

SOURCE BOOK FOR EFFICIENT AIR DUCT SYSTEMS IN EUROPE

Ch. Delmotte¹, J. Andersson², F.R. Carrié³, T. Malmstrom⁴, P. Wouters¹

¹ *Belgian Building Research Institute*
Boulevard Poincaré 79, B-1060 Brussels, Belgium
Tel +32 2 655 77 11 – Fax +32 2 653 07 29 – christophe.delmotte@bbri.be

² *Scandiaconsult*
Kappellgränd 7, P.O. Box 4205; S-10265 Stockholm; Sweden
Tel + 46 8 615 62 15 – Fax + 46 8 702 19 25 – johnny.andersson@scc.se

³ *Ecole Nationale des Travaux Publics de l'Etat (ENTPE)*
Rue Maurice Audin 2, F-69518 Vaulx-en-Velin, France
Tel +33 4 72047261 - Fax : +33 4 72047041 - remi.carrie@entpe.fr

⁴ *Royal Institute of Technology (KTH)*
Brinellvägen 34; S-10044 Stockholm; Sweden
Tel +46 8 790 78 36 – Fax +46 8 411 84 32 – tgm@bim.kth.se

ABSTRACT

Ventilation, air conditioning and air heating systems are of vital importance for the health and comfort of residents and other building users. However, there exists a substantial body of literature that shows that HVAC systems performance can be greatly affected by inferior quality ductwork. To avoid these problems, it is important to pay greater attention to the design, construction, installation, and maintenance of ductwork systems, bearing in mind that the primary functions of the HVAC systems must be fulfilled.

The European AIRWAYS project (running from December 1999 to December 2001 and partly supported by the European Save II programme) was set up in order to provide guidance to design and maintain efficient air duct systems, and to bring to light the energy saving opportunities in parallel to health, safety, and comfort issues.

The results of this work have been published in a book targeted at decision-makers concerned with indoor climate issues, including policy makers, architects, and designers. It provides condensed information on reasons behind better air duct system design and how this can be achieved. Check lists for important design issues are available. They are intended to be used in the practical design of duct systems.

The publication will be soon available on a CD-ROM that includes a literature survey as well as an annex report presenting the results of an inquiry of tools actually used within Europe for the design of air duct systems.

KEYWORDS

Ventilation, duct, ductwork, airtightness, pressure drop, energy

INTRODUCTION

As soon as a ventilation system is connected to more than one room, there is a need for a distribution system – a ductwork – to connect the different rooms to air-handling units and extract fans. The role of the ductwork is to transport safely the air from one point to another.

From this point of view, the air should neither be allowed to leave the supply duct nor be allowed to enter the extract ducts through leakage openings. The thermal properties of the air should also be kept along the duct avoiding excessive increase or decrease of its temperature and avoiding condensation of the moisture. The cleanliness of the air is of course important and the ductwork should not be itself a source of pollution.

In addition to these requirements, the duct has to deal with other constraints. The pressure losses along the duct should be as low as possible to reduce the fan energy use, while the section of the duct should be as small as possible in order not to take up too much space in the building. The resistance to noise transmission and the resistance to fire are two other qualities that one can expect from a ductwork.

It is therefore important to pay great attention to the design, construction, installation, and maintenance of ductwork systems, bearing in mind that the primary functions of the HVAC systems must be fulfilled.

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The participants to the AIRWAYS project are:

- Royal Institute of Technology, Sweden (coordinator);
- Belgian Building Research Institute, Belgium;
- Ecole Nationale des Travaux Publics de l'Etat, France; and
- Scandiaconsult, Sweden.

The results of this work have been published in a source book¹ targeted at decision-makers concerned with indoor climate issues, including policy makers, architects, and designers. It provides condensed information on reasons behind better air duct system design and how this can be achieved. The source book claims to be really a practical approach of the ductwork issues. Its style and the great number of illustrations make it accessible and pleasant to read.

¹ Malmström, T., Andersson, J., Carrié, F.R., Delmotte, Ch., Wouters, P. (2002). *Source book for efficient air duct systems in Europe*, Brussels, Belgium.

