

Carboline System Guide For Global Oil & Gas Projects

Surface Preparation ISO (NACE/SSPC)	1 st Coat	Mils (Microns)	2 nd Coat	Mils (Microns)	3 rd Coat	Mils (Microns)
Structural Steel, Piping, & Equipment to 120°C (250°F) <p>Applications <i>Cranes, derricks, deck buildings, piping, equipment, pipe racks decks, undersides, structural steel, ladders, handrails, compressors, storage tank & process vessel exteriors operating up to 120°C (250°F)</i></p>						
Sa 2.5 or Sa 2 (NACE 2 / SP 10 NACE 3 / SP 6)	Carbozinc 11 Series <i>Inorganic Zinc</i>	2-3 (50-75)	Carboguard 893, Carboguard 888, or Carbomastic 18 FC <i>Epoxy</i>	4-6 (100-150)	Carbothane 134 Series <i>Polyurethane</i>	2-2.5 (50-65)
Sa 2.5 or Sa 2 (NACE 2 / SP 10 NACE 3 / SP 6)	Carbozinc 11 Series <i>Inorganic Zinc</i>	3-5 (75-125)	Carboguard 893, Carboguard 888, or Carbomastic 18 FC <i>Epoxy</i>	4-6 (100-150)	Carboxane 2000 series <i>Modified Siloxane Hybrid</i>	3-7 (75-175)
Sa 2.5 or Sa 2 (NACE 2 / SP 10 NACE 3 / SP 6)	Carbozinc 859 or Carbozinc 858 <i>Organic Zinc</i>	3-5 (75-125)	Carboguard 893, Carboguard 888, or Carbomastic 18 FC <i>Epoxy</i>	4-6 (100-150)	Carbothane 134 Series <i>Polyurethane</i>	2-2.5 (50-65)
Sa 2.5 or Sa 2 (NACE 2 / SP 10 NACE 3 / SP 6)	Carbozinc 859 or Carbozinc 858 <i>Organic Zinc</i>	3-5 (75-125)	Carboguard 893, Carboguard 888, or Carbomastic 18 FC <i>Epoxy</i>	4-6 (100-150)	Carboxane 2000 series <i>Modified Siloxane Hybrid</i>	3-7 (75-175)
Piping and Equipment to 230°C (450°F) – Steel <p>Applications <i>Piping and equipment operating at 120-230°C (250-450°F)</i></p>						
Sa 2.5 (NACE 2 / SP 10)	Carbozinc 11 Series <i>Inorganic Zinc</i>	2-3 (50-75)	Thermaline 4900 R <i>Silicone Acrylic</i>	1.5 -2 (35-50)		
Piping and Equipment to 540°C (1000°F) – Steel <p>Applications <i>Exhaust stacks, piping and equipment operating at 230-540°C (450-1000°F)</i></p>						
Sa 2.5 (NACE 2 / SP 10)	Carbozinc 11 Series <i>Inorganic Zinc</i>	2-3 (50-75)	Thermaline 4700 <i>Silicone</i>	1.5 -2 (35-50)		
Insulated Piping and Equipment (See notes at right) <p>Applications <i>Insulated piping and equipment operating under conditions as noted.</i></p>						
Sa 2.5 (NACE 2 / SP 10)	Thermaline 450 <i>Novolac Epoxy</i>	6-8 (150-200)	Thermaline 450 <i>Novolac Epoxy</i>	6-8 (150-200)	Note: May be used up to 230°C (450°F)	
Sa 2.5 (NACE 2 / SP 10)	Thermaline 400, or Phenoline 187 <i>Epoxy Phenolic</i>	4-6 (100-150)	Thermaline 400, or Phenoline 187 <i>Epoxy Phenolic</i>	4-6 (100-150)	Note: May be used up to 205°C (400°F)	
Sa 2.5 (NACE 2 / SP 10)	Carbozinc 11 Series <i>Inorganic Zinc</i>	2-3 (50-75)	Thermaline 4700 <i>Silicone</i>	1.5 -2 (35-50)	Note: May be used up to 540°C (1000°F). Intended for carbon steel substrates only.	
Sa 2.5 (NACE 2 / SP 10)	Thermaline 4700 <i>Silicone</i>	1.5 -2 (35-50)	Thermaline 4700 <i>Silicone</i>	1.5 -2 (35-50)	Note: May be used up to 540°C (1000°F).	
Deck Plate (Light Duty) – Steel <p>Applications <i>Deck plate in areas of low traffic. Broadcast #36 additive into wet coating and back-roll where non-slip is needed.</i></p>						
Sa 2.5 or Sa 2 (NACE 2 / SP 10 NACE 3 / SP 6)	Carbozinc 859 or Carbozinc 858 <i>Organic Zinc</i>	3-5 (75-125)	Carboguard 890 or Carboguard 890 LT <i>Epoxy</i>	6-8 (150-200)	Carbothane 134 Series <i>Polyurethane</i>	2-2.5 (50-65)
Sa 2.5 or Sa 2 (NACE 2 / SP 10 NACE 3 / SP 6)	Carbozinc 859 or Carbozinc 858 <i>Organic Zinc</i>	3-5 (75-125)	Carboguard 890 or Carboguard 890 LT <i>Epoxy</i>	6-8 (150-200)	Carboxane 2000 series <i>Modified Siloxane Hybrid</i>	3-7 (75-175)
Sa 2.5 or Sa 2 (NACE 2 / SP 10 NACE 3 / SP 6)	Carbozinc 859 or Carbozinc 858 <i>Organic Zinc</i>	3-5 (75-125)	Carboguard 890 GF or Carboguard 890 LT GF <i>Epoxy Glass Flake</i>	8-15 (200-375)	Carbothane 134 Series <i>Polyurethane</i>	2-2.5 (50-65)
Sa 2.5 or Sa 2 (NACE 2 / SP 10 NACE 3 / SP 6)	Carbozinc 859 or Carbozinc 858 <i>Organic Zinc</i>	3-5 (75-125)	Carboguard 890 GF or Carboguard 890 LT GF <i>Epoxy Glass Flake</i>	8-15 (200-375)	Carbocrylic 1290 <i>Epoxy Acrylate</i>	2-6 (50-150)

