



Polymer Composites as Construction Materials

Application Summary Sheet 16

Title: Ducting and Air Conditioning System Components

Target Audience: Building Services Engineers, Architects, Heating and Ventilation Engineers, Service Engineers, AC System Manufacturers, Specifiers, Building Owners, Construction Contractors, Builders

Keywords: Heating, Ventilation, Cooling, Air Quality, HVAC, Polymer Composites.

Overview of application / summary:

Nowadays, increasing legislation on the air quality of working environments is placing greater emphasis on the performance of the air conditioning (AC) system. The AC system consists of numerous components, such as the ducting, dampers, louvres and other air control units. The concept of producing these components from composite materials has filtered from the aerospace industry, where composites are used because of their superior performance, corrosion resistance, light weight and design flexibility. Early fibreglass components were not widely accepted due to concerns about fibre transmission through the air stream. However, developments in materials and processes have now dispelled this as a viable concern. These developments have also made the use of composite AC system components cost effective on an industrial and domestic level.

Composite materials offer numerous engineering advantages over the metallics conventionally used in AC systems. They are now the chosen materials for clean room and hygiene AC systems, where they aid conformance to regulations with their corrosion and fire resistant properties and are electrically non-conductive. They are also now being employed extensively in harsh environments, where the ability to operate in moist environments under fluctuating temperatures without affecting performance or service life is a major advantage.

Significant benefits also lie in the construction of composite AC systems. Their low weight and manoeuvrability ensures the installation process is quick and easy. Composite materials provide low operating costs, they are more durable than steel and therefore last longer and they are thermally non-conductive which means energy costs are minimised. It is envisaged that they will become the exclusive choice for 'retro-fitting' existing systems that have experienced corrosion problems.

Impact of application

Engineering:

- The excellent strength-to-weight ratio and moisture resistance means they can be installed in low load capacity areas such as rooftops. The lightness also makes components easy to manoeuvre and assemble on site.
- Superior in-service performance to conventional duct materials. Composites can withstand continuous fluctuations in temperature and are not affected by moist environments due to inherent corrosion resistance.
- Higher damping characteristics produce lower noise emission.
- The flexibility of composite materials means that more intricate AC schemes and ducting networks can be designed.
- The properties of the material can be tailored with careful selection of resin and fibre systems to ensure optimum performance and meet any installation requirements or legislation, particularly in harsh environments.
- Tighter room temperature control is obtainable from the higher thermal stability of composites over metallics.
- Where ducting is visible, it can be inherently coloured as specified to aid installation and prevent painting.
- Composite systems can meet a Class 0 fire rating and have negligible smoke emission if required.
- Larger sections can be manufactured ensuring installation is rapid and is managed with the minimum of personnel and equipment.
- Special non-permeable layers can be incorporated in the duct wall during manufacture for particularly harsh gaseous or high pressure applications. This removes the need for post application of such protective coatings.

Financial:

- Although the initial cost of composite ducting is similar to that of conventional materials, which are more readily available, this is offset by numerous factors which reduce the through life cost of composite systems:
- The components do not require painting or protecting after manufacture and require little maintenance through their service life due to corrosion resistance.
- They can yield significant electrical energy consumption savings due to superior thermal efficiency and extremely low air leakage.
- Fewer personnel can install a composite system in much less time due to the weight savings over metal. Less on-site equipment is required.

Environmental:

- Higher thermal efficiency of the composite components leads to less energy usage in the building. On a large scale this reduces the depletion of global energy sources.

Social:

- Higher quality and tighter controlled environments available for clean room and hygiene applications from the most advanced composite systems.

Robustness of research

This application is not backed by extensive academic research. The concept was born from the aerospace industry where composites were first used for high performance ducting components operating in harsh conditions. The success of the material in this industry highlighted its suitability for this application, the operating environments being similar but less aggressive. Much of the information contained in this summary has been obtained from manufacturers of successful and cost effective composite AC components. Details of these companies can be seen in the 'Further Information' section at the foot of this summary.

Future developments

It is envisaged that composite ductwork will become a more readily available 'off-the-shelf' item as its uptake increases in new building specifications. It is also predicted that existing systems will be 'retro-fitted' with composite components where corrosion has been a problem. The flexibility of composite materials will encourage innovation in scheme design as the components can be positioned in different locations due to the lower load capacity required of the structural carrying elements.

Where to get further information

Companies

Kingspan - Pre-insulated FRP Ducting
www.insulation.kingspan.co.uk

Actonair - Composite AC System dampers
www.actonair.co.uk

Abbey Air Systems Ltd - Composite Ducting
Located Southampton, UK.
Tel: 02380222522

RoyalAire mechanical Inc.
www.royalair.com
An-Cor Industrial Plastics Inc.

www.an-cor.com

Control Process Systems Inc. - FRP duct and pie system/Air dampers
www.control.com

Websites

HEVAC - The Heating, Ventilation and Air Conditioning Manufacturers
Association (UK)
www.feta.co.uk/hevac