Certificate No: SAS F190094-04
Issue Date: 02/11/2021
Expiry Date: 19/05/2024

Certificate Of Fire Approval

This is to certify that the product(s) detailed below will be accepted for compliance with the applicable Lloyd's Register Rules and Regulations for use on offshore units classed with Lloyd's Register, and for use on offshore units and onshore facilities when authorised by contracting governments to issue the relevant certificates, licences, permits etc.

Manufacturer	**Morgan Advanced Materials**
Address	Thermal Ceramics, Tebay Road, Bromborough, Wirral, Merseyside, CH62 3PH, United Kingdom (UK)
Type	Structural Steel Jet Fire Protection System
Description	Structural Tubular Steel Sections, Cylindrical Vessels or Pipes protected with a Jet Fire Protection Jacket System – Type: “FireMaster Marine Plus Blanket”, for Jet Fire Exposures of up to 60 minutes
Trade Name	FireMaster Marine Plus Blanket
Specified Standard	ISO 22899-1:2007 “Determination of the Resistance to Jet Fires of Passive Fire Protection Materials, Part 1: General Requirements”

This certificate is not valid for equipment, the design or manufacture of which has been varied or modified from the specimen tested. The manufacturer should notify Lloyd's Register EMEA of any modification or changes to the equipment in order to obtain a valid Certificate.

The Design Appraisal Document and its supplementary Type Approval Terms and Conditions form part of this Certificate.

This certificate remains valid unless cancelled or revoked, provided the conditions in the attached Design Appraisal Document are complied with and the equipment remains satisfactory in service.

Keith Taylor

Keith Taylor

Team Lead Fire & Safety to Lloyd's Register EMEA
A member of the Lloyd's Register group

71 Fenchurch Street, London, EC3M 4BS, United Kingdom

ATTACHMENT TO CERTIFICATE OF FIRE APPROVAL No. SAS F190094-04

This Design Appraisal Document forms part of the Certificate.

This Certificate is an amendment of previous Lloyd's Register Certificate of Fire Approval No: SAS F190094-03

APPROVAL DOCUMENTATION

1. GL Noble Denton, Spadeadam Test Site, Cumbria, United Kingdom, Fire Test Report No's: 13956, Issue 3, dated 24 July 2013; and 13406, Issue 4, dated 22 February 2013, both for Tubular Jet Fire Tests.
2. DNV-GL, Spadeadam Test Site, Cumbria, United Kingdom, Fire Test Report No. 10179348, Rev. 1, dated 22 July 2020.
3. BRE Global, Watford, United Kingdom: Fire Test Report No. 278498, dated 11 July 2012; and Assessment Report No. CC 281408, dated 7 August 2012, hydrocarbon fire testing of tubular members.
4. Surveyors from Lloyd's Register's Liverpool and Newcastle Offices witnessed the jet fire tests.

CONDITIONS OF CERTIFICATION

1. Applications in each case to be approved by Lloyd's Register at the design stage.
2. Evaluation of the Jet Fire Test Results for "FireMaster Marine Plus Blanket" (128kg/m^3 density) insulation protection system with staggered overlap joints and a 0.6mm thick stainless steel outer cladding, when applied to tubular steel sections, pipes or jet fire cylindrical vessels of up to 500mm diameter, but not with corners or edge features and not exceeding an Hp/A factor of 205m^{-1} (Where 'Hp' is the outside circumference and 'A' is the cross-sectional area) is outlined in Appendices 1 to 5 of this Certificate. The thicknesses shall be derived using the project specific fire risks and performance criteria. i.e. critical core temperature, fire exposure duration, Hp/A section factor etc. The specific construction make-up and performance results of the jet fire tests conducted as part of the test package relating to this Certificate are detailed in Appendix 6 of this Certificate for supporting information only.
3. The "FireMaster Marine Plus Blanket" (128kg/m^3 density) insulation shall be held in place utilising stainless steel tie wire with a spacing of approximately 125mm centres. All joints between the "FireMaster Marine Plus Blanket" shall be installed with compressed butt joints. The first and second layers of "FireMaster Marine Plus Blankets" shall also be offset to reduce heat transfer.
4. The 0.6mm thick stainless steel sheet outer cladding shall be overlapped by: 75mm longitudinally; and 100mm from circumferential joints; and shall incorporate the application of "DOWSIL™ Firestop 700 Sealant" Manufactured by Dow Chemical Company Ltd. in the overlapping joints. The stainless steel sheet outer cladding shall be secured in position with stainless steel screws at a maximum spacing of 100mm centres and shall be held in place by stainless steel banding (20mm wide) with tightening securing clasps at a maximum spacing of 200mm centres.
5. Suitable approved insulation shall be applied to any other part of the protected exposed surfaces not covered by the insulation system, in all cases. In particular, attention is to be paid to means of securing boundaries and the prevention of heat bridging; an overlap of at least 150mm should be provided between the two systems where the insulation arrangements on the adjacent areas are the same or equivalent to the as-tested arrangements.
6. Composition and application of insulation material to be maintained in production and use in accordance with originally tested composition formula and method of application, and manufacturer's instructions.
7. Production items are to be manufactured in accordance with a quality control system which shall be maintained to ensure that items are of the same standard as the approved prototype.

