

## **Spiralite HVAC Insulated Ductwork Performance and Material Specifications**

This ductwork performance and material specification covers air-distribution HVAC ductwork systems and insulation requirements. It is offered as a guide to Specifiers for exceeding the minimum performance requirements set forth in the Building Regulations and Standards and related performance requirements in the United Arab Emirates.

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### **A. Summary Specification for Spiralite Insulated HVAC Ductwork:**

#### **Insulated Ductwork**

The contractor shall include for the manufacture, supply, delivery and installation materials necessary for the ductwork systems described in this specification.

Where insulated ductwork is specified on the drawings or in this specification, it shall be non-metal circular and flat oval insulated ductwork with an internal airtight laminate manufactured using zero ODP phenolic insulated panels with a minimum thickness of 20mm, or equal and approved.

The insulated ductwork shall be fabricated from the phenolic panels that comply with the requirements for UL Listing as a Class 1 Air Duct, to Standard for Safety UL 181 (Underwriters Laboratories: Factory Made Air Ducts & Air Connectors). The insulation panels shall have a Dubai Municipality Certificate of Product Conformity issued by Dubai Central Laboratories in terms of BS EN 13166:2015 and Dubai Civil Defence Certificate of Product Compliance issued under ISO/IEC 17065.

The thermal conductivity ( $\lambda$ ) of the insulation materials shall not exceed 0.022 W/m.K at 10° to 19°C mean (BS EN 12667) and 0.018 W/m.K at 10°C (ASTM C-518).

The insulated ductwork shall be constructed to a Class 'C' Air Leakage rating up to a minimum of 2,500 Pa BS and the Air Leakage Factor shall be no greater than  $0.003 \times P^{0.65}$  (l/s/m<sup>2</sup>) (BS EN 13403, BS EN 1507 and DW 144 (B&ESA 2013)). It shall be SMACNA and ASHRAE compliant and contribute towards the relevant environmental assessment programmes, including Dubai Municipality Green Ratings/AI Safat, Estidama/Pearl, LEED and BREEAM.

All materials and finishes shall be manufactured in accordance with BS EN 13403: 2003 - Ventilation for Buildings - Non-metallic ducts (ductwork made from insulation ductboards).

All insulated ductwork shall have a continuous internal laminate to provide a complete vapour seal in accordance with the general specification.

All ductwork fabrication, connection and installation shall be carried out by specialist operatives who have successfully completed a training course with the manufacturers and be certified as approved installers. All fabrication, connection

and installation will be done strictly in accordance with the manufacturers Fabrication Guide and Installation Guide and shall not deviate from these guides in any way.

All insulated ductwork which is visible or exposed may be provided with an additional coloured laminate to give a finish in accordance with the Architects requirements.

The Contractor shall allow for inspections by the manufacturer of the installation at 1st fix stage and thereafter phased attendance if necessary to meet the main contract programme.

The results/comments of the inspection shall be issued to the Project Engineer and incorporated in the O&M Manuals issued on completion of the installation.

**Testing:**

All ductwork systems shall be independently pressure tested, in part or in whole, as may be required, to Class 'C' and in accordance with the methodology set out in DW143 & DW144 as issued by the B&ES.

**Plant Room, Risers and External Ductwork:**

The insulated ductwork system installed in plant rooms, externally and areas where additional strength is required should be manufactured from 30mm phenolic insulation board and shall be provided with one of the following finishes applied during the manufacturing process:

- a) 5/6-ply weatherproofing laminate, or
- b) 9-ply "metal standard" laminate

The insulated ductwork system installed in risers should be manufactured from 30mm phenolic insulation board.

**B. Detailed Specification for Spirelite Insulated HVAC Ductwork:**

The contractor shall include for the manufacture, supply, delivery and installation materials necessary for the ductwork systems described in this specification.

Where insulated ductwork is specified on the drawings or in this specification, it shall be non-metal circular and flat oval insulated ductwork with an internal airtight laminate manufactured using zero ODP phenolic insulated panels with a minimum thickness of 20mm, or equal and approved.

