PHOSCRETE FORMULA 3-VO

TECHNICAL DATA GUIDE

Rapid Hardening MKP (Magnesium Potassium Phosphate) mortar for vertical, and overhead concrete repairs, both hand-packed and shotcrete installations. Provides long-term durability with structural integrity.

DESCRIPTION

PHOSCRETE® FORMULA 3-VO™ (F3-VO) is a two-part polymer-enhanced cementitious MPC (Magnesium-Phosphate-Cement) concrete repair mortar composed of magnesium oxide, potassium phosphate, and aggregates (Dry Mix) that must be mixed with pre-measured F3-VO Activator. Phoscrete F3-VO is rapid-hardening, with high-early strength gain. It is easy to apply by hand, trowel, or spray (wet process), and can be feather-finished.

F3-VO forms both a chemical and a mechanical bond to cured concrete and to itself. Phoscrete F3-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.
- Fast, easy, and accurate mixing in a bucket or pan mixer.
  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.
- 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 – heat/cool F3-VO Activator 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. (22.7 kg)
Polyethylene-lined paper bag
F3-VO Activator: 122 fl. oz. (3.6 l)
LDPE 1-gallon jug
Yield: 5.4 bf, 0.45 ft^3, 0.0127 m^3
48 bags and jugs per full pallet.

Small Bag Kit: [1] bag + [1] jug
Dry Mix: 22 lb. (10 kg)
Polyethylene-lined paper bag
F3-VO Activator: 54 fl. oz. (1.6 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)
HDPE 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.

Curing

Phoscrete Endure 1-gallon (3.8l) PET jugs *Upon set, apply to Phoscrete MPC to reduce evaporation and shrinkage.*

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	Independent Test Results	
Set Time	ASTM C191	Time of Setting by Vicat Needles	Initial | Final	17 min	22 min
	ASTM C403	Time of Setting by Penetration Resistance		15 min	18 min
Flow	ASTM C1437	Consistency (Flow %)	5 min	107%	
Density	ASTM C387	Density (Unit Weight) of Concrete		129.8 lb/ft^3	2243 kg/m^3
Air Content	ASTM C231	Air Content by Pressure Method		4.0%	

Strength Properties

Test	Specification	Description	Time	Independent Test Results	
				psi	MPa
Compressive Strength	ASTM C109	Compressive Strength of Hydraulic Cement Mortars Using 2-in. Cube Specimens	2 hours	2000	13.8
			1 day	3000	20.7
			28 days	6200	42.7
Flexural Strength	ASTM C78	Flexural Strength of Concrete Using Simple Beam with Third-Point Loading	1 day	500	3.4
			28 days	600	4.1
Bond Strength	ASTM C882	Bond Strength by Slant Shear:	1 day	2000	13.8
			7 days	2400	16.5
	ASTM C1583	Direct Bond Strength by Pull Off	28 days	299	2.1
Tensile Strength	ASTM C496	Splitting Tensile Strength of Cylindrical Concrete Specimens	28 days	540	3.7
Modulus of Elasticity	ASTM C469	Static Modulus of Elasticity and Poisson's Ratio of Concrete in Compression	28 days	2.5 E^{+06}	1.7 E^{+04}
				0.297	

Durability Properties

Test	Specification	Description	Test	Independent Test Results	
Free Shrinkage	ASTM C157	Length Change of Hardened Concrete (Std)	28 Days Wet | Dry	+0.006%	-0.042%
Freeze Thaw	ASTM C666-A	Resistance of Concrete to Rapid Freezing and Thawing in a Saturated Condition (300 cycles)	Durability Factor	99.2%	
Scaling	ASTM C672	Scaling Resistance of Concrete Surfaces Exposed to Deicing Chemicals (50 cycles) Results = Visual | Material Loss lbs./ft^2(%)	$CaCl_2$	Visual 0	0.0 lbs/ft^2
Resistivity	AASHTO T358	Surface Resistivity (kΩ-cm)	28 days	86.0 kΩ-cm	
Chlorides	ASTM C1202	Electrical Indication of Concrete's Ability to Resist Chloride Ion Penetration (Coulombs)	28 days	332 C	
	AASHTO T260	Chloride Content (%)	28 days Acid | Water	0.005%	0.004%

Independent accredited laboratory test reports are available upon request.

