Lloyd's Register

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 installations classed with Lloyd's Register, and for use on offshore installations when authorised by contracting governments to issue the relevant certificates, licences, permits etc.

Manufacturer	Morgan Advanced Materials, Thermal Ceramics
Address	Tebay Road Bromborough Wirral Merseyside CH62 3PH United Kingdom (UK)
Type	**STRUCTURAL STEEL HYDROCARBON FIRE PROTECTION SYSTEM**
Equipment Description	Structural Steel Tubular Sections protected with "FireMaster Marine Plus Blanket" insulation (Nominal Density 128kg/m^3)
Specified Standard	BS EN 13381-4:2009 (final issue 2013) and BS EN 1363-2:1999 for Hydrocarbon Fire Exposures only.

The attached Design Appraisal Document forms 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.

Date of issue	20 May 2019	Expiry date	19 May 2024
Certificate No.	SAS F190093	Signed	
Sheet No	1 of 17	Name	K. Taylor Surveyor to Lloyd's Register EMEA A Member of the Lloyd's Register Group

Note:

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 of any modification or changes to the equipment in order to obtain a valid Certificate.

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SAS F190093

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ATTACHMENT TO CERTIFICATE OF TYPE APPROVAL No. SAS F190093

This Design Appraisal Document forms part of the Certificate.

This Certificate is a replacement of previous Lloyd's Register EMEA Certificate of Fire Approval No. SAS F140129.

APPROVAL DOCUMENTATION

1. BRE Global, Watford, UK, Fire Test Report No. 278498, dated 11 July 2012.
2. BRE Global, Watford, UK, Assessment Report No. CC 281408, Review 1, Issue 3, dated 15 May 2019.

CONDITIONS OF CERTIFICATION

1. Evaluation of the Hydrocarbon Fire Test Results are given in Appendices 1 to 4 attached to this certificate
2. Consisting of: Various layers of 128kg/m^3 density "FIREMASTER MARINE PLUS BLANKET" fibre insulation retained to a steel structural tubular member by 2mm dia. stainless steel tie wires spaced at 250mm maximum centres and 75mm from circumferential insulation joints. Single layer insulation system with 20mm minimum overlap at all longitudinal joints and circumferential butt joints; multi-layer systems with staggered butt joints throughout
3. Applications in each case to be approved by Lloyd's Register at the design stage
4. 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
5. 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 and manufactured 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
Lieu-dit Les Plantées
St. Marcellin-en-Forez
F-42680
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Thermal Ceramics
2102 Old Savannah Road
Augusta
GA 30906
United States of America (USA)

Thermal Ceramics
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Dal Sung-Gun, Dae Gui-Shi
711 855
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Thermal Ceramics
Cerrada de la Paz No. 101
Zona Industrial la Paz
CP. 4218
Mineral de la Reforma Hidalgo
México

M/S 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
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Morgan Thermal Ceramics
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18 Kang An Road
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Pudong, Shanghai
201315
China

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

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

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).

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Appendix 1

Minimum thickness (mm) of "FIREMASTER MARINE PLUS BLANKET" (128kg/m³ density) applied to a structural steel Tubular Section necessary to restrict the mean temperature rise of the steel cores to the specified temperature (°C) at **10 minutes**, as a function of the cross sectional area and shape 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).

Structural Element Hp/A (m^{-1})	Minimum thickness (mm) at Design Temperature (°C)							
	50	100	150	200	250	300	350	400
60	25	25	25	25	25	25	25	25
65	27	25	25	25	25	25	25	25
70	28	25	25	25	25	25	25	25
75	30	25	25	25	25	25	25	25
80	31	25	25	25	25	25	25	25
85	32	25	25	25	25	25	25	25
90	33	25	25	25	25	25	25	25
95	34	25	25	25	25	25	25	25
100	34	25	25	25	25	25	25	25
105	35	25	25	25	25	25	25	25
110	36	25	25	25	25	25	25	25
115	36	25	25	25	25	25	25	25
120	37	25	25	25	25	25	25	25
125	38	26	25	25	25	25	25	25
130	38	27	25	25	25	25	25	25
135	38	27	25	25	25	25	25	25
140	39	28	25	25	25	25	25	25
145	39	28	25	25	25	25	25	25
150	40	29	25	25	25	25	25	25
155	40	29	25	25	25	25	25	25
160	40	30	25	25	25	25	25	25
165	41	30	25	25	25	25	25	25
170	41	31	25	25	25	25	25	25
175	41	31	25	25	25	25	25	25
180	41	31	26	25	25	25	25	25
185	42	32	26	25	25	25	25	25
190	42	32	27	25	25	25	25	25
195	42	32	27	25	25	25	25	25
200	42	33	27	25	25	25	25	25
205	43	33	28	25	25	25	25	25
210	43	33	28	25	25	25	25	25
215	43	34	28	25	25	25	25	25

