

Oil & Gas Midstream

System Guide

Coatings, Linings, and Fireproofing



Atmospheric Exposures

Clean to Bare Steel Substrates

PREP	PRIMER	DESCRIPTION	MID-COAT	DESCRIPTION	TOPCOAT	DESCRIPTION
Structural Steel, Piping, and Equipment – Carbon Steel						
Applications - Pipe Racks, reactors, process vessel exteriors, columns, drums, storage tanks, compressors, and other equipment operating up to 250°F (121°C)						
SP 6	Carbozinc 11 Series -or- Carbozinc 858 or 859 Series	Inorganic zinc primer for maximum corrosion protection -or- Organic zinc for quick topcoating and additional chemical resistance	Carboguard 635 VOC -or- Carboguard 60	Moisture tolerant chemical resistant epoxy -or- Epoxy polyamide for general purpose	Carbothane 134 Series -or- Carbothane 133 Series -or- Carboxane 2000 Series	High gloss weatherable acrylic urethane -or- Satin finish; high build urethane hybrid -or- Ultra-weatherable siloxane
SP 3	Carbomastic 15 Series -or- Carbomastic 615	Surface tolerant aluminum epoxy -or- Inert-flake filled, moisture tolerant, low temp cure epoxy	Carboguard 635 VOC -or- Carboguard 60	Moisture tolerant chemical resistant epoxy -or- Epoxy polyamide for general purpose	Carbothane 134 Series -or- Carbothane 133 Series -or- Carboxane 2000 Series	High gloss weatherable acrylic urethane -or- Satin finish; high build urethane hybrid -or- Ultra-weatherable siloxane

Systems over Existing Coatings*

PREP	OVERCOAT SEALER	DESCRIPTION	SPOT PRIMER	DESCRIPTION	TOPCOAT	DESCRIPTION
Structural Steel, Piping, and Equipment – Carbon Steel						
Applications - Pipe Racks, reactors, process vessel exteriors, columns, drums, storage tanks, compressors, and other equipment operating up to 250°F (121°C)						
SP 1 and/or SP 7	Rustbond Series (optional, as needed)	Penetrating epoxy sealer	Carbomastic 15 Series -or- Carboguard 635 VOC -or- Carboguard 60	Surface tolerant aluminum epoxy -or- Moisture tolerant, chemical resistant epoxy -or- Epoxy polyamide for general purpose	Carbothane 134 Series -or- Carbothane 133 Series -or- Carboxane 2000 Series	High gloss weatherable acrylic urethane -or- Satin finish; high build urethane hybrid -or- Ultra-weatherable siloxane

*Always determine suitability for overcoating prior to application (see Notes section).

Atmospheric Exposures

High Heat Applications

PREP	PRIMER	DESCRIPTION	TOPCOAT	DESCRIPTION
Uninsulated Piping and Equipment – Steel operating to 300°F (148°C) Applications - Piping, heaters, furnaces, boilers, stacks, columns, drums, vessels, heat exchangers, mufflers, valves, pumps and equipment operating up to 300°F (148°C).				
SP 3	Carbomastic 15 Series	Surface tolerant aluminum epoxy	Carbomastic 15 Series	Surface tolerant aluminum epoxy
SP 10	Carboguard 890 Series -or- Carboguard 690	High chemical resistant epoxy -or- Moisture tolerant, low temp cure epoxy	Carboguard 890 Series -or- Carboguard 690	High chemical resistant epoxy -or- Moisture tolerant, low temp cure epoxy

PREP	PRIMER	DESCRIPTION	TOPCOAT	DESCRIPTION	OPTIONAL THIRD COAT	DESCRIPTION
Uninsulated Piping and Equipment – Steel operating to 450°F (232°C) Applications - Piping, heaters, furnaces, boilers, stacks, columns, drums, vessels, heat exchangers, mufflers, valves and pumps and equipment operating at 250-450°F (121-232°C).						
SP 10	Carbozinc 11 Series	Inorganic zinc primer for maximum corrosion protection	Thermaline 4000 Series -or- Thermaline 4900 Series	Inorganic silicate; no heat cure requirement -or- Silicone acrylic	Thermaline 4000 Series -or- Thermaline 4900 Series	Inorganic silicate; no heat cure requirement -or- Silicone acrylic
Uninsulated Piping and Equipment – Steel operating up to 1000°F (538°C) Applications - Piping, heaters, furnaces, boilers, stacks, columns, drums, vessels, heat exchangers, mufflers, valves and pumps and equipment operating at 450-1000°F (232-538°C).						
SP 10	Carbozinc 11 Series	Inorganic zinc primer for maximum corrosion protection	Thermaline 4000 Series -or- Thermaline 4700 Series	Inorganic silicate; no heat cure requirement -or- Silicone	Thermaline 4000 Series -or- Thermaline 4700 Series	Inorganic silicate; no heat cure requirement -or- Silicone

