

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 Standard Fire Protection System
Description	Structural Steel 'I' and 'H' Sections protected with "FireMaster Marine Plus Blanket" Silicate Fibre Blanket (96 kg/m ³ density), for Standard (Cellulosic) Fire Exposures
Trade Name	FireMaster Marine Plus Blanket
Specified Standard	BS EN 1363-2:1999 "Fire resistance tests, Part 2: Alternative and additional procedures" BS EN 13381-4:2013 "Test methods for determining the contribution to the fire resistance of structural members, Part 4: Applied passive protection to steel members"

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.

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

Keith Taylor

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

Lloyd's Register Group Limited, its affiliates and subsidiaries and their respective officers, employees or agents are, individually and collectively, referred to in this clause as 'Lloyd's Register'. Lloyd's Register assumes no responsibility and shall not be liable to any person for any loss, damage or expense caused by reliance on the information or advice in this document or howsoever provided, unless that person has signed a contract with the relevant Lloyd's Register entity for the provision of this information or advice and in that case any responsibility or liability is exclusively on the terms and conditions set out in that contract.

ATTACHMENT TO CERTIFICATE OF FIRE APPROVAL No. LR21195641SF

This Design Appraisal Document forms part of the Certificate.

This Certificate is a renewal of previous Lloyd's Register Certificate of Fire Approval No: SAS F160115.

APPROVAL DOCUMENTATION

1. BRE Global Test Report, Watford, Herts, UK, Fire Test Report No's: 296765 Issue 1, dated 05 March 2015; 296766 Issue 1, dated 06 March 2015; 296767 Issue 1, dated 06 March 2015; 297811 Issue 1, dated 15 May 2016; 297812 Issue 1, dated 19 May 2015; and 297813 Issue 1, dated 19 May 2016. (Fire Tests)
2. BRE Global Assessment Report, Watford, Herts, UK, Report No's. CC 300892A, Review 1 Issue 1, dated 01 July 2020.; and CC 300892B, Review 1 Issue 1, dated 01 July 2020. (Regression Assessments)

CONDITIONS OF CERTIFICATION

1. Application in each case to be approved by Lloyd's Register at the design stage.
2. Evaluation of the results for Standard (Cellulosic) Fire Exposure for applications on Structural Steel 'I' or 'H' Sections are given in Appendices 1 to 12 of this Certificate.
3. The "FireMaster Marine Plus Blanket" Silicate Fibre Blanket (96 kg/m³ density) for Standard (Cellulosic) Fire Exposures may be considered for applications for Structural Steel 'I' or 'H' Sections and shall consist one of the following construction composition and securing arrangements depending upon the required protection system thickness:

Protection System Construction and Securing Arrangements:

Thickness:

≤ 52mm thick One Layer of "FireMaster Marine Plus Blanket" Silicate Fibre Blanket (96 kg/m³ density) retained to a steel structural member by 3mm diameter welded steel pins with a length of approximately 15mm greater than the blanket thickness, spaced at 150mm centres to all flanges, webs and 50mm from all insulation joints

> 52mm thick Two Layers of "FireMaster Marine Plus Blanket" Silicate Fibre Blanket (96 kg/m³ density) retained to a steel structural member by 3mm diameter welded steel pins with a length of approximately 15mm greater than the blanket thickness spaced at 150mm centres, to all flanges, webs and insulation joints

4. When multiple layers are used, the lesser thicknesses are to be positioned on the outside.
5. Suitable approved insulation shall be applied to any other part of the protected exposed surfaces not covered by the insulation protection 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.

ATTACHMENT TO CERTIFICATE OF FIRE APPROVAL No. LR21195641SF

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.

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 Hubei Province 448032 China	



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

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. LR21195641SF

APPENDIX 1 – 150°C Critical Core Temperature

Minimum thickness of “FireMaster Marine Plus Blanket” Silicate Fibre Blanket (96 kg/m³ density) with securing arrangements as per Condition No. 3 of this Certificate for **Standard (Cellulosic) Fire Exposures** applied to a structural steel ‘I’ and ‘H’ Sections, necessary to restrict the mean temperature rise of the steel core to **150°C**, within the specified time period, in 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 hydrocarbon fire (m); and
 ‘A’ is the cross-sectional area of the member exposed to the hydrocarbon fire (m²).

One OR Two Layers of “FireMaster Marine Plus Blanket” (96 kg/m³ density)					
<i>For insulation thicknesses ≤ 52mm = One Layer</i>			<i>For insulation thicknesses > 52mm = Two Layers</i>		
Structural Element Hp/A (m⁻¹)	Minimum thickness (mm) at fire duration (mins)				
	30	60	90	120	180
70	22	52	72	-	-
75	22	52	77	-	-
80	23	60	80	-	-
85	24	60	84	-	-
90	25	60	86	-	-
95	26	60	89	-	-
100	27	60	91	-	-
105	28	60	-	-	-
110	29	60	-	-	-
115	30	60	-	-	-
120	31	62	-	-	-
125	31	64	-	-	-
130	32	65	-	-	-
135	33	66	-	-	-
140	34	67	-	-	-
145	35	68	-	-	-
150	35	69	-	-	-
155	36	70	-	-	-
160	37	71	-	-	-
165	37	72	-	-	-
170	38	73	-	-	-
175	39	73	-	-	-
180	39	74	-	-	-
185	40	75	-	-	-
190	41	75	-	-	-
195	41	76	-	-	-

