



# PHOSCRETE FORMULA 1E-HC [Horizontal/Castable]

## TECHNICAL DATA GUIDE (Formerly Phoscrete HC-Endure™)

Very Rapid Hardening MPC (Magnesium Phosphate Cement) concrete for horizontal and castable installation and repairs. Provides long-term durability in cold weather environments.

### DESCRIPTION

PHOSCRETE FORMULA 1E-HC (F1E-HC) is a three-part cementitious concrete repair material composed of magnesium oxide, aluminosilicates, aggregates, and reinforcing fibers (Dry Mix), a liquid phosphate activator (Liquid Activator), plus a liquid soy-methyl-ester polystyrene (PHOSCRETE ENDURE) admixture that is a concrete durability enhancer. F1E-HC is very rapid hardening, and gains strength suitable to vehicular traffic in less than one hour at a wide range of ambient temperatures. F1E-HC forms both a chemical and a mechanical bond to cured concrete and to itself. F1E-HC meets ASTM C 928, Type R3.

### PROVEN APPLICATIONS

- ▶ Full depth and partial depth concrete repairs
- ▶ Interior and exterior concrete installation and repairs
- ▶ Horizontal surfaces: poured/castable applications
- ▶ Vertical and overhead structures: form and pour applications
- ▶ Bridge deck and parking deck repairs of reinforced concrete
- ▶ Highway concrete spall and rutting repairs
- ▶ Airport runway and apron concrete repairs
- ▶ Dowel bar retrofit, pre-cast joint grouting, bearing locations
- ▶ Freezer floors, industrial floors, and loading dock repairs
- ▶ Expansion joint nosing construction and repairs

### ADVANTAGES

- ▶ Labor and time saving material: no sandblasting of steel bars, no anti-corrosion primer, no sacrificial anodes, sets fast.
- ▶ Easy and accurate mixing: three components, Mix in bucket one minute. No water, pre-extended mix. self-consolidating, easy clean up with water.
- ▶ Rapid return to service: exceeds 4,000 psi (28 MPa) compressive strength and 1,500 psi (10 MPa) bond strength 1 hour after placement at 68°F (20°C).
- ▶ Durable and hydrophobic: exceptional freeze-thaw and salt scaling resistance, even when exposed to MgCl<sub>2</sub> and CaCl<sub>2</sub>.
- ▶ 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.
- ▶ Does not out-gas after cure: accepts sealers and polymer coatings as soon as 15 minutes following initial set.
- ▶ Chemically stable: no added chlorides, resists chloride penetration.
- ▶ Not a vapor barrier; allows on grade applications.
- ▶ Environmentally friendly: no odor, no free silica.
- ▶ All temperature use – sets in temperatures cold as -5°F (-20°C)  
-use Phoscrete Fast-Set/Slow-Set Admixture to manage setting/working time.

### Packaging

Full Kit: [1] bag + [1] jug + [1] bottle

Dry Mix bag: 55 lb. (25 kg)  
polyethylene-lined paper bag

Liquid Activator jug:

10.4 lb. (4.7 kg) HDPE plastic jug

**Kit Yield:** 0.45 ft<sup>3</sup> (0.0129 m<sup>3</sup>)

48 kits per full pallet.

**ENDURE Jug:** 1 gallon (3.8 l)

Add 1% ENDURE by weight of dry mix. Use provided measuring beaker.

**ENDURE Bottle:** 10 oz. (300 ml)

Use 1 ENDURE bottle per 50 lb. Large Pail of Dry Mix.

**Small Pail:** 12.8 lb. (5.8 kg)

HDPE pail contains Dry Mix paper bag, HDPE Liquid Activator jar, and HDPE Endure Jar.

**Small Pail Yield:** 1.0 bf  
(144 in<sup>3</sup>, 0.0024 m<sup>3</sup>)

### Mixing Ratio

*Pre-extended mix. Do not extend with sand or aggregate.*

Activator-To-Dry Ratio: 18.75%

Empty Liquid Activator into a clean plastic mixing bucket. Add 1% ENDURE Admix. Then add the entire pail of dry mix and mix thoroughly.