The insulated ductwork shall be fabricated from the phenolic panels that comply with the requirements for UL Listing as a Class 1 Air Duct, to Standard for Safety UL 181 (Underwriters Laboratories: Factory Made Air Ducts & Air Connectors). The insulation panels shall have a Dubai Municipality Certificate of Product Conformity issued by Dubai Central Laboratories in terms of BS EN 13166:2015 and Dubai Civil Defence Certificate of Product Compliance issued under ISO/IEC 17065.

The insulated ductwork shall be constructed to a Class 'C' Air Leakage rating up to a minimum of 2,500 Pa BS and the Air Leakage Factor shall be no greater than  $0.003 \times P_s^{0.65}$  (l/s/m<sup>2</sup>) (BS EN 13403, BS EN 1507 and DW 144 (B&ESA 2013)). It shall be SMACNA and ASHRAE compliant and contribute towards the relevant environmental assessment programmes, including Dubai Municipality Green Ratings/AI Safat, Estidama/Pearl, LEED and BREEAM.

All materials and finishes shall be manufactured in accordance with BS EN 13403: 2003 - Ventilation for Buildings - Non-metallic ducts (ductwork made from insulation ductboards).

All insulated ductwork shall have a continuous internal laminate to provide a complete vapour seal in accordance with the general specification.

All insulated ductwork which is visible or exposed may be provided with an additional coloured laminate to give a finish in accordance with the Architects requirements.

**Plant Room, Risers and External Ductwork:**

The insulated ductwork system installed in plant rooms, externally and areas where additional strength is required should be manufactured from 30mm phenolic insulation board and shall be provided with one of the following finishes applied during the manufacturing process:

5/6-ply weatherproofing laminate

9-ply "metal standard" laminate

The insulated ductwork system installed in riser should be manufactured from 30mm phenolic insulation board.

**Fabrication, Connection and Installation**

All materials and finishes shall be installed in accordance with the manufacturer's recommendation and in accordance with BS EN 13403: 2003 - Ventilation for Buildings - Non-metallic ducts (ductwork made from insulation ductboards), DW144 (B&ES 2013), SMACNA and ASHRAE standards.

All ductwork fabrication, connection and installation shall be carried out by specialist operatives who have successfully completed a training course with the manufacturers and be certified as approved installers. All fabrication, connection and installation will be done strictly in accordance with the manufacturers Fabrication Guide and Installation Guide and shall not deviate from these guides in any way.

The Contractor shall allow for inspections by the manufacturers of the ductwork installation at 1st fix stage including phased attendance if necessary to meet the main contract programme. The results/comments of the inspection shall be issued to the Engineer and incorporated in the O & M Manuals.

**Air Leakage**

All ductwork, regardless of pressure class, shall achieve the air leakage rate of Class C at pressure 2500Pa as defined in BS EN 13403, BS EN 1507, BS EN 12237 and HVCA DW 144, and the maximum permitted air leakage factor ( $f_{max}$ ) shall be no greater than:  $0.003 \times Ps^{0.65}$  (l/s/m<sup>2</sup>).

**Thermal Performance**

The thermal conductivity ( $\lambda$ ) of the insulation materials shall not exceed 0.022 W/m.K at 10° to 19°C mean (BS EN 12667) and 0.018 W/m.K at 10°C (ASTM C-518).

The thickness of insulation materials shall be such that it complies with the appropriate heat loss and heat gain figures as laid out in the TIMSA Guide and BS5422 (16.34 for warm air ductwork and -6.45 for chilled and dual purpose ductwork).

Under no circumstance shall the installed thickness of insulation be less than the specified thickness of insulation. Should the insulation material be susceptible to compression when stretched around the ductwork during installation, a 25% compression factor shall be taken into account i.e. the installed thickness shall be assumed to be 75% (25% compression) of nominal thickness

**Environmental Performance**

The ductwork insulation panels shall be manufactured from zero ODP, CFC & HCFC free Phenolic foam panels thermo-bonded on both sides to a 25mm micron 1mm low vapour permeability aluminium foil facing reinforced with a 5mm glass scrim. The phenolic panels shall be closed cell with a closed cell content of >90% and a minimum compressive strength of 200 kpa

The ductwork shall be constructed and installed such that the impact upon the environment is minimised. The Ecopoint score per linear metre of ductwork shall be no greater than 0.5 as determined in the 2008 BRE Global Environmental Profiles Methodology.

