



FireMaster[®] vessel fire protection system

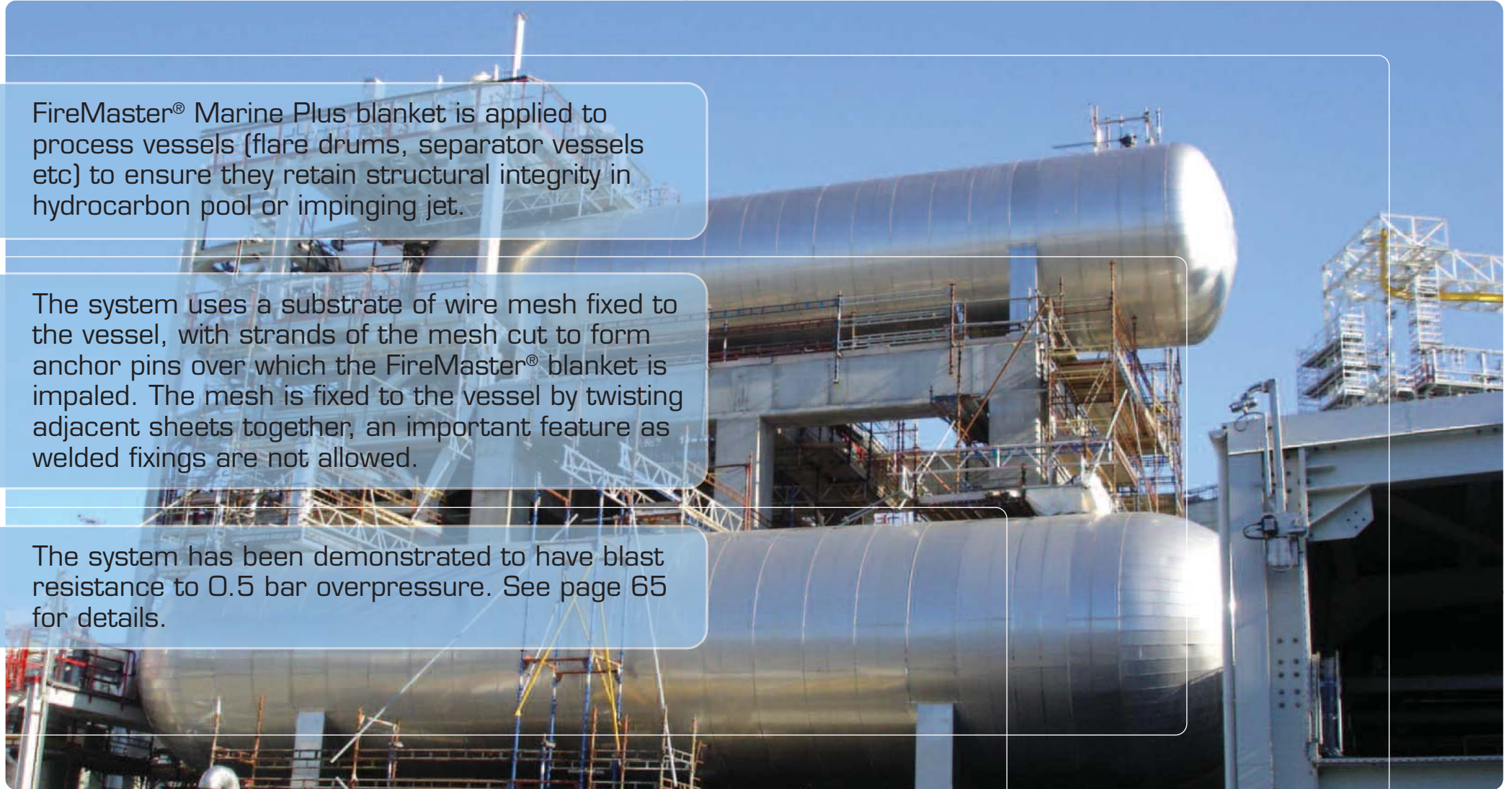
FireMaster® vessel fire protection system

Hydrocarbon and Jet Fire protection for process vessels

FireMaster® Marine Plus blanket is applied to process vessels (flare drums, separator vessels etc) to ensure they retain structural integrity in hydrocarbon pool or impinging jet.

