MATERIALS SCIENCE & ENGINEERING
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Our ref: FCO-3034/CO-4358

Mr Lorenzo Fazzini
L & A Fazzini Manufacturing Pty Ltd
23-25 Wentworth Street
GREENACRE NSW 2190

Dear Mr Fazzini,

HORIZONTAL AND VERTICAL DUCTS, BULKHEADS AND ENCLOSURES TO HVAC SERVICES CONSTRUCTED USING TRIMESH R100 AND R200 PANELS & VERMIDUCT AND /OR VERMITEX TH COMPOSITES USED AS FIRE SEPARATING ELEMENTS

Assessment No. FCO-3034
Your email of 28 October

INTRODUCTION

We have examined the information referenced by you on the likely performance of constructing horizontal and vertical bulkhead, ducts and /or enclosures for use on HVAC services utilising your combined Trimesh-Vermiduct and/or Vermitex TH spray insulation system if subjected to the test conditions of AS 1530.4-1997 or BS 476 Part 24.

This information includes:

- Australian Standard 1530, Methods for fire tests on building materials, components and structures, Part 4-1997, Fire-resistance tests of elements of building construction;
- British Standard 476, Fire tests on building materials and structures, Part 24:1987, Method for the determination of the fire resistance of ventilation ducts;
- CSIRO Letters of Assessment numbered FCO-2233, FCO-2247 and FCO-2189;
- CSIRO Sponsored Investigation test reports numbered FSH 0540, FSH 0649, FSH 0972, FSH 1042, FSZ 1043, FSV 1207 and FSH 1345 on various air-handling ducts and separating elements tested in accordance with AS 1350.4; and
- CSIRO Sponsored Investigation test report numbered FSH 0970 and FSH 1036 on air-handling ducts tested in accordance with BS 476:24-1987.

We have retained this information.

You have requested an assessment as to the performance of your Trimesh R100 and R200 panels sprayed with Vermiduct or Vermitex TH composites used to protect horizontal and vertical ducts, bulkheads and enclosures to HVAC services if tested in accordance with AS1530.4-1997 and BS476 Part 24-1987.

SUPPORTING INFORMATION

CSIRO Sponsored Investigation report numbered FSH 0540

On 28 January 1998 this Division conducted a full-scale fire-resistance test on duct systems in accordance with AS 1530.4-1997. The specimen comprised six ducts fabricated from galvanised sheet steel 0.8-mm thick and protected with Vermiduct sprayed insulation reinforced with square steel mesh; and two steel ducts protected with Vermiduct sprayed insulation without the aid of mechanical reinforcement.

Duct V1 was 2300-mm long and was fixed vertically into a 1650-mm x 650-mm opening in the 200-mm thick Hebel stab. The duct projected 100-mm into the furnace chamber and 2000-mm above the unexposed face of the Hebel panel. The duct was fixed to the slab with 8-mm masonry anchors through 1.6 mm thick steel angles which were in turn fixed to the ducts with self-tapping screws at 300-mm centres as shown in drawings numbered 0197-003 and 0197-004. The duct incorporated slip on propriety flange (SPF) joints and specifically transverse duct flange (TDF) joints, and had 10-mm thick polystyrene sheeting adhered to its perimeter by means of self-adhesive double-sided tape, as well as 25-mm x 25-mm x 1-mm square steel mesh wrapped to the duct perimeter.

The duct was protected on the outside with Vermiduct sprayed insulation and was exposed to the fire from the inside (internal fire). The average sprayed thickness of Vermiduct on the duct (including the polystyrene sheeting) ranged from 50-mm to 65-mm with an average thickness of 58.6-mm.

Duct V2 was of similar construction to Duct V1 with the exception of the following. Duct V2 incorporated Integrated Machine Rolled Flange (IMRF) joints and specifically 25-mm MEZ joints. The duct was protected on the outside with Vermiduct sprayed insulation and was exposed to the fire from the inside (internal fire). The average sprayed thickness of Vermiduct measured 50-mm. The duct was clad with 0.55-mm thick galvanised steel sheeting, which was fixed to the duct with self-tapping hex screws at 200-mm centres.

Duct H1 was 2350-mm long and was fixed horizontally into a 1650-mm wide x 650-mm high opening in a 230-mm thick brick wall. The ductwork projected 100-mm into the furnace chamber and extended 2250-mm outside the furnace. The duct was fixed to the brick wall with 8-mm masonry anchors through 1.6-mm thick steel angles which were in turn fixed to the ducts with self-tapping screws at 300-mm centres as shown in drawings numbered 0197 001, 0197 002 and 0197 003.