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8. The Certificate holder is solely responsible for the products supplied under this Certificate and to ensure that their products, whether manufactured by themselves or their licensee manufacturers, if agreed by Lloyd's Register, are fully compliant with the relevant statutory regulations and Lloyd's Register Class Rules as applicable and designed, manufactured and installed to the same quality and specifications as the prototype tested, including components that are designed and manufactured by third parties.

NOTES

1. The "FireMaster Marine Plus Blanket" insulation system may be assigned **Jet Fire Exposure Classifications** based on ISO 22899-1:2007, Section 15 (Exposure Type / Protected Equipment / Critical Core Temperature Rise / Minutes), depending on type of application, particular construction composition of the insulation system and maximum core temperatures specified, in accordance with ISO 22899-1:2007, Section 15.4, Critical Temperature Rise. Appendix 6 of this Certificate details the various specific classifications for the three jet fire exposure tests performed on a Tubular Sections (Hp/A's of $65m^{-1}$, $170m^{-1}$ & $205m^{-1}$), all fitted with a "FireMaster Marine Plus Blanket" ($128kg/m^3$ density) jet fire protection systems (26mm, 88mm & 75mm nominal thickness respectively).
2. The "Classifications" listed in Appendix 6 of this Certificate depend on the particular application, Hp/A Section Factor, insulation thickness and the maximum core temperature required, in accordance with ISO 22899-1:2007, Section 15.4. The Critical Temperature Rise for load bearing steel structures is typically 400°C, however some protected items may have significantly lower temperature limitations which should be taken into consideration at the design stage.
3. The Jet Fire Protection Jacket System was fitted over tubular steelwork specimens and was subjected to blast / gas explosion resistance tests as described in DNV-GL, Explosion Test Report No. 1XIW3BF-1, Rev. 0, dated 29 February 2016. It is noted that the tested specimens remained intact and were considered to be suitable in withstanding the following average and peak overpressures recorded:

Blast Test No.	Average Overpressure Recorded	Maximum Peak Overpressure Recorded
1	0.43 bar	0.52 bar
2	0.50 bar	0.68 bar

SCOPE

The test described in the procedure ISO 22899-1:2007 is one in which some of the properties of passive fire protection materials can be determined and is designed to give an indication of how passive fire protection materials will perform in a jet fire. The dimensions of the test specimen may be smaller than typical items of structure and plant and the release of gas may be substantially less than that which might occur in a credible event. However, individual thermal and mechanical loads imparted to the passive fire protection material, from the jet fire defined in the procedure described in ISO 22899-1: 2007, have been shown to be similar to those by large-scale jet fires resulting from high pressure releases of natural gas.

Although the test method has been designed to simulate some of the conditions that occur in an actual jet fire, it cannot reproduce them all exactly and the thermal and mechanical loads do not necessarily coincide. The results of this test do not guarantee safety but may be used as elements of a fire risk assessment for structures or plant. This should also take into account all the other factors that are pertinent to an assessment of the fire hazard for a particular end use. This test is not intended to replace the hydrocarbon fire resistance test (ISO/TR 834-3/EN 1363-2 or equivalent) but is seen as a complimentary test.

