

NORSOK

Standard M-501

Global System Guide



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NORSOK Standard M-501 is a standard written for the offshore industry to qualify and otherwise specify coating systems to protect offshore structures.

The standard was originally developed for the North Sea oil and gas market, but it has been globally accepted and used as the most predictive test standard for offshore service. The standard has undergone revisions over the years, with Edition 6 being the most current version. However, certain pre-qualified systems from earlier versions are still commonly used since the requirements (in many cases) were left unchanged.

The NORSOK standard accepts and utilizes several recognized global evaluation and testing methods, adding provisions deemed necessary to fill the broad corrosion protection needs of the petroleum industry, focusing on the marine and offshore environments. These protocols are globally recognized for their scope and applicability to the protection of offshore structures with regard to the selection of coating materials, surface preparation, application procedures, and inspection during construction and installation of offshore structures and associated facilities.

NORSOK M-501 describes nine separate coating systems. Some have subsystems, five of which must be “pre-qualified,” which means they must be rigorously tested by a third party and must meet minimum performance requirements. The remaining four coating systems do not require “pre-qualification.”

The systems outlined in this guide are Carboline coating systems that have been pre-qualified or otherwise recommended for each specific service.



Coating System No. 1

Service: Carbon steel operating up to 120°C / 248°F

Applications: Structural steel

Exteriors of equipment, vessels, piping and uninsulated valves

SYSTEM TYPE	PRE-QUALIFIED SYSTEMS	DFT (MICRONS)	PRODUCT DESCRIPTION
Zinc-free systems / Urethane topcoat*	Carbomastic 15	150	Epoxy amine
	Carbomastic 15	150	Epoxy amine
	Carbothane 134 HG	60	Acrylic polyurethane
Zinc-free systems / Isocyanate-free topcoat*	Carbomastic 19 AL	100	Cycloaliphatic amine epoxy
	Carbomastic 19 AL	100	Cycloaliphatic amine epoxy
	Carboxane 2000 TC	80	Siloxane modified multi-polymer
Inorganic zinc / Epoxy / Urethane topcoat	Carbozinc 11	75	Inorganic zinc primer
	Carboguard 893	130	Cycloaliphatic-amine epoxy
	Carbothane 134 HG	75	Acrylic polyurethane
	Carbozinc 11	90	Inorganic zinc primer
	Carboguard 890 LT	175	Cycloaliphatic-amine epoxy
	Carbothane 134 HG	60	Reactive acrylic
	Carbozinc 11	90	Inorganic zinc primer
	Carboguard 893 SG (LT)	150	Epoxy polyamide
	Carbothane 134 HG	75	Acrylic polyurethane
Organic zinc / Epoxy / Urethane topcoat	Carbozinc 858	75	Zinc-rich epoxy
	Carbomastic 15 LT	130	Modified epoxy mastic
	Carbothane 134 HP ² (fka: 834)	75	Acrylic aliphatic polyurethane
	Carbozinc 858	75	Zinc-rich epoxy
	Carboguard 60	175	Epoxy polyamide
	Carbothane 134 HG	60	Acrylic polyurethane
	Carbozinc 858	75	Zinc-rich epoxy
	Carboguard 893	175	Cycloaliphatic-amine epoxy
	Carbothane 134 HG	60	Acrylic polyurethane
	Carbozinc 858	75	Zinc-rich epoxy
	Carboguard 690	175	Epoxy phenalkamine
	Carbothane 134 HG	60	Acrylic polyurethane