Worker Protection and Insulation Needs

PREP	PRIMER	DESCRIPTION	INSULATIVE COATING	DESCRIPTION	TOPCOAT	DESCRIPTION
Uninsulated Piping and Equipment – Steel operating to 350°F (176°C) Applications - Apply to hot surfaces for worker protection. Use for thermal insulation to suppress solar heating of fuel storage tanks, ceilings, ductwork, etc. Eliminates sweating surfaces on condenser boxes, cold vessels, etc.						
SP 10	Carbozinc 11 Series -or- Carbozinc 859 Series	Inorganic zinc primer -or- Organic zinc primer	Carbotherm 551	Insulative epoxy coating	(Optional) Carbocrylic 3359 Series -or- Carbothane 133 Series	Weatherable acrylic finish

Linings for Storage Tanks and Vessels

All tank lining recommendations must be reconfirmed through Carboline Technical Service Department.

SERVICE CONDITIONS		GENERIC TYPE	PRODUCT	# OF COATS	Mils (µm) TOTAL
Solvent storage		Cycloaliphatic amine epoxy	Phenoline 385	2	12-15 (300-375)
		Epoxy amine	Phenoline Tank Shield Series	1	20-25 (500-625)
Acid, oxidizer, alkali storage		Flake pigment vinyl ester	Plasite 4300	2	35-45 (875-1125)
		Novolac epoxy	Plasite 4550 Series	1	40-50 (1000-1250)
Amine storage		Flake pigment vinyl ester	Plasite 4310	2	35-45 (875-1125)
		Epoxy novolac	Plasite 4550 Series	1	25-30 (625-750)
Brine storage (<150°)		Epoxy amine	Phenoline Tank Shield Series	1	20-25 (500-625)
		Glass-flake novolac	Phenoline 1205	2	12-15 (300-375)
Process water storage	230°F	Epoxy phenolic	Plasite 7159	2	12-15 (300-375)
	200°F	Proprietary epoxy	Plasite 4540	1	20-30 (500-750)
	180°F	Cycloaliphatic epoxy	Phenoline 385	2	10-12 (250-300)
	150°F	Epoxy amine	Phenoline Tank Shield Series	1	20-25 (500-625)
MEG storage		Epoxy amine	Phenoline Tank Shield Series	1	20-25 (500-625)
		Cycloaliphatic amine epoxy	Phenoline 385	2	10-12 (250-300)
Fuel, oil, diesel, gasoline storage		Epoxy amine	Phenoline Tank Shield Series	1	20-25 (500-625)
		Cycloaliphatic amine epoxy	Phenoline 385	2	10-12 (250-300)

Linings for Storage Tanks and Vessels

All tank lining recommendations must be reconfirmed through Carboline Technical Service Department.

SERVICE CONDITIONS		GENERIC TYPE	PRODUCT	# OF COATS	Mils (µm) TOTAL
Ethanol, gasoline + ethanol		Epoxy	Phenoline 385	2	12-14 (300-350)
		Epoxy	Phenoline 353 or 353 LT	2	12-14 (300-350)
		Epoxy novolac	Plasite 4500	1	20-25 (500-625)
Waste water, fire water, and potable water storage (NSF approved)		Epoxy	Carboguard 891 VOC	2	8-16 (200-400)
		Epoxy phenalkamine	Phenoline 341	1	15-20 (375-500)
Glass fiber reinforced laminated system	Holding primer	Flake-filled, epoxy novolac -or- General purpose epoxy	Phenoline 311 -or- Carboguard 60	1	2-3 (50-75)
	Patching mortar and caulk	Epoxy	Carboguard 695 PM or Carboguard 163 (spray)	1	As Needed
	Glass laminate	¾ oz. chopped strand fiberglass mat embedded between two 20-30 mil coats of Carboguard 695 CLR			
	Seal coat	100% Solids epoxy	Phenoline 341 -or- Phenoline Tank Shield Series -or- Plasite 4550 Series	1	20-30 (500-750)
Glass fiber reinforced laminate, restoration of existing systems.			Determined by condition based assessment	Consult Carboline to extend the life of your current tank bottom system.	