ATTACHMENT TO CERTIFICATE OF FIRE APPROVAL No. LR21195641SF

One OR Two Layers of "FireMaster Marine Plus Blanket" (96 kg/m³ density)					
<i>For insulation thicknesses ≤ 52mm = One Layer</i>			<i>For insulation thicknesses > 52mm = Two Layers</i>		
Structural Element Hp/A (m⁻¹)	Minimum thickness (mm) at fire duration (mins)				
	30	60	90	120	180
200	42	76	-	-	-
205	42	77	-	-	-
210	43	77	-	-	-
215	43	78	-	-	-
220	44	78	-	-	-
225	45	79	-	-	-
230	45	79	-	-	-
235	46	80	-	-	-
240	46	80	-	-	-
245	47	80	-	-	-
250	47	81	-	-	-
255	47	81	-	-	-
260	48	81	-	-	-
265	48	82	-	-	-
270	49	82	-	-	-
275	49	82	-	-	-
280	50	82	-	-	-
285	50	83	-	-	-
290	51	83	-	-	-
295	51	83	-	-	-
300	51	83	-	-	-
305	52	84	-	-	-
310	52	84	-	-	-
315	60	84	-	-	-
320	60	84	-	-	-
325	60	84	-	-	-
330	60	85	-	-	-
335	60	85	-	-	-
340	60	85	-	-	-
345	60	85	-	-	-
350	60	85	-	-	-
355	60	85	-	-	-
360	60	86	-	-	-
365	60	86	-	-	-
370	60	86	-	-	-

ATTACHMENT TO CERTIFICATE OF FIRE APPROVAL No. LR21195641SF

APPENDIX 2 – 200°C Critical Core Temperature

Minimum thickness of “FireMaster Marine Plus Blanket” Silicate Fibre Blanket (96 kg/m³ density) with securing arrangements as per Condition No. 3 of this Certificate for **Standard (Cellulosic) Fire Exposures** applied to a structural steel ‘I’ and ‘H’ Sections, necessary to restrict the mean temperature rise of the steel core to **200°C**, within the specified time period, in 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 hydrocarbon fire (m); and
 ‘A’ is the cross-sectional area of the member exposed to the hydrocarbon fire (m²).

One OR Two Layers of “FireMaster Marine Plus Blanket” (96 kg/m³ density)					
<i>For insulation thicknesses ≤ 52mm = One Layer</i>			<i>For insulation thicknesses > 52mm = Two Layers</i>		
Structural Element Hp/A (m⁻¹)	Minimum thickness (mm) at fire duration (mins)				
	30	60	90	120	180
70	19	39	60	80	-
75	19	39	60	85	-
80	19	41	60	89	-
85	19	43	62	92	-
90	19	45	65	-	-
95	19	47	68	-	-
100	19	49	70	-	-
105	20	51	73	-	-
110	20	60	75	-	-
115	21	60	77	-	-
120	22	60	78	-	-
125	22	60	80	-	-
130	23	60	81	-	-
135	23	60	83	-	-
140	24	60	84	-	-
145	25	60	85	-	-
150	25	60	86	-	-
155	26	60	87	-	-
160	26	60	88	-	-
165	27	60	89	-	-
170	27	60	90	-	-
175	28	61	91	-	-
180	28	62	92	-	-
185	29	63	92	-	-
190	29	64	-	-	-
195	30	64	-	-	-

ATTACHMENT TO CERTIFICATE OF FIRE APPROVAL No. LR21195641SF

One OR Two Layers of "FireMaster Marine Plus Blanket" (96 kg/m³ density)					
<i>For insulation thicknesses ≤ 52mm = One Layer</i>			<i>For insulation thicknesses > 52mm = Two Layers</i>		
Structural Element Hp/A (m⁻¹)	Minimum thickness (mm) at fire duration (mins)				
	30	60	90	120	180
200	30	64	-	-	-
205	31	65	-	-	-
210	31	66	-	-	-
215	32	67	-	-	-
220	32	67	-	-	-
225	33	67	-	-	-
230	33	67	-	-	-
235	33	68	-	-	-
240	34	68	-	-	-
245	34	69	-	-	-
250	35	69	-	-	-
255	35	70	-	-	-
260	35	70	-	-	-
265	36	70	-	-	-
270	36	71	-	-	-
275	36	71	-	-	-
280	37	71	-	-	-
285	37	71	-	-	-
290	37	72	-	-	-
295	38	72	-	-	-
300	38	72	-	-	-
305	38	73	-	-	-
310	39	73	-	-	-
315	39	73	-	-	-
320	39	73	-	-	-
325	40	74	-	-	-
330	40	74	-	-	-
335	40	74	-	-	-
340	41	74	-	-	-
345	41	74	-	-	-
350	41	75	-	-	-
355	41	75	-	-	-
360	42	75	-	-	-
365	-	75	-	-	-
370	-	75	-	-	-

ATTACHMENT TO CERTIFICATE OF FIRE APPROVAL No. LR21195641SF

APPENDIX 3 – 250°C Critical Core Temperature

Minimum thickness of “FireMaster Marine Plus Blanket” Silicate Fibre Blanket (96 kg/m³ density with securing arrangements as per Condition No. 3 of this Certificate for **Standard (Cellulosic) Fire Exposures** applied to a structural steel ‘I’ and ‘H’ Sections, necessary to restrict the mean temperature rise of the steel core to **250°C**, within the specified time period, in 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 hydrocarbon fire (m); and
 ‘A’ is the cross-sectional area of the member exposed to the hydrocarbon fire (m²).