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Structural Element Hp/A (m^{-1})	Minimum thickness (mm) at Design Temperature (°C)							
	50	100	150	200	250	300	350	400
220	43	34	29	25	25	25	25	25
225	43	34	29	25	25	25	25	25
230	44	34	29	25	25	25	25	25
235	44	34	30	26	25	25	25	25
240	44	35	30	26	25	25	25	25
245	44	35	30	26	25	25	25	25
250	44	35	30	27	25	25	25	25
255	44	35	31	27	25	25	25	25
260	44	35	31	27	25	25	25	25
265	45	36	31	27	25	25	25	25
270	45	36	31	28	25	25	25	25
275	45	36	31	28	25	25	25	25
280	45	36	32	28	25	25	25	25
285	45	36	32	28	25	25	25	25
290	45	36	32	29	26	25	25	25
295	45	37	32	29	26	25	25	25
300	45	37	32	29	26	25	25	25
305	46	37	33	29	26	25	25	25
310	46	37	33	29	27	25	25	25
315	46	37	33	30	27	25	25	25
320	46	37	33	30	27	25	25	25
325	46	37	33	30	27	25	25	25
330	46	37	33	30	27	25	25	25
335	46	38	34	30	28	25	25	25
340	46	38	34	31	28	25	25	25
345	46	38	34	31	28	26	25	25
350	46	38	34	31	28	26	25	25
355	46	38	34	31	28	26	25	25
360	46	38	34	31	29	26	25	25
365	47	38	34	31	29	26	25	25
370	47	38	34	31	29	27	25	25
375	47	38	35	32	29	27	25	25
380	47	38	35	32	29	27	25	25
385	47	39	35	32	29	27	25	25
390	47	39	35	32	29	27	25	25
395	47	39	35	32	30	27	25	25
400	47	39	35	32	30	28	25	25

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Appendix 2

Minimum thickness (mm) of "FIREMASTER MARINE PLUS BLANKET" (128kg/m³ density) applied to a structural steel Tubular Section necessary to restrict the mean temperature rise of the steel cores to the specified temperature (°C) at **15 minutes**, as a function of the cross sectional area and shape 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).

Structural Element Hp/A (m^{-1})	**Minimum thickness (mm) at Design Temperature (°C)**							
	50	**100**	**150**	**200**	**250**	**300**	**350**	**400**
60	36	25	25	25	25	25	25	25
65	38	25	25	25	25	25	25	25
70	40	25	25	25	25	25	25	25
75	41	25	25	25	25	25	25	25
80	42	25	25	25	25	25	25	25
85	43	27	25	25	25	25	25	25
90	44	28	25	25	25	25	25	25
95	45	29	25	25	25	25	25	25
100	46	31	25	25	25	25	25	25
105	47	32	25	25	25	25	25	25
110	48	32	25	25	25	25	25	25
115	48	33	25	25	25	25	25	25
120	49	34	26	25	25	25	25	25
125	50	35	27	25	25	25	25	25
130	50	36	28	25	25	25	25	25
135	51	36	29	25	25	25	25	25
140	51	37	29	25	25	25	25	25
145	52	37	30	25	25	25	25	25
150	52	38	31	25	25	25	25	25
155	52	38	31	26	25	25	25	25
160	53	39	32	26	25	25	25	25
165	53	39	32	27	25	25	25	25
170	53	40	33	27	25	25	25	25
175	54	40	33	28	25	25	25	25
180	54	41	34	29	25	25	25	25
185	54	41	34	29	25	25	25	25
190	55	41	35	30	25	25	25	25
195	55	42	35	30	26	25	25	25
200	55	42	35	30	26	25	25	25
205	55	42	36	31	27	25	25	25
210	56	43	36	31	27	25	25	25
215	56	43	37	32	28	25	25	25

