



REMR MATERIAL DATA SHEET CM-PC-1.1
 CONCRETE PATCHING MATERIAL: SET-45

1. NAME

SET-45

a. Do not add any sand, aggregate fines, or portland cement to Set-45 concrete.

2. MANUFACTURER

Master Builders, Inc.
 23700 Chagrin Blvd
 Cleveland, OH 44122
 Tel 216-831-5500

b. Do not use Set-45 for patches less than 1/2 in. deep.

c. Water content is critical. Do not deviate from the recommended water content printed on the product bag.

3. DESCRIPTION

One-component, expansive, fast-setting, magnesium phosphate concrete for concrete repair and for anchoring components to concrete.

d. When placing Set-45 in a closed area, provide adequate ventilation.

e. Do not use Set-45 as a precision, nonshrink grout.

f. Do not use Set-45 if it will come into contact with galvanized steel or aluminum.

4. APPLICABLE SPECIFICATIONS

ASTM C 928-80, "Standard Specification for Packaged, Dry, Rapid-Hardening Cementitious Materials for Concrete Repairs."

6. MANUFACTURER'S TECHNICAL DATA

Packaging: 50-lb polyethylene-lined bags

5. USES & LIMITATIONS

Uses: Set-45 is designed for: bridge deck and highway overlays; concrete pavement joint repairs; airport runway light installations; full-depth structural repairs; expansion device nosing; anchoring bridge railings; commercial freezer room repairs; truck dock repairs; parking deck and ramp repairs; and heavy industrial repairs.

Yield: A 50-lb bag mixed with the required amount of water produces a volume of approximately 0.4 cu ft.

Color: Dries to the color of portland-cement mortar.

Limitations: The manufacturer's literature lists the following precautions:

Mechanical Data:

Typical Compressive Strengths,* ASTM C 109 (Modified), psi
(Materials and Curing Times at Specified Temperatures)

	Plain Concrete at 72°F (22°C)	Set-45 Regular at 72°F (22°C)	Set-45 Regular at 36°F (22°C)	Set-45 Hot Weather at 95°F (35°C)
1-hour	---	2000	---	---
3-hour	---	5000	---	3000
6-hour	---	5000	1200	5000
1-day	500	6000	5000	6000
3-day	1900	7000	7000	7000
28-day	4000	8500	8500	8000

Typical Flexural Strengths,* ASTM C 78
(Modified), psi

	3-hour	24-hour	7-day
Set-45 Regular at 72°F (22°C)	600	900	1000
Set-45 Hot Weather at 95°F (35°C)	400	900	1000

Modulus of Elasticity, ASTM C 469, psi

	7-day	28-day
Set-45 Regular	4.18×10^6	4.55×10^6
Set-45 Hot Weather	4.90×10^6	5.25×10^6

* Tests were performed with neat material.

Freeze-thaw durability test, ASTM C 666, Procedure A: Both Regular and Hot Weather Set-45 achieved a relative dynamic modulus of 80% after 300 cycles.

Scaling resistance to deicing chemicals, ASTM C 672, Set-45 Regular and Set-45 Hot Weather formulas: After 5 and 25 cycles at a rating of 0, the surface showed no scaling. After 50 cycles at a rating of 1.5, the surface showed slight scaling.

Typical setting times, Gilmore, ASTM C 266: Set-45 Regular at 72°F (22°C) and Set-45 Hot Weather at 95°F (35°C) had the following typical setting times: initial, 10 to 15 min, final, 12 to 20 min.

Coefficient of thermal expansion, CRD-C 39-81: Both Set-45 Regular and Set-45 Hot Weather had coefficients which equaled $7.15 \times 10^{-6}/^{\circ}\text{F}$.

7. MANUFACTURER'S GUIDANCE FOR APPLICATION

Surface Preparation: A sound base is essential for good repairs. Remove all oil, grease, dirt, and loose, disintegrated, or unsound concrete from the areas to be patched.

Saw cut 1/2 in. deep or more to form the perimeter of each patch. A bond breaker is required at all joints. Featheredge patching is not recommended.

Where the bond between reinforcing steel and concrete is destroyed, remove the adjacent concrete to a depth that will provide a minimum of 3/4 in. of new concrete over all cleaned concrete surfaces and all exposed reinforcing steel. Remove rust from rebar by wire brushing or sandblasting. Do not use a bonding

agent on the steel or on the prepared concrete surface.