One OR Two Layers of “FireMaster Marine Plus Blanket” (96 kg/m³ density)					
<i>For insulation thicknesses ≤ 52mm = One Layer</i>			<i>For insulation thicknesses > 52mm = Two Layers</i>		
Structural Element Hp/A (m⁻¹)	Minimum thickness (mm) at fire duration (mins)				
	30	60	90	120	180
70	19	31	50	60	-
75	19	31	50	64	-
80	19	32	60	68	-
85	19	34	60	72	-
90	19	36	60	75	-
95	19	37	60	78	-
100	19	39	60	81	-
105	19	40	60	83	-
110	19	42	60	86	-
115	19	43	62	88	-
120	19	44	64	90	-
125	19	46	65	91	-
130	19	47	67	-	-
135	19	48	68	-	-
140	19	50	70	-	-
145	19	51	71	-	-
150	19	52	72	-	-
155	19	60	73	-	-
160	19	60	74	-	-
165	19	60	75	-	-
170	20	60	76	-	-
175	20	60	77	-	-
180	21	60	78	-	-
185	21	60	79	-	-
190	21	60	80	-	-
195	22	60	80	-	-

ATTACHMENT TO CERTIFICATE OF FIRE APPROVAL No. LR21195641SF

One OR Two Layers of "FireMaster Marine Plus Blanket" (96 kg/m³ density)					
<i>For insulation thicknesses ≤ 52mm = One Layer</i>			<i>For insulation thicknesses > 52mm = Two Layers</i>		
Structural Element Hp/A (m⁻¹)	Minimum thickness (mm) at fire duration (mins)				
	30	60	90	120	180
200	22	60	81	-	-
205	22	60	82	-	-
210	23	60	82	-	-
215	23	60	83	-	-
220	23	60	83	-	-
225	24	60	84	-	-
230	24	60	84	-	-
235	24	60	85	-	-
240	25	60	85	-	-
245	25	60	86	-	-
250	25	60	86	-	-
255	26	60	87	-	-
260	26	61	87	-	-
265	26	61	88	-	-
270	26	62	88	-	-
275	27	62	88	-	-
280	27	62	89	-	-
285	27	63	89	-	-
290	28	63	89	-	-
295	28	63	90	-	-
300	28	64	90	-	-
305	28	64	90	-	-
310	29	65	90	-	-
315	29	65	91	-	-
320	29	65	91	-	-
325	29	65	91	-	-
330	30	65	91	-	-
335	30	65	92	-	-
340	30	66	92	-	-
345	30	66	92	-	-
350	31	66	92	-	-
355	31	66	-	-	-
360	31	66	-	-	-
365	-	67	-	-	-
370	-	67	-	-	-

ATTACHMENT TO CERTIFICATE OF FIRE APPROVAL No. LR21195641SF

APPENDIX 4 – 300°C Critical Core Temperature

Minimum thickness of “FireMaster Marine Plus Blanket” Silicate Fibre Blanket (96 kg/m³ density) with securing arrangements as per Condition No. 3 of this Certificate for **Standard (Cellulosic) Fire Exposures** applied to a structural steel ‘I’ and ‘H’ Sections, necessary to restrict the mean temperature rise of the steel core to **300°C**, within the specified time period, in 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 hydrocarbon fire (m); and
 ‘A’ is the cross-sectional area of the member exposed to the hydrocarbon fire (m²).

One OR Two Layers of “FireMaster Marine Plus Blanket” (96 kg/m³ density)					
<i>For insulation thicknesses ≤ 52mm = One Layer</i>			<i>For insulation thicknesses > 52mm = Two Layers</i>		
Structural Element Hp/A (m⁻¹)	Minimum thickness (mm) at fire duration (mins)				
	30	60	90	120	180
70	19	25	42	60	87
75	19	25	42	60	-
80	19	26	44	60	-
85	19	27	46	60	-
90	19	29	48	60	-
95	19	30	50	60	-
100	19	31	60	63	-
105	19	33	60	66	-
110	19	34	60	69	-
115	19	35	60	71	-
120	19	36	60	73	-
125	19	37	60	75	-
130	19	38	60	77	-
135	19	39	60	79	-
140	19	41	60	80	-
145	19	42	60	82	-
150	19	43	62	83	-
155	19	44	63	85	-
160	19	45	64	86	-
165	19	46	65	87	-
170	19	47	66	88	-
175	19	48	67	89	-
180	19	49	68	90	-
185	19	50	69	91	-
190	19	51	69	92	-
195	19	52	70	-	-

ATTACHMENT TO CERTIFICATE OF FIRE APPROVAL No. LR21195641SF

One OR Two Layers of "FireMaster Marine Plus Blanket" (96 kg/m³ density)					
<i>For insulation thicknesses ≤ 52mm = One Layer</i>			<i>For insulation thicknesses > 52mm = Two Layers</i>		
Structural Element Hp/A (m⁻¹)	Minimum thickness (mm) at fire duration (mins)				
	30	60	90	120	180
200	19	60	71	-	-
205	19	60	72	-	-
210	19	60	72	-	-
215	19	60	73	-	-
220	19	60	73	-	-
225	19	60	74	-	-
230	19	60	75	-	-
235	19	60	75	-	-
240	19	60	76	-	-
245	19	60	76	-	-
250	19	60	77	-	-
255	19	60	77	-	-
260	19	60	77	-	-
265	19	60	78	-	-
270	19	60	78	-	-
275	19	60	79	-	-
280	20	60	79	-	-
285	20	60	79	-	-
290	20	60	80	-	-
295	20	60	80	-	-
300	20	60	80	-	-
305	21	60	81	-	-
310	21	60	81	-	-
315	21	60	82	-	-
320	21	60	82	-	-
325	21	60	82	-	-
330	22	60	82	-	-
335	22	60	82	-	-
340	22	60	83	-	-
345	22	60	83	-	-
350	22	60	83	-	-
355	22	60	83	-	-
360	23	60	84	-	-
365	-	60	84	-	-
370	-	60	84	-	-