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Structural Element Hp/A (m^{-1})	Minimum thickness (mm) at Design Temperature (°C)							
	50	**100**	**150**	**200**	**250**	**300**	**350**	**400**
220	56	43	37	32	28	25	25	25
225	56	43	37	33	29	25	25	25
230	56	44	38	33	29	25	25	25
235	57	44	38	33	29	26	25	25
240	57	44	38	34	30	26	25	25
245	57	44	38	34	30	27	25	25
250	57	44	39	34	30	27	25	25
255	57	45	39	34	31	27	25	25
260	57	45	39	35	31	28	25	25
265	58	45	39	35	31	28	25	25
270	58	45	40	35	32	28	25	25
275	58	45	40	36	32	29	26	25
280	58	46	40	36	32	29	26	25
285	58	46	40	36	33	29	26	25
290	58	46	40	36	33	30	27	25
295	58	46	41	37	33	30	27	25
300	58	46	41	37	33	30	27	25
305	59	46	41	37	34	31	28	25
310	59	46	41	37	34	31	28	25
315	59	47	41	37	34	31	28	26
320	59	47	42	38	34	31	29	26
325	59	47	42	38	35	32	29	26
330	59	47	42	38	35	32	29	26
335	59	47	42	38	35	32	29	27
340	59	47	42	38	35	32	30	27
345	59	47	42	39	35	33	30	27
350	59	47	42	39	36	33	30	27
355	60	48	43	39	36	33	30	28
360	60	48	43	39	36	33	31	28
365	60	48	43	39	36	33	31	28
370	60	48	43	39	36	34	31	28
375	60	48	43	40	37	34	31	29
380	60	48	43	40	37	34	31	29
385	60	48	43	40	37	34	32	29
390	60	48	43	40	37	34	32	29
395	60	48	44	40	37	35	32	30
400	60	48	44	40	37	35	32	30

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Appendix 3

Minimum thickness (mm) of "FIREMASTER MARINE PLUS BLANKET" (128kg/m³ density) applied to a structural steel Tubular Section necessary to restrict the mean temperature rise of the steel cores to the specified temperature (°C) at **30 minutes**, as a function of the cross sectional area and shape 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).

Structural Element Hp/A (m^{-1})	**Minimum thickness (mm) at Design Temperature (°C)**							
	50	**100**	**150**	**200**	**250**	**300**	**350**	**400**
60	68	41	27	25	25	25	25	25
65	71	44	30	25	25	25	25	25
70	73	46	32	25	25	25	25	25
75	75	48	34	25	25	25	25	25
80	76	50	36	27	25	25	25	25
85	78	52	38	29	25	25	25	25
90	79	53	40	31	25	25	25	25
95	80	55	42	32	25	25	25	25
100	82	56	43	34	27	25	25	25
105	83	57	45	35	28	25	25	25
110	84	58	46	37	30	25	25	25
115	84	59	47	38	31	25	25	25
120	85	60	48	39	32	27	25	25
125	86	61	49	40	33	28	25	25
130	87	62	50	42	35	29	25	25
135	87	63	51	43	36	30	25	25
140	88	64	52	44	37	31	26	25
145	89	64	53	44	38	32	27	25
150	89	65	54	45	39	33	28	25
155	90	65	54	46	40	34	29	25
160	90	66	55	47	40	35	30	26
165	91	67	56	48	41	36	31	27
170	91	67	56	49	42	37	32	27
175	92	68	57	49	43	38	33	28
180	92	68	58	50	44	38	33	29
185	92	68	58	50	44	39	34	30
190	93	69	59	51	45	40	35	31
195	93	69	59	52	46	40	36	31
200	93	70	60	52	46	41	36	32
205	94	70	60	53	47	42	37	33
210	94	70	60	53	47	42	38	33
215	94	71	61	54	48	43	38	34