SYSTEM TYPE	PRE-QUALIFIED SYSTEMS	DFT (MICRONS)	PRODUCT DESCRIPTION
Inorganic zinc / Epoxy / Isocyanate-free topcoat	Carbozinc 11	75	Inorganic zinc primer
	Carboguard E19	30	Epoxy polyamide primer
	Carbomastic 18 FC	130	Modified epoxy
	Carboxane 2000 Topcoat	75	Siloxane modified multi-polymer
	Carbozinc 11	75	Inorganic zinc primer
	Carboguard 893	130	Cycloaliphatic-amine epoxy
	Carbocrylic 1295 HS	75	Reactive acrylic
	Carbozinc 11	75	Inorganic zinc primer
	Carboguard E19	30	Epoxy polyamide primer
	Carbomastic 18 FC	130	Modified epoxy
	Carbocrylic 1295 HS	75	Reactive acrylic
	Carbozinc 11 FC	75	Inorganic zinc primer
	Carboguard E19	30	Epoxy polyamide primer
	Carbomastic 18 FC	130	Modified epoxy
	Carbocrylic 1295 HS	75	Reactive acrylic
	Carbozinc 11 FC	75	Inorganic zinc primer
	Carboguard E19	30	Epoxy polyamide primer
	Carbomastic 18 FC	130	Modified epoxy
	Carboxane 2000 Topcoat	75	Siloxane modified multi-polymer
	Carbozinc 11 FC	75	Inorganic zinc primer
	Carboguard 60	150	Epoxy polyamide
	Carbocrylic 1295 HS	75	Reactive acrylic
Organic zinc / Epoxy / Isocyanate-free topcoat	Carbozinc 858	75	Zinc-rich epoxy
	Carbomastic 15 LT	130	Modified epoxy mastic
	Carboxane 2000 Topcoat	75	Siloxane modified multi-polymer
	Carbozinc 858	75	Zinc-rich epoxy
	Carbomastic 18 FC	130	Modified epoxy
	Carbocrylic 1295 HS	75	Acrylic-epoxy
	Carbozinc 858	75	Zinc-rich epoxy
	Carbomastic 18 FC	130	Modified Epoxy
	Carboxane 2000 Topcoat	75	Siloxane modified multi-polymer
	Carbozinc 858	75	Zinc-rich epoxy
	Carboguard 893	130	Cycloaliphatic-amine epoxy
	Carboxane 2000 Topcoat	60	Siloxane modified multi-polymer

* The NORSOK M-501 standard requires zinc-rich primer as the first coat in System 1 qualification. Although this zinc-free system is not in accordance to the guidelines of the NORSOK M-501 standard, it has been tested and passed in accordance to the testing protocol of that standard (ISO 20340 testing protocol).



Coating System No. 2A & No. 2B

(Pre-qualification required for 2B topcoats: must have been pre-qualified under a System 1 test)

Service: All carbon steel operating up to 120°C / 248°F with:
System 2A: Thermal spray aluminum (or alloys of aluminum)
System 2B: Thermal spray zinc (or alloys of zinc)

Applications: All insulated surfaces of tanks, vessels, piping:
Flare booms and crane booms
(Optional): Underside of bottom deck including piping, jacket above splash zone, lifeboat stations

RECOMMENDED SYSTEMS (SYSTEM 2A)	DFT (MICRONS)	PRODUCT DESCRIPTION
TSA (operating at <120°C / 248°F) Carboguard 60 or Carboguard E19 Primer	200 As needed	Thermal spray aluminum or aluminum alloy Epoxy polyamide
TSA (operating at <120°C / 248°F) Thermaline 4700 Aluminum	200 35/coat (1-2 coats)	Thermal spray aluminum or aluminum alloy Aluminum-silicone

RECOMMENDED SYSTEMS (SYSTEM 2B)	DFT (MICRONS)	PRODUCT DESCRIPTION
TSZ Carboguard 60 or 60 LH Carbothane 134 HG	200 125 60	Thermal spray zinc or zinc alloy Epoxy polyamide Acrylic polyurethane
TSZ Carboguard E19 Primer Carbomastic 18 FC Caroxane 2000 Topcoat	100 25 125 75	Thermal spray zinc or zinc alloy Epoxy polyamide Modified epoxy Siloxane modified multi-polymer
TSZ Carboguard 893 Carbothane 134 HG	200 125 60	Thermal spray aluminum or aluminum alloy Cycloaliphatic amine epoxy Acrylic polyurethane
TSZ Carboguard E19 Primer Carbomastic 18 FC Carbocrylic 1295 HS	100 25 125 75	Thermal spray zinc or zinc alloy Epoxy polyamide Modified epoxy Reactive acrylic



Coating System No. 3

(Pre-qualification required for System 3B only)

Service: Specific lining services

Applications: System 3A: Potable water tanks (approved by relevant authorities)

System 3B: Ballast water tanks/Internal seawater filled compartments (IMO PSPC Qualified system is acceptable)

System 3C: Tanks for stabilized crude, diesel, and condensate

System 3D: Process vessels operating <75°C/167°F and <0.3 MPa

System 3E: Process vessels operating <80°C/176°F and <7.0 MPa

System 3F: Process vessels operating <130°C/266°F and <3.0 MPa

System 3G: Vessels for methanol, monoethylglycol, etc.