### Storage

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

### Shelf Life

**Dry Mix:** 24 months

**Liquid Activator:** 12 months

**Endure:** 18 months

(when properly stored)

### VOC Content

0 g/L: Less exempt solvents



# PHOSCRETE FORMULA 1E-HC [Horizontal/Castable]

Fresh Properties			Packaging	
Test	Specification	Description	Time	Typical Results
Set Time	ASTM C191	Time of Setting by Vicat Needles	Full Kit: [1] bag + [1] jug + [1] bottle Dry Mix bag: 15 min Supercooled ethylene-lined paper bag: 19 min	Final 13 min 19 min
Slump	ASTM C143	Slump of Hydraulic-Cement Concrete	Liquid Activator jug (25.4 cm)	
Density	ASTM C387	Density (Unit Weight) of Concrete	10.4 lb. (4.7 kg) HDPE plastic jug 141 lb/ft <sup>3</sup> 2,259 kg/m <sup>3</sup>	
Air Content	ASTM C231	Air Content by Pressure Method	Kit Yield: 0.45 ft <sup>3</sup> (0.0129 m <sup>3</sup> ) 48 kits per full pallet.	5.7%
Strength Properties			ENDURE Jug: 1 gallon (3.8 l)	
Test	Specification	Description	Time	Typical Results
Compressive Strength	ASTM C109	Compressive Strength of Hydraulic Cement Mortars Using 2-in. Cube Specimens	1 hour	5000 psi 34.5 MPa
			1 day	ENDURE Bottle: 50 oz. (300 ml) 7500 psi 62.1 MPa
			28 days	Use 1 ENDURE bottle per 50 lb. of Dry Mix. 8500 psi 79.3 MPa
Flexural Strength	ASTM C78	Flexural Strength of Concrete Using Simple Beam with Third-Point Loading	1 day	Large Pail of Dry Mix: 575 psi 3.4 MPa
			28 days	Small Pail: 12.8 lb. (5.8 kg) HDPE pail contains Dry Mix. 600 psi 4.8 MPa
Bond Strength	ASTM C882	Bond Strength by Slant Shear: Phoscrete - Concrete	1 hour	HDPE Liquid Activator paper bag: 1500 psi 10.3 MPa
			1 day	Jar and HDPE Jar: 2500 psi 17.2 MPa
		Bond Strength by Slant Shear: Phoscrete - Phoscrete	28 days	Small Pail Yield: 3000 psi 20.7 MPa
			1 hour	(141 in <sup>3</sup> , 0.0024 m <sup>3</sup> ) 1750 psi 12.1 MPa
Tensile Strength	ASTM C496	Splitting Tensile Strength of Cylindrical Concrete Specimens	Mixing Ratio: 2500 17.2 MPa	
Modulus of Elasticity	ASTM C469	Static Modulus of Elasticity and Poisson's Ratio of Concrete in Compression	28 days extended mix: 3000 psi 20.7 MPa	Do not extend with sand or aggregate. Add Activator-To-Dry Ratio: 18.75% 6.9 E+06 2.1 E+06
Durability Properties			entire pail of dry mix and mix thoroughly.	
Test	Specification	Description	Test	Typical Results
Free Shrinkage	ASTM C157	Length Change of Hardened Concrete (Std)	Storage: 28 days Wet/Dry in clean, dry conditions in unopened original packaging.	0.00% -0.03%
Freeze Thaw	ASTM C666-A	Resistance of Concrete to Rapid Freezing and Thawing in a Saturated Condition (300 cycles)	Durability	94.5%
Scaling	ASTM C672	Scaling Resistance of Concrete Surfaces Exposed to Deicing Chemicals (50 cycles) Results = Visual   Material Loss lbs./ft <sup>2</sup>	Shelf Life	Dry Mix: 24 months Liquid Activator: 12 months NaCl Visual = 0 Endure: 18 months (when properly stored)
Chlorides	ASTM C1202	Electrical Indication of Concrete's Ability to Resist Chloride Ion Penetration (Coulombs)	VOC Content	38 C (negligible) 0 g/L: Less exempt solvents
	AASHTO T260	Chloride Content (%)	28 days	.004% .004%
Abrasion	California CT-550	Determining the Surface Abrasion Resistance of Concrete Specimens (mass loss)	24 hours	16 g 1.8%

All results were obtained at Lab temp of 68°F (20°C) with both components, Dry Mix and Liquid Activator, stored at Lab temp.  
 † Supercooled Liquid Activator at 40°F (10°C)