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Structural Element Hp/A (m^{-1})	Minimum thickness (mm) at Design Temperature (°C)							
	50	**100**	**150**	**200**	**250**	**300**	**350**	**400**
220	94	71	61	54	48	44	39	35
225	95	71	62	55	49	44	39	35
230	95	71	62	55	49	45	40	36
235	95	72	62	56	50	45	41	36
240	95	72	63	56	50	46	41	37
245	96	72	63	56	51	46	42	38
250	96	72	63	57	51	47	42	38
255	96	73	64	57	52	47	43	39
260	96	73	64	58	52	48	43	39
265	97	73	64	58	53	48	44	40
270	97	73	65	58	53	48	44	40
275	97	74	65	59	53	49	45	40
280	97	74	65	59	54	49	45	41
285	97	74	65	59	54	50	45	41
290	97	74	66	60	54	50	46	42
295	98	74	66	60	55	50	46	42
300	98	75	66	60	55	51	47	43
305	98	75	66	60	55	51	47	43
310	98	75	67	61	56	51	47	43
315	98	75	67	61	56	52	48	44
320	98	75	67	61	56	52	48	44
325	98	75	67	61	57	52	48	45
330	99	75	67	62	57	53	49	45
335	99	76	68	62	57	53	49	45
340	99	76	68	62	57	53	49	46
345	99	76	68	62	58	54	50	46
350	99	76	68	63	58	54	50	46
355	99	76	68	63	58	54	50	47
360	99	76	68	63	58	54	51	47
365	99	76	69	63	59	55	51	47
370	99	76	69	63	59	55	51	47
375	100	77	69	64	59	55	51	48
380	100	77	69	64	59	55	52	48
385	100	77	69	64	59	56	52	48
390	100	77	69	64	60	56	52	49
395	100	77	69	64	60	56	53	49
400	100	77	70	64	60	56	53	49

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Appendix 4

Minimum thickness (mm) of "FIREMASTER MARINE PLUS BLANKET" (128kg/m³ density) applied to a structural steel Tubular Section necessary to restrict the mean temperature rise of the steel cores to the specified temperature (°C) at **45 minutes**, as a function of the cross sectional area and shape 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).

Structural Element Hp/A (m^{-1})	**Minimum thickness (mm) at Design Temperature (°C)**							
	50	**100**	**150**	**200**	**250**	**300**	**350**	**400**
60	100	64	45	32	25	25	25	25
65	103	67	48	35	26	25	25	25
70	106	70	51	38	29	25	25	25
75	108	73	54	41	32	25	25	25
80	110	75	56	44	34	27	25	25
85	112	77	59	46	36	29	25	25
90	114	79	61	48	39	31	25	25
95	115	80	63	50	41	33	27	25
100	117	82	64	52	43	35	29	25
105	118	83	66	54	45	37	31	25
110	119	84	67	56	46	39	32	27
115	120	86	69	57	48	40	34	28
120	121	87	70	59	49	42	35	30
125	122	88	71	60	51	43	37	31
130	123	89	73	61	52	45	38	33
135	124	89	74	62	54	46	40	34
140	125	90	75	64	55	48	41	35
145	126	91	76	65	56	49	42	37
150	126	92	77	66	57	50	43	38
155	127	92	77	67	58	51	45	39
160	128	93	78	68	59	52	46	40
165	128	94	79	69	60	53	47	41
170	129	94	80	70	61	54	48	42
175	129	95	81	70	62	55	49	43
180	130	95	81	71	63	56	50	44
185	130	96	82	72	64	57	51	45
190	131	96	82	73	65	58	52	46
195	131	97	83	73	65	59	53	47
200	131	97	84	74	66	60	53	48
205	132	98	84	75	67	60	54	49
210	132	98	85	75	68	61	55	49
215	133	98	85	76	68	62	56	50