SYSTEM NO.	RECOMMENDED SYSTEMS	DFT (MICRONS)	PRODUCT DESCRIPTION
System 3A	Phenoline Tank Shield	350-500	Solvent-free epoxy phenalkamine
	Carboguard 891 VOC Carboguard 891 VOC	150 150	Cycloaliphatic amine epoxy Cycloaliphatic amine epoxy
System 3B (Pre-qualified)	Carbomastic 18 FC Carbomastic 18 FC	175 175	Modified epoxy Modified epoxy
	Carboguard 635* Carboguard 635	160 160	Epoxy phenalkamine Epoxy phenalkamine
	Carboguard 60 LH (C901)* Carboguard 60 LH	175 175	Epoxy polyamide Epoxy polyamide
System 3C	Phenoline Tank Shield	350-500	Solvent-free epoxy
	Plasite 4500 FS	500	Solvent-free; fast-cure epoxy
	Phenoline 353 LT Phenoline 353 LT	150 150	Epoxy-novolac Epoxy-novolac
System 3D	Phenoline 353 or 353 LT Phenoline 353 or 353 LT	150 150	Epoxy-novolac Epoxy-novolac
	Phenoline 1205 Phenoline 1205	175 175	Glass-flake epoxy novolac Glass-flake epoxy novolac
System 3E	Plasite 4550 Series	500-650	Solvent-free epoxy novolac
System 3F	Carbozinc 11	75	Inorganic ethyl-silicate zinc

*May be used over preconstruction primer Carboweld 17FG or Carboweld 11.

Coating System No. 4

(Pre-qualification required)

Service: Non-skid deck system

Applications: Walkways

Escape routes

Lay down areas

SYSTEM TYPE	PRE-QUALIFIED SYSTEMS	DFT (MICRONS)	PRODUCT DESCRIPTION
	Carbozinc 859 Carboguard 890 GF with Filler 47 Carbothane 134 HG	90 300 60	Zinc-rich epoxy Non-skid; glass-flake epoxy Acrylic polyurethane
Hummervoll System 1:	HI EP Sealer HI EP Deck Coat Quarts Sand HI EP Deck Top Coat	150 350 400 700	Epoxy Sealer High-build epoxy Aggregates High-build epoxy
Hummervoll System 2:	HI EP Sealer HI EP Deck Coat Quarts Sand HI EP Deck Top Coat Al. Oksyd	- 200 800 1250 750	Epoxy Sealer High-build epoxy Aggregates High-build epoxy Anti-skid broadcast aggregates

Coating System No. 5A

(Pre-qualification required)

Service: Epoxy-based fire protection

Applications: As required by end user

PRE-QUALIFIED SYSTEMS	DFT (MICRONS)	PRODUCT DESCRIPTION
Carbozinc 858 Carboguard 60 or E19 Primer Pyroclad X1	75 35 As required	Zinc-rich epoxy Epoxy polyamide tie-coat Epoxy fireproofing
TSA Carboguard 60 or E19 Primer Pyroclad X1	200 75 As required	Thermal spray aluminum/alloy Epoxy tiecoat Fireproofing

*Pre-qualification system was tested without a topcoat over the epoxy fireproofing; however, Carboline recommends one of the topcoat options for exterior offshore use. For more information about the topcoat options please contact your Carboline representative.