ATTACHMENT TO CERTIFICATE OF FIRE APPROVAL No. LR21195641SF

APPENDIX 5 – 350°C Critical Core Temperature

Minimum thickness of “FireMaster Marine Plus Blanket” Silicate Fibre Blanket (96 kg/m³ density) with securing arrangements as per Condition No. 3 of this Certificate for **Standard (Cellulosic) Fire Exposures** applied to a structural steel ‘I’ and ‘H’ Sections, necessary to restrict the mean temperature rise of the steel core to **350°C**, within the specified time period, in 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 hydrocarbon fire (m); and
 ‘A’ is the cross-sectional area of the member exposed to the hydrocarbon fire (m²).

One OR Two Layers of “FireMaster Marine Plus Blanket” (96 kg/m³ density)					
<i>For insulation thicknesses ≤ 52mm = One Layer</i>			<i>For insulation thicknesses > 52mm = Two Layers</i>		
Structural Element Hp/A (m⁻¹)	Minimum thickness (mm) at fire duration (mins)				
	30	60	90	120	180
70	19	20	35	49	70
75	19	20	35	49	75
80	19	22	37	52	80
85	19	23	39	60	84
90	19	24	41	60	87
95	19	25	42	60	91
100	19	26	44	60	-
105	19	27	46	60	-
110	19	28	48	60	-
115	19	29	50	62	-
120	19	30	51	64	-
125	19	31	60	66	-
130	19	32	60	67	-
135	19	33	60	69	-
140	19	34	60	71	-
145	19	34	60	72	-
150	19	35	60	73	-
155	19	36	60	75	-
160	19	37	60	76	-
165	19	38	60	77	-
170	19	39	60	78	-
175	19	40	60	79	-
180	19	40	60	80	-
185	19	41	60	81	-
190	19	42	61	82	-
195	19	43	62	83	-

ATTACHMENT TO CERTIFICATE OF FIRE APPROVAL No. LR21195641SF

One OR Two Layers of "FireMaster Marine Plus Blanket" (96 kg/m³ density)					
<i>For insulation thicknesses ≤ 52mm = One Layer</i>			<i>For insulation thicknesses > 52mm = Two Layers</i>		
Structural Element Hp/A (m⁻¹)	Minimum thickness (mm) at fire duration (mins)				
	30	60	90	120	180
200	19	44	63	83	-
205	19	44	63	84	-
210	19	45	64	85	-
215	19	46	65	86	-
220	19	47	65	86	-
225	19	48	66	87	-
230	19	48	66	87	-
235	19	49	67	88	-
240	19	50	67	89	-
245	19	50	68	89	-
250	19	51	68	90	-
255	19	52	69	90	-
260	19	52	69	91	-
265	19	60	70	91	-
270	19	60	70	91	-
275	19	60	71	92	-
280	19	60	71	92	-
285	19	60	71	-	-
290	19	60	72	-	-
295	19	60	72	-	-
300	19	60	72	-	-
305	19	60	73	-	-
310	19	60	73	-	-
315	19	60	73	-	-
320	19	60	74	-	-
325	19	60	74	-	-
330	19	60	74	-	-
335	19	60	75	-	-
340	19	60	75	-	-
345	19	60	75	-	-
350	19	60	75	-	-
355	19	60	76	-	-
360	19	60	76	-	-
365	-	60	76	-	-
370	-	60	76	-	-

ATTACHMENT TO CERTIFICATE OF FIRE APPROVAL No. LR21195641SF

APPENDIX 6 – 400°C Critical Core Temperature

Minimum thickness of “FireMaster Marine Plus Blanket” Silicate Fibre Blanket (96 kg/m³ density) with securing arrangements as per Condition No. 3 of this Certificate for **Standard (Cellulosic) Fire Exposures** applied to a structural steel ‘I’ and ‘H’ Sections, necessary to restrict the mean temperature rise of the steel core to **400°C**, within the specified time period, in 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 hydrocarbon fire (m); and
 ‘A’ is the cross-sectional area of the member exposed to the hydrocarbon fire (m²).

One OR Two Layers of “FireMaster Marine Plus Blanket” (96 kg/m³ density)					
<i>For insulation thicknesses ≤ 52mm = One Layer</i>			<i>For insulation thicknesses > 52mm = Two Layers</i>		
Structural Element Hp/A (m⁻¹)	Minimum thickness (mm) at fire duration (mins)				
	30	60	90	120	180
70	19	19	30	42	60
75	19	19	30	42	62
80	19	19	31	45	67
85	19	19	33	47	71
90	19	20	35	50	75
95	19	21	36	52	78
100	19	21	38	60	81
105	19	22	39	60	84
110	19	23	41	60	86
115	19	24	42	60	89
120	19	25	44	60	91
125	19	26	45	60	-
130	19	26	47	60	-
135	19	27	48	60	-
140	19	28	50	62	-
145	19	29	51	63	-
150	19	29	52	65	-
155	19	30	60	66	-
160	19	31	60	67	-
165	19	32	60	68	-
170	19	32	60	69	-
175	19	33	60	70	-
180	19	34	60	71	-
185	19	34	60	72	-
190	19	35	60	73	-
195	19	36	60	74	-

