Carboline System Guide for Pipelines & Storage Terminals

New Construction / Maintenance	Surface Preparation (SSPC)	1st Coat	Mils (µm)	2nd Coat	Mils (µm)	3rd Coat	Mils (µm)
Storage Tank Externals, Compressor Stations, Equipment and Associated Piping Located in a coastal or other area of severe atmospheric corrosion				**Applications** *Storage tank shells, fixed cone roofs, buildings, above ground piping, pipe racks, compressors, equipment, , process vessel exteriors, structural steel, stairs, ladders, and handrails operating up to 250°F (121°C)*			
New	SP 10 SP 6	Carbozinc 11 Series *Inorganic Zinc*	2-3 (50-75)	Carboguard 800 Series *Epoxy*	4-6 (100-150)	Carbothane 134 Series *Polyurethane*	2-2 ½ (50-62)
New	SP 10 SP 6	Carbozinc 859 *Organic Zinc*	3-5 (75-125)	Carboguard 800 Series *Epoxy*	4-6 (100-150)	Carbothane 134 Series *Polyurethane*	2-2 ½ (50-62)
New	SP 10 SP 6	Carbozinc 859 *Organic Zinc*	3-5 (75-125)			Carboxane 2000 *Hybrid Siloxane*	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 *Surface Tolerant Epoxy* (spot or full as needed)	4-6 (100-150)	Carboguard 800 Series *Epoxy*	4-6 (100-150)	Carbothane 134 Series *Polyurethane*	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 *Surface Tolerant Epoxy* (spot or full as needed)	5-7 (125-175)			Carbothane 133 HB *Polyurethane*	3-5 (75-125)
Maintenance (Economical)	SP 6 (spot) SP 7	Carboguard 800 Series *Epoxy* (spot or full as needed)	4-6 (100-150)	Carboguard 800 Series *Epoxy*	4-6 (100-150)	Carbothane 134 Series *Polyurethane*	2-2 ½ (50-62)
Storage Tank Externals, Compressor Stations, Equipment and Associated Piping Located in an area of moderate atmospheric corrosion				**Applications** *Storage tank shells, fixed cone roofs, buildings, above ground piping, pipe racks, compressors, equipment, process vessel exteriors, structural steel, stairs, ladders, and handrails operating up to 250°F (121°C)*			
New or Maintenance	SP 6 (spot) SP 7 SP 2 / SP 3 SP 12-WJ-2L	Carbomastic 615 HS or Carbomastic 90 *Surface Tolerant Epoxy* (spot or full as needed)	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)
Over-coating Galvanized Steel				**Applications** *Over-coating galvanized steel or other surfaces to provide color coordination 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 or 893 SG *Epoxy*	3-5 (75-125)			Carbothane 134 Series *Polyurethane*	2-2 ½ (50-62)
New or Maintenance	SP 7	Rustbond or Rustbond FC *100% Solids* *Epoxy Sealer*	1-2 (25-50)			Carbothane 134 Series *Polyurethane*	2-2 ½ (50-62)
Floating Roofs – Aboveground Storage Tanks				**Applications** *External surface of floating roofs on aboveground storage tanks and other roof designs that create standing water.*			
New	SP 10 SP 6	Carbozinc 859 *Organic Zinc*	3-5 (75-125)	Carboguard 890 *Epoxy*	4-6 (100-150)	Carboguard 890 *Epoxy*	4-6 (100-150)
New or Maintenance	SP 6 (spot) SP 7 SP 2 / SP 3 SP 12-WJ-2L	Carbomastic 15 or Carbomastic 615 HS *Surface Tolerant Epoxy* (spot or full as needed)	5-7 (125-175)	Carbomastic 15 or Carbomastic 615HS *Epoxy*	4-6 (100-150)		
New or Maintenance (Economical)	SP 10 SP 6	Carboguard 890 or Carboguard 893 SG *Epoxy*	4-6 (100-150)	Carboguard 890 or Carboguard 893 SG *Epoxy*	4-6 (100-150)		