Coating System No. 6A, 6B, & 6C

(Pre-qualification required for 6A & 6B topcoats: must have been pre-qualified under System 1 test)

Applications: System 6A: Un-insulated stainless steel

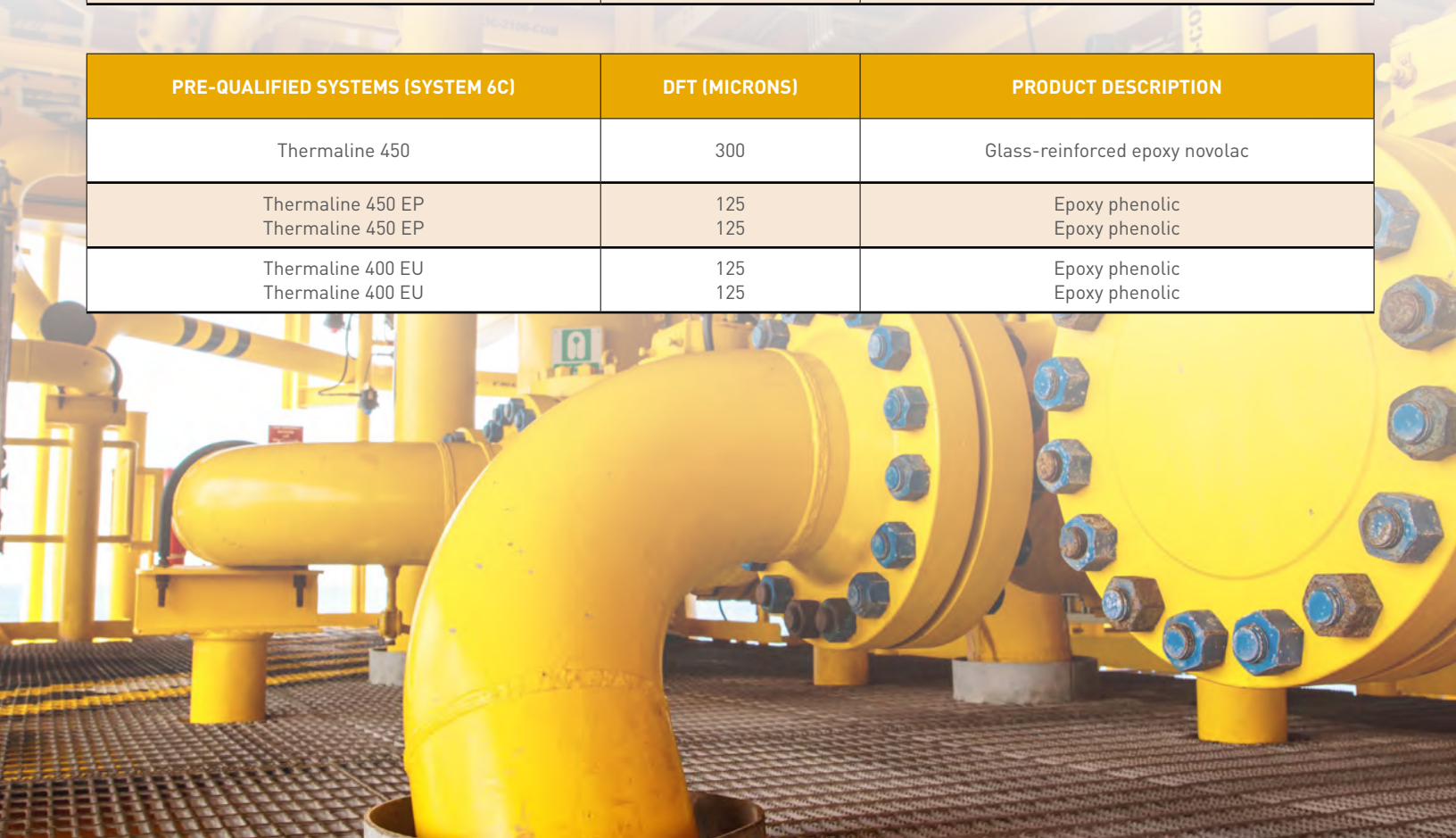
System 6B: Hot dip galvanized steel

System 6C: Insulated stainless steel piping and vessels up to 150°C / 302°F

PRE-QUALIFIED SYSTEMS (SYSTEM 6A)	DFT (MICRONS)	PRODUCT DESCRIPTION
Carboguard 60	50	Epoxy polyamide
Carboguard 60	100	Epoxy polyamide
Carbothane 134 HG	75	Acrylic polyurethane
Carboguard E19 Primer	50	Epoxy polyamide
Carbomastic 18 FC	100	Modified epoxy
Carboxane 2000 Topcoat	75	Siloxane modified multi-polymer
Carboguard 893	50	Cycloaliphatic amine epoxy
Carboguard 893	100	Cycloaliphatic amine epoxy
Carbothane 134 HG or 134 HP	75	Acrylic polyurethane