Surface Preparation ISO (NACE/SSPC)	1 st Coat	Mils (Microns)	2 nd Coat	Mils (Microns)	3 rd Coat	Mils (Microns)
Deck Plate (Normal Duty) – Steel						
Applications <i>Deck plate in areas of normal to high traffic. For non-slip, mix #47 additive into the 1209 prior to application or broadcast into wet coating and back-roll.</i>						
Sa 2.5 or Sa 2 (NACE 2 / SP 10 NACE 3 / SP 6)	Carbozinc 859 or Carbozinc 858 <i>Organic Zinc</i>	3-5 (75-125)	Carboguard 1209 w/ #47 <i>Glass Flake Epoxy</i>	14-20 (350-500)	Carbothane 134 Series <i>Polyurethane</i>	2-2.5 (50-65)
Sa 2.5 or Sa 2 (NACE 2 / SP 10 NACE 3 / SP 6)	Carbozinc 859 or Carbozinc 858 <i>Organic Zinc</i>	3-5 (75-125)	Carboguard 1209 w. #47 <i>Glass Flake Epoxy</i>	14-20 (350-500)	Carbocrylic 1290 <i>Epoxy Acrylate</i>	2-6 (50-150)
Splash Zone – Steel						
Applications <i>Platform legs, pilings, risers, conductors, structural steel, cross bracing, boat bumpers, boat landings and other steel components in the splash zone or tidal area (typically -5 to +5 m from mean sea level).</i>						
Sa 2.5 (NACE 2 / SP 10)	Carbozinc 859 or Carbozinc 858 <i>Organic Zinc</i>	3-5 (75-125)	Carboguard 1209 <i>Glass Flake Epoxy</i>	10-15 (250-375)	Carbothane 134 Series (optional) <i>Polyurethane</i>	2-2.5 (50-65)
Sa 2.5 (NACE 2 / SP 10)	Carbozinc 859 or Carbozinc 858 <i>Organic Zinc</i>	3-5 (75-125)	Carboguard 1209 <i>Glass Flake Epoxy</i>	10-15 (250-375)	Carbocrylic 1290 (optional) <i>Epoxy Acrylate</i>	2-6 (50-150)
Sa 2.5 (NACE 2 / SP 10)	Carboguard 893 or Carboguard 888 (optional primer) <i>Epoxy</i>	4-6 (100-150)	Carboguard 1209 <i>Glass Flake Epoxy</i>	10-15 (250-375)	Carbothane 134 Series (optional) <i>Polyurethane</i>	2-2.5 (50-65)
Sa 2.5 (NACE 2 / SP 10)	Carbozinc 859 or Carbozinc 858 <i>Organic Zinc</i>	3-5 (75-125)	Carboguard 890 GF or Carboguard 890 LT GF <i>Epoxy Glass Flake</i>	8-15 (200-375)	Carbothane 134 Series (optional) <i>Polyurethane</i>	2-2.5 (50-65)
Sa 2.5 (NACE 2 / SP 10)	Carboguard 890 GF or Carboguard 890 LT GF <i>Epoxy Glass Flake</i>	8-15 (200-375)	Carboguard 890 GF or Carboguard 890 LT GF <i>Epoxy Glass Flake</i>	8-15 (200-375)	Carbothane 134 Series (optional) <i>Polyurethane</i>	2-2.5 (50-65)
Ballast Tanks and Seawater Immersion						
Applications <i>Ballast tank linings and coating of Structural steel, hulls, valves, caissons, sumps, etc. located in water immersion service or below waterline including subsea components like wellheads, piping, manifolds, etc.</i>						
Sa 2.5 (NACE 2 / SP 10)	Carboguard 890 <i>Epoxy</i>	6-8 (150-200)	Carboguard 890 <i>Epoxy</i>	6-8 (150-200)		
Sa 2.5 (NACE 2 / SP 10)	Carbomastic 18 NT or Carbomastic 18 FC <i>Epoxy</i>	6-8 (150-200)	Carbomastic 18 NT or Carbomastic 18 FC <i>Epoxy</i>	6-8 (150-200)		
Subsea Insulation						
Applications <i>Provide insulation and corrosion protection to subsea valves, piping, manifolds, etc.</i>						
Sa 2.5 (NACE 2 / SP 10)	Polibrid E31 <i>Elastomeric Polyurethane</i>	Up to 100 mm (4 inches) as required				
Over-coating Galvanized Steel						
Applications <i>Over-coating galvanized steel or other surfaces to provide color coordination and UV protection. May be used on stainless, bronze, brass, fiberglass, etc.</i>						
Sa 1 (NACE 4 / SP 7)	Carboguard 888 <i>Epoxy</i>	3-5 (75-125)	Carbothane 134 Series <i>Polyurethane</i>	2-2.5 (50-65)		
Sa 1 (NACE 4 / SP 7)	Rustbond or Rustbond FC <i>Epoxy Sealer</i>	1-2 (25-50)	Carbothane 134 Series <i>Polyurethane</i>	2-2.5 (50-65)		