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Structural Element Hp/A (m^{-1})	Minimum thickness (mm) at Design Temperature (°C)							
	50	**100**	**150**	**200**	**250**	**300**	**350**	**400**
220	133	99	86	76	69	62	56	51
225	133	99	86	77	69	63	57	52
230	134	99	87	78	70	64	58	52
235	134	100	87	78	71	64	59	53
240	134	100	87	79	71	65	59	54
245	134	100	88	79	72	66	60	54
250	135	101	88	79	72	66	60	55
255	135	101	89	80	73	67	61	56
260	135	101	89	80	73	67	62	56
265	135	101	89	81	74	68	62	57
270	136	102	90	81	74	68	63	57
275	136	102	90	82	75	69	63	58
280	136	102	90	82	75	69	64	59
285	136	102	91	82	76	70	64	59
290	137	102	91	83	76	70	65	60
295	137	103	91	83	76	71	65	60
300	137	103	91	83	77	71	66	61
305	137	103	92	84	77	72	66	61
310	137	103	92	84	78	72	67	62
315	137	103	92	84	78	72	67	62
320	138	104	92	85	78	73	68	62
325	138	104	93	85	79	73	68	63
330	138	104	93	85	79	74	68	63
335	138	104	93	86	79	74	69	64
340	138	104	93	86	80	74	69	64
345	138	104	94	86	80	75	70	65
350	139	105	94	86	80	75	70	65
355	139	105	94	87	80	75	70	65
360	139	105	94	87	81	76	71	66
365	139	105	94	87	81	76	71	66
370	139	105	94	87	81	76	71	66
375	139	105	95	88	82	77	72	67
380	139	105	95	88	82	77	72	67
385	139	105	95	88	82	77	72	68
390	140	106	95	88	82	77	73	68
395	140	106	95	88	83	78	73	68
400	140	106	96	89	83	78	73	69

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Appendix 5

Minimum thickness (mm) of "FIREMASTER MARINE PLUS BLANKET" (128kg/m³ density) applied to a structural steel Tubular Section necessary to restrict the mean temperature rise of the steel cores to the specified temperature (°C) at **60 minutes**, as a function of the cross sectional area and shape 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).

Structural Element Hp/A (m^{-1})	Minimum thickness (mm) at Design Temperature (°C)							
	50	100	150	200	250	300	350	400
60	132	88	63	47	35	27	25	25
65	136	91	67	51	39	30	25	25
70	139	94	70	54	43	34	26	25
75	142	97	73	57	46	37	29	25
80	144	100	76	60	49	39	32	26
85	147	102	79	63	51	42	34	28
90	149	104	81	66	54	45	37	30
95	150	106	83	68	56	47	39	33
100	-	107	85	70	59	49	41	35
105	-	109	87	72	61	52	44	37
110	-	110	89	74	63	54	46	39
115	-	112	91	76	65	56	47	41
120	-	113	92	78	67	57	49	42
125	-	114	94	79	68	59	51	44
130	-	115	95	81	70	61	53	46
135	-	116	96	82	71	62	54	47
140	-	117	97	84	73	64	56	49
145	-	118	99	85	74	65	57	50
150	-	119	100	86	76	67	59	52
155	-	119	101	87	77	68	60	53
160	-	120	102	88	78	69	61	54
165	-	121	102	90	79	71	63	56
170	-	122	103	91	80	72	64	57
175	-	122	104	92	81	73	65	58
180	-	123	105	92	82	74	66	59
185	-	123	106	93	83	75	67	60
190	-	124	106	94	84	76	68	61
195	-	124	107	95	85	77	69	62
200	-	125	108	96	86	78	70	63
205	-	125	108	97	87	79	71	64
210	-	126	109	97	88	80	72	65
215	-	126	110	98	89	81	73	66

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Structural Element Hp/A (m^{-1})	Minimum thickness (mm) at Design Temperature (°C)							
	50	100	150	200	250	300	350	400
220	-	126	110	99	89	81	74	67
225	-	127	111	99	90	82	75	68
230	-	127	111	100	91	83	76	69
235	-	128	112	100	91	84	76	70
240	-	128	112	101	92	84	77	70
245	-	128	113	102	93	85	78	71
250	-	129	113	102	93	86	79	72
255	-	129	113	103	94	86	79	73
260	-	129	114	103	94	87	80	73
265	-	129	114	104	95	88	81	74
270	-	130	115	104	96	88	81	75
275	-	130	115	105	96	89	82	75
280	-	130	115	105	97	89	83	76
285	-	131	116	105	97	90	83	77
290	-	131	116	106	98	91	84	77
295	-	131	116	106	98	91	84	78
300	-	131	117	107	98	92	85	79
305	-	131	117	107	99	92	86	79
310	-	132	117	107	99	93	86	80
315	-	132	118	108	100	93	87	80
320	-	132	118	108	100	94	87	81
325	-	132	118	108	101	94	88	81
330	-	132	118	109	101	94	88	82
335	-	133	119	109	101	95	89	82
340	-	133	119	109	102	95	89	83
345	-	133	119	110	102	96	89	83
350	-	133	119	110	102	96	90	84
355	-	133	120	110	103	96	90	84
360	-	133	120	111	103	97	91	85
365	-	134	120	111	103	97	91	85
370	-	134	120	111	104	98	92	86
375	-	134	120	111	104	98	92	86
380	-	134	121	112	104	98	92	86
385	-	134	121	112	105	99	93	87
390	-	134	121	112	105	99	93	87
395	-	134	121	112	105	99	93	88
400	-	135	121	113	106	100	94	88

