Composite PFP and Thermal Insulation Systems for Process Equipment

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ContraTherm® JF120

The TRULY Passive
Fire Protection

Passive: “subjected to an action without responding“
What do we mean by a Composite PFP?

“A Composite is a multi phase or multi layer material where one or more components are present to enhance the performance of the whole”
Constituent parts of ContraTherm®

- ContraTherm C50 Insulation Layer
- ContraTherm Tie-Coat
- D2004 Composite Top Skin
- Blasted & Primed Steel Surface
Function of Tiecoat

ContraTherm Tie-Coat

Blasted & Primed Steel Surface
Function of Tiecoat

- Present to aid adhesion to substrate
- Must be applied over primed steel
- Approved primers
  - Interline 994
  - Sigma Phenguard
Description of C50 Insulation

ContraTherm C50 Insulation Layer

ContraTherm Tie-Coat

Blasted & Primed Steel Surface
Description of C50 Insulation

- C50 is a “Syntactic” foam
  *No expansion on application (or shrinkage on cure)*

- Material is hand applied and cold curing

- Excellent thermal insulation performance
  *(Density = 270 Kgm\(^{-3}\); K-Value = 0.05 W/mK)*

- Foam is Closed Cell hence water uptake is minimal
C50 Application
Description of Topskin

- ContraTherm C50 Insulation Layer
- ContraTherm Tie-Coat
- Blasted & Primed Steel Surface
- D2004 Composite Top Skin
Description of Topskin

- *Fibre reinforced phenolic resin*
- *Reinforcement is combination of Glass for strength and Silica for fire resistance*
- *Impermeable to water*
- *Unaffected by weather or salt exposure*
Topskin Application
Principal Material Properties

Improved Performance ContraTherm®

Was JF211

Now Called JF120
# Mechanical Properties

<table>
<thead>
<tr>
<th>Property</th>
<th>C50 D2004</th>
<th>C50 D2004</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Density</strong></td>
<td>270 Kgm(^{-3}) (cured)</td>
<td>1300 Kgm(^{-3})</td>
</tr>
<tr>
<td><strong>Young’s Modulus</strong></td>
<td>465 MPa</td>
<td>5660 MPa</td>
</tr>
<tr>
<td><strong>Tensile Strain to failure</strong></td>
<td>1%</td>
<td>1.65%</td>
</tr>
<tr>
<td><strong>Tensile Strength</strong></td>
<td>5.15 MPa</td>
<td>61.6 MPa</td>
</tr>
<tr>
<td><strong>Shear Strength / Modulus</strong></td>
<td>0.76 MPa / 121 MPa</td>
<td></td>
</tr>
<tr>
<td><strong>Compressive Strength</strong></td>
<td>18.82 MPa</td>
<td></td>
</tr>
<tr>
<td><strong>Water Absorption</strong></td>
<td>&lt;1% by weight</td>
<td></td>
</tr>
<tr>
<td><strong>Blast Overpressure Resistance</strong></td>
<td>4.2 Bar (unaffected)</td>
<td></td>
</tr>
</tbody>
</table>
### Thermal Properties

<table>
<thead>
<tr>
<th>Property</th>
<th>Data</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operating Temperature</td>
<td>-196 to 185°C</td>
<td>(AML can design bespoke systems for use at much higher temperatures)</td>
</tr>
<tr>
<td>Thermal Conductivity @ 25 °C</td>
<td>C50 D2004</td>
<td>0.05 W m(^{-1}) K(^{-1}) 0.2 W m(^{-1}) K(^{-1})</td>
</tr>
<tr>
<td>Specific Heat Capacity</td>
<td>C50</td>
<td>1.5 Jg(^{-1}) °C(^{-1})</td>
</tr>
<tr>
<td>Expansion Coefficient</td>
<td>C50 D2004</td>
<td>20.7 x10(^{-6}) 23.96x10(^{-6})</td>
</tr>
</tbody>
</table>
Thermal Conductivity Compared with Alternatives

<table>
<thead>
<tr>
<th>Material</th>
<th>ContraTherm® C50</th>
<th>Foamglass®</th>
<th>Rockwool™</th>
</tr>
</thead>
<tbody>
<tr>
<td>K-Value</td>
<td>0.034 – 0.062</td>
<td>0.048 – 0.051</td>
<td>0.033 – 0.093</td>
</tr>
</tbody>
</table>
Thermal Conductivity

K-Value from – 165 to + 175 deg C
## Fire Smoke and Toxicity

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jet Fire Resistance</td>
<td>J120 (thickness dependent)</td>
</tr>
<tr>
<td>Smoke Generation NES 711</td>
<td>8.71</td>
</tr>
<tr>
<td>Toxicity Index NES 713</td>
<td>1.41</td>
</tr>
<tr>
<td>Spread of Flame BS476 Pt 7</td>
<td>Class 1</td>
</tr>
<tr>
<td>Limiting Oxygen Index</td>
<td>72%</td>
</tr>
</tbody>
</table>
Description of JF test and Discussion of Results
Benefits of Using ContraTherm® JF120

- Truly “Passive” (no reactions)
- Flexible application procedure
- Ambient curing
- Wide operating temperature
- Unaffected by marine environment
Some Recent Contracts Successfully Completed by Alderley Materials Ltd
Sanha

- Type: LPG FPSO with de-propaniser plant
- Client: JGC Corporation
- Operator: Chevron Texaco
- Max Throughput: 37,370 bpd LPG
- Storage Capacity: 135,000m³
- Scope of Supply: 5 off LPG process vessels
Type: LPG FPSO with de-propaniser plant
Client: SBM
Operator: Total Fina Elf
Scope of Supply: Jet fire protection for ESDVs and riser head equipment onboard TotalFinaElf’s Girassol facility. Ranging in size from 1½ inch umbilicals, ESDV covers, up to a 32 inch dynamic bundle assembly.
Belanak

- **Client:** PT McDermott
- **Operator:** Conoco Philips
- **Throughput:** 500m cu ft gas + 100,000 barrels oil & condensate, up to 24,140 barrels LPG per day
- **Storage Capacity:** 1 m barrels
- **Scope of Supply:** Passive Fire Protection to 25 process vessels, total area approximately 4500m² plus pipework. The tallest column is 230 ft.