## GENERAL INSTALLATION GUIDELINES

- Refer to [Phoscrete Formula 1 \[MALP Series\] Full Installation Guide](#), for the most complete documentation on best installation practices.
- Refer to [Phoscrete Warm Temperature Guidelines](#) and [Phoscrete 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), supercooling in a freezer at 10°F (-12°C). Liquid Activator's freezing point is -20°F (-29°C).
- Refer to [Phoscrete Best Practices for Endure Admix Usage Chart](#) for details on working with Phoscrete Admixtures (Endure, Fast-Set, Slow-Set)

## SURFACE PREPARATION

- Concrete surface must be sound and fully cured.
- Remove loose, damaged, and contaminated concrete.
- Concrete profile should reach minimum CSP of 7-9 per ICRI Guidelines. Water-blasting is not recommended.
- Repair area must not be less than 1-inch (2.5 cm) deep. >2-inch (>5 cm) 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.
- Clean the surface of the area to be repaired from oil, grease, and other bond-inhibiting materials.
- Surface must be frost-free, dry, and free of standing water. Use heat (torch) to eliminate surface moisture.
- 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 lost 25% or more of their original diameter must be replaced.

## PRIMER COAT

*For challenging applications, where maximum bond strength is required, use Phoscrete Primer. Using a cooled Liquid Activator, apply a scrub coat of Phoscrete Primer to the prepared concrete substrate. Be sure to fill all voids. Complete the primer coat by placing a ¼ in. (1.5 cm) thin layer of Phoscrete Primer over the scrub coat, either wet or dry. Wait at least 15 minutes for Phoscrete Primer to set and bond prior to proceeding with PHOSCRETE F1E-HC full repair installation. If Phoscrete Primer is not available, Phoscrete VO or HC can be used as an alternative, with cooled Liquid Activator.*

## MIXING

- Mix PHOSCRETE F1E-HC at the placement site.
- The mix ratio is 18.75% Liquid Activator to Dry Mix. On-site measurement for partial unit mixing is not recommended. Inaccurate measurements will lead to poor material performance.
- When mixing Full Kits, 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 multiple Full Kits at once, use a paddle-style mortar mixer for placing large quantities (>2 cy) of Phoscrete.
- 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.
- Pour the Liquid Activator into a clean bucket or mortar mixer first. Next add three [3] Endure Admix scoops. Add Phoscrete Fast-or Slow-Set Admixture. as needed. Then add Dry Mix into the bucket or mortar mixer, preferably while slowly running the mixer.
- Mix for about 1 minute, until the material is fully wetted out and shows a uniform consistency. Do not over-mix.
- A batch of Phoscrete MPC must be mixed, placed, and finished within 5 - 15 minutes depending on ambient temperature.

## APPLICATION

- Install immediately after mixing. Discard the batch if the material begins to setup in the pail or mixer.
- Using a trowel or float, or with a gloved hand, scrub Phoscrete into the bottom and sides of the area to be repaired, being careful to fill all voids. Force the material against the edges of the repair.
- Place Phoscrete level to the adjacent concrete surface. Screed off excess.
- Finish Phoscrete using clean concrete floats and trowels. Polymer floats work best. Tap on surface with trowel to bring liquid to the surface for best finish. Clean Phoscrete from trowels with a water-dampened cloth. Do not pour water on repair. Stop finishing once the surface of the placed material develops a "skin."
- If the material finishes higher than the adjacent surface, use a diamond grinder to level surface as soon as 15 minutes following final set.



## APPLICATION *(continued from page 3)*

- ▶ When multiple layers are applied, scarify the surface by scratching crisscross lines in the layer with a trowel prior to set for best adhesion. Phoscrete bonds to itself with no cold joints, whether wet or completely cured. If installing in lifts, do not apply a final layer thinner than 1-inch (2.5 cm).
- ▶ If rain begins prior to final set, cover the surface with plastic sheeting for at least 15 minutes following initial set.
- ▶ On sloped surfaces, pour the material at the bottom of the slope and work your way up. Use a hand screed 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 15 minutes after initial set. Standard compression or silicone seals can be applied immediately after grinding. Refer to Phoscrete's [Expansion Joint Installation and Repair](#).

## CLEANING

- ▶ In-between batches, clean tools with water 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 F1E-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: 1-inch (2.5 cm), 2-inches (5 cm) recommended. Maximum application thickness: none
- ▶ Minimum ambient temperature: -5°F (-20°C)
- ▶ Do not use water when mixing, placing, or finishing PHOSCRETE F1E-HC
- ▶ When wet, PHOSCRETE F1E-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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