The duct also incorporated a vertical riser duct; this portion of the duct was not sprayed with Vermiduct (as shown on drawing numbered 0197 003). The duct incorporated slip on propriety flange (SPF) joints and specifically 25-mm MEZ joints, and incorporated 25-mm x 25-mm x 1-mm square mesh wrapped to the duct perimeter and tensioned by means of plastic inserts. The duct was supported by trapeze hangers with 8-mm diameter threaded rods and 40-mm x 40-mm x 5-mm steel angle supports. The duct also incorporated one access panel measuring 600-mm x 600-mm.

The duct was protected on the outside with Vermiduct sprayed insulation and was exposed to the fire from the inside (internal fire). The average sprayed thickness of Vermiduct on the duct ranged from 45-mm to 62-mm with an average thickness of 53.9-mm.

Duct H2 was of similar construction to Duct H1 with the exception of the following. The duct incorporated 10-mm thick polystyrene sheeting adhered to its perimeter by means of self-adhesive double-sided tape, as

well as 25-mm x 25-mm x 1-mm square steel mesh wrapped to its perimeter and fixed with self-tapping screws.

The duct was protected on the outside with Vermiduct sprayed insulation and was exposed to the fire from the inside (internal fire). The average sprayed thickness of Vermiduct on the duct (including the polystyrene sheeting) ranged from 52-mm to 67-mm with an average of 61.2-mm.

Duct H3 was 5220-mm long and was fixed horizontally at both ends into 1650-mm wide x 650-mm high openings in a 230-mm thick brick wall with 100-mm of ductwork projecting outside the furnace on each end. The duct was fixed to the wall using 6-mm masonry anchors through 1.6 mm thick steel angles which were in turn fixed to the ducts with self-tapping screws at 300 mm centres as shown in drawings numbered 0197 001 and 0197 004. The duct incorporated Drive Slip (DS) joints, one access panel measuring 600-mm x 600-mm, and was supported by trapeze hangers with 10-mm diameter threaded rods and 40-mm x 40-mm x 5 mm steel angle supports.

The duct was protected on the outside with Vermiduct sprayed insulation sprayed directly to contour without any mechanical reinforcement and was exposed to the fire from the outside (external fire). The average sprayed thickness of Vermiduct on the duct ranged from 35-mm to 49-mm with an average of 42.5-mm.

Duct H4 was of similar construction to Duct H3 except for the following differences. Duct H4 had 25-mm x 25-mm x 1 mm square steel mesh wrapped to its perimeter and tensioned by means of plastic inserts. The duct was protected on the outside with Vermiduct sprayed insulation and was exposed to the fire from the outside (external fire). The average sprayed thickness of Vermiduct on the duct ranged from 35-mm to 59-mm with an average of 48.5-mm.

The test was terminated after a period of 124 minutes; all ducts maintained the structural adequacy and integrity criterion for the duration of the test. A full description of the test specimen and the test results are detailed in CSIRO Sponsored investigation report numbered FSH 0540.

CSIRO Sponsored Investigation report numbered FSH 0649

On 22 December 1998 this Division conducted a full-scale fire-resistance test in accordance with AS1530.4-1997 on a 5.2-m long x 3.6-m high and 2.4-m wide steel frame enclosure. The top and vertical sides of the whole enclosure (including the 3.6m high walls) were constructed using 30-mm (R100) and 50-mm (R200) Trimesh. The core of the northern, southern and the western walls were internally insulated with a polymer infill (R225). On the top surface and eastern walls, 50% of the Trimesh' foil was exposed to the fire side, whilst on the remaining 50% the sprayed coating was exposed to the fire side. This ensured that the Trimesh is bi-directional in terms of fire attack (i.e. fire tested from both sides).

The perimeter walls of the enclosure were penetrated by a fire damper module (2400-mm x 900-mm), a electrical cable tray (AS1530.4 Appendix D configuration) and pipes (PVC 50-mm and 150-mm, steel 100-mm and copper pipes (50-mm and 150-mm) services.

