Technical Insulation
Great Britain & Ireland

A Duct is for Life...

An Independent Analysis of The 'Whole Life' Costs of Differing HVAC Duct Specifications

Kingspan®

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Introduction

Executive Summary

The Kingspan KoolDuct® System should be an automatic consideration where "whole life" costing is a requirement as:

- installation of the Kingspan KoolDuct® System can save over 22% on capital cost; and
- over a 30 year life cycle the Kingspan KoolDuct® System can also make a saving of over 48% on life cycle costs.

Current Practice & The Alternatives

Background

The purpose of this independent report is to examine the relative 'whole life' costs of insulated sheet metal ductwork and The Kingspan KoolDuct® System, their relative performance with regards to 'whole life' costs and the benefits this can provide.

'Whole life' costing takes account of the total cost of an item over its life, including durability, energy savings and maintenance, as well as initial purchase price.

Current Practice

Traditionally the majority of HVAC ductwork is manufactured using galvanised sheet steel, which is installed first and then insulated separately as a second operation. The selection of ductwork material is therefore generally assumed. Additionally, the construction project client's specification for ductwork is normally limited to a set of performance criteria rather than a specific material.

The actual selection of the ductwork material is made by the mechanical service sub contactor, or more often, its ductwork sub-sub-contractor. Indeed, because of existing manufacturing set-ups, it may be disadvantageous to move away from the existing specification norms and use The Kingspan KoolDuct® System.

Services design co-ordination commonly occurs concurrently with construction and little or no attention is paid to the operating cost of the ductwork system.

However, the air-leakage of the ductwork system can have a significant impact on the Building Emission Rate (BER) of the building. The electrical consumption of the fan running a ductwork system can increase substantially if the air-leakage of the system is higher.

The Alternative

The Kingspan KoolDuct® System can reduce air-leakage rates to a fraction of those typical of rectangular sheet metal ductwork. This cutting edge System offers triple benefits of cutting energy use, cutting operational carbon dioxide (CO_2) emissions and cutting costs.

The Kingspan KoolDuct® System reduces the capital and life cycle costs when compared with insulated metal ductwork, whilst, at the same time, offering additional advantages to the specifying engineer, the architect, the M & E contractor, the fabricator, the facilities manager, the property developer and the building owner.

The Kingspan KoolDuct® System comprises premium performance Kingspan KoolDuct® panels, fabrication methods, coupling systems and a complete line of accessories to produce pre-insulated rectangular ductwork in sections up to 2.95 m long.

Kingspan KoolDuct® panels comprise a fibre-free rigid thermoset phenolic insulation core faced with silver aluminium foil on both sides.

Fibre-free Core

An Independent Review

Kingspan Technical Insulation asked Rider Levett Bucknall to carry out research assessing how the use of The Kingspan KoolDuct® System could affect capital and whole life costs when compared with insulated galvanised steel ductwork.

To achieve this, they conducted a detailed cost analysis of differing HVAC ductwork specifications.

The *installed cost* of ductwork fabricated from the Kingspan KoolDuct® System was found to be cheaper than that of galvanised sheet steel ductwork.

Expected energy demand and cleaning of the different ductwork systems was not considered as part of the latest analysis. Depending on the operational parameters for the ventilation system, the enhanced airtightness of The Kingspan KoolDuct® System could allow considerable energy savings to be achieved over time - further reducing operational costs.

Once the above data had been analysed, the capital, operating and 'whole life' costs were calculated.

Current Practice & The Alternatives

Results of the Analysis

Rider Levett Bucknall conducted a detailed cost analysis, consulting with a number of suppliers and installers. Each company was issued with a standardised duct layout comprising a number of different duct dimensions and components, including straight sections, 45 and 90 degree bends and tapers. They were then asked to provide supply and installation costings for two comparative specifications of the different ductwork systems:

- The Kingspan KoolDuct® System with 22 mm thick panels vs galvanised steel ductwork with 40 mm mineral fibre.
- The Kingspan KoolDuct® System with 30 mm thick panels vs galvanised steel ductwork with 50 mm mineral fibre.