Flush the area thoroughly with clean water to remove dust, then air blast to remove all water before placing the Set-45. (Note: Set-45 bonds better to a surface dry interface.)

Equipment: Have the proper measuring containers and tools on the job. Be certain the labor force is adequate to handle the rapid-setting Set-45.

Use a mortar-type mixer as the shearing action of the blades yields optimum blending. For large jobs, the mixer should be capable for mixing up to 500 lb of material. A continuous-type mixer may be used. For smaller quantities, an electric drill with a jiffler-type mixer may also be used.

Addition of Aggregate:

Under 1-in. depth--Use neat material for shallow patches. Set-45 should not be used for patches less than 1/2-in.

Deep patches--A 50-lb bag of Set-45 may be extended by adding up to 30 lb of thoroughly washed, dried, uniform-size, sound 1/4- to 1/2-in. round aggregate. When using angular aggregate, reduce the amount added to obtain proper workability. (Note: Do not add any sand, aggregate fines, or portland cement to Set-45.)

Mixing: Locate the mixer as close as possible to the repair area. Allow no more than 10 min to mix, place, and finish Set-45 in normal temperatures of 72°F (22°C).

NOTE: Water content is critical. Use 1/2 gal of water per 50-lb bag of Set-45. In certain conditions, the water content may vary between 3-1/2 and 4 pints; but, in normal situations, do not deviate from the recommended water content or mixing instructions.

IMPORTANT: Always follow this mixing order:

a. Pour clean water into mixer at the rate of 1/2 gal per 50-lb bag of Set-45.

b. Add aggregate, if necessary, for deep patches. If damp aggregate is used, reduce the water content accordingly.

c. Add Set-45. Mix the Set-45 approximately 1 to 1-1/2 min.

Placing: After mixing, immediately place the Set-45, working from side to side. Do not place Set-45 in lifts. Work the material firmly into the bottom and sides of the patch to ensure a good bond. Do not use a bonding agent.

Level the Set-45 and screed to the elevation of the surrounding concrete. When properly screeded, Set-45 will self-level and yield a skid-resistant finish. Seal the edges and all saw cuts with light hand floating. Minimal finishing is required. Do not retemper Set-45.

Clean tools and mixer frequently with water to prevent build-up.

Special Considerations: The setting speed of Set-45 is dependent upon both the temperature of the mixture and the area to be repaired.

Cold weather, below 50°F (10°C)--Heat the concrete surface until it is warm to the touch. Use warm material and warm the water to 90°F (32°C) to increase the hardening speed. Keep the patch warm by tenting or insulating. This will aid in obtaining a more rapid strength development in cold weather. Do not use anti-freeze or accelerators.

Hot weather, over 85°F (29°C)--Set-45 Hot Weather Formula is recommended. Keep the material cool. The

use of ice water for mixing is recommended to extend the working time. (Caution: Placing Set-45 on a hot concrete surface may affect bond. When the sun has heated the surface excessively, delay placement until the slab temperature has been lowered by additional dampening of the area. Be certain to remove all standing water immediately prior to application of Set-45.)

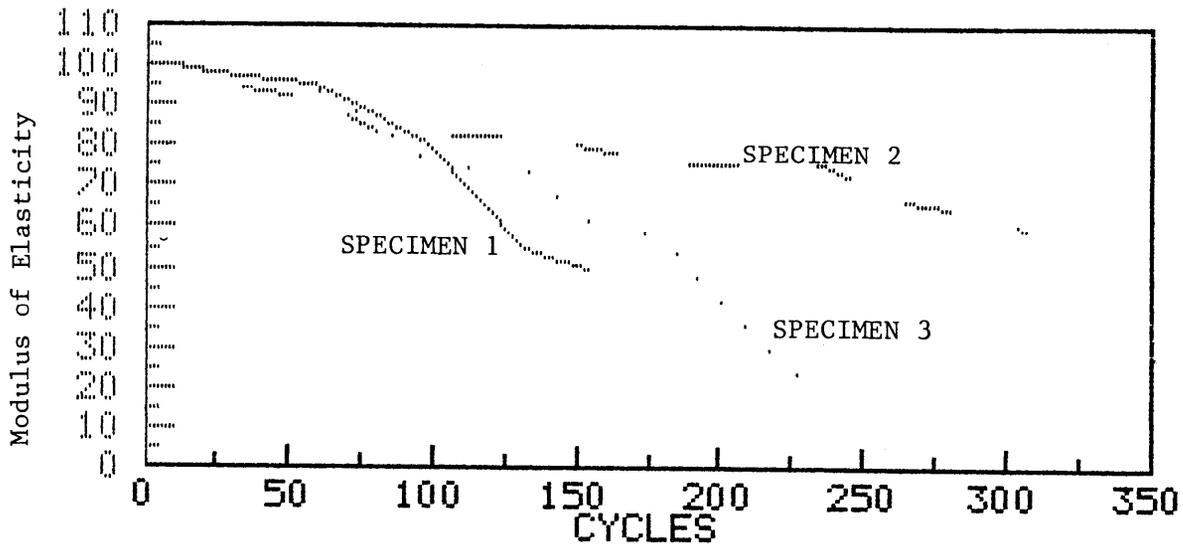
Curing: Set-45 should be allowed to air dry for a proper cure. Do not use a curing compound or wet-curing process. In normal temperatures, Set-45 patches will take traffic approximately 45 min to 1 hr after placing.

