

1. Record Nr.	UNINA9910544872303321
Titolo	Mechanical ventilation amid the COVID-19 pandemic : a guide for physicians and engineers // Amir A. Hakimi [and three others], editors
Pubbl/distr/stampa	Cham, Switzerland : , : Springer, , [2022] ©2022
ISBN	3-030-87978-X
Descrizione fisica	1 online resource (267 pages)
Disciplina	614.8
Soggetti	Artificial respiration COVID-19 (Disease) Respirators (Medical equipment)
Lingua di pubblicazione	Inglese
Formato	Materiale a stampa
Livello bibliografico	Monografia
Nota di bibliografia	Includes bibliographical references and index.
Nota di contenuto	Intro -- Preface -- Contents -- About the Editors -- Chapter 1: Establishment of the Bridge Ventilator Consortium -- Part I: Lung Physiology and Ventilator Basics -- Chapter 2: An Overview of Lung Anatomy and Physiology -- Lung Anatomy -- Trachea and Bronchi -- Pulmonary Neurovasculature -- Lung Mechanics -- Compliance and Elastance -- Airway Resistance and Drive Pressure -- Work of Breathing -- Gas Exchange -- Ventilation -- Perfusion -- Dead Space -- Shunt -- A-a Gradient -- V/Q Mismatch -- Carbon Dioxide -- Bohr Effect -- O2 Delivery to Tissues -- Haldane Effect -- Oxyhemoglobin Dissociation Curve -- Hypoxemia vs. Hypoxia -- Altitude Effects on Gas Exchange -- Normal Physiologic Parameters -- References -- Chapter 3: Respiratory Mechanics and Ventilation -- History of Mechanical Ventilation -- Noninvasive Positive-Pressure Ventilation -- Positive-Pressure Invasive Ventilators -- Basics of Mechanical Ventilation -- Ventilator Settings -- Reference -- Chapter 4: Mechanical Ventilators and Monitors: An Abridged Guide for Engineers -- Who Uses a Ventilator? What Level of Training Is Needed? -- Which Patients Benefit from This Device? -- Monitoring Physiologic Parameters -- Oxygenation and Pulse Oximetry -- Carbon Dioxide and Capnography -- Volume Capnography -- Transcutaneous CO2 Monitoring -- Arterial Blood Gas vs. Venous Blood Gas -- Airway

Pressures -- Peak Inspiratory Pressure vs. Plateau Pressure -- Auto-PEEP vs. Extrinsic PEEP -- Respiratory Rate -- Respiratory Set vs. Actual Rate -- Ventilator Sensed Rate -- Humidity (Heat and Moisture Exchangers vs. Heated Humidifier vs. Heated-Wire Circuits) -- Tidal Volume -- Patient-Ventilator Synchrony Monitoring -- Patient-Ventilator Synchrony/Dyssynchrony Introduction -- Ineffective Triggering -- Double Triggering and Reverse Triggering -- Flow Dyssynchrony and Auto-Triggering.

Setup and Form Factor of Contemporary Ventilators -- References -- Chapter 5: An Overview of Mechanical Ventilation and Development of the UC San Diego MADVent -- Introduction -- Spontaneous Respiration -- The Purpose and Basic Functions of a Ventilator -- The Evolution of Assisted Ventilation -- Types of Modern Ventilation -- CMV: Continuous Mandatory Ventilation -- A/C: Assist/Control Ventilation -- IMV: Intermittent Mandatory Ventilation -- SIMV: Synchronized Intermittent Mandatory Ventilation -- S/T:

Spontaneous/Timed Ventilation -- CSV: Continuous Spontaneous Ventilation -- APRV: Airway Pressure Release Ventilation -- CPAP: Continuous Positive Airway Pressure -- Pressure Support (PS) -- Patient-Triggered -- Ventilator-Initiated -- Time-Terminated -- Volume-Targeted -- Designing Ventilators for Clinical Use -- Regulations and Standards -- IEC 60601-1:2005+AMD1:2012+AMD2:2020 CSV -- IEC 60601-1-11 -- ISO 18652 -- ISO 5356-1 -- 21 CFR Part 820 or ISO 13485 -- ISO 14971 -- IEC 62304:2015 -- AAMI TIR69:2017 and ANSI/IEEE C63.27:2017 -- ISO 7010 -- Example Design: Inexpensive Bag-Based Ventilator -- Conclusions --

References -- Chapter 6: An Introduction to Noninvasive Ventilation -- Introduction -- High-Flow Nasal Cannula -- HFNC in COVID-19 Patients -- CPAP -- CPAP in COVID-19 Patients -- BiPAP -- BiPAP in COVID-19 Patients -- Survival Mode with Noninvasive Ventilation in a Resource-Limited Setting -- References -- Chapter 7: Noninvasive Ventilation and Mechanical Ventilation to Treat COVID-19-Induced Respiratory Failure -- Introduction -- Noninvasive Ventilation (NIV) -- Prone Positioning -- Mechanical Ventilation -- Tracheostomy -- References -- Part II: SARS CoV-2 Transmission and Innovative Protective Barriers -- Chapter 8: COVID-19 Pathophysiology and COVID-19-Induced Respiratory Failure -- Pathophysiology of COVID-19.