Rider Levett Bucknall then averaged the quotations provided to generate an indicative costing for each specification.

Supply and Install Costs

The results showed that in both scenarios, significant savings could be achieved with The Kingspan KoolDuct® System. In the first scenario, it was possible to achieve average cost savings of £3,735.16, a reduction of 21.8%. The savings were even greater in the second scenario with estimated costs falling by over £4,012 (22%).

A summary of the total installed cost, (labour and materials, including fixings and first level support members), per linear metre of ductwork, for the different duct sizes of each ductwork specification, is shown in Table 1.

Refer to Appendix 1 for a break down of costs.

Whole Life Cost

Rider Levett Bucknall then carried out a whole life cost analysis, considering the cost of maintaining and repairing the different ductwork specifications over time. The research suggested that the cost of maintaining The Kingspan KoolDuct® System manufactured from 22 mm thick panels, would be just over half that of the galvanised steel ductwork (£3,230 vs £6,190) whilst savings of 48% could be achieved on The Kingspan KoolDuct® System manufactured from 30 mm thick panels, over the alternative galvanised steel system; the research assumed that changes and adaptations over time are less costly and ductwork fabricated from The Kingspan KoolDuct® System is less likely to be damaged during routine maintenance. See Figure 1 and Table 2.

Refer to Appendix 2 for a breakdown of maintenance and repair costs.

Duct Size (mm)	Installed Cost (2020 Update) (£/lin.m)		Cost Saving (%)
	30 mm Kingspan KoolDuct®	50 mm Mineral Fibre Insulated Galvanised Sheet Steel	
200 x 200	£ 56.84	£ 90.24	37.01
400 x 400	£ 92.34	£ 126.49	27.00
600 x 600	£ 153.01	£ 170.01	10.00
800 x 800	£ 197.25	£ 216.41	8.85
1000 x 1000	£ 203.09	£ 279.30	27.29
1200 x 1200	£ 321.56	£ 371.36	13.41
All	**£ 1024.09**	**£ 1253.81**	**18.32**

Table 1: A summary of the installed cost comparison between ductwork fabricated from The Kingspan KoolDuct® System & Mineral Fibre Insulated Galvanised Sheet Steel ductwork.

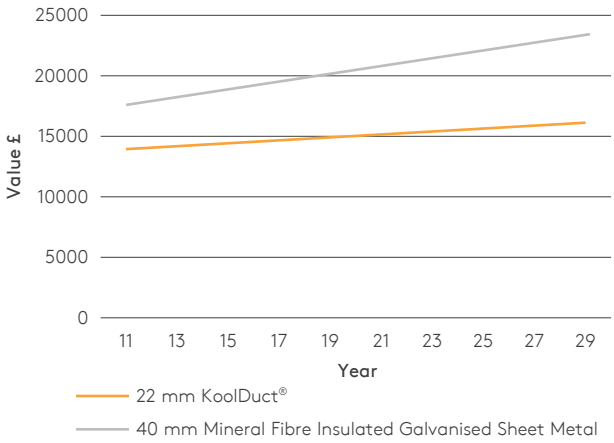

Figure 1: Whole Life cost comparison between The Kingspan KoolDuct® System Mineral Fibre Insulated Galvanised Sheet Steel ductwork.

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Legend	Technology	Capital Cost (£)	Saving (%)	Maintenance and Repair Cost (Over 30 yrs) (£)	Saving (%)	'Whole Life Cost' (£)	Saving (%)
	40 mm Mineral Fibre Insulated Galvanised Sheet Steel	17,152.61	21.8	6,190.00	47.8	23,342.61	27.8
	22 mm The Kingspan KoolDuct® System	13,417.45		3,320.00		16,647.45	
	Saving (£)	3,735.16		2,960.00		6,695.16	

Table 2: Capital Cost and Whole Life Cost comparison between The Kingspan KoolDuct® System and Mineral Fibre Insulated Galvanised Sheet Steel ductwork.

