PHOSCRETE FORMULA 1-VO

TECHNICAL DATA GUIDE

Very Rapid Hardening MALP (Magnesium Aluminum Liquid Phosphate) concrete for vertical and overhead installation and repairs. Provides long-term durability with structural integrity.

DESCRIPTION

PHOSCRETE® FORMULA 1-VO™ (F1-VO) is a two-part polymer-enhanced cementitious MPC (Magnesium-Phosphate-Cement) concrete repair material composed of magnesium oxide, aluminosilicates and aggregates (Dry Mix), that must be mixed with pre-measured F1-VO Activator. Phoscrete F1-VO is very rapid hardening with high-early strength gain. It is easy to apply by hand with a trowel and can be feather-finished. F1-VO stops corrosion of steel on contact and forms both a chemical and a mechanical bond to cured concrete and to itself. Phoscrete F1-VO allows fast completion of concrete repairs. F1-VO meets ASTM C 928, Type R3.

PROVEN APPLICATIONS

- Vertical and overhead: above grade and below grade concrete structures
- Rehabilitation of concrete bridge structural elements, including soffits, beams, caps, piers, and columns
- Rehabilitation of marine structures including seawalls, navigation locks, guide walls, reservoirs, dams, and discharge tunnels
- Rapid repair of new construction concrete's defects, notably pre-cast shapes
- Rapid repair of spalls on concrete pavements and floors
- Rapid repair of sidewalks, stairs, sills, and culverts
- Rapid repair of building facades, parking structures and tilt-up walls

ADVANTAGES

- Labor and time-saving - no sandblasting of steel bars, no anti-corrosion primer, no sacrificial anodes.
- Fast, easy, and accurate mixing in a bucket.
  Two pre-measured components: dry mix in a bag and liquid activator in a jug.
- Easy to apply: high-build, non-sag.
- Easy to finish using a trowel, screed, or sponge; can be feather-finished.
- High early and ultimate compressive, bond, flexural, and tensile strengths.
- Freeze-thaw resistant.
- Very low shrinkage.
- Strong bond to clean cured concrete and to itself with no cold joints.
- Stops rust and inhibits corrosion: converts iron oxide to metal phosphate.
- Does not out-gas after cure: accepts sealers and polymer coatings as soon as 30 minutes following initial set.
- Chemically stable: no added chlorides, resists chloride penetration.
- All temperature use –works fast even in sub-freezing temperatures. Cool F1-VO Activator in warm temperatures and use Phoscrete Fast-Set/Slow-Set Admixtures to manage setting/working time.
- Environmentally friendly – no VOCs, no odor.

Packaging

Large Bag Kit: [1] bag + [1] jug
Dry Mix: 50 lb. (22.5 kg)
Polyethylene -lined paper bag
F1-VO Activator: 96 fl. oz. (2.8 l)
LDPE 1-gallon jug
Yield: 5.4 bf, 0.45 ft^3, 0.0127 m^3
52 bags and jugs per full pallet.

Small Bag Kit: [1] bag + [1] jug
Dry Mix: 22 lb. (10 kg)
Polyethylene -lined paper bag
F1-VO Activator: 42 fl. oz. (1.2 l)
LDPE ½-gallon jug
Yield: 2.4 bf, 0.20 ft^3, 0.0056 m^3
96 bags and jugs per full pallet.

Small Pail Kit: [1] bag + [1] jar
Dry Mix: 11 lb. (5 kg) *paper bag*
F1-VO Activator: 21 fl. oz. (0.6 l)
PET jar
Yield: 1.2 bf, 0.10 ft^3, 0.0028 m^3
64 small pails per full pallet.

Mixing Ratio

Pre-measured, pre-extended.
Mix [1] jug into [1] bag.
Use color-matched bags and jugs.
Always add liquid first.
Do not extend with sand or aggregate.

Storage

Store in clean, dry conditions in unopened, original packaging.