ATTACHMENT TO CERTIFICATE OF FIRE APPROVAL No. LR21195641SF

One OR Two Layers of "FireMaster Marine Plus Blanket" (96 kg/m³ density)					
<i>For insulation thicknesses ≤ 52mm = One Layer</i>			<i>For insulation thicknesses > 52mm = Two Layers</i>		
Structural Element Hp/A (m⁻¹)	Minimum thickness (mm) at fire duration (mins)				
	30	60	90	120	180
200	19	36	60	75	-
205	19	37	60	76	-
210	19	38	60	76	-
215	19	38	60	77	-
220	19	39	60	78	-
225	19	40	60	78	-
230	19	40	60	79	-
235	19	41	60	80	-
240	19	41	61	80	-
245	19	42	61	81	-
250	19	43	62	81	-
255	19	43	62	82	-
260	19	44	63	82	-
265	19	44	63	83	-
270	19	45	64	83	-
275	19	46	64	84	-
280	19	46	65	84	-
285	19	47	65	85	-
290	19	47	65	85	-
295	19	48	66	85	-
300	19	48	66	86	-
305	19	49	66	86	-
310	19	49	67	86	-
315	19	50	67	87	-
320	19	50	67	87	-
325	19	51	68	87	-
330	19	51	68	88	-
335	19	52	68	88	-
340	19	52	69	88	-
345	19	60	69	89	-
350	19	60	69	89	-
355	19	60	69	89	-
360	19	60	70	90	-
365	-	60	70	90	-
370	-	60	70	90	-

ATTACHMENT TO CERTIFICATE OF FIRE APPROVAL No. LR21195641SF

APPENDIX 7 – 450°C Critical Core Temperature

Minimum thickness of “FireMaster Marine Plus Blanket” Silicate Fibre Blanket (96 kg/m³ density) with securing arrangements as per Condition No. 3 of this Certificate for **Standard (Cellulosic) Fire Exposures** applied to a structural steel ‘I’ and ‘H’ Sections, necessary to restrict the mean temperature rise of the steel core to **450°C**, within the specified time period, in 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 hydrocarbon fire (m); and
 ‘A’ is the cross-sectional area of the member exposed to the hydrocarbon fire (m²).

One OR Two Layers of “FireMaster Marine Plus Blanket” (96 kg/m³ density)					
<i>For insulation thicknesses ≤ 52mm = One Layer</i>			<i>For insulation thicknesses > 52mm = Two Layers</i>		
Structural Element Hp/A (m⁻¹)	Minimum thickness (mm) at fire duration (mins)				
	30	60	90	120	180
70	19	19	26	37	60
75	19	19	26	37	60
80	19	19	27	39	60
85	19	19	29	41	60
90	19	19	30	43	63
95	19	19	31	45	67
100	19	19	33	47	70
105	19	19	34	49	73
110	19	19	35	51	76
115	19	20	37	60	78
120	19	21	38	60	80
125	19	22	39	60	83
130	19	22	40	60	85
135	19	23	42	60	87
140	19	24	43	60	88
145	19	24	44	60	90
150	19	25	45	60	92
155	19	25	46	60	-
160	19	26	48	60	-
165	19	27	49	60	-
170	19	27	50	61	-
175	19	28	51	62	-
180	19	28	52	64	-
185	19	29	60	65	-
190	19	30	60	65	-
195	19	30	60	66	-

ATTACHMENT TO CERTIFICATE OF FIRE APPROVAL No. LR21195641SF

One OR Two Layers of "FireMaster Marine Plus Blanket" (96 kg/m³ density)					
<i>For insulation thicknesses ≤ 52mm = One Layer</i>			<i>For insulation thicknesses > 52mm = Two Layers</i>		
Structural Element Hp/A (m⁻¹)	Minimum thickness (mm) at fire duration (mins)				
	30	60	90	120	180
200	19	31	60	67	-
205	19	31	60	68	-
210	19	32	60	69	-
215	19	32	60	70	-
220	19	33	60	70	-
225	19	33	60	71	-
230	19	34	60	72	-
235	19	34	60	72	-
240	19	35	60	73	-
245	19	35	60	73	-
250	19	36	60	74	-
255	19	36	60	75	-
260	19	37	60	75	-
265	19	37	60	76	-
270	19	38	60	76	-
275	19	38	60	77	-
280	19	39	60	77	-
285	19	39	60	77	-
290	19	40	60	78	-
295	19	40	60	78	-
300	19	41	60	79	-
305	19	41	60	79	-
310	19	41	61	79	-
315	19	42	61	80	-
320	19	42	61	80	-
325	19	43	62	81	-
330	19	43	62	81	-
335	19	44	62	81	-
340	19	44	63	82	-
345	19	44	63	82	-
350	19	45	63	82	-
355	19	45	64	82	-
360	19	46	64	83	-
365	-	-	64	83	-
370	-	-	64	83	-

ATTACHMENT TO CERTIFICATE OF FIRE APPROVAL No. LR21195641SF

APPENDIX 8 – 500°C Critical Core Temperature

Minimum thickness of “FireMaster Marine Plus Blanket” Silicate Fibre Blanket (96 kg/m³ density) with securing arrangements as per Condition No. 3 of this Certificate for **Standard (Cellulosic) Fire Exposures** applied to a structural steel ‘I’ and ‘H’ Sections, necessary to restrict the mean temperature rise of the steel core to **500°C**, within the specified time period, in 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 hydrocarbon fire (m); and
 ‘A’ is the cross-sectional area of the member exposed to the hydrocarbon fire (m²).