Additional Analysis

Previous analysis and reviews of The Kingspan KoolDuct® System has shown the following.

On *durability*, Kingspan KoolDuct® panels consist of a densely cross linked structure which does not readily break down and are not prone to long term degradation.

Case studies have shown that the Kingspan KoolDuct® System has remained in excellent condition with joints and seams sealed and preventing moisture ingress.

On *energy use*, Rider Levett Bucknall carried out a separate study, based on the results of research carried out by BSRIA to investigate the estimated effect on fan power of different duct air leakage rates. The research showed that The Kingspan KoolDuct® System can save over 30% on the annual electricity cost of running a fan compared with the performance of standard galvanised sheet steel ductwork.

Gloucester Leisure Centre

The Kingspan KoolDuct® System was installed in 2002 and is inspected annually and no reduction in performance since its installation has been reported.

The energy consumption of the fan was based on air leakage rates conforming to air tightness Class D for The Kingspan KoolDuct® System and Class A for standard galvanised sheet steel ductwork.

On *cleaning*, an assessment carried out by the National Association of Air Duct Specialists UK (NAAD UK) of how best to clean and maintain ductwork fabricated from the pre-insulated Kingspan KoolDuct® System, showed that the ductwork can be effectively cleaned by a competent technician using a mechanical rotary brush with plastic fibres (polypropylene is recommended) at a speed of up to 900 RPM. Further information can be found on our website at **www.kingspanductwork.co.uk**.

Research into *maintenance* and **repair** suggested that ductwork fabricated from The Kingspan KoolDuct® System suffers minimal *damage* and thus requires minimal repairs, particularly where ductwork is installed within a ceiling void. In circumstances where a repair is required, it concluded that ductwork fabricated from The Kingspan KoolDuct® System can be repaired quickly by simply replacing the damaged area, whereas the entire section of sheet metal ductwork would need to be replaced, with the lagging as a second operation.

Appendix 1

Capital Cost Comparison Between Galvanised Sheet Steel Ductwork and the Kingspan KoolDuct® System

Research, conducted in the UK by independent consultants Rider Levett Bucknall, into the installed cost of differing insulated HVAC ductwork specifications, and subject to periodic updates, continues to show that the installed cost of ductwork fabricated from The Kingspan KoolDuct® System is less expensive than that of ductwork constructed from galvanised sheet steel and insulated with mineral fibre.

The research utilises cost data submitted in 2020 from a number of ductwork and insulation contractors across the UK and based on a standardised duct layout.