Passive Fire Protection

Up to 4 hour UL 1709 rating

Surface Preparation ISO (NACE/SSPC)	1 st Coat	Thickness µm (mils)	2 nd Coat	Thickness µm (mils)	3 rd Coat	Mils (Microns)
Fireproofing – Carbon Steel						
<i>Applications Structural steel, decks, bulkheads, vessel supports, living quarters, control buildings, etc.</i>						
Sa 2.5 (NACE 2 / SP 10)	Carboguard 888 3-5 mils (75-125µm) or Carboguard 859 3-5 mils (75-125µm) or Carbozinc 11 Series 2-3 mils (50-60µm)		Nullifire System E <i>Intumescent Epoxy</i>	As Required	Carbothane 134 Series <i>Polyurethane</i>	2-2.5 (50-65)
			Pyrocrete 241 or Pyrocrete 40 <i>Cementitious</i>	As Required	Carboguard 1340 <i>Epoxy sealer</i> Followed by... Carbothane 133 HB <i>Polyurethane</i>	1-2 (25-50)
						2-2.5 (50-65)

Fireproofing Notes:

- Other primers than those listed may be acceptable. Consult your Carboline Sales Representative for specific advice.
- System E and Pyrocrete 241 have passed Jet Fire Testing. In addition, Pyrocrete 241 has passed the 3 Bar Blast Test.
- Pyrocrete 40 and Nullifire System E are also certified to BS 476 part 20-21.