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Appendix 6

Minimum thickness (mm) of "FIREMASTER MARINE PLUS BLANKET" (128kg/m³ density) applied to a structural steel Tubular Section necessary to restrict the mean temperature rise of the steel cores to the specified temperature (°C) at **90 minutes**, as a function of the cross sectional area and shape 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).

Structural Element Hp/A (m^{-1})	Minimum thickness (mm) at Design Temperature (°C)							
	50	100	150	200	250	300	350	400
60	-	134	99	77	61	49	39	31
65	-	139	104	82	66	53	43	35
70	-	143	108	86	70	57	47	39
75	-	146	112	90	74	61	51	42
80	-	149	116	94	78	65	54	46
85	-	-	119	97	81	69	58	49
90	-	-	122	101	85	72	61	52
95	-	-	125	104	88	75	64	55
100	-	-	128	107	91	78	67	57
105	-	-	130	109	93	81	70	60
110	-	-	132	112	96	83	72	63
115	-	-	134	114	98	86	75	65
120	-	-	136	116	101	88	77	67
125	-	-	138	118	103	90	79	70
130	-	-	140	120	105	93	82	72
135	-	-	141	122	107	95	84	74
140	-	-	143	124	109	97	86	76
145	-	-	144	125	111	99	88	78
150	-	-	146	127	112	100	89	79
155	-	-	147	129	114	102	91	81
160	-	-	148	130	116	104	93	83
165	-	-	149	131	117	105	95	85
170	-	-	150	133	119	107	96	86
175	-	-	-	134	120	108	98	88
180	-	-	-	135	121	110	99	89
185	-	-	-	137	122	111	100	91
190	-	-	-	138	124	112	102	92
195	-	-	-	139	125	114	103	93
200	-	-	-	140	126	115	104	95
205	-	-	-	141	127	116	106	96
210	-	-	-	142	128	117	107	97
215	-	-	-	143	129	118	108	98

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Structural Element Hp/A (m^{-1})	Minimum thickness (mm) at Design Temperature (°C)							
	50	100	150	200	250	300	350	400
220	-	-	-	144	130	119	109	100
225	-	-	-	145	131	120	110	101
230	-	-	-	145	132	121	111	102
235	-	-	-	146	133	122	112	103
240	-	-	-	147	134	123	113	104
245	-	-	-	147	134	124	114	105
250	-	-	-	148	135	125	115	106
255	-	-	-	149	136	126	116	107
260	-	-	-	149	137	127	117	108
265	-	-	-	150	137	127	118	109
270	-	-	-	-	138	128	119	110
275	-	-	-	-	139	129	120	110
280	-	-	-	-	139	130	120	111
285	-	-	-	-	140	130	121	112
290	-	-	-	-	141	131	122	113
295	-	-	-	-	141	132	123	114
300	-	-	-	-	142	132	123	114
305	-	-	-	-	142	133	124	115
310	-	-	-	-	143	134	125	116
315	-	-	-	-	144	134	125	117
320	-	-	-	-	144	135	126	117
325	-	-	-	-	145	136	127	118
330	-	-	-	-	145	136	127	119
335	-	-	-	-	146	137	128	119
340	-	-	-	-	146	137	129	120
345	-	-	-	-	147	138	129	121
350	-	-	-	-	147	138	130	121
355	-	-	-	-	147	139	130	122
360	-	-	-	-	148	139	131	122
365	-	-	-	-	148	140	131	123
370	-	-	-	-	149	140	132	124
375	-	-	-	-	149	141	132	124
380	-	-	-	-	150	141	133	125
385	-	-	-	-	150	142	133	125
390	-	-	-	-	150	142	134	126
395	-	-	-	-	-	142	134	126
400	-	-	-	-	-	143	135	127

