

Carboline System Guide for the Oil & Gas Industry

New Construction / Maintenance	Surface Preparation (SSPC)	1 st Coat	Mils (µm)	2 nd Coat	Mils (µm)	3 rd Coat	Mils (µm)
Structural Steel, Piping, and Equipment				<i>Applications</i> Cranes, derricks, deck buildings, piping, equipment, pipe racks decks, undersides, structural steel, ladders, handrails, compressors, storage tank & process vessel exteriors operating to 250°F (121°C)			
New	SP 10 SP 6	Carbozinc 11 Series <i>Inorganic Zinc</i>	2-3 (50-75)	Carboguard 800 Series <i>Epoxy</i>	4-6 (100-150)	Carbothane 134 Series <i>Polyurethane</i>	2-2 ½ (50-62)
New	SP 10 SP 6	Carbozinc 859 <i>Organic Zinc</i>	3-5 (75-125)	Carboguard 800 Series <i>Epoxy</i>	4-6 (100-150)	Carbothane 134 Series <i>Polyurethane</i>	2-2 ½ (50-62)
New	SP 10 SP 6	Carbozinc 859 <i>Organic Zinc</i>	3-5 (75-125)			Carboxane 2000 <i>Mod. Siloxane Hybrid</i>	3-7 (75-175)
Maintenance (Exceptional Protection)	SP 6 (spot) SP 7 SP 2 / SP 3 SP 12-WJ-2L	Carbomastic 15 or Carbomastic 615 HS (spot prime) <i>Surface Tolerant Epoxy</i>	4-6 (100-150)	Carboguard 800 Series <i>Epoxy</i>	4-6 (100-150)	Carbothane 134 Series <i>Polyurethane</i>	2-2 ½ (50-62)
Maintenance (Good Protection)	SP 6 (spot) SP 7 SP 2 / SP 3 SP 12-WJ-2L	Carbomastic 15 or Carbomastic 615 HS (spot prime) <i>Surface Tolerant Epoxy</i>	5-7 (125-175)			Carbothane 133 HB <i>Polyurethane</i>	3-5 (75-125)
Maintenance (Economical)	SP 6 (spot) SP 7	Carboguard 893 or Carboguard 888 (spot prime) <i>Epoxy</i>	4-6 (100-150)	Carboguard 800 Series <i>Epoxy</i>	4-6 (100-150)	Carbothane 134 Series <i>Polyurethane</i>	2-2 ½ (50-62)
Piping and Equipment to 450°F/232°C – Steel				<i>Applications</i> Piping and equipment operating to 450°F (232°C)			
New or Maintenance	SP 10	Carbozinc 11 Series <i>Inorganic Zinc</i>	2-3 (50-75)	Thermaline 4900R <i>Silicone Acrylic</i>	1 ½ -2 (38-50)		
Piping and Equipment to 1000°F/538°C – Steel				<i>Applications</i> Exhaust stacks, piping and equipment operating to 1000°F (538°C)			
New or Maintenance	SP 10	Carbozinc 11 Series <i>Inorganic Zinc</i>	2-3 (50-75)	Thermaline 4700 <i>Silicone</i>	1 ½ -2 (38-50)		
New or Maintenance	SP 10	Carbozinc 4765 <i>Silicone Zinc</i>	2-3 (50-75)	Thermaline 4700 <i>Silicone</i>	1 ½ -2 (38-50)	Designed for under insulation	
Piping and Equipment to 800°F/427°C – Steel				<i>Applications</i> Insulated piping and equipment operating to 800°F (427°C)			
New or Maintenance	SP 10 SP 3	Carbozinc 2977 <i>Silicone Alkyd Zinc</i>	2-2 ½ (50-62)	Thermaline 4700 <i>Silicone</i>	1 ½ -2 (38-50)	Note: May be applied to a 300°F (148°C) operating service.	
Insulated Piping & Equipment - Steel or Stainless Steel				<i>Applications</i> Insulated piping and equipment operating up to temperature noted.			
New or Maintenance	SP 10	Thermaline 450 <i>Novolac Epoxy</i>	8-12 (200-300)			Note: may be used up to 450°F (230°C)	
New or Maintenance	SP 10	Phenoline 187 Primer <i>Phenolic Epoxy</i>	4-6 (100-150)	Phenoline 187 Finish <i>Phenolic Epoxy</i>	4-6 (100-150)	Note: may be used up to 400°F (205°C)	
Deck Plate (Light Duty) – Steel				<i>Applications</i> Deck plate in areas of low traffic. For non-slip, broadcast #36 or #47 additive into wet 890 GF then seal with additional 890 GF.			
New	SP 10	Carbozinc 859 <i>Organic Zinc</i>	3-5 (75-125)	Carboguard 890 GF or Carboguard 890 LT GF <i>Epoxy</i>	8-15 (200-375)	Carbothane 134 Series <i>Polyurethane</i>	2-2 ½ (50-62)
Maintenance (High Performance)	SP 6 (spot) SP 7 SP 2 / SP 3	Carbomastic 15 or Carbomastic 615 HS (spot prime) <i>Surf. Tolerant Epoxy</i>	4-6 (100-150)	Carboguard 890 GF or Carboguard 890 LT GF <i>Epoxy</i>	8-15 (200-375)	Carbothane 134 Series <i>Polyurethane</i>	2-2 ½ (50-62)
Maintenance (Economical)	SP 6 (spot) SP 7	Carboguard 893 or Carboguard 888 (spot prime) <i>Epoxy</i>	4-6 (100-150)	Carboguard 890 GF or Carboguard 890 LT GF <i>Epoxy</i>	8-15 (200-375)	Carbothane 134 Series <i>Polyurethane</i>	2-2 ½ (50-62)