New Construction / Maintenance	Surface Preparation (SSPC)	1st Coat	Mils (µm)	2nd Coat	Mils (µm)	3rd Coat	Mils (µm)
Piping and Equipment to 450°F/232°C – Steel				**Applications** *Piping and equipment operating to 450°F (232°C)*			
New or Maintenance	SP 10	Carbozinc 11 Series *Inorganic Zinc*	2-3 (50-75)	Thermaline 4900R *Silicone Acrylic*	1 ½ -2 (38-50)		
Piping and Equipment to 1000°F/538°C – Steel				**Applications** *Exhaust stacks, piping and equipment operating to 1000°F (538°C)*			
New or Maintenance	SP 10	Carbozinc 11 Series *Inorganic Zinc*	2-3 (50-75)	Thermaline 4700 *Silicone*	1 ½ -2 (38-50)		
New or Maintenance	SP 10	Carbozinc 4765 *Silicone Zinc*	2-3 (50-75)	Thermaline 4700 *Silicone*	1 ½ -2 (38-50)	Designed for under insulation	
Piping and Equipment to 800°F/427°C – Steel				**Applications** *Piping and equipment operating to 800 (427°C)*			
New or Maintenance	SP 10 SP 3	Carbozinc 2977 *Silicone Alkyd Zinc*	2-2 ½ (50-62)	Thermaline 4700 *Silicone*	1 ½ -2 (38-50)	**Note:** May be applied to a 300°F (148°C) operating surface.	
Insulated Piping and Equipment - Steel or Stainless Steel				**Applications** *Insulated piping and equipment operating up to temperature noted.*			
New or Maintenance	SP 10	Thermaline 450 *Novolac Epoxy*	8-12 (200-300)			**Note:** may be used up to 450°F (230°C)	
New or Maintenance	SP 10	Phenoline 187 Primer *Phenolic Epoxy*	4–6 (100-150)	Phenoline 187 Finish *Phenolic Epoxy*	4–6 (100-150)	**Note:** may be used up to 400°F (205°C)	

Pipeline Protection

New Construction / Maintenance	Surface Preparation (SSPC)	1st Coat	Mils (µm)	2nd Coat	Mils (µm)	3rd Coat	Mils (µm)
External Coating of Buried Piping –Steel				**Applications** *External surface of buried pipelines, valves, manifolds, girth weld repair, etc.*			
New or Maintenance	SP 6 SP 2 / SP 3	Bitumastic 50 *Coal Tar Mastic*	12-18 (300-450)				
New or Maintenance	SP 10	Bitumastic 300 M *Coal Tar Epoxy*	16-24 (400-600)				
New or Maintenance	SP 6 SP 2 / SP 3	Carbomastic 615 HS *Surface Tolerant Epoxy*	10-18 (250-450)	**Note:** Tolerant of damp surfaces			
New or Maintenance	SP 10	CTU 1 *Coal Tar Urethane*	20-35 (500-875)				
New or Maintenance	SP 10	Plasite 4500 *100% Solids Epoxy*	20-40 (500-1000)				
New or Maintenance	SP 10	Plasite 4550 *100% Solids Novolac Epoxy*	20-40 (500-1000)	**Note:** Use for pipe temperatures up to 225° F			
Internal Coating of Piping –Steel				**Applications** *Internal surface of piping and buried pipelines.*			
New or Maintenance	SP 10	Plasite 7122 *Epoxy Phenolic*	6-7 (150-175)	Plasite 7122 *Epoxy Phenolic*	6-7 (150-175)	**Other products as listed in the "Linings for Storage Tanks and Vessel" section may also be used as appropriate.**	
New or Maintenance	SP 10	Plasite 7159 *Epoxy Phenolic*	6-7 (150-175)	Plasite 7159 *Epoxy Phenolic*	6-7 (150-175)		
New or Maintenance	SP 10	Plasite 4500 *100% Solids Epoxy*	20-40 (500-1000)				