ATTACHMENT TO CERTIFICATE OF FIRE APPROVAL No. SAS F190094-04

PLACES OF PRODUCTION

Thermal Ceramics France
Saint Marcellin Plant
Lieu-dit Les Plantées St.
Marcellin-en-Forez, F-42680
France

Thermal Ceramics Inc.
2102 Old Savannah Road
Augusta
GA 30906
United States of America (USA)

Thermal Ceramics Korea (Daegu)
1-31 Bookdong, Non Gong Eup
Dal Sung-Gun, Dae Gui-Shi
711 855
Republic of Korea

Grupo Industrial Morgan SA de CV
Cerrada de la Paz No. 101
Zona Industrial la Paz
CP. 4218
Mineral de la Reforma Hidalgo
México

Murugappa Morgan Thermal Ceramics Ltd.
Plot No. 26 & 27 SIPCOT Industrial Complex
Ranipet 632 403
Vellore District, Tamil Nadu
India

Murugappa Morgan Thermal Ceramics Ltd.
Plots No. 681 Village Moti Bhoyan
Kalol-sanand Road
Dist. Gandhinagar
Pin 382 721, Gujarat
India

Morgan Thermal Ceramics (Shanghai) Co., Ltd.
18 Kang An Road
Kangqiao Industrial Zone
Pudong, Shanghai
201315
China

Morgan Kailong (Jingmen) Thermal Ceramics Co., Ltd.
No. 20-1, Quankou Road
Jingmen City
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448032
China

Morgan Advanced Materials Industries Limited
PO Box 146109
Plot No. KHIA4-07A
Khalifa Industrial Zone
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United Arab Emirates (UAE)

Keith Taylor
Team Lead, Fire & Safety
Fire & Safety, Statutory Discipline Team
UK&I Technical Support Office, Marine & Offshore
Lloyd's Register EMEA

Supplementary Type Approval Terms and Conditions

This Certificate and Design Appraisal Document relates to type approval, it certifies that the prototype(s) of the product(s) referred to herein has/have been found to meet the applicable design criteria for the use specified herein, it does not mean or imply approval for any other use, nor approval of any products designed or manufactured otherwise than in strict conformity with the said prototype(s).

ATTACHMENT TO CERTIFICATE OF FIRE APPROVAL No. SAS F190094-04

APPENDIX 1 – 10 Minute Jet Fire Duration

Minimum thickness (mm) of the "FireMaster Marine Plus Blanket" (128kg/m^3 density) for **jet fires** applied to Structural Steel tubular sections, necessary to restrict the mean temperature rises of the steel cores to the specified temperature (°C) at **10 minutes**, as a function of the cross-sectional area and exposed perimeter of the structural element, represented by the Hp/A value.

Where: 'Hp' is the perimeter of the member exposed to the jet fire (m); and
'A' is the cross-sectional area of the member exposed to the jet fire (m^2).

Structural Element Hp/A (m^{-1})	Minimum thickness (mm) at Design Temperature (°C)				
	200	250	300	350	400
60	25	25	25	25	25
65	27	25	25	25	25
70	28	25	25	25	25
75	30	25	25	25	25
80	31	25	25	25	25
85	32	25	25	25	25
90	33	25	25	25	25
95	34	25	25	25	25
100	34	25	25	25	25
105	35	25	25	25	25
110	36	25	25	25	25
115	36	25	25	25	25
120	37	25	25	25	25
125	38	26	25	25	25
130	38	27	25	25	25
135	38	27	25	25	25
140	39	28	25	25	25
145	39	28	25	25	25
150	40	29	25	25	25
155	40	29	25	25	25
160	40	30	25	25	25
165	41	30	25	25	25
170	41	31	25	25	25
175	41	31	25	25	25
180	41	31	26	25	25
185	42	32	26	25	25
190	42	32	27	25	25
195	42	32	27	25	25
200	42	33	27	25	25
205	43	33	28	25	25

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APPENDIX 2 – 15 Minute Jet Fire Duration

Minimum thickness (mm) of the "FireMaster Marine Plus Blanket" (128kg/m^3 density) for **jet fires** applied to Structural Steel tubular sections, necessary to restrict the mean temperature rises of the steel cores to the specified temperature (°C) at **15 minutes**, as a function of the cross-sectional area and exposed perimeter of the structural element, represented by the Hp/A value.

Where: 'Hp' is the perimeter of the member exposed to the jet fire (m); and
'A' is the cross-sectional area of the member exposed to the jet fire (m^2).