New Construction / Maintenance	Surface Preparation (SSPC)	1 st Coat	Mils (µm)	2 nd Coat	Mils (µm)	3 rd Coat	Mils (µm)
Deck Plate (Normal Duty) – Steel				Applications Deck plate in areas of normal to high traffic. For non-slip, #47 additive may be mixed into 1209 prior to application.			
New	SP 10	Carbozinc 859 Organic Zinc	3-5 (75-125)	Carboguard 1209 Glass Flake Epoxy	14-20 (350-500)	Carbothane 134 Series Polyurethane	2-2 ½ (50-62)
Maintenance	SP 6 (spot) SP 7 or SP 11	Carboguard 893 or Carboguard 888 (spot) Epoxy	4-6 (100-150)	Carboguard 1209 Glass Flake Epoxy	14-20 (350-500)	Carbothane 134 Series Polyurethane	2-2 ½ (50-62)
Splash Zone – Steel				Applications 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 –10 to +15 ft. from mean sea level).			
New (Corrosion & Abrasion Protection)	SP 10	Carbozinc 859 Organic Zinc	3-5 (75-125)	Carboguard 1209 Glass Flake Epoxy	10-14 (250-350)	Carbothane 134 Series (optional) Polyurethane	2-2 ½ (50-62)
New (Maximum Abrasion & Impact Protection)	SP 10	Carboguard 1207 Aggregate Filled Epoxy	100-180 (2500- 4500)			Carbothane 134 Series (optional) Polyurethane	2-2 ½ (50-62)
Maintenance (Maximum Corrosion Protection)	SP 10	Carbomastic 15 or Carbomastic 615 HS Surface Tolerant Epoxy	4-6 (100-150)	Carbomastic 15 or Carbomastic 615 HS Surface Tolerant Epoxy	4-6 (100-150)	Carbothane 133 HB Polyurethane	3-5 (75- 125)
Maintenance (Corrosion & Abrasion Protection)	SP 10	Carboguard 893 or Carboguard 888 Epoxy	4-6 (100-150)	Carboguard 1209 Flake Glass Epoxy	10-14 (250-350)	Carbothane 133 HB (optional) Polyurethane	3-5 (75- 125)
Ballast Tanks and Seawater Immersion				Applications Ballast tank linings and coating of structural steel, hulls, caissons, sumps, etc. located in water immersion service or below waterline			
New or Maintenance	SP 10	Bitumastic 300 M Coal Tar Epoxy	8-12 (200-300)	Bitumastic 300 M Coal Tar Epoxy	8-12 (200-300)		
New or Maintenance	SP 10	Carboguard 890 Epoxy	4-6 (100-150)	Carboguard 890 Epoxy	4-6 (100-150)		
New or Maintenance	SP 10	Carboguard 635 Epoxy	4-6 (100-150)	Carboguard 635 Epoxy	4-6 (100-150)		
New or Maintenance	SP 10	Carbomastic 15 Surface Tolerant Epoxy	4-6 (100-150)	Carbomastic 15 Surface Tolerant Epoxy	4-6 (100-150)		
Subsea Equipment				Applications External coating of subsea trees, valves, piping, manifolds, etc.			
New	SP 10	Carboguard 890 Epoxy	4-6 (100-150)	Carboguard 890 Epoxy	4-6 (100-150)		
New	SP 10	Carboguard 635 Epoxy	4-6 (100-150)	Carboguard 635 Epoxy	4-6 (100-150)		
New	SP 10	Carboguard 890 GF Glass Flake Epoxy	8-10 (200-250)	Carboguard 890 GF Glass Flake Epoxy	8-10 (200-250)	Note: Can withstand elevated temperature	
New	SP 10	Carboguard 1209 Glass Flake Epoxy	8-10 (200-250)	Carboguard 1209 Glass Flake Epoxy	8-10 (200-250)	Note: Can withstand elevated temperature	
New	SP 10	Phenoline 1205 Glass Flake Novolac Epoxy	8-10 (200-250)	Phenoline 1205 Glass Flake Novolac Epoxy	8-10 (200-250)	Note: Suitable for high temperature service	
New	SP 10	Plasite 4550S 100% Solids Novolac Epoxy	20-40 (500-1000)			Note: Suitable for high temperature service	
Insulation of Subsea Equipment				Applications Provide insulation and corrosion protection to subsea valves, piping, manifolds, etc.			
New	SP 10	Polibrid E31 Elastomeric Polyurethane	Up to 4 inches as required				
Over-coating Galvanized Steel				Applications Over-coating galvanized steel or other surfaces to provide color and UV protection. May be used on stainless, bronze, brass, fiberglass, etc.			
New or Maintenance	SP 1	Galoseal WB Water Borne Acrylic	0.5-1 (12-25)	Carbothane 134 Series Polyurethane	2-2 ½ (50-62)		
New or Maintenance	SP 7	Carboguard 888 Epoxy	3-5 (75-125)	Carbothane 134 Series Polyurethane	2-2 ½ (50-62)		
New or Maintenance	SP 7	Rustbond 100% Solids Epoxy Sealer	1-2 (25-50)	Carbothane 134 Series Polyurethane	2-2 ½ (50-62)		