All insulation materials shall have a Green Guide Rating no less than A as assigned by the BRE in the Green Guide 2008 Summary Ratings and published in the BRE Green Book Live.

## **Fire and Smoke Performance**

The phenolic insulation panels and laminates shall be rated as Class O to the relevant Building Regulations and Building Standards when tested to BS 476 Part 6 and 7 and must achieve a Surface Burning Characteristic/Flame Spread Index of < 25/50 when tested to ASTM E 84-08a and UL 723.

Ductwork fabricated from the phenolic insulation panels shall be UL Listed as a Class 1 Air Duct, to Standard for Safety UL 181 (Underwriters Laboratories: Factory Made Air Ducts & Air Connectors).

The Duct insulation panels shall have a EuroClass classification of Class B (BS EN 13501- 1: 2007 + A1:2009) with the additional classification:

- Smoke production shall be s1
- Flaming droplets shall be d0

When tested to BS EN ISO 5659-2 (Smoke Density) ductwork shall achieve a mean maximum specific optical density no greater than 0 at 25 kW/m<sup>2</sup> both in the presence and absence of a pilot flame, 7 at 50 kW/m<sup>2</sup> in the absence of a pilot flame and 6 at 50 kW/m<sup>2</sup> in the presence of a pilot flame.

The insulation panels (with a nominal density of 55-60kg/m<sup>3</sup>) shall be tested to BS 6401:1983 and the mean specific optical density of smoke generation in flaming mode shall not exceed 23.

Other fire and smoke characteristics of the insulation panels:

- The Weighted Toxic Fumes Index shall be < 0.3R (BS 6853:1999)
- The Toxicity Index shall be < 6 (NES 713)
- The Hydrogen Cyanide concentration shall be Zero (0) (NES 713)
- The Oxygen Index shall be > 33% (materials with an oxygen index greater than 28% are generally self-extinguishing (BS EN ISO 4589-2))

## **Acoustic Performance**

The insulation panels shall have:

- An Average Sound Reduction Index of 14.1 dB (BS 2750-3)
- A Noise Reduction Coefficient NRC shall be 0.05 (ASTM C423-02)

Ductwork that is indicated as requiring sound abatement shall be lined with a sound absorbent material, in accordance with the manufacturer's instructions.

## **Other Requirements**

All materials used for the installation of the ductwork system shall be approved by the duct manufacturer, including internal connectors and connection accessories, fire dampers, volume control dampers, access doors and support mechanisms.

Connection to standard ductwork system components such as fans, dampers etc. shall be accommodated by the selection of the appropriate sized mezz flange or by spigotted connection as outlined in the manufacturers System Installation Guide.

Supports shall be provided at centres not exceeding 3m, at all changes in direction and branch connections. All ductwork plant and ancillaries shall be independently supported.

All externally mounted insulated ductwork shall be provided with a weatherproof protective aluminium finish, suitable for the application, laminated onto the phenolic panels during the manufacture of the ductwork.

Each external duct segment must be joined over internal connectors and sealed using tiger connectors and matching 100mm weatherproof tape. There should be no gaps between the segments and tape should not be applied to a damp or dirty surface.

It shall be the responsibility of the contractor to ensure that the insulated ductwork system is properly and adequately installed and supported. A number of support systems are available and it shall be the responsibility of the contractor to ensure that the chosen method is compatible with the insulated ductwork system.

Polyisobutylene sheet (PIB) is not an acceptable weatherproof coating for insulated ductwork and shall not be used in any way.