Within the same specimen, spanning the 5.2-m length of the enclosure, included a duct that was compositely built using a 1000-mm high x 1000-mm wide x 2600-mm long x 0.8-mm thick sheet metal duct on the northern half. The southern half was constructed with Trimesh R100 panels which were 30-mm thick with no core and with a layer of aluminium foil fixed to its inner surface using 5-mm aluminium speed clips at 400-mm centres. The internal clearance dimensions of the Trimesh duct were 1000-mm high x 1000-mm wide x 2600-mm long. The overall thickness of both sections was 40-mm when sprayed with Vermiduct

insulation. The duct was suspended from three sets of trapeze hangers at nominal 2000-mm centres. The trapeze rods were protected with Vermibloc covers.

The two duct sections were aligned together using four 200-mm long 75-mm x 75-mm x 1.2-mm thick angles set into the corners of the sheet metal duct with 100-mm protruding into the Trimesh section. Trimesh panels where then located over 30-mm x 30-mm x 30-mm x 0.55-mm thick C section fixed to the flange of the steel duct and these were fixed to the C channel with 12-14 x 75-mm long self-tapping screws. Steel plates 75-mm x 75-mm x 1.2-mm thick were used in conjunction with the screws as washers. A nominally 600-mm x 600-mm access panel was let into the eastern face of the Trimesh duct. The access panel measured 55-mm thick.

The composite duct specimen maintained structural adequacy for the 240 minute duration of the test , whilst maintaining integrity for 205 minutes and insulation for 151 minutes. A full description of the test specimen and the test results are detailed in CSIRO Sponsored investigation report numbered FSH 0649.

CSIRO Sponsored Investigation report numbered FSH 0972

Subsequent to the tests listed above, on 10 May 2003 this Division conducted a full-scale fire-resistance test in accordance with BS 476 Part 24 on three duct systems. The ducts were also instrumented in accordance with the requirements of AS 1530.4-1997. The three ducts consisted of two horizontal ducts, Duct H1-B was subjected to internal fire exposure and Ducts H2-A and V1-C were subjected to external fire exposure.

The ducts were constructed from nominal 0.8-mm thick galvanized steel sheeting with all longitudinal seams of the Pittsburgh lock type. The transverse joint consisted of Integrated Machine Rolled Flange (IMRF), or 38-mm TDF. The IMRF joints were sealed with closed cell fire retarded foam tape. Each duct section was of variable length and nominally 1000-mm wide x 250-mm deep.

Duct V1 consisted of a nominal 4500-mm high duct which extended nominally 2000-mm above the furnace roof. The hole in the roof was nominally 1050-mm wide x 300-mm deep and did not have any packing except for the Vermiduct spray.

The duct was secured to the furnace roof, above and below, with 75 mm x 75 mm x 1.6 mm steel angles along all four sides. The angle was secured to the roof with 12-mm masonry anchors and to the duct with self-tapping screws.

Duct H1-B was nominally 6340-mm long and installed horizontally into a 1050-mm wide x 800-mm high opening in a brickwork wall. The length of duct inside the furnace was nominally 3610-mm and outside the furnace was nominally 2500-mm. The end of the duct was then connected into a transition piece which then fed into an exhaust fan. The flow rate through the duct was set to 3 m/s before the start of the test. Inside the furnace the duct had an opening in accordance with BS476:24 for internal exposure for type B ducts.

The duct was supported by trapeze hangers with 8-mm diameter threaded rods and 40-mm x 40-mm x 5-mm angles. The duct also had two access panels measuring nominally 198-mm x 332-mm, one inside the furnace the other outside the furnace.

Duct H2-A was of similar construction to Duct H1-B except it had a T -Junction and a 90^{o} bend as shown in drawing HA-1073-1 and was closed to the furnace. Before the start of the test the pressure was set inside the duct to minus 300 Pa below laboratory pressure.

The Vermiduct Fire Spray material was then applied as per the manufactures instructions in layers up to 20-mm thick until the required thickness was achieved. The applied density of the Vermiduct was nominally 293kg/m³.

The ducts were sprayed at the following thickness:

- Duct V1-C sprayed to 30-mm thickness;
- Duct H1-B sprayed to 50-mm thickness;
- Duct H2-A sprayed to 60-mm thickness.

The spray was applied so that the transverse duct joints were not visible i.e. the thickness over the transverse joints was of reduced thickness.

The test was terminated after 240 minutes, a full description of the test specimen and the test results are detailed in CSIRO Sponsored Investigation report numbered FSH 0972.