New Construction / Maintenance	Surface Preparation (SSPC)	1 st Coat	Mils (µm)	2 nd Coat	Mils (µm)	3 rd Coat	Mils (µm)
Damp Surfaces				Applications For application over surfaces where condensation occurs. Blot surface dry and apply primer by brush.			
Maintenance	SP 7 SP 2 / SP 3 SP 12-WJ-2L	Carboguard 635 Epoxy	4-6 (100-150)	Carboguard 635 Epoxy	4-6 (100-150)		
Maintenance	SP 7 SP 2 / SP 3 SP 12-WJ-2L	Carboguard 615 HS Epoxy	5-8 (125-200)	Carboguard 615 HS Epoxy	5-8 (125-200)		
Onshore Atmospheric Protection –Steel				Applications Onshore facilities, exterior of tanks, piping, compressors, vessels, etc. located onshore in moderate environment operating up to 250°F (121°C)			
New or Maintenance	SP 6 SP 2 / SP 3	Carbomastic 615 HS or Carbomastic 90 Surface Tolerant Epoxy	4-6 (100-150)	Carbothane 134 Series Polyurethane	2-2 ½ (50-62)		
New or Maintenance	SP 6	Carboguard 800 Series Epoxy	4-6 (100-150)	Carbothane 134 Series Polyurethane	2-2 ½ (50-62)		