COVID-19-Induced Respiratory Failure -- References -- Chapter 9: Spread of COVID-19 and Personal Protective Equipment -- Spread of COVID-19 -- Personal Protective Equipment and Its Role in Preventing Spread Among Healthcare Workers and Communities -- References -- Chapter 10: An Overview of Personal Protective Equipment and Disinfection -- Protection of Personnel -- Environmental Protection -- References -- Part III: Bridge Ventilator Design and Components -- Chapter 11: What Is a Bridge Ventilator? Basic Requirements, the Bag Valve Mask, and the Breathing Circuit -- Chapter 12: Hardware Considerations -- Evolution of the Actuating Arm -- Printed Circuit Board (PCB) Design -- Optical Reflectors -- Pulse with Modulation (PWM) Board -- Power Supply -- Pressure Transducers -- User Input Controls -- High-Priority Alarms -- Overpressure -- Underpressure -- Loss of Power -- Low-Priority Alarms -- Tidal Volume Out of Spec -- Motor End of Life -- Outline of Motor Power Requirement Estimate -- Energy/Power into Ambu Bag -- Power Loss In 10 ft. Long Tube -- Power/Energy Loss in Pulmonary Resistance -- Energy/Power for Lung Compliance -- Reference -- Chapter 13: Software Considerations -- Software Overview -- Analog Input Acquisition -- Hardware and Timer Interrupts -- PWM Timer

and Encoder Interrupts -- Motor Control Task -- Alarm Class -- Display Class -- Flash Storage -- Watchdog Timer -- Doxygen Documentation -- Chapter 14: Development of Emergency Resuscitators: Considerations for Mechanical and Electrical Components -- Introduction -- Motor Systems -- Stepper Motor -- Basic Principles of Operation -- Stepper Motor Operation -- Encoders -- Servomotor -- Motor System Considerations and Comparison -- Conclusion -- References -- Chapter 15: Incorporating Patient Assist Mode: The ABBU Experience -- ABBU Synchronous Operation Testing. Chapter 16: A Qualitative Overview of Emergency Resuscitators Approved in the COVID-19 Pandemic -- Introduction -- Resuscitators vs. Ventilators -- SecondBreath LLC -- Coventor Adult Manual Resuscitator Compressor -- Umbulizer -- PVA Prevent (RECALLED) -- Spiro Wave -- Virgin Orbit Resuscitator -- Venti-Now -- Fitbit Flow -- Air Boost Austin P51 -- Apollo ABVMN -- LifeMech A-VS -- Conclusions and Parting Design Considerations -- References -- Part IV: Regulatory Factors and Device Testing -- Chapter 17: Innovation and Regulation: The FDA's Response to the COVID-19 Pandemic -- Timeline of Initial SARS-CoV-2 Response -- Implementation of the Emergency Use Authorization -- Ventilator and Ventilator Accessory EUAs -- Ventilators -- Ventilator Tubing Connectors -- Challenges Associated with the FDA's Emergency Use Authorization -- Availability of Information to Clinicians -- Lack of Data on Patient Use -- Future Directions -- The Future of the FDA Umbrella EUA -- The Response to Future Pandemics -- References -- Chapter 18: Regulatory Considerations for Bridge Ventilators -- Medical Devices 101 -- What Is a Medical Device? -- Medical Device Design -- Herding Cats (Creating the Team) -- Mindset -- Team of Many Hats (Exploit Previous Experience) -- Bells and Whistles: How Much Is Too Much for an Emergency Use Authorization (EUA) Device? -- Performance and Analytical Testing to Support Bells and Whistles -- Conclusion -- Tips -- Reference -- Chapter 19: Human Factors Considerations in the User Interface Design of Bridge Ventilator Devices -- Introduction -- The Human Factors Engineering (HFE) Process -- HFE Process Details -- User Research -- Contextual Inquiry -- Use Scenarios -- Risk Analysis -- Usability Objectives or Goals -- Iterative Design -- Usability Evaluation and Testing -- Post-implementation Analysis -- Regulator Expectations -- References. Chapter 20: Preclinical Animal Testing of Emergency Resuscitator Breathing Devices -- Introduction -- Objectives of the Study -- Materials -- Animal Monitoring -- Anesthesia and Drugs -- Study Protocol -- Inducing and Maintaining Anesthesia -- Vascular Cutdown and Blood Pressure Catheter Placement -- Healthy Lung Data Collection -- Tidal Volume Test -- Acute Lung Injury by Saline Lavage (Porcine ARDS Lung Model) -- Injured Lung Data Collection -- ARDS Tidal Volume Test -- Respiratory Rate Test -- ARDS PEEP Test -- Euthanasia -- References -- Part V: Pandemic Innovations -- Chapter 21: Multiplex Ventilation: Requirements and Feasibility of Ventilator Splitters -- Introduction -- Purpose of Ventilatory Splitters -- Mechanisms of Split Ventilation -- Simple Shared Ventilation Strategy -- Individualized Shared Ventilation Strategies -- Pressure-Mode Individualized Ventilation Devices -- Volume-Mode Devices -- Other Ventilator Splitter Designs -- Implementation -- Advantages -- Limitations -- Conclusions -- References -- Chapter 22: CPAP-to-Ventilator: Open-Source Documentation, UC Irvine -- Project Overview -- Components List -- Modifying a CPAP Device to Gain Access to Blower and Connecting ESC -- CPAP-to-Ventilator Wiring Diagram -- Arduino Code -- Limitations and Areas for Improvement -- Disclaimer --

Chapter 23: Alternatives to Conventional Noninvasive Positive-Pressure Ventilation Devices -- Standard Noninvasive Ventilation -- Innovative Noninvasive Ventilation Devices -- Snorkel Masks -- Advantages -- Disadvantages -- Helmets -- Advantages -- Disadvantages -- Discussion -- Conclusion -- References -- Chapter 24: Development of an Inexpensive Noninvasive Ventilation Hood -- Introduction -- Methods -- Results -- Discussion -- Conclusion -- References -- Chapter 25: Collaborations and Accomplishments Among the Bridge Ventilator Consortium Teams.
Index.