CSIRO Sponsored Investigation report numbered FSH 1042

On 28 March 2004 this Division conducted a full-scale fire-resistance test in accordance with AS1530.4-1997 on two ducts protected with Vermiduct sprayed insulation. Duct A was subjected to external fire exposure and Duct B was subjected to internal fire exposure. The ducts were constructed from nominal 0.8-mm thick galvanized steel sheeting with all longitudinal seams of the Pittsburgh lock type. The transverse joint consisted of Integrated Machine Rolled Flange (IMRF), or 38-mm TDF. The IMRF joints were sealed with closed cell fire retarded foam tape. Each duct section was of variable length and nominally 1000-mm wide x 250-mm deep.

Duct B was nominally 6340-mm long and installed horizontally into a 1050-mm wide x 300-mm high opening in a brickwork wall. The length of duct inside the furnace was nominally 3610-mm and outside the furnace was nominally 2500-mm. The end of the duct was then connected into a transition piece which then fed into an exhaust fan. The flow rate through the duct was set to 3 m/s before the start of the test. Inside the furnace the duct had an opening in accordance with BS476 Part 24 for internal exposure for type B ducts.

The duct was supported by trapeze hangers with 12-mm diameter threaded rods and 40-mm x 40-mm x 5-mm angles. The support rods were fitted with circular pre-cast Vermiduct sections and the gap sprayed to a depth of at least 20 mm. The duct also had two access panels measuring nominally 198-mm x 332-mm, one inside the furnace the other outside the furnace.

Duct A was of similar construction to Duct B except it had a T-Junction and a 90° bend and was closed to the furnace. Before the start of the test the pressure was set inside the duct to minus 300 Pa below laboratory pressure.

The Vermiduct fire spray material was then applied as per the manufactures instructions in a single layer at least 20-mm thick. The applied density of the Vermiduct was nominally 293kg/m³.

Duct B failed insulation over one of the support hangers due to a reduced thickness in spray in this area. If the spray had the specified minimum 20-mm thickness over the support bracket then it is considered insulation failure would not have occurred until the next temperature recorded, in excess of the test failure criteria, at 115 minutes.

The test was terminated after 240 minutes, a full description of the test specimen and the test results are detailed in CSIRO Sponsored investigation report numbered FSH 1042.

CSIRO Sponsored Investigation report numbered FSZ 1043

The specimen comprised a nominal 300-mm x 50-mm high mild steel cable tray supported at 1200-mm centres with M10 threaded rods with a nominal 50-mm x 50-mm x 5-mm thick angle. The cable tray was supported by two nominal 75-mm x 75-mm x 8-mm thick angles on the underside of the tray.

Cables complying with Appendix D, Group A of AS 4072:1992 were positioned along the cable tray. After the cables were installed adhesive pins were positioned at 300-mm centres, with one speed clip on each pin, inside the furnace. The tray was then wrapped in Trimesh and secured in position with speed clips. The Vermiduct was sprayed to an overall thickness of 35-mm. The hanging rods were left un-coated.

The test following the guidelines and principles of Australian Standard/New Zealand Standard 3013:1995 Electrical Installations – Classification of the fire and mechanical performance of wiring systems with performance observed in respect of the following criteria:

- Cables complying with Appendix D1 Group A of AS 4072: 1992 - Circuit Integrity - No failure after 120 minutes.

CSIRO Sponsored Investigation report numbered FSV 1207

The specimen tested on the 15th June 2006 comprised Trimesh wall panels sprayed with Vermitex TH cementitious compound to form a non-loadbearing partition with overall nominal dimensions of 3020-mm high x 3000-mm wide x 70-mm thick. Specimen construction comprised a steel perimeter track section (Rondo Part No. 661C) bolted to the top, bottom and one vertical side of the specimen containing frame using M12 bolts at 600-mm centres. The steel perimeter track used on the remaining vertical edge of the specimen was fixed to the top and bottom track only. A 50-mm wide x 10-mm thick strip of Insufoam was inserted within the steel bottom perimeter track section. Hilti CP611A fire rated mastic was used to provide a seal between the steel perimeter frame and the specimen containing frame. The top perimeter track incorporated five vertical M12 threaded rods located at nominally 600-mm centres extending to nominally 300-mm above the bottom perimeter track.