The system uses a substrate of wire mesh fixed to the vessel, with strands of the mesh cut to form anchor pins over which the FireMaster® blanket is impaled. The mesh is fixed to the vessel by twisting adjacent sheets together, an important feature as welded fixings are not allowed.

The system has been demonstrated to have blast resistance to 0.5 bar overpressure. See page 65 for details.



- Weather-protective cladding is applied over the system using ring supports.

- Fire tested in hydrocarbon pool fires for 3 hours. Fire tested for 190 minutes Jet Fire Protection to ISO 22899-1 standard. JF/Process Vessel/195/180. Blanket also provides thermal insulation for the vessel as well as fire insulation.

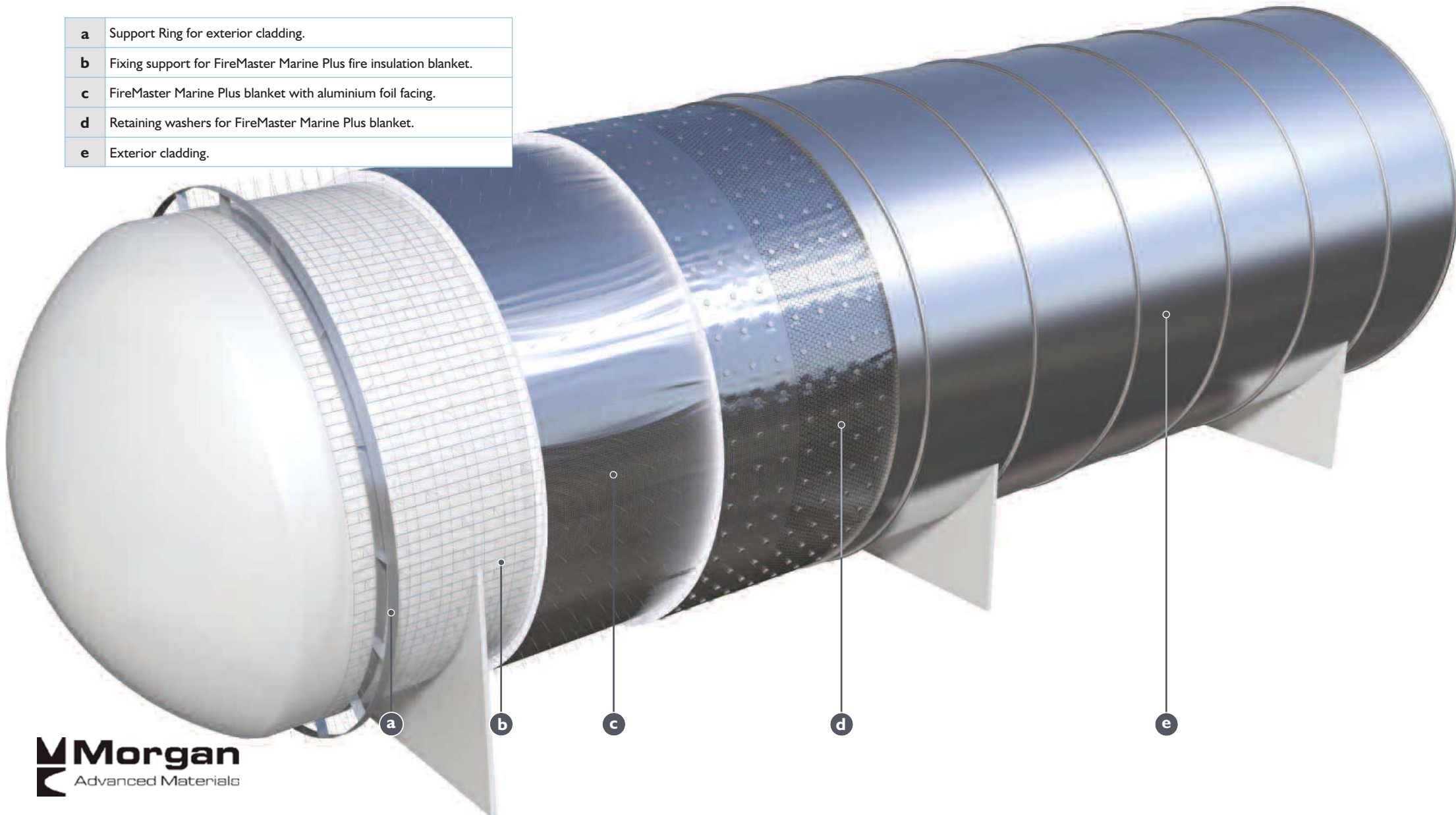
- Ideally suited for vessels operating at above-ambient temperatures where heat-reactive fire protection materials cannot be used without secondary insulation being first applied around the vessel.