GENERAL INSTALLATION GUIDELINES

- Refer to Phoscrete Formula 3 [MKP Series] Full Installation Guide, for the most complete documentation on best installation practices, including recommended tools and mixing equipment.
- Cool Activator on ice to 40°F and/or use Slow-Set Admix in temperatures above 77°F (25°C) for additional working time.
- Warm Activator in hot water and/or mix longer when working in cold temperatures for faster set.
- Refer to Phoscrete's Best Practices for Cold Temperature and Warm Temperature Guidelines for details on mixing times and working with Phoscrete Admixtures (Fast-Set, Slow-Set).

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.

REBAR COAT

Phoscrete Rebar Coat (RC) is recommended as a corrosion inhibitor when installing Phoscrete Formula 3 (F3) for concrete repairs when the substrate contains exposed steel bars. Phoscrete Rebar Coat stops rust on contact and prevents future corrosion, including the ring anode (halo) effect.

- RC is very fast setting. Chill the activator and/or dry mix for longer working time.
- Mix, then quickly hand-apply a thin layer of Rebar Coat to steel bars, followed immediately by a thicker coat at approximately ¼" (½ cm) uniform thickness using gloved hands.
- Proceed with installation of Phoscrete F3.
- Phoscrete F3 bonds to Rebar Coat with no cold joints, when cured.

MIXING

- Mix Phoscrete F3-VO at the placement site. Mix [1] jug of F3-VO Activator into [1] bag F3-VO Dry Mix. Match colored labels on bags and jugs to ensure proper mixing ratio. *Note: 22 lb. Kits of F3-VO have light gold labels and pair with ½-gallon jugs. 50 lb. Kits have gold labels and pair with 1-gallon jugs.*
- DO NOT MIX USING PARTIAL BAGS OR JUGS.
  Note: F3-VO Activator jugs contain liquids with different densities. Using a partial jug does not guarantee equal distribution of liquids.
- Use a five [5] gallon bucket or larger for mixing kit (Phoscrete's 8 gallon heavy-duty mixing bucket is highly recommended). Mix with a paddle (Phoscrete's urethane auger is highly recommended), and a dual or variable speed drill suitable for mixing (Bosch GBM-9-16 is highly recommended).
- When mixing multiple bags for shotcrete or pumping applications, use the Phoscrete Pan Mixer and ShotPump™.
- 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.
- First, empty the entire jug into a clean bucket. Next, add other Phoscrete admixtures (Fast-Set, Slow-Set, Fibers) as needed. Then quickly add Dry Mix into the bucket while slowly running the mixer.
- Mix with the drill at full speed for at least two [2] minutes, and until the material is fully wetted out and shows a uniform consistency. DO NOT UNDER MIX. Using a mixing paddle other than Phoscrete's urethane auger will require additional mixing time. In colder temperatures, mix longer: ADD one [1] minute additional mixing time for every 5°F (~3°C) COLDER than 73°F (23°C). Refer to Phoscrete's Best Practices for Cold Temperature for a mixing temperature guideline chart.

HAND-PACK APPLICATION

- A batch of Phoscrete F3-VO must be placed and finished within 15 - 25 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 F3-VO is a thixotropic material: vibration and tapping with a trowel increases flow.
- Scrub in a thin layer of F3-VO into the area to be repaired using a gloved hand, being careful to fill all voids.
- Fill the repair in lifts using gloved hands and concrete margin trowels. 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 F3-VO can be feather-finished.
- Wipe F3-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.

SHOTCRETE APPLICATION

- Use only Phoscrete's ShotPump™ equipment or other Phoscrete-approved equipment for wet shotcrete installations.
- Phoscrete ShotPump is easy to operate with minimal training, and easy cleanout.
- Phoscrete ShotPump may be used with bucket mixes or with the Phoscrete Pan Mixer.
- Phoscrete Large Bag Kits (50 lbs. / 22.7 kg) are recommended for shotcrete installations.
- Follow surface preparation guidelines above.
- Follow hand-pack application guidelines above for finishing.
- Contact Phoscrete installation support to discuss your specific application and requirements.

CURING

- Once Phoscrete F3-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 F3-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 the 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 F3-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). F3-VO can be feather finished. Note: no maximum thickness limitation with Phoscrete F3-VO
- Minimum ambient temperature: 35°F (2°C)
- 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.

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HEALTH, SAFETY, AND ENVIRONMENTAL

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