The wall panel system incorporated Trimesh R100 wall panels measuring 1200-mm wide x 2200-mm long x 30-mm thick. These Trimesh panels incorporated a layer of aluminium foil fixed to one face of the panel using speed clips at 300-mm and 400-mm centres. The Trimesh R100 wall panels were installed inside the steel perimeter frame and incorporated the vertical M12 threaded rods located within the panels. The M12 threaded rods were wire tied to the Trimesh panels on the side opposite to the aluminium foil backing. All butt joints between the Trimesh panels of the partition system were reinforced using 300-mm wide RG1 lapping strip installed centrally over the joint and wire tied to the Trimesh panels using 1.25-mm diameter tie wire at 300-mm centres.

The Vermitex TH cementitious based spray compound was spray applied directly to the foil backing of the Trimesh R100 wall panels to a thickness of 30-35-mm within the Trimesh panel and allowed to dry. The final thickness was then built up with Vermitex TH to provide an overall cover of 70 mm.

The test was terminated after 240 minutes and the wall system as tested achieved fire resistance levels (FRL) of - /240/240. A full description of the test specimen and the test results are detailed in CSIRO Sponsored investigation report numbered FSV 1207.

CSIRO Sponsored Investigation report numbered FSH 1345

The specimen tested on the 20th April 2009 comprised of a Trimesh ceiling which spanned 3020-mm x 6020-mm constructed using Trimesh R200 panels. The panel thickness was 50-mm and incorporated a layer of aluminium foil fixed on external face. The foil was secured with 5mm speed clips at 300 and 400-mm centres.

One coat of Vermitex TH was sprayed to a thickness of 30-35 mm over the Trimesh plane and allowed to dry. The final thickness was then built up with Vermitex TH to provide an overall cover of 60-mm. The ceiling system was instrumented in accordance with ASTM E119-08a, Standard Test Methods for Fire Tests of Building Construction and Materials. The ceiling was exposed to the heating conditions specified in Figure 3.1 of UL 1709 – 2005, Rapid Rise Fire Tests of Protection Materials for Structural Steel, for the first half of the fire endurance test, and as specified in Section 4 of ASTM E1529-06, Standard Test Methods for Determining Effects of Large Hydrocarbon Pool Fire on Structural Members and Assemblies, for the second half of the fire endurance test.

The tested satisfied the integrity and insulation criteria as specified in ASTM E119 – 2008a criteria for fire endurance for the 241 minute duration of the test.

CSIRO Sponsored Investigation report numbered FSH 970

On the 10 May 2003 this Division conducted a fire resistance test in accordance with BS476 Part 24 on three ducts. The test consisted of two horizontal ducts, Duct H1-B subjected to internal fire exposure and H2-A and V1-C, subjected to external fire exposure. The ducts were constructed from nominal 0.8-mm thick galvanized steel sheeting with all longitudinal seams of the Pittsburgh lock type. The transverse joint consisted of Integrated Machine Rolled Flange (IMRF), or 38-mm TDF. The IMRF joints were sealed with closed cell fire retarded foam tape. Each duct section was of variable length and nominally 1000-mm wide x 250-mm deep.

Duct V1 consisted of a nominal 4500-mm high duct with nominally 2000-mm above the furnace roof. The hole in the roof was nominally 1050-mm wide x 300-mm deep and did not have any packing except for the Vermiduct spray. The duct was secured to the furnace roof, above and below, with nominal angles 75 mm x 75 mm x 1.6-mm thick along all sides. The angle was secured to the roof with 12 masonry anchors and to the duct with self tapping screws.

Duct H1-B was nominally 6340-mm long and installed horizontally into a 1050-mm wide x 800-mm high opening in a brickwork wall. The length of duct inside the furnace was nominally 3610 mm and outside the furnace was nominally 2500 mm. The end of the duct was then connected into a transition piece which then fed into an exhaust fan. The flow rate through the duct was set to 3 m/s before the start of the test. Inside the furnace the duct had an opening in accordance with BS476:24 for internal exposure for type B ducts. The duct was supported by trapeze hangers with 8-mm diameter threaded rods and 40 mm x 40 mm x 5 mm angles. The duct also had two access panels measuring nominally 198-mm x 332-mm, one inside the furnace the other outside the furnace.

Duct H2-A was of similar construction to Duct H1-B except it had a T-Junction and a 90° bend as shown in drawing HA-1073-1 and was closed to the furnace. Before the start of the test the pressure was set inside the duct to minus 300 Pa below laboratory pressure.