Shelf Life

Dry Mix: 24 months
Activator: 12 months
(when properly stored)

VOC Content

0 g/L: Less exempt solvents

LABORATORY TEST DATA

Fresh Properties

Test	Specification	Description	Time	Typical Results	
Set Time	ASTM C403	Time of Setting by Penetration Resistance	Initial | Final	8 min	9 min
Slump	ASTM C143	Slump of Hydraulic-Cement Concrete	5 min	10.25 in (26 cm)	
Density	ASTM C387	Density (Unit Weight) of Concrete		132.9 lb/ft^3	2259 kg/m^3
Air Content	ASTM C231	Air Content by Pressure Method		5.7%	

Strength Properties

Test	Specification	Description	Time	Typical Results	
				psi	MPa
Compressive Strength	ASTM C109	Compressive Strength of Hydraulic Cement Mortars Using 2-in. Cube Specimens	1 hour	4500	31.0
			1 day	8500	58.6
			28 days	10000	68.9
Flexural Strength	ASTM C78	Flexural Strength of Concrete Using Simple Beam with Third-Point Loading	1 day	575	3.4
			28 days	600	4.8
Bond Strength	ASTM C882	Bond Strength by Slant Shear: Phoscrete - Concrete	1 hour	1500	10.3
			1 day	2500	17.2
			28 days	3000	20.7
		Bond Strength by Slant Shear: Phoscrete - Phoscrete	1 hour	1750	12.1
			1 day	2500	17.2
			28 days	3000	20.7
Tensile Strength	ASTM C496	Splitting Tensile Strength of Cylindrical Concrete Specimens	1 day	810	6.9
Modulus of Elasticity	ASTM C469	Static Modulus of Elasticity and Poisson's Ratio of Concrete in Compression	28 days	3.1 E^{+06}	21 E^{+04}
				0.274	

Durability Properties

Test	Specification	Description	Test	Typical Results	
Free Shrinkage	ASTM C157	Length Change of Hardened Concrete (Std)	28 Days Wet | Dry	+0.03%	-0.03%
Freeze Thaw	ASTM C666-A	Resistance of Concrete to Rapid Freezing and Thawing in a Saturated Condition (300 cycles)	Durability Factor	95.5%	
Chlorides	ASTM C1202	Electrical Indication of Concrete's Ability to Resist Chloride Ion Penetration (Coulombs)	28 days	83 C (negligible)	
	AASHTO T260	Chloride Content (%)	28 days	.004%	.004%

Laboratory test reports are available upon request.

GENERAL INSTALLATION GUIDELINES

- Refer to Phoscrete Formula 1 [MALP Series] Full Installation Guide, for the most complete documentation on best practices.
- Refer to Warm Temperature Guidelines and Cold Temperature Guidelines, for information on how to mix Phoscrete materials in warm (>70°F/20°C) and cold climates (<50°F/10°C), The Guidelines contain information about the use of Phoscrete Fast- and Slow-Set Admixtures, and best practices for cooling or supercooling the Liquid Activator. Cooling the Liquid Activator can be achieved on ice at 40°F (4°C) or supercooling in a freezer at 10°F (-12°C). Liquid Activator's freezing point is -10°F (-23°C).

SURFACE PREPARATION

- The concrete surface must be sound and fully cured.
- Remove loose, damaged, and concrete contaminated by oil, grease, and other bond-inhibiting materials.
- When saw-cutting or shot-blasting, remove surface dust and slurry with air or water (allow to dry prior to application).
- Surface must be frost-free, dry, and free of standing water. Gently apply heat (torch) to eliminate surface moisture.
- Concrete profile should reach minimum CSP (Concrete Surface Profile) of 6 per ICRI Guidelines.
- Remove loose scale (rust) from steel bars with a wire brush. Sandblasting is not required.
- Replace reinforcing bars according to instructions from the designer. Generally, bars that have lost 25% or more of their original diameter must be replaced.

PRIMER COAT

Phoscrete Primer is recommended as a pre-treatment when installing Phoscrete Formula 1 (F1) for concrete repairs when the substrate contains reactive aggregates (notably limestone), and in high stress environments, and when maximum bond strength is desired. Phoscrete Primer is ideal for preparing substrates for vertical, overhead, and horizontal concrete repairs, including expansion joints.