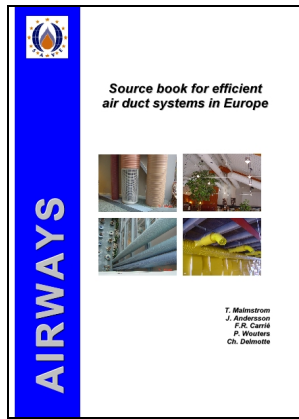


Figure 1 : Cover page of the source book

The first part of the source book gives an overview of different ventilation principles and components used in such systems. It explains some reasons why and how a ductwork system should be carefully designed and describes how less energy can be used in the duct system. It also gives examples on how better ductwork can be introduced in Europe and discusses the cost elements and whether a good quality ductwork really costs more than one of lower quality.

The second part shows different ways of integrating a duct system into the building, how to reduce noise transmission and fire hazards, system flow and tightness characteristics, and maintenance requirements. It compares space requirements and costs for circular and rectangular ducts.

The third part describes duct manufacture and installation and also how the quality of the system is controlled before taking it into operation. It points out the importance of maintaining the duct systems during its lifetime.

The fourth part presents several illustrated practical examples and case studies of duct installations, good and bad.

Finally, the last part of the source book comprises a large number of ductwork checklists that can be used by the different actors from the programming phase to operation and maintenance. The checklists are intended to be used in the practical design of duct systems.

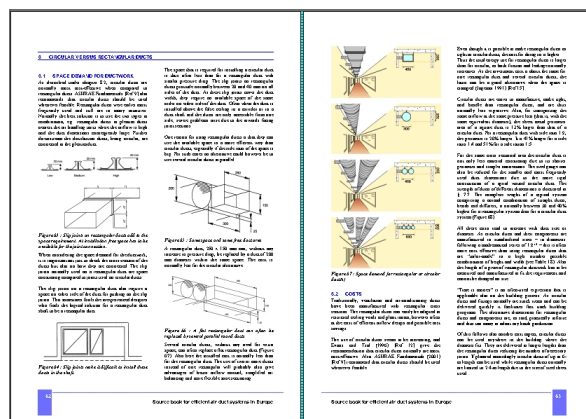


Figure 2 : Illustration of the content of the source book

ANNEX REPORTS, SPREADSHEETS AND PRESENTATIONS

In addition to the source book, a number of annex reports, spreadsheets and Power Point presentations are also available. They are available together with the source book on a single CD-ROM.

The report “Traditions in the design, installation and maintenance of duct systems” presents the results of an enquiry on duct procedures in Europe. Designers of HVAC systems, installers, contractors and building owners in different European countries have been interviewed or asked to answer enquiries sent out to provide a background on tools and facilities that are used as well as what and how quality requirements on ductwork are expressed and controlled. The evaluation of this material shows that there is a certain difference between the way technicians in northern and southern Europe use ductwork. For instance, the former seem to be more accustomed to use circular ducts as a standard solution whenever suitable while technicians in southern Europe use more rectangular ductwork. The answers mainly show that ductwork in many countries is considered as an important part of the building installations and that this part of the design work is done meticulously.

A “Review of International Literature Related to Ductwork for Ventilation Systems” has also been written in the framework of the Airways project. This document based on more than 100 references deals with the various aspects of the ductwork from the point of view of the existing literature. This document has been selected for publication by the Air Infiltration and Ventilation Centre (AIVC) as one of its Technical Notes (n°56).

Spreadsheets for calculation of different parameters are available. They allow to calculate:

- The hydraulic and the equivalent diameter of a rectangular duct;
- The friction factor and the pressure drop in a straight duct;
- The heat flux and the temperature drop when air passes through an insulated double-cased straight duct.

In order facilitate the presentation of the source book during seminars, specific Power Point presentations have been developed and are included in the CD-ROM.

CONCLUSION

The source book deals with the main aspects of the ductworks like pressure losses, airtightness, space demand, etc. Moreover the different phases of the building life are taken into consideration.

Although some important theoretical aspects are present in the source book, it is mostly a practical approach of the ductwork based on field experience. This practical approach is emphasised by the style of the book and by the great number of illustrations.

Annex reports, spreadsheets and presentations complete the source book. The collection is an interesting and accessible practical source of information for all the professionals who deal with ductwork in the daily practice.