Linings for Process Tanks and Vessels

Service Conditions		Generic Type	Product	Coats	Mils (µm)
Crude Oil, Gas Condensate, Produced Water, or Seawater Storage	120°F (48°C)	Coal Tar Epoxy	Bitumastic 300M	1-2	16-24 (400-600)
	150°F (65°C)	Epoxy Phenolic	Plasite 7122	2	12-15 (300-375)
	150°F (65°C)	Low Temp Cure Epoxy	Plasite 9057	2	12-16 (300-400)
	130°F (55°C)	100% Solids Epoxy	Plasite 4500	1	20-40 (500-1000)
	130°F (55°C)	Epoxy	Plasite 9060	2	12-15 (300-375)
Potable Water Storage (NSF Approved)		Epoxy	Carboguard 891	2	8-12 (200-300)
		Epoxy	Carboguard 691	1-2	10-16 (250-400)
		100% Solids Epoxy	Plasite 140 S	1	20-30 (500-750)
Jet Fuels, Diesel, Gasoline Storage	Meets Mil-C-4556E	Epoxy	Plasite 9060	2	12-15 (300-375)
	Meets Mil-P-23236	Epoxy Phenolic	Phenoline 187 Primer & Finish	2	8-12 (200-300)
		Low Temp Cure Epoxy	Plasite 9057	2	12-16 (300-400)
		100% Solids Novolac Epoxy	Plasite 4550	1	20-40 (500-1000)
Pressure Vessels, Separators, Treaters (Oil, Gas, Water)	230°F (110°C) & 500 ppm H ₂ S	Epoxy	Plasite 7159	2	10-12 (250-300)
	200°F (95°C) & 500 ppm H ₂ S	Glass Flake Epoxy Novolac	Phenoline 1205	2	16-20 (400-500)
	200°F (120°C) & 0.5% H ₂ S	Modified Epoxy	Plasite 9052	2	12-16 (300-400)
	250°F (124°C) & 500 ppm H ₂ S	Phenolic	Plasite 3070	3	5-7 (125-175)
Amine Contactors (DEA, MDEA, TEA)	100°F (38°C) TEA – 150°F (65°C)	Epoxy	Plasite 9060	2	12-15 (300-375)
	100°F (38°C) TEA – 212°F (100°C)	Vinyl Ester	Plasite 4300	2	35-45 (875-1125)
Glycol Contactors (EG, DEG, TEG)	EG: 150°F (65°C) DEG / TEG: 100°F (38°C)	Epoxy	Plasite 9060	2	12-15 (300-375)
	EG: 150°F (65°C) DEG / TEG: 120°F (48°C)	Vinyl Ester	Plasite 4300	2	35-40 (875-1000)
	EG: 200°F (93°C) DEG / TEG: 150°F (65°C)	Phenolic	Plasite 3070	3	5-7 (125-175)
Drilling & Workover Fluids		Epoxy Phenolic	Plasite 7122	2	12-14 (300-350)
		Glass Flake Epoxy Novolac	Phenoline 1205	2	16-20 (400-500)
	20% HCl: 120°F (48°C) 25% NaOH: 120°F (48°C)	100% Solids Novolac Epoxy	Plasite 4550	1	20-40 (500-1000)
	20% HCl: 120°F (48°C) 10% HCl: 150°F (65°C)	Vinyl Ester	Plasite 4300	2	35-45 (875-1125)