Structural Element Hp/A (m^{-1})	Minimum thickness (mm) at Design Temperature (°C)				
	200	250	300	350	400
60	36	25	25	25	25
65	38	25	25	25	25
70	40	25	25	25	25
75	41	25	25	25	25
80	42	25	25	25	25
85	43	27	25	25	25
90	44	28	25	25	25
95	45	29	25	25	25
100	46	31	25	25	25
105	47	32	25	25	25
110	48	32	25	25	25
115	48	33	25	25	25
120	49	34	26	25	25
125	50	35	27	25	25
130	50	36	28	25	25
135	51	36	29	25	25
140	51	37	29	25	25
145	52	37	30	25	25
150	52	38	31	25	25
155	52	38	31	26	25
160	53	39	32	26	25
165	53	39	32	27	25
170	53	40	33	27	25
175	54	40	33	28	25
180	54	41	34	29	25
185	54	41	34	29	25
190	55	41	35	30	25
195	55	42	35	30	26
200	55	42	35	30	26
205	55	42	36	31	27

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APPENDIX 3 – 30 Minute Jet Fire Duration

Minimum thickness (mm) of the "FireMaster Marine Plus Blanket" (128kg/m^3 density) for **jet fires** applied to Structural Steel tubular sections, necessary to restrict the mean temperature rises of the steel cores to the specified temperature (°C) at **30 minutes**, as a function of the cross-sectional area and exposed perimeter of the structural element, represented by the Hp/A value.

Where: 'Hp' is the perimeter of the member exposed to the jet fire (m); and
'A' is the cross-sectional area of the member exposed to the jet fire (m^2).

Structural Element Hp/A (m^{-1})	Minimum thickness (mm) at Design Temperature (°C)				
	200	250	300	350	400
60	68	41	27	25	25
65	71	44	30	25	25
70	73	46	32	25	25
75	75	48	34	25	25
80	76	50	36	27	25
85	78	52	38	29	25
90	79	53	40	31	25
95	80	55	42	32	25
100	82	56	43	34	27
105	83	57	45	35	28
110	84	58	46	37	30
115	84	59	47	38	31
120	85	60	48	39	32
125	86	61	49	40	33
130	87	62	50	42	35
135	87	63	51	43	36
140	88	64	52	44	37
145	89	64	53	44	38
150	89	65	54	45	39
155	90	65	54	46	40
160	90	66	55	47	40
165	91	67	56	48	41
170	91	67	56	49	42
175	92	68	57	49	43
180	92	68	58	50	44
185	92	68	58	50	44
190	93	69	59	51	45
195	93	69	59	52	46
200	93	70	60	52	46
205	94	70	60	53	47

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APPENDIX 4 – 45 Minute Jet Fire Duration

Minimum thickness (mm) of the "FireMaster Marine Plus Blanket" (128kg/m^3 density) for **jet fires** applied to Structural Steel tubular sections, necessary to restrict the mean temperature rises of the steel cores to the specified temperature (°C) at **45 minutes**, as a function of the cross-sectional area and exposed perimeter of the structural element, represented by the Hp/A value.

Where: 'Hp' is the perimeter of the member exposed to the jet fire (m); and
'A' is the cross-sectional area of the member exposed to the jet fire (m^2).

Structural Element Hp/A (m^{-1})	Minimum thickness (mm) at Design Temperature (°C)				
	200	250	300	350	400
60	100	64	45	32	25
65	103	67	48	35	26
70	106	70	51	38	29
75	108	73	54	41	32
80	110	75	56	44	34
85	112	77	59	46	36
90	114	79	61	48	39
95	115	80	63	50	41
100	117	82	64	52	43
105	118	83	66	54	45
110	119	84	67	56	46
115	120	86	69	57	48
120	121	87	70	59	49
125	122	88	71	60	51
130	123	89	73	61	52
135	124	89	74	62	54
140	125	90	75	64	55
145	126	91	76	65	56
150	126	92	77	66	57
155	127	92	77	67	58
160	128	93	78	68	59
165	128	94	79	69	60
170	129	94	80	70	61
175	129	95	81	70	62
180	130	95	81	71	63
185	130	96	82	72	64
190	131	96	82	73	65
195	131	97	83	73	65
200	131	97	84	74	66
205	132	98	84	75	67

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APPENDIX 5 – 60 Minute Jet Fire Duration

Minimum thickness (mm) of the "FireMaster Marine Plus Blanket" (128kg/m^3 density) for **jet fires** applied to Structural Steel tubular sections, necessary to restrict the mean temperature rises of the steel cores to the specified temperature (°C) at **60 minutes**, as a function of the cross-sectional area and exposed perimeter of the structural element, represented by the Hp/A value.

Where: 'Hp' is the perimeter of the member exposed to the jet fire (m); and
'A' is the cross-sectional area of the member exposed to the jet fire (m^2).