After the ducts were installed adhesive pins were positioned at 300-mm centres, with one speed clip on each pin, inside and outside the furnace. The ducts were then wrapped in square steel mesh nominally 25-mm x 25 mm x 1-mm thick and secured in position with more speed clips. The Vermiduct Fire Spray

material was then applied as per the manufactures instructions in layers up to 20-mm thick until the required thickness was achieved. The ducts were sprayed at the following thickness:

- Duct V1-C spayed to 30-mm thickness;
- Duct H1-B sprayed to 50-mm thickness;
- Duct H2-A sprayed to 60-mm thickness.

The spray was applied so that the joints were not visible i.e. the thickness over the joints was of reduced thickness. The test was terminated after 240 minutes, a full description of the test specimen and the test results are detailed in CSIRO Sponsored investigation report numbered FSH 970.

CSIRO Sponsored Investigation report numbered FSH 1036

On 28 February 2004 this Division conducted a fire resistance test in accordance with BS467 Part 24 on two ducts sprayed with Vermiduct spray insulation material. The test specimen consisted of two horizontal ducts, Duct A subjected to external fire exposure and Duct B subjected to internal fire exposure and a damper.

The ducts were constructed from nominal 0.8-mm thick galvanized steel sheeting with all longitudinal seams of the Pittsburgh lock type. The transverse joint consisted of Integrated Machine Rolled Flange (IMRF), or 38-mm TDF. The IMRF joints were sealed with closed cell fire retarded foam tape. Each duct section was of variable length and nominally 1000-mm wide x 250-mm deep.

Duct B was nominally 6340-mm long and installed horizontally into a 1050-mm wide x 340-mm high opening in a brickwork wall. The length of duct inside the furnace was nominally 3610 mm and outside the furnace was nominally 2500 mm. The end of the duct was then connected into a transition piece which then fed into an exhaust fan. The flow rate through the duct was set to 3 m/s before the start of the test. Inside the furnace the duct had an opening in accordance with BS476:24 for internal exposure for type B ducts. The duct was supported by trapeze hangers with 10-mm diameter threaded rods and 40-mm x 40-mm x 5-mm angles. The support rods were fitted with circular pre-cast Vermiduct sections and the gap sprayed to a depth of at least 20-mm.

The duct also had two access panels measuring nominally 198-mm x 332-mm, one inside the furnace the other outside the furnace. Under the duct on the outside of the furnace were three pipes, a 50-mm copper, a 50-mm PVC and a 60-mm steel pipe. The mesh was positioned over the pipes and spayed to the same depth as the rest of the duct. The pipes extended out from the spray by at least 200-mm on each end. The PVC pipe had a fire collar either side of the edge of the spray.

Duct A was of similar construction to Duct B except it had a T-Junction and a 90° bend as shown in drawing FT476/204A and was closed to the furnace. Before the start of the test the pressure was set inside the duct to minus 300 Pa below laboratory pressure. Inside the furnace above the duct were three pipes, a 50-mm copper, a 50-mm PVC and a 60-mm steel pipe. The mesh was positioned over the pipes and spayed to the same depth as the rest of the duct. The pipes extended out from the spray by at least 200 mm on each end. The PVC pipe had a fire collar either side of the edge of the spray.

After the ducts were installed, adhesive, pins were positioned at 300-mm centres, with one speed clip on each pin, inside and outside the furnace. The ducts were then wrapped in square steel mesh nominally 25-mm x 25 mm x 1-mm thick and secured in position with more speed clips. The Vermiduct Fire Spray material was then applied as per the manufactures instructions to a nominal thickness of 20-mm.

The test was terminated after 240 minutes, a full description of the test specimen and the test results are detailed in CSIRO Sponsored investigation report numbered FSH 1036.

ANALYSIS

The critical performance requirements for the spray insulation systems and that of any protection method attached to ducting is the ability to restrict the temperature rise within the duct. This performance is a factor of the thermal conductivity of the protection material, the thickness of the protection material, the ability of the protection material to remain in place (also termed 'stickability') and the severity of the fire exposure.

As can be seen from the comprehensive test results presented, the structural adequacy and integrity of the systems were of little concern in the fire resistance test reported in FSH 0540 and the test observations documented that no failure under these criteria were imminent at the time the testing was terminated.