Specialty Applications

PREP	1ST COAT	DESCRIPTION	2ND COAT	DESCRIPTION	OPTIONAL THIRD COAT	DESCRIPTION
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.						
SP 1 -or- SP 7	Galoseal WB -or- Carboguard 60	Acrylic bonding primer -or- Epoxy polyamide for general purpose	Carbocrylic 3359 Series -or- Carbothane 134 Series -or- Carbothane 133 Series	Industrial, weatherable acrylic finish -or- High gloss weatherable acrylic urethane -or- Satin finish; high build urethane hybrid		
Floating Roof of Storage Tanks – Steel						
Applications - Exterior surface of the floating roof on storage tanks where standing water might be present.						
SP 6	Carbozinc 859 -or- Carbomastic 15 Series -or- Carbomastic 615 Series	Organic zinc primer -or- Surface tolerant aluminum epoxy -or- Cold cure high performance epoxy	Carboguard 60	Epoxy polyamide for general purpose	Carboguard 60	Epoxy polyamide for general purpose
SP 2 or SP 3	Rustbond Series	Penetrating sealer	Carbomastic Series or Carboguard Series	Spot primers and stripe coat epoxies	Carboguard 60	Epoxy polyamide for general purpose

PREP	1ST COAT	DESCRIPTION	2ND COAT	DESCRIPTION	OPTIONAL THIRD COAT	DESCRIPTION
Walkways (Non-Slip Areas) - Steel						
Applications - For applications where non-slip walking surfaces are required.						
SP 10	Carbozinc 859 -or- Carboguard 60	Organic zinc for quick topcoating and additional chemical resistance -or- General purpose epoxy	Carboguard 1209 with filler #47 or #36 -or- Carboguard 869 Non-Skid	Heavy-duty, glass-flake, non-skid epoxy -or- Medium-duty, non-skid epoxy	Carbothane 134 Series	High gloss weatherable acrylic urethane

Pipeline Protection

NEW CONSTRUCTION / MAINTENANCE	SURFACE PREPARATION (SSPC)	1ST COAT	MILS (µm)	NOTES
External Coating of Buried Piping –Steel				
Applications: External surface of buried pipelines, valves, manifolds, girth weld repair, etc.				
New or Maintenance	SP 10	Bitumastic 300 M Coal Tar Epoxy	16-24 (400-600)	
New or Maintenance Transitions	SP 6 SP 2 / SP 3	Carbomastic 615 Surface Tolerant Epoxy	10-18 (250-450)	Note: Tolerant of damp surfaces
Girthwelds or Dig-Outs	SP 10	SP-2888 R.G.*	20-50 (500-1250)	Spray grade, brush or cartridge
Directional Drill ARO or Mechanical Protection	SP 10	SP-2888 R.G.*	40-70 (1000-1750)	Single coat application (spray)
Internal Coating of Piping –Steel				
Applications: Internal surface of piping and buried pipelines.				
New or Maintenance	SP 10	Polyclad 951 64% Solids Epoxy	2-6 mils (50-300)	API 5L2 for dry natural gas
New	SP 10	Polyclad 952 75% Solids Epoxy	2-6 mils (50-300)	API 5L2 for dry natural gas
New	SP 10	Polyclad 956 100% Solids Epoxy	2-6 mils (50-300)	API 5L2 for dry natural gas
New or Maintenance	SP 10	Phenoline Tank Shield Series	20-25 (500-625)	Crude oil pipe lining

*Specialty Polymer Coatings, part of the Carboline Company

NOTES:

1. **Carbozinc 11 Series** consists of four inorganic zinc products designed to meet every need: **Carbozinc 11, 11 VOC, 11 FC, 11 HS, and 11 WB.**
2. **Carbothane 134 Series** include several choices of high gloss acrylic urethanes to meet your needs: **134 HG, 134 VOC, 134 LV, 134 MC, 134 WB, and 134 HP.**
3. **Phenoline Tank Shield Series** includes **Phenoline Tank Shield** (standard airless spray) and **Phenoline Tank Shield Plus** (plural component airless spray).
4. **Carbothane 133 Series** may be used in lieu of 134 Series when a satin finish and higher film build characteristics are desired. **Carbothane 133 Series** includes **133 HB, 133 VOC, 133 MC, 133 LV, and 133 LH** used where VOC regulations dictate.
5. **Thermaline 4900 VOC** and **Thermaline 4700 VOC** may be substituted for **Thermaline 4900** and **Thermaline 4700**, respectively, as local VOC regulations dictate.
6. In maintenance painting, some coats may be eliminated depending on the condition of the existing paint system. Please consult your Carboline Sales Representative.
7. Heavily pitted steel can make coating application more complicated. Please consult your Carboline Sales Representative for specific advice.
8. The application technique of stripe coating edges and weld lines will improve coating system performance.
9. **Surface Cleaner 3** is a water based cleaner that is effective in cleaning and degreasing surfaces prior to painting.
10. 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.
11. **Phenoline 311** or **Carboguard 60** may be used as a holding primer for many lining applications. Consult Technical Service for specific applications.
12. **Plasite 4503** may be used as a primer for severely pitted steel tank bottoms.



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