Duct Size (mm)					Average Supply and Install Price Returned			
Duct Size (mm)		Unit	Quantity	KoolDuct® Flange Joint	KoolDuct® 22 mm	Metal Duct with 40 mm Mineral Fibre	KoolDuct® 30 m	Metal Duct with 50 mm Mineral Fibre
200 x 200	Straight	Metre	12	Tiger Connector	£ 646.44	£ 1,000.32	£ 682.11	£ 1,082.84
	Shoe	Item	1	Glue, Tape and Silicone	£ 37.38	£ 76.03	£ 48.52	£ 77.68
	45 Degree bend	Item	1	Tiger Connector	£ 35.44	£ 85.13	£ 49.96	£ 85.91
	Taper	Item	1	Tiger Connector	£ 69.41	£ 83.92	£ 78.87	£ 93.86
	90 Square bend	Item	1	Tiger Connector	£ 52.21	£ 94.02	£ 63.22	£ 97.92
400 x 400	Straight	Metre	12	Tiger Connector	£ 1,083.36	£ 1,417.00	£ 1,108.09	£ 1,517.88
	Shoe	Item	1	Glue, Tape and Silicone	£ 46.70	£ 95.03	£ 58.16	£ 98.22
	45 Degree bend	Item	1	Tiger Connector	£ 45.45	£ 114.75	£ 62.51	£ 119.09
	Taper	Item	1	Tiger Connector	£ 60.71	£ 128.44	£ 75.53	£ 134.57
	90 Square bend	Item	1	Tiger Connector	£ 95.11	£ 138.51	£ 108.80	£ 144.24
600 x 600	Straight	Metre	12	4-Bolt Flange	£ 1,818.37	£ 1,915.31	£ 1,836.10	£ 2,040.15
	Shoe	Item	1	Mechanical fix	£ 83.07	£ 127.12	£ 99.41	£ 132.03
	45 Degree bend	Item	1	4-Bolt Flange	£ 97.24	£ 153.45	£ 121.73	£ 159.86
	Taper	Item	1	4-Bolt Flange	£ 114.34	£ 174.05	£ 137.23	£ 181.93
	90 Square bend	Item	1	4-Bolt Flange	£ 182.54	£ 208.57	£ 202.38	£ 214.14
800 x 800	Straight	Metre	12	4-Bolt Flange	£ 2,313.56	£ 2,388.83	£ 2,367.02	£ 2,596.95
	Shoe	Item	1	Mechanical fix	£ 112.80	£ 176.28	£ 135.87	£ 189.93
	45 Degree bend	Item	1	4-Bolt Flange	£ 127.41	£ 208.36	£ 158.32	£ 221.55
	Taper	Item	1	4-Bolt Flange	£ 148.53	£ 219.09	£ 170.29	£ 233.59
	90 Square bend	Item	1	4-Bolt Flange	£ 243.38	£ 296.65	£ 282.63	£ 317.40
1000 x 1000	Straight	Metre	12	4-Bolt Flange	£ 2,330.40	£ 3,139.20	£ 2,437.11	£ 3,351.56
	Shoe	Item	1	Mechanical fix	£ 130.86	£ 237.56	£ 153.14	£ 250.98
	45 Degree bend	Item	1	4-Bolt Flange	£ 171.06	£ 286.33	£ 202.59	£ 300.79
	Taper	Item	1	4-Bolt Flange	£ 185.00	£ 285.12	£ 205.14	£ 298.54
	90 Square bend	Item	1	4-Bolt Flange	£ 327.53	£ 415.97	£ 363.57	£ 434.52
1200 x 1200	Straight	Metre	6	4-Bolt Flange	£ 1,860.15	£ 2,102.74	£ 1,929.33	£ 2,228.17
	Shoe	Item	1	Mechanical fix	£ 166.11	£ 310.08	£ 185.81	£ 327.85
	45 Degree bend	Item	1	4-Bolt Flange	£ 205.98	£ 387.97	£ 248.36	£ 400.34
	Taper	Item	1	4-Bolt Flange	£ 214.47	£ 350.43	£ 237.28	£ 376.13
	90 Square bend	Item	1	4-Bolt Flange	£ 412.54	£ 536.35	£ 461.96	£ 575.26

Table 3: Installed cost comparison between The Kingspan KoolDuct® System and Mineral Fibre Insulated Galvanised Sheet Steel ductwork.

Appendix 2

Estimated Whole Life Cost (30 years) Comparison Between Galvanised Sheet Steel Ducting and The Kingspan KoolDuct® System

Table 4 shows the assumptions used by Ryder Levitt Bucknall in the 'whole life' cost model and 'whole life' cost graphs.

Cost Element	Start Year	Maintenance Frequencies (years)	
		KoolDuct®	Sheet Metal
Damage / alterations to ducts	11	2 (2%)	3 (3%)

Table 4.

Note: An indicative component replacement of 2% per every 2 annums for Kingspan KoolDuct® and 3% every 2 annums for metal ductwork both starting at the 11th year of the period to allow for damage and alterations to the system, each with a 20% cost adjustment factor to facilitate the removal of damaged or adjusted components.

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