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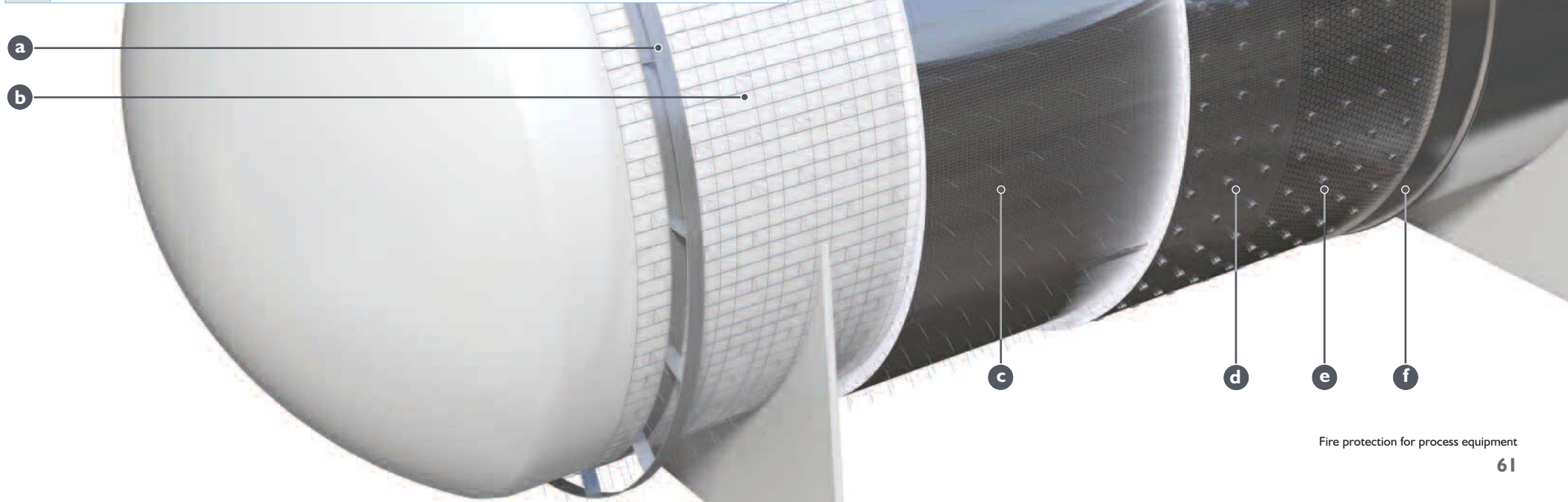
Hydrocarbon and Jet fire protection for process vessels

a	Support Ring for exterior cladding.
b	Fixing support for FireMaster Marine Plus fire insulation blanket.
c	FireMaster Marine Plus blanket with aluminium foil facing.
d	Retaining washers for FireMaster Marine Plus blanket.
e	Exterior cladding.