One OR Two Layers of “FireMaster Marine Plus Blanket” (96 kg/m³ density)					
<i>For insulation thicknesses ≤ 52mm = One Layer</i>			<i>For insulation thicknesses > 52mm = Two Layers</i>		
Structural Element Hp/A (m⁻¹)	Minimum thickness (mm) at fire duration (mins)				
	30	60	90	120	180
70	19	19	22	32	60
75	19	19	22	32	60
80	19	19	24	34	60
85	19	19	25	36	60
90	19	19	26	38	60
95	19	19	27	40	60
100	19	19	28	41	60
105	19	19	29	43	62
110	19	19	31	45	65
115	19	19	32	46	68
120	19	19	33	48	70
125	19	19	34	50	73
130	19	19	35	51	75
135	19	19	36	60	77
140	19	20	37	60	79
145	19	20	38	60	80
150	19	21	39	60	82
155	19	21	40	60	83
160	19	22	41	60	85
165	19	22	42	60	86
170	19	23	43	60	88
175	19	23	44	60	89
180	19	24	45	60	90
185	19	24	46	60	91
190	19	25	47	60	92
195	19	25	48	60	-

ATTACHMENT TO CERTIFICATE OF FIRE APPROVAL No. LR21195641SF

One OR Two Layers of "FireMaster Marine Plus Blanket" (96 kg/m³ density)					
<i>For insulation thicknesses ≤ 52mm = One Layer</i>			<i>For insulation thicknesses > 52mm = Two Layers</i>		
Structural Element Hp/A (m⁻¹)	Minimum thickness (mm) at fire duration (mins)				
	30	60	90	120	180
200	19	26	49	60	-
205	19	26	50	61	-
210	19	27	50	62	-
215	19	27	51	62	-
220	19	28	52	63	-
225	19	28	60	64	-
230	19	28	60	65	-
235	19	29	60	65	-
240	19	29	60	66	-
245	19	30	60	66	-
250	19	30	60	67	-
255	19	30	60	68	-
260	19	31	60	68	-
265	19	31	60	69	-
270	19	32	60	69	-
275	19	32	60	70	-
280	19	32	60	70	-
285	19	33	60	71	-
290	19	33	60	71	-
295	19	34	60	72	-
300	19	34	60	72	-
305	19	34	60	72	-
310	19	35	60	73	-
315	19	35	60	73	-
320	19	35	60	74	-
325	19	36	60	74	-
330	19	36	60	74	-
335	19	36	60	75	-
340	19	37	60	75	-
345	19	37	60	75	-
350	19	37	60	76	-
355	19	38	60	76	-
360	19	38	60	76	-
365	-	-	60	76	-
370	-	-	60	77	-

ATTACHMENT TO CERTIFICATE OF FIRE APPROVAL No. LR21195641SF

APPENDIX 9 – 550°C Critical Core Temperature

Minimum thickness of “FireMaster Marine Plus Blanket” Silicate Fibre Blanket (96 kg/m³ density) with securing arrangements as per Condition No. 3 of this Certificate for **Standard (Cellulosic) Fire Exposures** applied to a structural steel ‘I’ and ‘H’ Sections, necessary to restrict the mean temperature rise of the steel core to **550°C**, within the specified time period, in 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 hydrocarbon fire (m); and
 ‘A’ is the cross-sectional area of the member exposed to the hydrocarbon fire (m²).

One OR Two Layers of “FireMaster Marine Plus Blanket” (96 kg/m³ density)					
<i>For insulation thicknesses ≤ 52mm = One Layer</i>			<i>For insulation thicknesses > 52mm = Two Layers</i>		
Structural Element Hp/A (m⁻¹)	Minimum thickness (mm) at fire duration (mins)				
	30	60	90	120	180
70	19	19	19	28	60
75	19	19	19	28	60
80	19	19	20	30	60
85	19	19	21	32	60
90	19	19	23	33	60
95	19	19	24	35	60
100	19	19	25	36	60
105	19	19	25	38	60
110	19	19	26	39	60
115	19	19	27	41	60
120	19	19	28	42	61
125	19	19	29	43	63
130	19	19	30	45	65
135	19	19	31	46	67
140	19	19	32	48	69
145	19	19	33	49	71
150	19	19	34	50	73
155	19	19	35	52	74
160	19	19	36	60	76
165	19	19	36	60	77
170	19	19	37	60	79
175	19	19	38	60	80
180	19	20	39	60	81
185	19	20	40	60	82
190	19	21	40	60	83
195	19	21	41	60	85

