RESEARCH HIGHLIGHT

Technical Series 00-117

Mechanical and Electrical Systems in Apartments and Multi-Suite Buildings: A Practitioner's Handbook

INTRODUCTION

CMHC has created a design guide specific to mechanical and electrical systems in apartment and other multi-suite buildings. The guide provides recommendations for the features and operating characteristics of mechanical and electrical systems for this class of buildings. It also provides practical design guidelines and describes the system layouts and operating strategies for effective and efficient building services. Principally intended for HVAC system designers, this handbook is also appropriate for college and university students, installers, building inspectors and building owners and operators. A summary of the publication follows.

PURPOSE AND SCOPE OF THE HANDBOOK

The CMHC publication *Mechanical and Electrical Systems in Apartments and Multi-Suite Buildings: A Practitioner's Handbook* summarizes and consolidates relevant data, design concepts and other information to provide practical guidelines for people involved in the design of apartment building mechanical and electrical systems. It addresses design techniques used in space heating and cooling, ventilation, plumbing and electrical power systems.

The Handbook covers all buildings classified as Part 3 buildings of Residential Occupancy under the National Building Code of Canada (NBCC), including midrise and highrise, non-combustible construction; lowrise, combustible construction; and '4-plex' or '6-plex' housing with a common entrance for all suites. There is some application for other domiciliary buildings, such as dormitories, motels, hotels and nursing homes. The manual does not cover NBCC Part 9 buildings: townhouses; '4-plex' housing where each unit has its own street-level entrance; and detached or semi-detached houses.

CHAPTER TWO: PROJECT DEVELOPMENT

Diligent application of the project development approach outlined in this chapter will assist designers in optimizing the design of mechanical and electrical systems. Included in the chapter is an explanation of typical design tasks and criteria, maintenance considerations, and issues related to noise reduction and vibration control. As part of the work to develop this handbook, a study was undertaken to determine generic cost comparisons of some common heating, cooling and ventilation systems. The final section of this chapter looks at energy and water conservation, waste management and recycling issues.

CHAPTER THREE: HEATING -ONLY SYSTEMS

Heating-only systems provide space heating to suites and common areas. Beginning with a review of system types, heating load calculations, and general design recommendations, this chapter examines all heating systems appropriate for use in multi-suite buildings, such as central hydronic, forced air, electric resistance, and fossil-fuel-fired unitary heating systems. The final section discusses snow-melting systems for sidewalks, vehicle entrances, and driveways.

CHAPTER FOUR: COOLING -ONLY SYSTEMS

This chapter examines central hydronic cooling sytems, where chilled water is generated centrally and then distributed to chilled water terminal units in each suite; and unitary (in-suite) systems, where the cooling is generated in a terminal unit dedicated to the suite. Load calculation and efficiency issues are also discussed.

CHAPTER FIVE: CENTRAL HYDRONIC DISTRIBUTION PIPING SYSTEMS

Central hydronic systems are used for heating and cooling, and in combined heating and cooling systems. This chapter presents hydronic distribution piping systems, pump sizing and selection criteria. It provides specific guidelines for installation, including detailed schematics and drawings, equations and other important specifications. Piping details and configurations are presented.

CHAPTER SIX: COMBINED HEATING AND COOLING SYSTEMS

Combined heating and cooling systems have both the heating and cooling delivered by the same terminal unit. The actual sources of heating and cooling energy, however, may be different. This chapter focuses on how such systems are combined at the terminal unit. Several combined heating and cooling systems are looked at, including central hydronic, central hydronic heating and unitary cooling, central hydronic heating and cooling with supplementary unitary heating, unitary heating and cooling, and water-loop heat pump systems. Preferable layouts are described for each system.

CHAPTER SEVEN: VENTILATION SYSTEMS

The critical design considerations related to supply and exhaust air ventilation systems are discussed in detail in this chapter, including defining the air exchange requirements for each space, the location of ventilating equipment and air intake and exhaust openings, integrating the ventilation system into the heating and cooling system, sizing the distribution ductwork, risers, branches, grilles and diffusers, defining operating sequences, selecting controls, and occupancy and operation/ maintenance considerations. The chapter covers supply systems, exhaust systems, and miscellaneous systems required for areas such as swimming pools, parking garages, emergency generator rooms and electrical vaults, wet/dry storage areas, and garbage and recycling rooms. Influencing environmental conditions such as stack and wind effects are also discussed.

CHAPTER EIGHT: AUTOMATIC CONTROL SYSTEMS

The focus in this chapter is on the different control system technologies available and the factors to consider in selecting a control system for a particular project. The characteristics, advantages and disadvantages of conventional control systems such as thermostats, packaged electronic, programmable thermostats and direct digital control systems are examined. The final section looks at various building automation systems that control and monitor all the building's automated systems (e.g. security surveillance, alarm and access, fire alarm, energy management, lighting, HVAC, utility demand, communication) from a single control point.

CHAPTER NINE: ELECTRIC POWER CONVERSION

This chapter explains the basics of transformers and electrical distribution in apartment buildings, and covers key areas such as motor classifications and characteristics, operating costs and motor controls.

An overview of the various types of lamps available and in general use for multi-unit residential applications includes energy-saving and efficacy issues for individual units, common areas, and exterior lighting and parking garages. Also considered are energy requirements for elevators, automotive vehicle heaters, and emergency power and co-generation considerations.

CHAPTER TEN: DOMESTIC WATER SUPPLY SYSTEMS

This chapter provides information on the design and installation of both cold and hot water piping systems, the selection and sizing of domestic hot water heaters, heating domestic hot water using recovered heat (from grey water drainage or from heat pumps) or solar energy, the selection of plumbing fixtures, and considerations for heating swimming pool water. There is also discussion of energy conservation, water re-use and water conservation measures applicable to multi-unit buildings.

CHAPTER ELEVEN: COMMISSIONING

The final chapter of the guide explains the issues, costs and benefits of commissioning mechanical and electrical systems. It provides general commissioning guidelines that should be established between the designer and the owner. The chapter discusses final commissioning documentation which provides a comprehensive and well organized set of documents concerning the HVAC and electrical systems, as well as the results of all tests and related activities. Pre-start, start-up and functional performance tests are described for different systems.

APPENDICES

Climatic data for system sizing is provided in the appendices, as are unit conversion factors, insulation requirements and a glossary of electrical terms.

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Research Report: *Mechanical and Electrical Systems in Apartments and Multi-Suite Buildings: A Practitioner's Handbook*

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Housing Research at CMHC

Under Part IX of the ***National Housing Act***, the Government of Canada provides funds to CMHC to conduct research into the social, economic and technical aspects of housing and related fields, and to undertake the publishing and distribution of the results of this research.

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