

The background image is a photograph of a surgical room. In the foreground, two surgeons in blue scrubs and masks are performing an operation on a patient. Above them are two large surgical light fixtures with multiple glowing orange lamps. The ceiling is visible, showing a complex network of white HVAC ducts, pipes, and bundles of white cables. A circular gauge or control panel is mounted on the ceiling near the ducts. The overall lighting is a mix of the warm orange from the surgical lights and the cooler greenish-white from the ambient room lights.

HVAC Design Manual for **Hospitals and Clinics**

Second Edition



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FOREWORD

This second edition of *HVAC Design Manual for Hospitals and Clinics* adds updated information, provides in-depth design recommendations based on best practices, and presents proven, cost-effective, and reliable solutions that result in low maintenance cost and high reliability. Our intent is that this edition of the manual focuses specifically on heating, ventilating, and air-conditioning (HVAC) system design for health care facilities, omitting general system descriptions that are readily available in other ASHRAE publications. Instead, our focus has been to present “what’s different” about health care HVAC.

Although not a consensus document, this manual draws heavily on ANSI/ASHRAE/ASHE Standard 170-2008, *Ventilation of Health Care Facilities*, which is a consensus document. Citations of the standard throughout this book should be understood to include its Addenda a to t and v.

This edition is the result of a concerted effort by a fine group of volunteers whose job was made immensely easier by having the first edition to build upon. By intent, the authoring committee was composed primarily of consulting engineers with long experience in the design and construction of health care facilities. Jeff Hardin and John Kramer worked hard on both editions. Hospital engineers John Kramer, Heather Platt, and Ron Westbrook also wrote chapters and provided invaluable input to the entire book. Engineering editorial assistance was provided by John Murphy, and Walter Grondzik was technical editor. Kelley Short and Kelsey Grondzik assisted with tables and illustrations.

The intended audience for this manual includes

- consulting engineers;
- experienced hospital designers who will use it as a reference;
- mechanical engineers who wish to become familiar with health care design;
- young engineers who seek a career specializing in health care HVAC design;
- facility managers;
- infection control personnel;
- managers of planning and design;
- maintenance staff;
- contractors;
- developers; and
- code, accreditation, and licensure officials.

Finally, I want to thank Layle Thomas for her fantastic organizational and editorial expertise, which was invaluable in coordinating the efforts of over 32 volunteers.

It has been my honor to chair this committee.

Dan Koenigshofer, PE, M Public Health, HFDP, SASHE
Dewberry Engineers
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CHAPTER 1

OVERVIEW OF HEALTH CARE HVAC SYSTEMS

HVAC systems in health care facilities provide a broad range of services in support of populations who are uniquely vulnerable to an elevated risk of health, fire, and safety hazard. These heavily regulated, high-stakes facilities undergo continuous maintenance, verification, inspection, and recertification; typically operate 24 hours/day, 7 days/week; and are owner-occupied for long life cycles. Health care HVAC systems must be installed, operated, and maintained in spatial and functional conjunction with a host of other essential building services, including emergency and normal power, plumbing and medical-gas systems, automatic transport, fire protection, and myriad IT systems, all within a constrained building envelope. Health care facilities and services are characterized by high rates of modification because of the continuously evolving science and economics of health care, and consume large quantities of energy and potable water. The often unique environmental conditions associated with these facilities, and the critical performance, reliability, and maintainability of the HVAC systems necessary to their success, demand a specialized set of engineering practices and design criteria established by model codes and standards and enforced by authorities having jurisdiction.

Health care facilities vary widely in the nature and complexity of services they provide and the relative degree of illness or injury of the patients treated—from a neighborhood general practitioner's office to large regional or university medical centers and specialty hospitals. Facilities in the health care category can include, in addition to the practitioner's office, neighborhood clinics, mental wellness centers, birthing centers, imaging facilities, hospice care, and long-term nursing care, among others. As a rule, environmental control requirements and

1.1 INTRODUCTION

1.2 BASIC CLASSIFICATION OF HEALTH CARE FACILITIES