ATTACHMENT TO CERTIFICATE OF FIRE APPROVAL No. LR21195641SF

One OR Two Layers of "FireMaster Marine Plus Blanket" (96 kg/m³ density)					
<i>For insulation thicknesses ≤ 52mm = One Layer</i>			<i>For insulation thicknesses > 52mm = Two Layers</i>		
Structural Element Hp/A (m⁻¹)	Minimum thickness (mm) at fire duration (mins)				
	30	60	90	120	180
200	19	21	42	60	86
205	19	22	43	60	86
210	19	22	44	60	87
215	19	22	44	60	88
220	19	23	45	60	89
225	19	23	46	60	90
230	19	24	46	60	91
235	19	24	47	60	91
240	19	24	48	60	92
245	19	25	49	60	-
250	19	25	50	60	-
255	19	25	51	61	-
260	19	26	51	62	-
265	19	26	52	62	-
270	19	26	60	63	-
275	19	27	60	63	-
280	19	27	60	64	-
285	19	27	60	64	-
290	19	28	60	65	-
295	19	28	60	65	-
300	19	28	60	66	-
305	19	28	60	66	-
310	19	29	60	66	-
315	19	29	60	67	-
320	19	29	60	67	-
325	19	30	60	68	-
330	19	30	60	68	-
335	19	30	60	68	-
340	19	30	60	69	-
345	19	31	60	69	-
350	19	31	60	69	-
355	19	31	60	70	-
360	19	32	60	70	-
365	-	-	60	70	-
370	-	-	60	70	-

ATTACHMENT TO CERTIFICATE OF FIRE APPROVAL No. LR21195641SF

APPENDIX 10 – 600°C Critical Core Temperature

Minimum thickness of “FireMaster Marine Plus Blanket” Silicate Fibre Blanket (96 kg/m³ density) with securing arrangements as per Condition No. 3 of this Certificate for **Standard (Cellulosic) Fire Exposures** applied to a structural steel ‘I’ and ‘H’ Sections, necessary to restrict the mean temperature rise of the steel core to **600°C**, within the specified time period, in 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 hydrocarbon fire (m); and
 ‘A’ is the cross-sectional area of the member exposed to the hydrocarbon fire (m²).

One OR Two Layers of “FireMaster Marine Plus Blanket” (96 kg/m³ density)					
<i>For insulation thicknesses ≤ 52mm = One Layer</i>			<i>For insulation thicknesses > 52mm = Two Layers</i>		
Structural Element Hp/A (m⁻¹)	Minimum thickness (mm) at fire duration (mins)				
	30	60	90	120	180
70	19	19	19	26	60
75	19	19	19	26	60
80	19	19	19	27	60
85	19	19	19	29	60
90	19	19	20	30	60
95	19	19	20	32	60
100	19	19	21	33	60
105	19	19	22	35	60
110	19	19	23	36	60
115	19	19	24	37	60
120	19	19	25	39	60
125	19	19	26	40	60
130	19	19	27	42	60
135	19	19	28	43	60
140	19	19	29	44	62
145	19	19	29	46	64
150	19	19	30	47	66
155	19	19	31	48	67
160	19	19	32	50	69
165	19	19	33	51	70
170	19	19	34	52	71
175	19	19	34	60	72
180	19	19	35	60	74
185	19	19	36	60	75
190	19	19	37	60	76
195	19	19	38	60	77

ATTACHMENT TO CERTIFICATE OF FIRE APPROVAL No. LR21195641SF

One OR Two Layers of "FireMaster Marine Plus Blanket" (96 kg/m³ density)					
<i>For insulation thicknesses ≤ 52mm = One Layer</i>			<i>For insulation thicknesses > 52mm = Two Layers</i>		
Structural Element Hp/A (m⁻¹)	Minimum thickness (mm) at fire duration (mins)				
	30	60	90	120	180
200	19	19	38	60	78
205	19	19	39	60	79
210	19	19	40	60	80
215	19	19	41	60	80
220	19	19	41	60	81
225	19	19	42	60	82
230	19	19	43	60	83
235	19	19	44	60	84
240	19	20	44	60	84
245	19	20	45	60	85
250	19	20	46	60	86
255	19	21	46	60	86
260	19	21	47	60	87
265	19	21	48	60	87
270	19	22	49	60	88
275	19	22	49	60	89
280	19	22	50	60	89
285	19	23	51	60	90
290	19	23	51	60	90
295	19	23	52	60	91
300	19	23	60	61	91
305	19	24	60	61	91
310	19	24	60	61	92
315	19	24	60	62	92
320	19	25	60	62	-
325	19	25	60	63	-
330	19	25	60	63	-
335	19	25	60	63	-
340	19	26	60	64	-
345	19	26	60	64	-
350	19	26	60	64	-
355	19	26	60	64	-
360	19	27	60	65	-
365	-	-	60	65	-
370	-	-	60	65	-

ATTACHMENT TO CERTIFICATE OF FIRE APPROVAL No. LR21195641SF

APPENDIX 11 – 650°C Critical Core Temperature

Minimum thickness of “FireMaster Marine Plus Blanket” Silicate Fibre Blanket (96 kg/m³ density) with securing arrangements as per Condition No. 3 of this Certificate for **Standard (Cellulosic) Fire Exposures** applied to a structural steel ‘I’ and ‘H’ Sections, necessary to restrict the mean temperature rise of the steel core to **650°C**, within the specified time period, in 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 hydrocarbon fire (m); and
 ‘A’ is the cross-sectional area of the member exposed to the hydrocarbon fire (m²).