PRE-QUALIFIED SYSTEMS (SYSTEM 6B)	DFT (MICRONS)	PRODUCT DESCRIPTION
Carboguard 60	50	Epoxy polyamide
Carboguard 60	100	Epoxy polyamide
Carbothane 134 HG	75	Acrylic polyurethane
Carboguard E19 Primer	50	Epoxy polyamide
Carbomastic 18 FC	100	Modified epoxy
Carboxane 2000 Topcoat	75	Siloxane modified multi-polymer

PRE-QUALIFIED SYSTEMS (SYSTEM 6C)	DFT (MICRONS)	PRODUCT DESCRIPTION
Thermaline 450	300	Glass-reinforced epoxy novolac
Thermaline 450 EP	125	Epoxy phenolic
Thermaline 450 EP	125	Epoxy phenolic
Thermaline 400 EU	125	Epoxy phenolic
Thermaline 400 EU	125	Epoxy phenolic



Coating System No. 7A, 7B, & 7C

(Pre-qualification required)

Applications: System 7A: Carbon and stainless steel in the splash zone

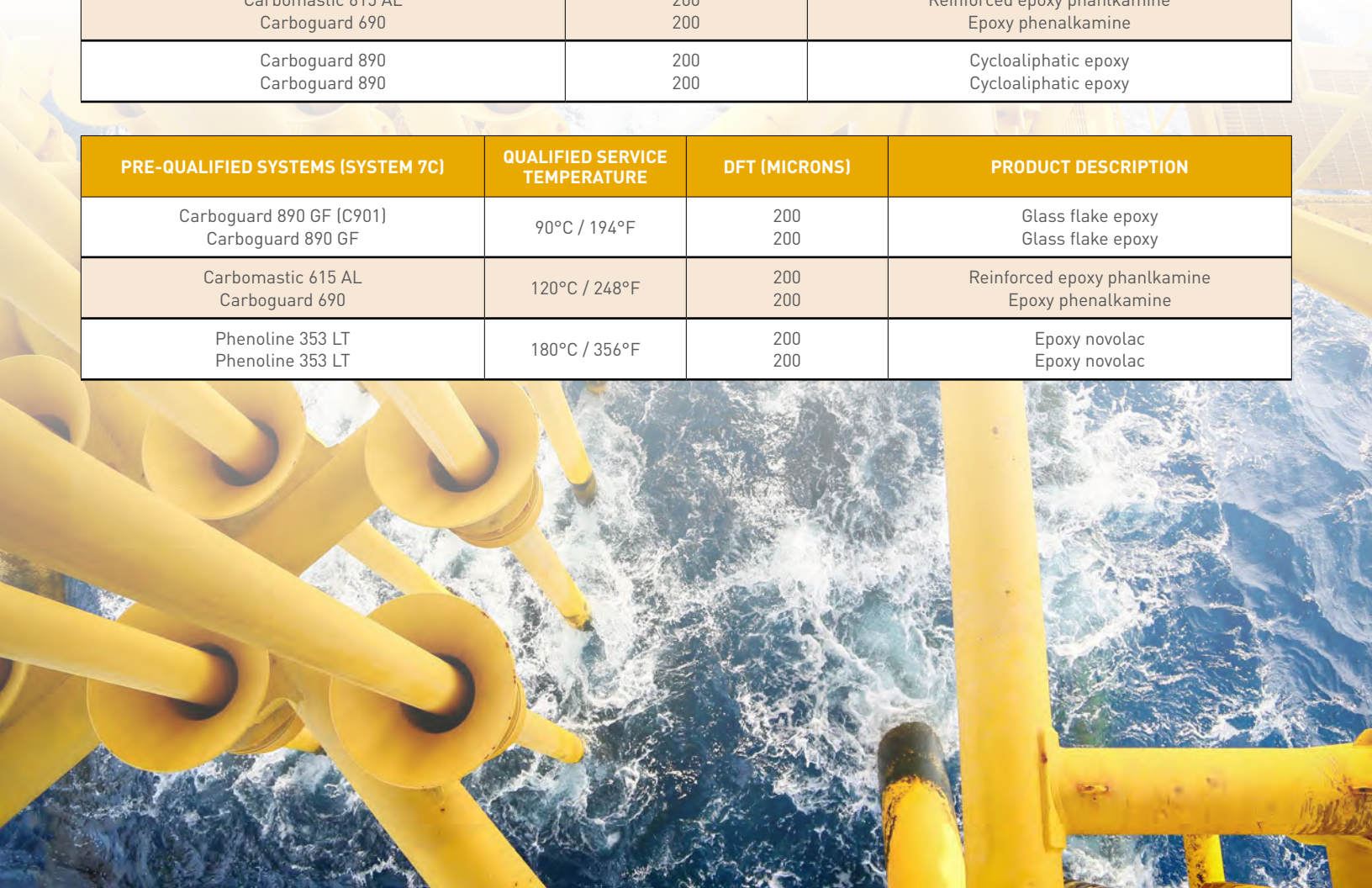
System 7B: Submerged carbon and stainless steel up to 50°C/122°F