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Appendix 7

Minimum thickness (mm) of "FIREMASTER MARINE PLUS BLANKET" (128kg/m³ density) applied to a structural steel Tubular Section necessary to restrict the mean temperature rise of the steel cores to the specified temperature (°C) at **120 minutes**, as a function of the cross sectional area and shape 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).

Structural Element Hp/A (m^{-1})	Minimum thickness (mm) at Design Temperature (°C)							
	50	100	150	200	250	300	350	400
60	-	-	135	107	86	71	58	48
65	-	-	141	112	92	76	63	52
70	-	-	146	118	97	81	68	57
75	-	-	-	123	102	86	73	61
80	-	-	-	128	107	91	77	65
85	-	-	-	132	111	95	81	69
90	-	-	-	136	115	99	85	73
95	-	-	-	140	119	103	89	77
100	-	-	-	143	123	106	92	80
105	-	-	-	146	126	110	96	83
110	-	-	-	149	129	113	99	86
115	-	-	-	-	132	116	102	89
120	-	-	-	-	135	119	105	92
125	-	-	-	-	138	122	108	95
130	-	-	-	-	140	124	110	98
135	-	-	-	-	143	127	113	Q2
140	-	-	-	-	145	129	115	103
145	-	-	-	-	147	132	118	105
150	-	-	-	-	149	134	120	107
155	-	-	-	-	-	136	122	109
160	-	-	-	-	-	138	124	112
165	-	-	-	-	-	140	126	114
170	-	-	-	-	-	142	128	116
175	-	-	-	-	-	144	130	117
180	-	-	-	-	-	145	132	119
185	-	-	-	-	-	147	134	121
190	-	-	-	-	-	149	125	123
195	-	-	-	-	-	150	137	124
200	-	-	-	-	-	-	139	126
205	-	-	-	-	-	-	140	128
210	-	-	-	-	-	-	142	131
215	-	-	-	-	-	-	143	131

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Structural Element Hp/A (m^{-1})	Minimum thickness (mm) at Design Temperature (°C)							
	50	100	150	200	250	300	350	400
220	-	-	-	-	-	-	144	132
225	-	-	-	-	-	-	146	133
230	-	-	-	-	-	-	147	135
235	-	-	-	-	-	-	148	136
240	-	-	-	-	-	-	149	137
245	-	-	-	-	-	-	-	139
250	-	-	-	-	-	-	-	140
255	-	-	-	-	-	-	-	141
260	-	-	-	-	-	-	-	142
265	-	-	-	-	-	-	-	143
270	-	-	-	-	-	-	-	144
275	-	-	-	-	-	-	-	145
280	-	-	-	-	-	-	-	146
285	-	-	-	-	-	-	-	148
290	-	-	-	-	-	-	-	148
295	-	-	-	-	-	-	-	149
300	-	-	-	-	-	-	-	150
305	-	-	-	-	-	-	-	-
310	-	-	-	-	-	-	-	-
315	-	-	-	-	-	-	-	-
320	-	-	-	-	-	-	-	-
325	-	-	-	-	-	-	-	-
330	-	-	-	-	-	-	-	-
335	-	-	-	-	-	-	-	-
340	-	-	-	-	-	-	-	-
345	-	-	-	-	-	-	-	-
350	-	-	-	-	-	-	-	-
355	-	-	-	-	-	-	-	-
360	-	-	-	-	-	-	-	-
365	-	-	-	-	-	-	-	-
370	-	-	-	-	-	-	-	-
375	-	-	-	-	-	-	-	-
380	-	-	-	-	-	-	-	-
385	-	-	-	-	-	-	-	-
390	-	-	-	-	-	-	-	-
395	-	-	-	-	-	-	-	-
400	-	-	-	-	-	-	-	-