Linings for Process Tanks and Vessels

Surface preparation: ISO Sa 3 or Sa 2.5 (NACE 1 / SP 5 or NACE 2 / SP 10)

Service Conditions	Generic Type	Product	Coats	Total Thickness Mils (µm)
Produced Oil, Produced Water, or Seawater Storage	Ambient	Epoxy	Carboguard 890	2 12-16 (300-400)
	Ambient	Epoxy	Carbomastic 18 NT	2 12-20 (300-500)
	Up to 65°C (150°F)	Epoxy Phenolic	Plasite 7122	2 12-15 (300-375)
Potable Water Storage (Approved)	NSF	Epoxy	Carboguard 891	2 10-14 (250-350)
	BS 6920	Epoxy	Carboguard 703	1 16-50 (400-1250)
Jet Fuels, Diesel, Gasoline Storage	Meets Mil-C-4556E	Modified Epoxy	Plasite 9060	2 12-15 (300-375)
	23236	Epoxy Phenolic	Phenoline 187 Primer & Finish	2 8-12 (200-300)
		Epoxy Phenolic	Plasite 7122	2 12-15 (300-375)
Pressure Vessels, Separators, Treaters (Oil, Gas, Water)	Up to 95°C (200°F)	Glass Flake Epoxy Novolac	Phenoline 1205	2 16-20 (400-500)
	Up to 110°C (230°F)	Modified Epoxy	Plasite 7159	2 10-12 (250-300)
	Up to 110°C (230°F)	Epoxy Phenolic	Phenoline 368 WG	2 12-14 (300-350)
Amine Contactors (DEA, MDEA, TEA)	Up to 38°C (100°F)	Modified Epoxy	Plasite 9060	2 12-15 (300-375)
	TEA - 65°C (150°F)	Epoxy Phenolic	Plasite 7122	2 12-15 (300-375)
Glycol Contactors (MEG, DEG, TEG)	MEG to 65°C (150°F) DEG, TEG to 38°C (100°F)	Modified Epoxy	Plasite 9060	2 12-15 (300-375)
	MEG only to 38°C (100°F)	Epoxy Phenolic	Plasite 7122	2 12-15 (300-375)
Drilling & Workover Fluids		Epoxy Phenolic	Plasite 7122	2 12-15 (300-375)
		Glass Flake Epoxy Novolac	Phenoline 1205	2 16-20 (400-500)

Note: Carboline has an extensive offering of specialized high performance lining products to meet your needs. Consult your Carboline Sales Representative for specific recommendations.

General Notes:

1. Carbozinc 11 Series consists of four inorganic zinc products designed to meet every need:
 - Carbozinc 11: Standard high performance inorganic zinc silicate.
 - Carbozinc 11 VOC: High performance inorganic zinc silicate designed to meet local VOC limits of 3.2 lbs./gal. (389 g/l)
 - Carbozinc 11 HS: High performance inorganic zinc silicate designed to meet local VOC limits of 2.4 lbs./gal. (288 g/l)
2. Carbothane 134 Series include a choice of three polyurethane topcoats to meet your needs:
 - Carbothane 134 HG: Excellent performance polyurethane exceeds SSPC Paint 36 Level 3 requirements by 2.5 times.
 - Carbothane 134 HS: Meets SSPC Paint 36 Level 3 requirements. May be used where VOC regulations allow.
3. Carboxane 2000 Series includes a choice of three modified siloxane hybrid topcoats to meet your needs:
 - Carboxane 2000: Superior siloxane topcoat exceeding the requirements of SSPC Paint 36 Level 3 by 4.5 times.
 - Carboxane 2000 WG: Winter grade version of Carboxane 2000 with same superior performance.
 - Carboxane 2000 Topcoat: Same superior performance as Carboxane 2000 but formulated for thinner film application.
4. Thermaline 4900 VOC and Thermaline 4700 VOC may be substituted for Thermaline 4900 and Thermaline 4700, respectively, as local VOC regulations dictate.
5. Carbocrylic 1290 may have limited availability in some geographic areas. Please consult your Carboline Representative for alternates when needed.
6. The application technique of stripe coating edges and weld lines will improve coating system performance.
7. Surface Cleaner 3 is a water based, biodegradable cleaner that is effective in cleaning and degreasing surfaces prior to painting.
8. Plasite 7122L may be substituted for Plasite 7122 where VOC regulations dictate.
9. Plasite 7122 and 7159 are available in High Abrasion Resistant (HAR) versions.