System 7C: Submerged carbon and stainless steel greater than 50°C/122°F

PRE-QUALIFIED SYSTEMS (SYSTEM 7A)	DFT (MICRONS)	PRODUCT DESCRIPTION
Carbozinc 859 Carboguard 1209	100 450	Zinc-rich epoxy High load; glass flake epoxy
Carboguard 1209 Carboguard 1209	425 425	High load; glass flake epoxy High load; glass flake epoxy
Carboguard 890 GF Carboguard 890 GF	225 225	Glass flake epoxy Glass flake epoxy
Carboglas 1601 SZ Carboglas 1601 SZ	500 500	Glass flake fumarate polyester Glass flake fumarate polyester

PRE-QUALIFIED SYSTEMS (SYSTEM 7B)	DFT (MICRONS)	PRODUCT DESCRIPTION
Carboguard 890 GF Carboguard 890 GF	200 200	Glass flake epoxy Glass flake epoxy
Carbomastic 615 AL Carboguard 690	200 200	Reinforced epoxy phanlkamine Epoxy phenalkamine
Carboguard 890 Carboguard 890	200 200	Cycloaliphatic epoxy Cycloaliphatic epoxy

PRE-QUALIFIED SYSTEMS (SYSTEM 7C)	QUALIFIED SERVICE TEMPERATURE	DFT (MICRONS)	PRODUCT DESCRIPTION
Carboguard 890 GF (C901) Carboguard 890 GF	90°C / 194°F	200 200	Glass flake epoxy Glass flake epoxy
Carbomastic 615 AL Carboguard 690	120°C / 248°F	200 200	Reinforced epoxy phanlkamine Epoxy phenalkamine
Phenoline 353 LT Phenoline 353 LT	180°C / 356°F	200 200	Epoxy novolac Epoxy novolac



Coating System No. 8

Service: Structural steel with maximum operating temperatures less than 80°C/176°F

Applications: Internal and fully dry and ventilated areas

PRE-QUALIFIED SYSTEMS	DFT (MICRONS)	PRODUCT DESCRIPTION
Carbozinc 858 Carboguard E19 Primer or Rustbond	60 25	Zinc-rich epoxy Epoxy polyamide primer
Carboguard 60	150	Epoxy polyamide
Carboguard 893	150	Cycloaliphatic amine epoxy

Coating System No. 9

Service: Steel with maximum operating temperatures less than 150°C

Applications: Bulk supplied carbon steel valves

PRE-QUALIFIED SYSTEMS	DFT (MICRONS)	PRODUCT DESCRIPTION
Thermaline 450	300	Glass-reinforced epoxy novolac
Thermaline 450 EP Thermaline 450 EP	150 150	Epoxy phenolic Epoxy phenolic
Thermaline 400 EU Thermaline 400 EU	150 150	Epoxy phenolic Epoxy phenolic

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