Where the insulated ductwork is exposed to view it shall be finished to the architect's requirements, ensuring the manufacturers have approved the type of finish for use. An enhanced finish will normally be provided by an additional laminate applied ductwork the manufacture of the ductwork, unless there is a specific requirement for cladding or painting or other coating.

All ductwork systems shall be independently pressure tested, in part or in whole, as may be required, to Class 'C' and in accordance with the methodology set out in DW143 & DW144 as issued by the B&ES.

Insulated ductwork should not be used for:

- Fire Rated Ductwork
- Fire and Smoke Extract Ductwork
- Kitchen Fume Extract Ductwork
- Other prohibited applications as detailed in BS EN 13403: 2003

**C. Quality standards of the phenolic foam insulation panels:**

Comprising a thermoset phenolic core faced on both sides with a durable and protective low vapour permeability 25 micron aluminium foil reinforced with a 5mm glass tissue bonded to the phenolic core. These panels are also available with a 23 micron black coated aluminium foil, reinforced with a 5mm glass tissue facing on one side. They feature:

- D. A thermal conductivity of 0.022 W/m.K at 10°-19° C (BS EN 12667) and 0.018 W/m.K at 10°C (ASTM C-518)
- E. Density of 55 – 60 kg/metre<sup>3</sup>
- F. Perpendicular compressive strength >200 kN/m<sup>2</sup> at 10% compression (EN 826)
- G. Fire and smoke performance to the Building Regulations/Standards:
  - a. Class 0 (Low Risk Scotland) fire classification
  - b. BS 476-6: Fire tests on building materials and structures. Method of test for fire propagation for products. Fire propagation index ≤12 and sub-index (i1)
  - c. BS 476-7: Fire tests on building materials and structures. Method of test to determine the classification of the surface spread of flame of products
  - d. EN 13501: EuroClass BS 1-d0
  - e. EN ISO 5659-2: Smoke Generation and Obfuscation
- H. Compliance with the requirements for UL Listing as a Class 1 Air Duct, to Standard for Safety UL 181 (Underwriters Laboratories: Factory Made Air Ducts & Air Connectors)
- I. Closed cell content > 90% for non-wicking and resistance to moisture penetration (ISO 4590)
- J. Vapour resistance (aluminium foil) of 1000 MNs/g
- K. Toxicity index <7.0 (NES 713)
- L. Oxygen Index >33% (BS EN ISO 4589-2)
- M. Ozone Depletion Potential (ODP) of 0 (Zero)
- N. Global Warming Potential (GWP) <5 (Low)
- O. No CFCs, HCFCs and HFCs
- P. Thicknesses of 20mm to 30mm to satisfy requirements of the TIMSA Guide, BS 5422, NHS CO2, NES Specification Expert Y50 and DEO Specification 037
- Q. Operating temperature range between -20°C and 80°C (80°C max for aluminium foil face)
- R. Manufactured under a Quality Management System approved to BS EN ISO 9001
- S. Manufactured to Environmental Management Standards approved to BS EN ISO 14001
- T. Manufactured to BS EN 13403, BE EN 13166 and BS EN 14314
- U. Certified by Dubai Civil Defence
- V. Approved by Dubai Central Laboratories
- W. Complies with Dubai Green Building Regulations/Al Safat
- X. Trustmark approval from the Abu Dhabi Quality and Conformity Council

Y. Approved Green Label Singapore

**D. Insulated ductwork design parameters:**

- Suitable for low, medium and high pressure systems
- Mean air velocity (maximum) - 50 m/s or 10,000 fpm
- Air tightness – Class C at 2,500 Pa
- Design pressure (maximum)
  - Positive: 2,500 Pa
  - Negative: 750 Pa
- Air leakage limits –  $0.003 \times p^{0.65}$  litres per second per square metre of duct surface area
- Temperature - Internal air temperature of -20°C to +80°C / -4°F to +176°F
- Size – 100 to 500 mm diameter as standard, up to 2,000 mm diameter non-standard (provided that the recommended manufacture and installation procedures are strictly observed)

**Spiralite Energy Saving Ductwork is manufactured and supplied by Khansaheb Industries LLC**

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