One OR Two Layers of “FireMaster Marine Plus Blanket” (96 kg/m³ density)					
<i>For insulation thicknesses ≤ 52mm = One Layer</i>			<i>For insulation thicknesses > 52mm = Two Layers</i>		
Structural Element Hp/A (m⁻¹)	Minimum thickness (mm) at fire duration (mins)				
	30	60	90	120	180
70	19	19	19	22	60
75	19	19	19	22	60
80	19	19	19	24	60
85	19	19	19	25	60
90	19	19	19	26	60
95	19	19	19	27	60
100	19	19	19	29	60
105	19	19	19	30	60
110	19	19	20	31	60
115	19	19	20	32	60
120	19	19	21	34	60
125	19	19	22	35	60
130	19	19	23	36	60
135	19	19	23	37	60
140	19	19	24	39	60
145	19	19	25	40	60
150	19	19	26	41	60
155	19	19	26	42	60
160	19	19	27	43	61
165	19	19	28	44	63
170	19	19	28	45	64
175	19	19	29	47	65
180	19	19	30	48	66
185	19	19	31	49	67
190	19	19	31	50	68
195	19	19	32	51	69

ATTACHMENT TO CERTIFICATE OF FIRE APPROVAL No. LR21195641SF

One OR Two Layers of "FireMaster Marine Plus Blanket" (96 kg/m³ density)					
<i>For insulation thicknesses ≤ 52mm = One Layer</i>			<i>For insulation thicknesses > 52mm = Two Layers</i>		
Structural Element Hp/A (m⁻¹)	Minimum thickness (mm) at fire duration (mins)				
	30	60	90	120	180
200	19	19	33	52	70
205	19	19	33	60	71
210	19	19	34	60	72
215	19	19	34	60	73
220	19	19	35	60	74
225	19	19	36	60	75
230	19	19	36	60	75
235	19	19	37	60	76
240	19	19	38	60	77
245	19	19	38	60	77
250	19	19	39	60	78
255	19	19	39	60	79
260	19	19	40	60	79
265	19	19	41	60	80
270	19	19	41	60	80
275	19	19	42	60	81
280	19	19	42	60	81
285	19	19	43	60	82
290	19	19	44	60	82
295	19	19	44	60	83
300	19	19	45	60	83
305	19	19	45	60	84
310	19	19	46	60	84
315	19	19	46	60	85
320	19	19	47	60	85
325	19	19	47	60	85
330	19	19	48	60	86
335	19	19	49	60	86
340	19	19	49	60	87
345	19	20	50	60	87
350	19	20	50	60	87
355	19	20	51	60	88
360	19	20	51	60	88
365	-	-	60	60	88
370	-	-	60	60	89

ATTACHMENT TO CERTIFICATE OF FIRE APPROVAL No. LR21195641SF

APPENDIX 12 – 700°C Critical Core Temperature

Minimum thickness of “FireMaster Marine Plus Blanket” Silicate Fibre Blanket (96 kg/m³ density) with securing arrangements as per Condition No. 3 of this Certificate for **Standard (Cellulosic) Fire Exposures** applied to a structural steel ‘I’ and ‘H’ Sections, necessary to restrict the mean temperature rise of the steel core to **700°C**, within the specified time period, in 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 hydrocarbon fire (m); and
 ‘A’ is the cross-sectional area of the member exposed to the hydrocarbon fire (m²).

One OR Two Layers of “FireMaster Marine Plus Blanket” (96 kg/m³ density)					
<i>For insulation thicknesses ≤ 52mm = One Layer</i>			<i>For insulation thicknesses > 52mm = Two Layers</i>		
Structural Element Hp/A (m⁻¹)	Minimum thickness (mm) at fire duration (mins)				
	30	60	90	120	180
70	19	19	19	19	60
75	19	19	19	19	60
80	19	19	19	20	60
85	19	19	19	21	60
90	19	19	19	23	60
95	19	19	19	24	60
100	19	19	19	25	60
105	19	19	19	26	60
110	19	19	19	27	60
115	19	19	19	28	60
120	19	19	19	29	60
125	19	19	19	30	60
130	19	19	19	31	60
135	19	19	19	32	60
140	19	19	20	33	60
145	19	19	21	34	60
150	19	19	21	35	60
155	19	19	22	36	60
160	19	19	22	37	60
165	19	19	23	38	60
170	19	19	24	39	60
175	19	19	24	40	60
180	19	19	25	41	60
185	19	19	25	42	60
190	19	19	26	43	61
195	19	19	26	44	62

ATTACHMENT TO CERTIFICATE OF FIRE APPROVAL No. LR21195641SF

One OR Two Layers of "FireMaster Marine Plus Blanket" (96 kg/m³ density)					
<i>For insulation thicknesses ≤ 52mm = One Layer</i>			<i>For insulation thicknesses > 52mm = Two Layers</i>		
Structural Element Hp/A (m⁻¹)	Minimum thickness (mm) at fire duration (mins)				
	30	60	90	120	180
200	19	19	27	45	63
205	19	19	27	46	64
210	19	19	28	47	65
215	19	19	29	47	66
220	19	19	29	48	66
225	19	19	30	49	67
230	19	19	30	50	68
235	19	19	31	51	69
240	19	19	31	52	69
245	19	19	32	60	70
250	19	19	32	60	71
255	19	19	33	60	71
260	19	19	33	60	72
265	19	19	34	60	72
270	19	19	34	60	73
275	19	19	35	60	73
280	19	19	35	60	74
285	19	19	36	60	74
290	19	19	36	60	75
295	19	19	37	60	75
300	19	19	37	60	76
305	19	19	37	60	76
310	19	19	38	60	77
315	19	19	38	60	77
320	19	19	39	60	77
325	19	19	39	60	78
330	19	19	40	60	78
335	19	19	40	60	78
340	19	19	41	60	79
345	19	19	41	60	79
350	19	19	42	60	80
355	19	19	42	60	80
360	19	19	42	60	80
365	-	-	60	60	80
370	-	-	60	60	81