- Scrub in a thin layer of Primer into the area to be repaired using a gloved hand, being careful to fill all voids and cover all exposed aggregates.
- Apply Primer to maintain at least ¼" (½ cm) uniform thickness over the bond interface using gloved hands and concrete margin trowels. Do not apply Primer to reinforcing steel.
- Wait at least 15 minutes, and until the material is no longer malleable (you can't press your finger and indent the primer surface), before proceeding with installation of Phoscrete F1.
- Phoscrete F1 bonds to Primer with no cold joints, when cured.

MIXING

- Mix PHOSCRETE F1-VO at the placement site.
- Mix [1] jug of F1-VO Activator into [1] bag F1-VO Dry Mix. Match colored labels on bags and jugs to ensure proper mixing ratio.
  Note: 22 lb. Kits of F1-VO have light purple labels and pair with ½-gallon jugs. 50 lb. Kits have purple labels and pair with 1-gallon jugs.
- DO NOT MIX USING PARTIAL BAGS OR JUGS.
  Note: F1-VO Activator jugs contain liquids with different densities. Using a partial jug does not guarantee equal distribution of liquids.
- Use a heavy-duty five [5] gallon bucket for mixing. Mix with a paddle (Phoscrete's urethane auger is highly recommended), using a dual or variable speed drill suitable for mixing (Bosch GBM-9-16 is highly recommended).
- When mixing Small Pail Kits, use a minimum 18v variable speed drill on the high torque setting. For professional use, Phoscrete's small urethane auger is highly recommended.
- Agitate then empty entire jug or jar into a clean bucket first. Next add other Phoscrete admixtures (Fast-Set, Slow-Set) as needed. Then add Dry Mix into the bucket while slowly running the mixer.
- Mix for a minimum of 45 seconds, and until the material is completely wetted out (no dry material remains) and begins to fold over on itself, showing a putty consistency. Do not under-mix or over-mix.

HAND-PACK APPLICATION

- A batch of Phoscrete F1-VO must be placed and finished within 5 - 15 minutes after mixing, temperature dependent.
- Install immediately after mixing. Discard the remainder of the batch once the material begins to set up in the pail.
- Phoscrete F1-VO is a thixotropic material: vibration and tapping with a trowel increases flow.
- Scrub in a thin layer of F1-VO into the area to be repaired using a gloved hand, being careful to fill all voids.
- Fill the repair in lifts using concrete floats and margin trowels. Force the material against the edges of the repair. In-between lifts, scarify the surface by scratching crisscross lines in the layer with a trowel prior to set for best bond adhesion. Phoscrete bonds to itself with no cold joints, whether wet or completely cured.
- Finish the repair using margin trowels or a water-dampened stucco sponge. Phoscrete F1-VO can be feather-finished.
- Wipe F1-VO from trowels with a water-dampened cloth. Do not pour water on the repair.
- If rain begins prior to final set, protect the repair area with plastic sheeting for at least 30 minutes following initial set.

CURING

- Once Phoscrete F1-VO achieves initial set (you can't press a nail into the center of the material), paint or spray-apply a thin coat of Phoscrete Endure™ to the exposed surface. This prevents evaporation while the material cures, reducing drying shrinkage.
- Phoscrete Endure absorbs quickly into Phoscrete F1-VO.

CLEANING

- In-between batches, clean tools with a water-dampened towel, and wipe off excess water prior to contact with Phoscrete.
- When the job is completed, clean tools with water. Clean hands with soap and water.

LIMITATIONS

- Do not use any primer or admixtures other than those provided by Phoscrete.
- Do not extend PHOSCRETE F1-VO with aggregate. Do not add sand and/or any type of cement.
- Do not mix partial units.
- Minimum recommended thickness for partial depth repairs: ½ inch (1.27 cm). F1-VO can be feather finished. Note: no maximum thickness limitation with Phoscrete F1-VO
- Minimum ambient temperature: -5°F (-20°C)
- Do not use water when mixing, placing, or finishing PHOSCRETE F1-VO
- When wet, PHOSCRETE F1-VO cannot be placed in direct contact with galvanized steel (zinc). Apply Phoscrete Primer first.
- Proper application is the responsibility of the user. Field visits by Phoscrete personnel are for the purpose of making technical recommendations, not for supervising or providing quality control on the jobsite.

LIMITED WARRANTY NOTICE

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HEALTH, SAFETY, AND ENVIRONMENTAL

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