Passive Fire Protection

Fire Rating	Surface Preparation (SSPC)	1 st Coat	Mils (µm)	2 nd Coat	Mils (µm)	3 rd Coat	Mils (µm)
Fireproofing – Carbon Steel							
				<i>Applications Structural steel, decks, bulkheads, vessel supports, living quarters, control buildings, etc.</i>			
Up to 4 Hrs. UL 1709 Rating	SP 10	Carbozinc 888 <i>Epoxy</i>	3-5 (75-125)	Nullifire System E <i>Intumescent Epoxy</i>	As Required	Carbothane 134 Series <i>Polyurethane</i>	2-2 ½ (50-62)
Up to 4 Hrs. UL 1709 Rating	SP 10	Carbozinc 11 Series <i>Inorganic Zinc</i>	2-3 (50-75)	Pyrocrete 241 <i>Cementitious</i>	As Required	Carboguard 1340 <i>Epoxy sealer</i> Followed by...	1-2 (25-50)
						Carbothane 133 HB <i>Polyurethane</i>	3-5 (75-125)

General Notes:

- 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)
 - Carbozinc 11 FG: An economical inorganic zinc silicate designed for easy application.
- Carboguard 800 Series Epoxies are designed to meet your needs:
 - Carboguard 893: High solids epoxy primer or intermediate that provides excellent corrosion protection.
 - Carboguard 893 SG: Economical epoxy with excellent corrosion protection and an extended re-coat window.
 - Carboguard 888: Low temperature cure epoxy with excellent corrosion protection and an extended re-coat window.
 - Carboguard 890: High solids epoxy providing excellent corrosion protection and chemical resistance. Optional Glass Flake (GF) additive is available.
 - Carboguard 890 LT: Low temperature cure, high solids epoxy with excellent corrosion protection and chemical resistance. Optional Glass Flake (GF) additive is available.
- Carbothane 134 Series include a choice of two polyurethane topcoats to meet your needs:
 - Carbothane 134 HG: Superior performance polyurethane exceeding the requirements of SSPC Paint 36 Level 3.
 - Carbothane 134 VOC: Equivalent performance of 134 HG with lower VOC, 1.58 lbs/gal (190 g/l).
- Carbothane 133 HB topcoat may be used in lieu of 134 Series where a satin finish is desired. 133 HB may be applied at humidity levels of 90%. Carbothane 133 LH or 133 VOC may be substituted for Carbothane 133 HB as local VOC regulations dictate.
- Carboxane 2000 may be used in lieu of Carbothane 133 HB or 134 Series when an ultra-durable performance topcoat is desired.
- Carbomastic 15, Carboguard 890, Carboguard 561, Rustbond, and many other products are also available in low temperature cure versions. Please consult the product data sheet.
- Thermaline 4900 VOC and Thermaline 4700 VOC may be substituted for Thermaline 4900R and Thermaline 4700, respectively, as local VOC regulations dictate.
- Rustbond may be used as a primer/sealer overcoat over existing, aged paints (with appropriate topcoats) in many maintenance applications as an economical approach to maintenance painting.
- In maintenance painting, some coats may be eliminated depending on the condition of the existing paint system. Please consult your Carboline Sales Representative.
- Heavily pitted steel can make coating application more complicated. Please consult your Carboline Sales Representative for specific advice.
- The application technique of stripe coating edges and weld lines will improve coating system performance.
- Where superior abrasion resistance is required on deck surfaces, prime edges with 893 and apply a full coat of Carboguard 1207 with reduced silica content. A topcoat of 134 Series polyurethane may be added for color and protection. Consult your Carboline Sales Representative for special application procedures.
- Surface Cleaner 3 is a water based, biodegradable cleaner that is effective in cleaning and degreasing surfaces prior to painting.
- Where surface preparation designations of SSPC SP 10, SP 6, SP 7, SP 3, and SP 2 are used the ISO designations of Sa 2 ½, Sa 2, Sa 1, St 3, and St 2 (respectively) are also applicable.
- Plasite 4500 and 4550 are also available in airless spray versions (i.e., 4500 S and 4550 S).
- Plasite 7122L may be substituted for Plasite 7122 where VOC regulations dictate.
- Plasite 4300, 7122, and 7159 are available in High Abrasion Resistant (HAR) versions.
- For Fireproofing Systems, other primers than those listed may be acceptable. Consult your Carboline Sales Representative for specific advice.