Linings for Storage Tanks and Vessels

Service Conditions		Generic Type	Product	Coats	Mils (µm) Total
Crude Oil Storage	120°F (48°C)	Coal Tar Epoxy	**Bitumastic 300 M**	1-2	16-20 (400-500)
	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 (500-100)
	130°F (55°C)	Epoxy	**Plasite 9060**	2	12-15 (300-375)
Jet Fuels, Diesel, Gasoline Storage	Meets Mil-C-4556E	Epoxy	**Plasite 9060**	2	12-14 (300-350)
	Meets Mil-P-23236	Epoxy Phenolic	**Phenoline 187 Primer & Finish**	2	8-12 (200-300)
		Epoxy Phenolic	**Plasite 7122**	2	12-15 (300-375)
		Low Temp Cure Epoxy	**Plasite 9057**	2	12-16 (300-400)
		100% Solids Epoxy	**Plasite 4500**	1	20-40 (500-100)
		100% Solids Novolac Epoxy	**Plasite 4550**	1	20-40 (500-100)
Ethanol, Gasoline + Ethanol	Meets Mil-C-4556E	Epoxy	**Plasite 9060**	2	12-14 (300-350)
		Epoxy Phenolic	**Plasite 7159**	2	10-12 (250-300)
		100% Solids Novolac Epoxy	**Plasite 4550**	1	20-40 (500-100)
Waste and 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)
Glass Fiber Reinforced Laminate System	Holding Primer (optional)	Epoxy Polyamide	**Plasite 7133**	1	1-4 (25-100)
	Pit Filler / Self Leveling	Epoxy	**Semstone 110**	1	20-25 (500-625)
	Glass Laminate	Roll ¾ oz. chopped strand fiberglass mat into Semstone 110.			
	Seal Coat	Epoxy	**Semstone 110**	1	10-15 (250-375)
	Finish Coat	100% Solids Novolac Epoxy	**Plasite 4500 or 4550**	1	20-30 (500-750)

Passive Fire Protection

Fire Rating	Surface Preparation (SSPC)	1st Coat	Mils (µm)	2nd Coat	Mils (µm)	3rd Coat	Mils (µm)
Fireproofing – Carbon Steel				**Applications** *Structural steel, pipe ranks, vessel supports, control buildings, etc.*			
Up to 4 Hrs. UL 1709 Rating	SP 10	Carbozinc 11 Series *Inorganic Zinc*	2-3 (50-75)	Pyrocrete 241 *Cementitious*	As Required	Carboguard 1340* *Epoxy sealer* Followed by… Carbothane 133 HB *Polyurethane*	1-2 (25-50) 3-5 (75-125)

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)
    - Carbozinc 11 FG: An economical inorganic zinc silicate designed for easy application.
2. 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.
    - Carboguard 890 LT: Low temperature cure, high solids epoxy with excellent corrosion protection and chemical resistance.
3. Carbothane 134 Series include a choice of two polyurethane topcoats to meet your needs:
    - Carbothane 134 HG: Superior performance polyurethane exceeds 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).
4. 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.
5. Carboxane 2000 may be used in lieu of Carbothane 133 HB or 134 Series when an ultra-durable performance topcoat is desired.
6. Thermaline 4900 VOC and Thermaline 4700 VOC may be substituted for Thermaline 4900R and Thermaline 4700, respectively, as local VOC regulations dictate.
7. 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 panting.
8. In maintenance painting, some coats may be eliminated depending on the condition of the existing paint system. Please consult your Carboline Sales Representative.
9. Heavily pitted steel can make coating application more complicated. Please consult your Carboline Sales Representative for specific advice.
10. The application technique of stripe coating edges and weld lines will improve coating system performance.
11. Surface Cleaner 3 is a water-based, biodegradable cleaner that is effective in cleaning and degreasing surfaces prior to painting.
12. 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.
13. Plasite 7122L may be substituted for Plasite 7122 where VOC regulations dictate.
14. Plasite 7133, Carboguard 888, or Carboguard 891 may be used as a holding primer if needed under 4550 or 4500 tank linings.
15. Carboguard 501 may be used to seal seams, caulk joints, and cove areas as needed during storage tank lining operations.
16. Plasite 7122 and 7159 are available in High Abrasion Resistant (HAR) versions.
17. Plasite 4500 and 4550 are also available in airless spray versions (i.e., 4500 S and 4550 S).
18. For Fireproofing Systems, other primers than those listed may be acceptable. Consult your Carboline Sales Representative for specific advice.