

# Industrial Air Handling Processes

*Railio /*

Association of Finnish Manufacturers of Air Handling Equipment, Helsinki, Finland

## Introduction

The aim of this presentation is to provide an overview of Chapter 9 in the DESIGN GUIDE BOOK OF INDUSTRIAL AIR TECHNOLOGY, Volume A, FUNDAMENTALS:

## Design Guide Book, Chapter 9

The purpose of this chapter is to present the basic features of air handling processes and equipment. The aim is provide a link between the basic theories of the air handling processes, presented in Chapter 4, and the equipment covered in the "System and Equipment" book and further in the Application booklets for different industrial branches.

This chapter also briefly addresses the basic issues required in order to have energy-efficient design of air handling systems and equipment. These include the space requirements of equipment and component pressure losses. Also good design practices, including system balancing and efficient running are dealt with.

Chapter 9 also addresses some essential aspects which are required in the selection of the system and equipment at the detailed design stage. The essential issues include: principles of automatic control, noise reduction, material problems such as erosion, corrosion, maintenance and cleaning of equipment. In the Fundamentals, these issues are not dealt with in detail, as so much depends on the actual system or equipment itself. Details are covered in the Systems and Equipment book (Volume B), and further in the Application booklets ("Volume C"). However, a brief description of the common features is necessary in order to address these important issues related to the system and product developers as well as the designers.

The basic question for this chapter is:

**"What are the theoretical aspects of air handling units, ductwork design, and the optimisation of building energy systems"**

Linking with the other chapters can be related as:

Chapter 4 covers the physical fundamentals of the air handling processes

- for example, the construction of the Mollier diagram

## **Chapter 9** Covers the basic air handling processes

- for example, HOW to apply the Mollier diagram, as a basic tool in heat exchanger design

The "Systems and equipment" volume describes the actual equipment, and its technical characteristics.

- for example: Heat exchangers as products, heat recovery sections in air handling units, with detailed descriptions of various functions, control strategies etc.

The main objectives of air handling system are dealt with in various subchapters

- Contaminant removal from indoor spaces and processes
- Supply of cleaned and/or treated air for occupied spaces
- The control of the thermal and pressure conditions, in treated spaces

All the above has to be carried out in a safe, reliable and energy-efficient manner.

## **The Main Contents of Different Parts in Chapter 9**

### **Filters**

These features are described in the paper by Gustavsson (1), including the need to remove different types and sizes of particles, filtration mechanisms, filter classification and test standards, and life cycle issues.

### **Heat Exchangers and Air Handling Processes**

General theory and main types of heat exchangers and heat recovery devices

Air handling processes

- humidification and dehumidification
- air heating and cooling
- air mixing

### **Fans**

General issues, fan categories

Fan types: Centrifugal fans, Axial fans

Effect of speed of revolution

Fan and duct network, connections

Series fan connection

Fan volume flow regulation

### **Automatic Control of the Air Handling Systems**

Methods for control, types of control equipment

Processes

Controllers: types and selection according to process requirements

Use of frequency converters

Building Control Station

### **Air Distribution System, Ductwork .**

These items are briefly covered as the main focus is on the product and system level, the main factors are covered in the "Systems and equipment" volume. The basic fundamentals for air and gas flow in ducts have been covered in Chapter 4, and in Chapter 9 includes friction loss calculation, design methods, thermal losses by transmission and leakage of air from ducts.

### **Noise Control in Air Handling Units and Air Distribution Systems**

The basic issues of noise control are presented in Chapter 5 of the Fundamentals book, mainly from the physiological point of view. In Chapter 9, issues relating to noise generated by the air handling units and ductwork, criteria for acceptable air handling unit and HVAC system noise levels and associated design problems are described.

### **Fundamentals for Energy Optimisation in the Systems, Brief Description.**

This subchapter briefly deals with the energy aspects for air handling systems, covering fan efficiency from the system point of view, heat recovery optimisation, pressure losses from the design point of view, and demand-control strategies.

## **References**

1. Gustavsson, Jan, IAQ and Air Filters. (manuscript for Ventilation 2000)