Structural Element Hp/A (m^{-1})	Minimum thickness (mm) at Design Temperature (°C)				
	200	250	300	350	400
60	132	88	63	47	35
65	136	91	67	51	39
70	139	94	70	54	43
75	142	97	73	57	46
80	144	100	76	60	49
85	147	102	79	63	51
90	149	104	81	66	54
95	150	106	83	68	56
100	-	107	85	70	59
105	-	109	87	72	61
110	-	110	89	74	63
115	-	112	91	76	65
120	-	113	92	78	67
125	-	114	94	79	68
130	-	115	95	81	70
135	-	116	96	82	71
140	-	117	97	84	73
145	-	118	99	85	74
150	-	119	100	86	76
155	-	119	101	87	77
160	-	120	102	88	78
165	-	121	102	90	79
170	-	122	103	91	80
175	-	122	104	92	81
180	-	123	105	92	82
185	-	123	106	93	83
190	-	124	106	94	84
195	-	124	107	95	85
200	-	125	108	96	86
205	-	125	108	97	87

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APPENDIX 6 – JET FIRE TEST RESULTS

Test Results for Insulated Tubular Section Hp/A 65m^{-1} (26mm thick) [GL Noble Denton Report No. 13956, Issue 3, dated 24 July 2013]:

Test Description: A jet fire test was performed on a steel tubular section with an Hp/A section factor of 65m^{-1} in accordance with ISO 22899-1:2007.

Description of Test Specimen: 3 metre long circular steel hollow section 219mm OD/203mm ID, wall thickness: 8.0mm and a Section Factor (Hp/A) of 65m^{-1}; fitted with a "FireMaster Marine Plus Blanket " jet fire resistant insulation system with both circumferential and longitudinal joints of the insulation and the 0.6mm thick stainless steel outer cladding sheets, all secured by stainless steel securing bands 20mm wide x 1mm thick with screw fasteners, fitted around the jacket at 200mm centres and 100mm from circumferential joints, which were overlapped for 75mm and sealed with "Dow Corning Firestop 700" mastic.

The stainless steel cladding panel longitudinal joints were secured together by No. 8 stainless steel self-tapping screws at 100mm centres and the specimen insulation consisted of: two layers of "FireMaster Marine Plus Blanket" with staggered overlap joints (both 13mm thick, 128 kg/m^3 density), with a total nominal thickness of 26mm.

Integrity: 60 minutes (protection remained intact for duration of test)

Insulation: The following maximum temperature rises for **jet fire exposure** were recorded on the tubular specimen (Hp/A of 65m^{-1}) in line with ISO 22899-1:2007:

after 15 minutes of exposure	158.0°C	after 45 minutes of exposure	416.8°C
after 30 minutes of exposure	303.6°C	after 60 minutes of exposure	511.3°C

Classification: The "FireMaster Marine Plus Blanket" tubular specimen (Hp/A of 65m^{-1}) protection system may be assigned the following Jet Fire Exposure Classifications (Exposure Type / Protected Equipment / Critical Temperature Rise / Minutes) in line with ISO 22899-1:2007:

JF/Tubular Sections/100/5	**JF/Tubular Sections/300/25**	**JF/Tubular Sections/500/55**
JF/Tubular Sections/150/10	**JF/Tubular Sections/350/35**	**JF/Tubular Sections/550/60**
JF/Tubular Sections/200/15	**JF/Tubular Sections/400/40**	
JF/Tubular Sections/250/20	**JF/Tubular Sections/450/45**	

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Test Results for Insulated Tubular Section Hp/A 205m^{-1} (75mm thick) [GL Noble Denton Report No. 13406, Issue 4, dated 22 February 2013]:

Test Description: A jet fire test was performed on a steel tubular section with an Hp/A section factor of 205m^{-1} in accordance with ISO 22899-1:2007.

Description of Test Specimen: 3 metre long circular steel hollow section 193.7mm OD/183.7mm ID, wall thickness: 5.0mm and a Section Factor (Hp/A) of 205m^{-1}; fitted with a "FireMaster Marine Plus Blanket " jet fire resistant insulation system with both circumferential and longitudinal joints of the insulation and the 0.6mm thick stainless steel outer cladding sheets, all secured by stainless steel securing bands 20mm wide x 1mm thick with screw fasteners, fitted around the jacket at 200mm centres and 100mm from circumferential joints, which were overlapped for 75mm and sealed with "Dow Corning Firestop 700" mastic.