For the test reported in FSH 0972 observations made during and after the completion of the test show that the failures occurred because:

- Insulation failure for H1-B at 185 minutes occurred at a thermocouple located over a transverse duct joint. As the Vermiduct material had not been profiled over the joint the thickness of the Vermiduct at this point was approximately 12-mm (over the 38-mm TDF joints).
- Subsequent insulation failure occurred at 227 minutes when a roving thermocouple was positioned at a point where the insulation had cracked due to the sagging of the duct at the mid-point between supports.
- Insulation failure of H2-A at 16 minutes occurred due to leakage through the access panel that was installed without a seal. Subsequent insulation failures occurred between 60 minutes and 192 minutes depending on proximity to the access panel.
- At 229 minutes the portion of the duct A inside the furnace collapsed due to failure of the 8-mm thick support rods. Increasing these rods to 10-mm would increase the loadbearing capacity by 56% as well as reducing the surface area-to-mass ratio (a measure of the heat intake of the rod) by 20%

For the test reported in FSH 1042 test observations made after the completion of the test showed that the thickness of the spray at the point of insulation failure of Duct B was due to a reduced thickness of spray over one of the support angles in the underside of the duct. If the spray had been the specified thickness then it is considered that the duct would have in fact failed insulation, at the next temperature recorded in excess of the test failure criteria which was, at 115 minutes.

Based on previous test evidence if the thickness of the spray is increased to at least 30-mm where the duct exits both sides of the wall it is considered that the insulation failure would have occurred at the thermocouples positioned further away from the wall. The next insulation failures occurred at 151 minutes.

CONCLUSION/ASSESSMENT

Based on the test data presented and the factors relating to the construction details, it is the assessment of this Division that the Vermiduct or Vermitex TH spray coating when applied to a Trimesh wire frame panel as detailed in the above listed test reports, in additional to the details contained in your Trimesh Installation Manual and reported in FSH 0540, FSH 0972 and FSH 1042 would be capable of the following fire-resistance levels listed in Table 1 if tested in accordance with AS 1530.4-1997 or BS 476 Part 24-1987.

Table 1

HORIZONTAL AND VERTICAL DUCTS, BULKHEADS AND ENCLOSURES TO HVAC SERVICES CONSTRUCTED FROM TRIMESH & VERMIDUCT AND /OR VERMITEX TH COMPOSITES AND USED AS FIRE SEPARATING ELEMENTS

FRL's of elements sprayed with Vermiduct and/or Vermitex TH to Trimesh R100 and R200 panels to comply with the requirements of AS1530.4 and BS476 Part 24:

	Vermiduct or Vermitex TH Thickness (mm)			
Direction of fire attack	**Separating Element up to 1600 x 1600-mm**	**Separating Element up to 2400 x 2400-mm**	**Separating Element up to 4800 x3600-mm**	**FRL**
External/Internal	**30(R100)**	**35(R100)**	**35(R100)**	**- /60/60**
External/Internal	**35(R100)**	**40(R100)**	**45(R100)**	**- /90/90**
External/Internal	**45(R100)**	**50(R100)**	**55(R200)**	**- /120/120**
External/Internal	**55(R100)**	**60(R200)**	**65(R200)**	**- /180/180**
External/Internal	**65(R100)**	**70(R200)**	**75(R200)**	**- /240/240**

Notes:

i. R100 = 30-mm x 2-mm TRIMESH; R200 = 50 x 2-mm TRIMESH;
ii. Trimesh elements to be constructed in accordance with LAF Trimesh Manual and to comply with AS 4254 or BS EN 1505:1998 pressure ratings;
iii. Trimesh construction which needs to cater for additional pressures and loads must be approved by an engineer;
iv. Trapeze centres at maximum 1520 mm (Refer FCO 2542) comprising 50 x 50 x 6.5-mm angle & hanging rods ≥ 12 mm diameter (Refer to LAF Duct Construction Table for hanging Rod sizes);
v. Manufacturer supplied Access Panel equal to IGNISEAL with rebated edges and non-combustible Fire seal;
vi. In all cases, except where Insulation criteria is waived, the spray thickness for 150-mm distance each side of a penetration to be ≥ 30mm. Alternatively use LAF Torqduct elements to provide a fire resistant collar on the perimeter.

TERM OF VALIDITY

This assessment report will lapse on the 30 November 2018. Should you wish for us to re-examine this assessment with a view to the possibility of extending its term of validity, would you please apply to us three to four months before the date of expiry. This Division reserves the right at any time to change or withdraw this report in the light of new knowledge.

Yours faithfully

Manager, Fire Testing and Assessment
22 November 2013