

Our ref: DPM-0868

Matt Smyth  
Smyth International B.V.  
Edisonstraat 9c  
2723 RS Zoetermeer  
The Netherlands

20<sup>th</sup> August 2009

Dear Matt

<b>Phenclad – Fire Performance Assessment</b>
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Following discussion with yourself and your submission of fire test data for Phenclad, to determine its potential compliance with London Underground Standard 1-085, I confirm that this data has been reviewed and that the product does comply with the requirements given in the Standard. Details of my assessment are given below.

### **1.0 Material Description**

A description of the material evaluated is given below:

Product Name: Phenclad  
General Description: Phenolic resin composite reinforced with fibreglass, chopped strand mat.  
Thickness: 3.5 mm (typical)  
Density: 1.4 – 1.5 g/cm<sup>3</sup>

### **2.0 London Underground Fire Performance Requirements**

Fire performance test criteria are given in London Underground Standard 1/085 A1 'Fire Safety Performance of Materials'. This Standard requires that testing should be carried out according to the following parameters:

- Combustibility/flammability to BS 476: Parts 6 & 7 to attain a Class 0 rating.
- Smoke Emission testing to BS 6853.

- Toxic fume emission testing (BS 6853 and methodology as outlined in LU Standard 1/085).

Materials which comply with this Standard can be installed in rolling stock and in below ground stations without restriction.

### **3.0 Fire Performance Assessment**

The various aspects of testing Phenclad are described below:

#### Combustibility/ Flammability

Combustibility testing to BS 476: Parts 6 and 7 was carried out by Warrington Fire (ref. Report Nos. 59397 and 59398, dated 20.04.93.) with the overall result that the product attained a Class 0 classification.

#### Smoke Emission

Smoke emission testing to BS 6853: 1999 D.8.4 (panel test) was conducted by Warrington Fire (ref. Report No. L12348, dated 06.05.93.) with the following results: Ao (on) 0.86, Ao (off) 1.15. This compares to the requirements of Ao (on) <3.5, Ao (off) <5.4, for vertical surfaces in stations, as given in LU Standard 1/085.

#### Toxic Fume Emission

The potential for toxic fume emission was evaluated according to the methodology outlined in LU Standard 1/085 for qualitative analysis using x-ray fluorescence spectroscopy (ref. report R144651, dated 05.10.06., issued by 4-Rail Services Ltd). The analysis gave a sulphur content of 0.91%, indicating a potential for the production of sulphur dioxide gas. Considering a potential station fire in which the Phenclad (at a thickness of 3.5 mm) is the sole source of combustion, a fire region of 1.25 m<sup>2</sup> and a dispersal volume of 700 m<sup>3</sup>, then the concentration of sulphur dioxide (assuming 100% conversion) would be 63 ppm. This value is well below the IDLH (Immediately Dangerous to Life and Health) value of 100 ppm and, hence, Phenclad is considered to be compliant at a thickness of 3.5 mm. Further calculation shows that the maximum allowable thickness is 5.5 mm.

#### Assurance

In the test reports issued by Warrington Fire, the material description is given as 'Coloured Phenolic Laminate'. No product name is given. Subsequently, however, Smyth Composites have confirmed in writing (ref. letter addressed to Karl, Brittin, Senior Project Manager, Design Rationale Ltd, dated 17<sup>th</sup> August 2009) that the Warrington reports relate to Phenclad and that there has been no change in formulation and product design since the time of testing in 1993.

#### **4.0 Conclusions**

Phenclad composite is compliant with the requirements of London Underground Standard 1/085 'Fire Safety Performance of Materials' for station applications. Compliance enables this material to be installed in below ground as well as surface stations without restriction. This relates to the typical manufactured thickness of 3.5 mm and also to thicker laminates up to a maximum of 5.5 mm. Compliance does not apply to rolling stock.

An entry for Phenclad has been made in our 'Deemed to Comply Register' under number *MB-DTC-1127-FSE-1*.

This assessment relates only to fire performance and does not cover any 'fitness for purpose' aspects.

#### **5.0 Conditions of Acceptance**

Acceptance of Phenclad is subject to the material composition remaining unchanged from that previously described and that satisfactory quality assurance is maintained. London Underground should be advised in writing of any intention to alter the composition or to cease or suspend production. It should be noted that a change in composition could adversely affect fire performance and nullify its compliance to LU Standard 1-085.

This letter is issued with the proviso that it is only used in connection with your dealings with London Underground Ltd and associated companies and contractors dealing with the London Underground network and will not be published in whole or in part to any outside party.

If you have any queries, I will be pleased to discuss further.

Yours Sincerely

Derek McGovern  
Materials Technology, Projects Directorate  
London Underground  
(Email: [derek.mcgovern@metronetrail.com](mailto:derek.mcgovern@metronetrail.com))