The stainless steel cladding panel longitudinal joints were secured together by No.8 stainless steel self-tapping screws at 100mm centres and the specimen insulation consisted of: two layers of "FireMaster Marine Plus Blanket" with staggered overlap joints (first layer 50mm thick and second layer 25mm thick, both 128 kg/m^3 density), with a total nominal thickness of 75mm.

Integrity: 60 minutes (protection remained intact for duration of test)

Insulation: The following maximum temperature rises for **jet fire exposure** were recorded on the tubular specimen (Hp/A of 205m^{-1}) in line with ISO 22899-1:2007:

after 15 minutes of exposure	36.2°C	after 45 minutes of exposure	346.7°C
after 30 minutes of exposure	190.9°C	after 60 minutes of exposure	474.0°C

Classification: The "FireMaster Marine Plus Blanket" tubular specimen (Hp/A of 205m^{-1}) protection system may be assigned the following Jet Fire Exposure Classifications (Exposure Type / Protected Equipment / Critical Temperature Rise / Minutes) in line with ISO 22899-1:2007:

JF/Tubular Sections/100/20	**JF/Tubular Sections/250/35**	**JF/Tubular Sections/400/50**
JF/Tubular Sections/150/25	**JF/Tubular Sections/300/40**	**JF/Tubular Sections/450/55**
JF/Tubular Sections/200/30	**JF/Tubular Sections/350/45**	**JF/Tubular Sections/500/60**

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Test Results for Insulated Tubular Section Hp/A 170m^{-1} (88mm thick) [DNV-GL Report No. 10179348, Rev. 1, dated 22 July 2020]:

Test Description: A jet fire test was performed on a steel tubular section with an Hp/A section factor of 170m^{-1} in accordance with ISO 22899-1:2007.

Description of Test Specimen: 3 metre long circular steel hollow section 114.3mm OD/101.7mm ID, wall thickness: 6.3mm and a Section Factor (Hp/A) of 170m^{-1}; fitted with a "FireMaster Marine Plus Blanket" jet fire resistant insulation system with both circumferential and longitudinal joints of the insulation and 0.7mm thick stainless steel outer cladding sheets, all secured by stainless steel securing bands 20mm wide x 1mm thick with screw fasteners, fitted around the jacket at 200mm centres and 100mm from circumferential joints, which were overlapped for 75mm and sealed with "DOWSIL™ Firestop 700 Sealant" Manufactured by Dow Chemical Company Ltd.

The stainless steel cladding panel longitudinal joints were secured together by stainless steel rivets (Ø10mm) at 100mm centres longitudinally and 88mm centres circumferentially and the specimen insulation consisted of: two layers of "FireMaster Marine Plus Blanket" with staggered overlap joints (first layer 38mm thick and second layer 50mm thick, both 128 kg/m^3 density), with a total nominal thickness of 75mm.

A vapour protection barrier was incorporated into this "FireMaster Marine Plus Blanket" Protection System and composed of 1 layer of 0.049mm thick "VaporStop™ Foil 12/25/12" Manufactured by Temati, installed over the first 38mm thick layer of Morgan FireMaster Marine Plus Blanket (Density: 128 kg/m^3). All joints in the "VaporStop™ Foil 12/25/12" were overlapped by 75mm and sealed with "VaporStop™ Foil 12/25/12" Adhesive Tape Manufactured by Temati.

Integrity: 65 minutes (protection remained intact for duration of test)

Insulation: The following maximum temperature rises for **jet fire exposure** were recorded on the tubular specimen (Hp/A of 170m^{-1}) in line with ISO 22899-1:2007:

after 15 minutes of exposure	41.0°C	after 60 minutes of exposure	359.1°C
after 30 minutes of exposure	157.6°C	after 65 minutes of exposure	388.9°C
after 45 minutes of exposure	264.8°C		

Classification: The "FireMaster Marine Plus Blanket" tubular specimen (Hp/A of 170m^{-1}) protection system may be assigned the following Jet Fire Exposure Classifications (Exposure Type / Protected Equipment / Critical Temperature Rise / Minutes) in line with ISO 22899-1:2007:

JF/Tubular Sections/100/20	**JF/Tubular Sections/250/40**	**JF/Tubular Sections/400/65**
JF/Tubular Sections/150/25	**JF/Tubular Sections/300/50**	
JF/Tubular Sections/200/35	**JF/Tubular Sections/350/55**	