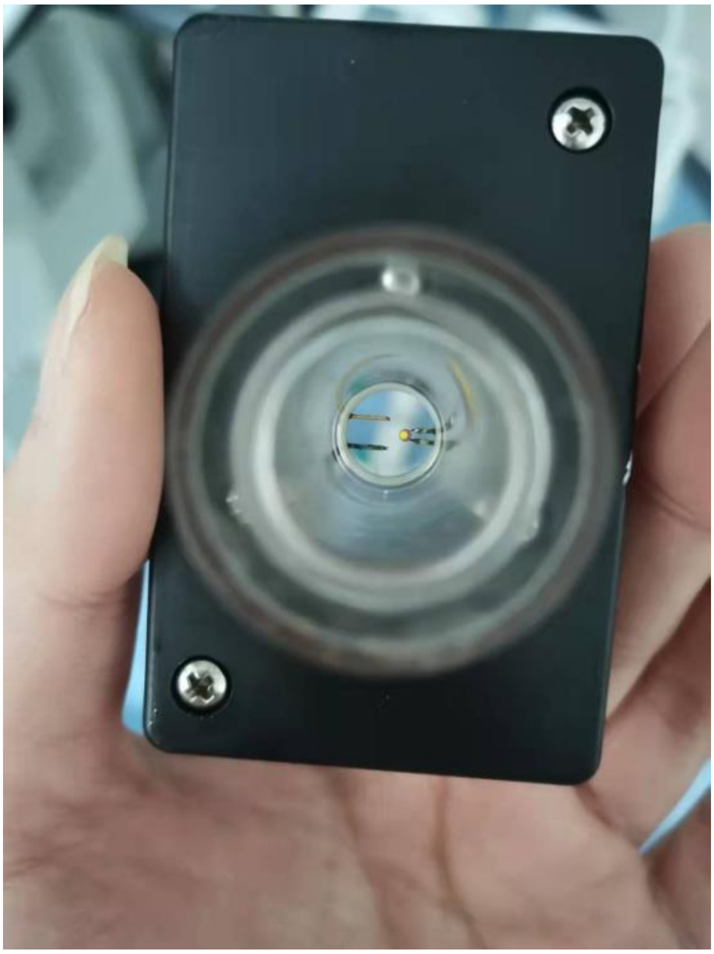

Figure 3: Flow sensor with corroded pins.

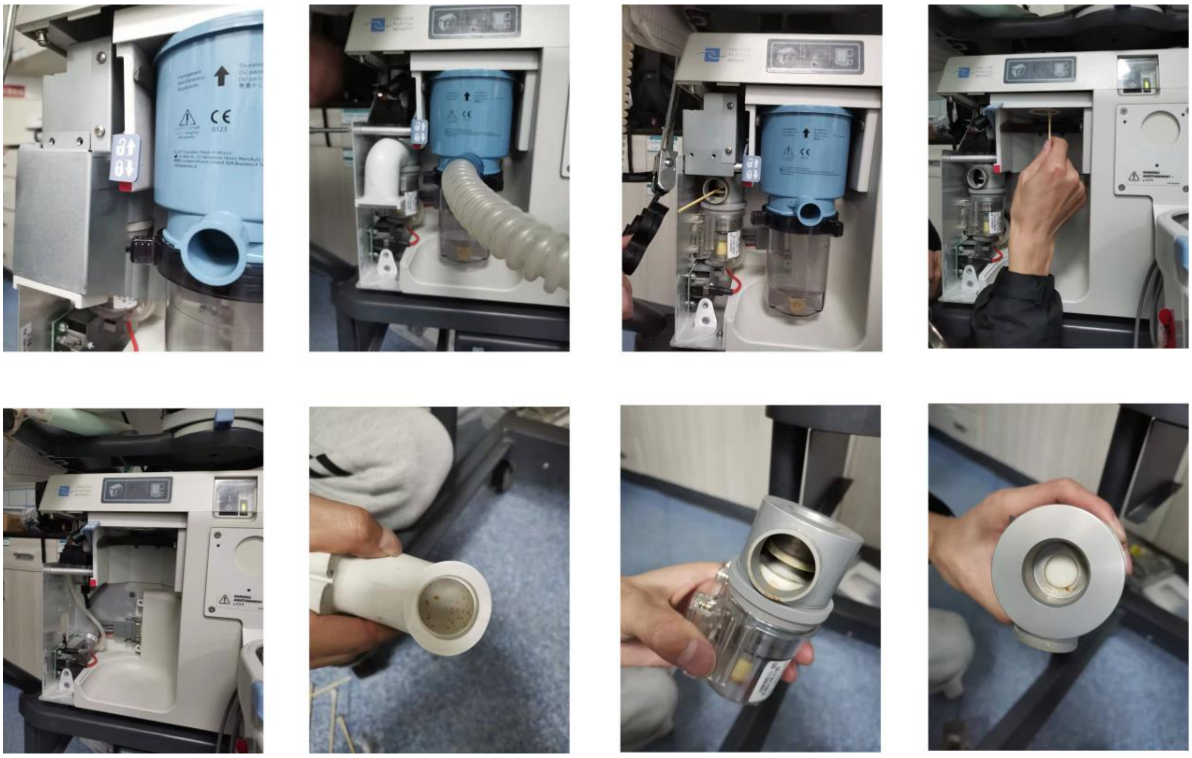

Figure 4: Disassembly and Maintenance

4. PB840 VENTILATOR MAINTENANCE

4.1 Normal Operation and Maintenance by the Department Using It.

1) PB840 recommends that the air source be oil-free and dry, clean and free of any lubricants or other components, and dry without any moisture to avoid damaging the ventilator.

2) Use AC power without connecting to a power adapter (plug-in) and ensure that the power plug is within the operator's line of sight.

3) Filters are installed at both the inhalation and exhalation ends. The exhalation end filter is heated to reduce the generation of condensate in the filter during heating and humidification.

4.2 Medical Engineering Department Maintenance

1) Develop a ventilator maintenance plan based on factors such as the frequency and duration of ventilator use, and promptly remind the departments using the ventilator to replace easily worn parts to ensure its proper function.

2) Regularly check the safety performance of the ventilator and keep detailed records.

REFERENCES

[1] Lin Yongsheng, Yang Zhenyu, Xie Jiayu. Repair of ventilator malfunctions in hospitals [J]. Medical Equipment, 2016, 29(11):67-68.
[2] Zheng Dan. Structure and common fault diagnosis of Tyco PB840 ventilator [J]. Medical Equipment, 2022, 35(08):118-119.
[3] Yang Zhicheng, Zhang Tonggang, Wang Ziming, You Yuming. Fault analysis, handling and daily maintenance of 806 air compressor for PB840 ventilator [J]. Medical Equipment, 2021, 34(21):145-146.
[4] He Jiandi, Hu Xiaocong. System structure, working principle and maintenance case of PB840 ventilator [J]. Medical Equipment, 2015, 28(01):96-97.
[5] Ye Meng. System structure, working principle of airway system and common faults of PB840 ventilator [J]. Medical Equipment, 2018, 31(18):155-156.

[6] Wei Pengfei, Tian Yongli, Tian Hao, Chen Beibei. Case analysis of PB840 ventilator repair[J]. China Medical Equipment, 2020, 35(04):170-172.
[7] Luo Yehui. Centralized fault analysis and maintenance of PB840 ventilator [J]. China Medical Equipment, 2019, 34(07): 182-184.
[8] Zheng Yinda. Common faults and maintenance of PB840 ventilator [J]. Medical Equipment, 2019, 32(10): 128-129.