PHOSCRETE FORMULA 3-HC

(Formerly Phoscrete Formula 3E-HC)

TECHNICAL DATA GUIDE

Rapid Hardening MKP (Magnesium Potassium Phosphate) concrete for horizontal and castable installation, repairs, and overlays. Provides long-term durability in all-weather environments.

DESCRIPTION

PHOSCRETE® FORMULA 3-HC™ (F3-HC) is a two-part cementitious MPC (Magnesium-Phosphate-Cement) concrete composed of magnesium oxide, potassium phosphate, aluminosilicates, aggregates, reinforcing fibers (Dry Mix) that must be mixed with water, plus a liquid soy-methyl-ester polystyrene (PHOSCRETE ENDURE™) admixture that is a concrete durability enhancer. F3-HC is rapid hardening, and gains strength suitable to vehicular traffic in two hours at moderate ambient temperatures. F3-HC forms both a chemical and a mechanical bond to cured concrete and to itself. PHOSCRETE F3-HC meets ASTM C 928, Type R3.

PROVEN APPLICATIONS

- Fast-track bridge deck overlay with a minimum thickness ½ inch (1.25 cm)
- Full depth and partial depth concrete repairs
- Horizontal surfaces: poured/castable applications
- Pavement repairs, parking structures, marine structures.
- Airport runway and apron concrete repairs

ADVANTAGES

- Labor and time saving material: fast setting, self-consolidating, no sandblasting of steel bars, no anti-corrosion primer, no curing treatments, easy clean up with water.
- Easy and accurate mixing: two components plus water: Dry Mix in a bag and ENDURE in a bottle. Pre-extended mix.
- Can be pumped using bulk sacks and metered water for large volume pours and concrete pavement overlays.
- Rapid return to service: exceeds 3,000 psi (20.7 MPa) compressive strength and 2,000 psi (13.8 MPa) bond strength 2 hours following placement at 68°F (20°C). Ultimate strengths exceed 7,000 psi (48 MPa) compressive and 3,000 psi (20.7 MPa) bond.
- Freeze-thaw and salt scaling resistance, even when exposed to $MgCl_2$ and $CaCl_2$.
- Fiber reinforced: high flexural strength and ductility.
- Strong mechanical and chemical bond to clean cured concrete and to itself. with no cold joints.
- Stops rust and inhibits corrosion: converts iron oxide to metal phosphate.
- Chemically stable: no added chlorides, resists chloride penetration.
- Not a vapor barrier; allows on grade applications.
- Environmentally friendly: no odor.
- All temperature use: heat/cool water and use Phoscrete Fast-Set/Slow-Set admixtures to manage setting/working time.

Packaging

Bulk Sack 2200 lb. (1000 kg)
Bulk Sack Yield: 18 ft^3 - 0.66 yd^3 (0.509 m^3)

Dry Mix Bag: 55 lb. (25 kg) polyethylene-lined paper bag
Bag Yield: 0.45 ft^3 (0.0129 m^3)
48 kits per full pallet.

Endure Jug: 100 fl. oz. (3 l)
Add 1% ENDURE by weight of dry mix. Use provided measuring cup to measure 8 oz.

Small Pail: 11 lb. (5 kg)
HDPE pail contains Dry Mix Bag, HDPE jar contains: Endure 1.6 oz (47 ml) and water 20 oz (592 ml)
Small Pail Yield: 1.0 bf (144 in^3, 0.0024 m^3)

Mixing Ratio

Pre-extended mix. Do not extend with sand or aggregate.
Water-To-Dry Mix Ratio: 11.85%
Measure 6.25 lbs water (100 fl. oz, 3 l) per 55 lb. Dry Mix Bag.
Pre-measure water + 1% Endure Admix + any other Phoscrete admixtures into clean plastic mixing bucket, mortar mixer, or pan mixer. Then add the entire bag(s) of dry mix and mix thoroughly.

Storage

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

Shelf Life *(when properly stored)*

Dry Mix: 24 months
ENDURE: 18 months

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	18 min	22 min
	ASTM C403	Time of Setting by Penetration Resistance		20 min	25 min
Slump	ASTM C143	Slump of Hydraulic-Cement Concrete	5 min	7.0 in (17.8 cm)	
Density	ASTM C387	Density (Unit Weight) of Concrete		136 lb/ft^3	2178 kg/m^3
Air Content	ASTM C231	Air Content by Pressure Method		4.8%	

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	3000	20.7
			3 hours	4000	27.6
			1 day	5000	34.5
			28 days	7000	48.2
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: Phoscrete - Concrete	2 hours	2000	13.8
			1 day	2400	16.5
			28 days	3000	20.7
Tensile	ASTM C496	Splitting Tensile Strength of Cylindrical Concrete	28 days	640	4.4
Modulus of	ASTM C469	Static Modulus of Elasticity	28 days	4.3 E^{+06}	3.0 E^{+04}