Hydrocarbon and Jet fire protection for process vessels - detail view

a	Support Ring for exterior cladding used on main body of vessel. Stainless steel 3mm thick 40mm wide strip with height adjusted to meet insulation thickness using 3mm up-stand steel sections at no less than 200mm centres. The support rings are placed over the blanket retaining mesh and clamped into place at their edge. If required, the cladding rings can be applied over a fibreglass tape to avoid direct contact with the vessel steel although this is not required for fire protection performance. Cladding support rings are normally spaced no more than 125mm from the cladding sheet edge and at 600 mm centres nominally. As the FireMaster blanket width is 610mm, a 600 cladding support ring spacing is most convenient. FireMaster blanket should be tightly fitted into the support ring either by packing a separate strip or inserting the blanket edge into the ring void.
b	Fixing support for FireMaster Marine Plus Blanket. Welded mesh, stainless or galvanised steel 50mm x 50mm x 2mm. The mesh is cut and bent outwards to form a fixing pin for the blanket at 200mm centres. Individual sheets of mesh are attached together by twisting the edge strands of the mesh together. If necessary the mesh can be attached using steel banding straps for additional support.
c	FireMaster Marine Plus blanket 128 kg/m ³ density with (optional) aluminium foil facing applied in a minimum of 2 layers. Thickness to be used is to be verified for each application in accordance with design fire, fire duration and specified critical temperature requirements. The system has been fire tested for 190 minutes in a Jet Fire to ISO 22899-1 standard using 88mm of FireMaster Marine Plus Blanket insulation achieving JF/Process Vessels/200/180 classification. Contact Morgan Thermal Ceramics for advice on thickness requirements for individual applications.
d	Retaining washer for FireMaster Marine Plus Blanket usually 38mm diameter friction-fit type. Galvanised or stainless steel. The cut mesh strand is bent over the washer to secure the washer.
e	Optional layer of wire mesh.
f	Exterior Cladding appropriate to the fire scenario. For Jet fire protection, 0.6mm 304 Grade stainless steel is used.



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Hydrocarbon and Jet fire protection for process vessels - detail view

a	Exterior cladding on dome ends of vessel. Segments have swaged edge seams. Grade of steel and fixing of the segment sections to each other is as outlined in (b) below. Cladding support rings are not normally required for dome end segments.
b	<p>Exterior cladding for main vessel body, 0.6mm 304 grade stainless steel may be used for Jet Fires up to 190 minutes duration. Cladding edges to overlap by 75mm. The top overlapping cladding panel has swaged edges. (See detail drawing below right).</p> <p>Fixings used to join the cladding sections together are inserted centrally into the swage. Where swaged edges meet (e.g. vertical and horizontal edges), the swage is terminated at 75mm from the sheet edge to allow for a tight overlap.</p> <p>Fixing of cladding segments to be made with no. 8 stainless steel screws or 10mm diameter stainless steel rivets at 100mm spacing.</p> <p>Stainless steel banding straps 20mm wide at 200mm centres can be used for secondary support of the cladding if required, but do not form part of the fire protection system requirement. A mastic sealant may be used between cladding joints if required for weather protection purposes but is not a requirement for fire protection performance.</p>





Explosion resistance testing of FireMaster[®] Process Equipment fire protection systems

Explosion resistance testing of FireMaster® Process Equipment fire protection systems



The following systems were tested for explosion resistance at the DNV-GL Spadeadam test site in 2015:

- FireMaster Vessel Fire Protection System
- FireMaster RES System installed onto a 3 inch schedule xxs pipe
- FireMaster Pipe Fire Protection System
 - o 3inch schedule 40 pipe insulated with two alternative insulation specifications:
 - 76mm FireMaster Marine Plus Blanket + 40mm of Microporous flexible (total outside diameter of pipe 322mm)
 - 38mm FireMaster Marine Plus Blanket + 76mm Microporous flexible (total outside diameter of pipe 306mm)



Pipes and RES system installed in explosion chamber prior to explosion testing.



FireMaster vessel system installed on back wall of explosion chamber prior to explosion testing.

Explosion resistance testing of FireMaster® Process Equipment fire protection systems

The specimens were subjected to two consecutive explosions with the following overpressures

Test	Average Overpressure (mbar)	Average Duration (ms)
1	430	170
2	500	170

After each test the specimens were examined and assessed for integrity of the fire protection system.

Test Sample	Assessment of Damage	
	Test 1	Test 2
FireMaster Pipe 1	Some deformation of the end caps	Some deformation of the end caps
FireMaster Pipe 2	Some deformation of the end caps	Some deformation of the end caps
FireMaster RES	Some deformation of the end caps RES box rotated 90°	Some deformation of the end caps. Loss of some rivets near centre of pipe
FireMaster Vessel System	No damage or deformation of FireMaster blanket	No damage or deformation of FireMaster blanket



FireMaster Vessel system after 2nd explosion test. No damage occurred to the cladding. An inspection of the insulation was made after removal of the cladding and no damage or compression of the insulation thickness was noted.



RES system after second explosion test.



Pipe system after second explosion test.