Ventilator, Intensive Care

Health problem addressed
Ventilators provide temporary ventilatory support or respiratory assistance to patients who cannot breathe on their own or who require assistance to maintain adequate ventilation because of illness, trauma, congenital defects, or drugs (e.g., anesthetics).

Product description
Ventilators consist of a flexible breathing circuit, a control system, monitors, and alarms. The gas is delivered using a double-limb breathing circuit. The gas may be heated or humidified using appropriate devices. The exhalation limb releases the gas to the ambient air. Intensive care ventilators are usually connected to a wall gas supply. Most ventilators are microprocessor controlled and regulate the pressure, volume, and FiO2. Power is supplied from either an electrical wall outlet or a battery.

Principles of operation
The control mode provides full support to patients who cannot breathe for themselves. In this mode, the ventilator provides mandatory breaths at preset time intervals and does not allow the patient to breathe spontaneously. Assist/control modes also provide full support by delivering an assisted breath whenever the ventilator senses a patient’s inspiratory effort and by delivering mandatory breaths at preset time intervals. With volume-controlled breaths, a control system is used to ensure that a set tidal volume is delivered during the inspiratory cycle. Pressure-controlled breaths regulate flow delivery to attain and sustain a clinician-set inspiratory pressure level for a set time so that the ventilator delivers controlled or assisted breaths that are time cycled. Combination modes are also available.

Operating steps
Users first check that the unit is ready for use (e.g., run performance and calibration checks). They next make sure that settings (including alarm levels) are correct and appropriate for the patient type and condition. Once completed, the patient is connected to the ventilator. When the ventilator-patient connection is completed, users ensure the patient is being properly ventilated. While patient is being ventilated, caregivers monitor/evaluate the patient, and respond promptly to alarms.

Reported problems
Risk of acquiring pneumonia may be minimized by following proper infection control procedures. Leaks in the breathing circuit or components may prevent the ventilator from delivering the appropriate amount of ventilation. Proper maintenance and avoiding operator errors or machine failures can be critical. Critical changes in patient conditions can be missed if alarms are not set properly or are not noted by clinical staff.

Use and maintenance
User(s): Physicians, nurses, respiratory therapist, other medical staff
Maintenance: Biomedical or clinical engineer/technician, medical staff, manufacturer/servicer
Training: Initial training by manufacturer, operator’s manuals, user’s guide

Environment of use
Settings of use: Intensive care, critical care settings, surgery
Requirements: Uninterruptible power source, battery backup, proper tubing/masks

Product specifications
Approx. dimensions (mm): 125 x 40 x 62
Approx. weight (kg): 67
Consumables: Batteries, tubing, masks, filters
Price range (USD): 9,000 - 60,000
Typical product life time (years): 8, depends on hours used
Shelf life (consumables): NA

Types and variations
Cart or stand mounted