Durability Properties					
Test	**Specification**	**Description**	**Test**	**Independent Test Results**	
Free Shrinkage	ASTM C157	Length Change of Hardened Concrete (Std)	28 Days Wet | Dry	+0.05%	-0.05%
Freeze Thaw	ASTM C666-A	Resistance of Concrete to Rapid Freezing and Thawing in a Saturated Condition (300 cycles)	Durability Factor	95%	
Scaling	ASTM C672	Scaling Resistance of Concrete Surfaces Exposed to Deicing Chemicals (100 cycles) Results = Visual | Material Loss lbs./ft^2(%)	NaCl	Visual 0	0.0 lbs/ft^2
Chlorides	ASTM C1202	Electrical Indication of Concrete's Ability to Resist Chloride Ion Penetration (Coulombs)	28 days	500 C	
	AASHTO T260	Chloride Content (%)	28 days Acid | Water	0.007%	0.002%
Abrasion	ASTM C779 Procedure B	Abrasion Resistance of Horizontal Concrete Surfaces	28 days	30 minutes	0.043 in
				60 minutes	0.060 in

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.
- Refer to Phoscrete Best Practices Guidelines for details on working with Phoscrete Admixtures (Endure, Fast-Set, Slow-Set).
- Cool water on ice below 40°F for additional flow during placement, and for additional working time when finishing.
- Warm water when working in cold temperatures for faster set.

SURFACE PREPARATION

- Concrete surface must be sound and fully cured.
- Remove loose, damaged, and contaminated concrete, such as oil, grease, and other bond-inhibiting materials.
- Surface must be frost-free, dry, and free of standing water.
- Concrete profile should reach minimum CSP (Concrete Surface Profile) of 7-9 per ICRI Guidelines.
- Remove loose scale (rust) from steel bars with a wire brush. Sandblasting is not required.
- In case of repair applications, the repair area should not be less than 0.5 in (1.25 cm) deep. >2-inch (>5 cm) minimum depth is recommended. Saw-cut the edges of the repair area parallel and perpendicular to traffic to limit the number of load-bearing stress points.

MIXING

- Mix PHOSCRETE F3-HC at the placement site.
- The mix ratio is 11.4% water to Dry Mix. On-site mixing of partial Dry Mix bags is not recommended. Inaccurate measurements will lead to poor material performance.
- When mixing bulk sacks, use a silo-style continuous mortar mixer or heavy-duty pan mixer for large volume applications.
- When mixing bags, 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 (min. 7-amp, ½" chuck, side handle).
- When mixing up to 8 bags at once, use a paddle-style mortar mixer for placing large quantities (>2 cy) of F3-HC.
- When mixing Small Pails, use a minimum 18v variable speed drill on the high torque setting. For professional use, Phoscrete's small urethane auger is highly recommended.
- When mixing Patch Kit tubs, use the provided stirrer and mix by hand until the material is completely wetted out.
- Measure and pour water into a clean bucket or mixer first. Next measure and add ENDURE Admix liquid, and other Phoscrete admixtures (Fast-Set, Slow-Set) as needed. Then add Dry Mix into the bucket or drum, preferably while slowly running the mixer.
- Mix for about 2 minutes, or until the material is fully wetted out and shows a uniform consistency. Do not over-mix.

APPLICATION

- A batch of Phoscrete must be mixed, placed, and finished within 15 - 25 minutes from mixing, temperature dependent.
- Phoscrete is thixotropic, so use vibration or tap with a trowel to increase flow.
- For concrete overlays:
  - Pour, place, and screed the material quickly to increase finishing time.
  - Finish F3-HC by trowel, float, vibrating screed, or broom.
- For repair applications:
  - Scrub in a thin layer of F3-HC into the bottom and sides of the area to be repaired, using a trowel, float, or 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 adhesion bond. Phoscrete bonds to itself with no cold joints, whether wet or completely cured.
  - Finish the repaired area using clean concrete floats and trowels. Plastic floats work best. Tap on surface with trowel to bring liquid to the surface for best finish. When installing in lifts, do not apply a final layer thinner than ½ inch (1.27 cm).
- Wipe Phoscrete from trowels with a water-dampened cloth. Do not pour water on repair.
- If the material finishes higher than the adjacent surface, use a diamond grinder to level surface as soon as 30 minutes following final set. Scarify or groove as necessary to insure adequate tire traction.
- If rain begins prior to final set, cover the surface with plastic sheeting for at least 30 minutes following initial set.

APPLICATION *(continued from page 3)*

- On sloped surfaces, pour the material at the bottom of the slope and work your way up. Use a hand screed or float to move the material up the slope. When installing on steep inclines, use forms, or work in smaller increments (one kit at a time), and allow the material to set prior to the next pour.
- For expansion joint nosings, ensure that the hardened repair material is not higher than the approach slab. Use a grinding tool to cut a 45° bevel at the edge of the joint no sooner than 30 minutes after initial set. Compression or silicone seals can be applied immediately after grinding, or once the material temperature cools below 100°F (38°C). Refer to Phoscrete's Expansion Joint Installation and Repair Guidelines.

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 F3-HC with aggregate. Do not add sand and/or any type of cement.
- Do not mix partial units unless accurately pre-measured.
- Minimum application thickness: 0.5-inch (1.25 cm), 2-inches (5 cm) recommended.
- Maximum application thickness for full and partial depth repairs: none
- Minimum ambient temperature: 35°F (2°C)
- When wet, PHOSCRETE F3-HC cannot be placed in direct contact with galvanized steel (zinc).
- 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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