8. CORPS OF ENGINEERS' EVALUATION

Mechanical and Physical Data (Set 45 Regular):

Compressive Str,	1-hr	4410
ASTM C 109, psi	2-hr	5970
	3-hr	6350
Compressive Str,	24-hr	6000
ASTM C 39, psi	28-day	9240

Rapid Freezing and Thawing, ASTM C 666, Relative Dynamic Modulus of Elasticity, %:



Mechanical and Physical Data (Set 45 Regular): (Continued)

Mod of Elast,	24-hr	5.16×10^6
ASTM C 469, psi	28-day	5.85×10^6
Flexural Str,	3-hr	560
ASTM C 78, psi	24-hr	880
	28-day	1010
Bond to Conc,	24-hr	1990
ASTM C 882, psi	28-day	2250
Shrinkage,	GR-83-10*	
percent		
	(Unconfined condition) ¹	0.137
	(Concrete patch) ²	0.006

* Bureau of Reclamation Technical Report Standard.

- 1 An exotherm of 60°F was reported on the shrinkage specimen using a mix design of 50 lb of material, 25 lb of aggregate, and 1/2 gal of water.
- 2 An exotherm of 30°F was reported on the shrinkage specimen using a mix design of 50 lb of material, 25 lb of aggregate, and 1/2 gal of water.

Permeability (Hassler Cell)*:

<u>Source</u>	<u>Pressure, psi Confining</u>	<u>Water Permeability microdarcies</u>
51	101	15.0
92	160	11.0
195	266	1.6

* Specimen length, 5.95 in.; diameter, 3.0 in.

Literature Review Findings:

The material has a good service record when used in steel mill refractory work and generally has performed well as a repair material on bridge deck applications.

Permeability and water absorption of the material have been reported from low to high. The consistency of the material and environment it was exposed to were not identified, making it difficult to establish whether it is a variation on the material performance or application procedures.

Results reported on the long-term durability of the material since 1970 have ranged from excellent to questionable. Similar results have also been reported on laboratory specimens tested in accordance with ASTM C 666.

Results from one study revealed severe strength loss when material was exposed to high heat (100°C) for a long period of time (24 hr). The same study revealed that under autoclave expansion tests, the material disintegrated. This would indicate a potential problem in using the material in a large volume due to the high exotherm with set.

Field Experience:

Set-45 was used to repair concrete walls and floors downstream of a steel

liner at Isabella Dam in January 1983. The repair failed.

Set-45 was used to repair honeycombed areas and voids in the concrete along the invert of the conduit at Mulberry Dam in March 1970. Performance has been reported as good.

9. ENVIRONMENTAL CONSIDERATIONS

Reasonable caution should guide the preparation, repair, and cleanup phases of concrete or mortar repair activities involving potentially hazardous and toxic chemical substances. Manufacturer's recommendations to protect occupational health and environmental quality should be carefully followed. Material safety data sheets should be obtained from the manufacturers of such materials. In cases where the effects of a chemical substance on occupational health or environmental quality are unknown, chemical substances should be treated as potentially hazardous toxic materials.

10. AVAILABILITY & COSTS

Availability: This material is available throughout the US through a network of local distributors.

Costs: Varies; approximately 30¢ to 40¢ per pound or \$20 per 50-lb bag.

11. TECHNICAL SERVICES

Master Builders maintains a worldwide network of sales and technical assistance offices. Corporate headquarters in Cleveland, Ohio (216-831-5500), can provide information on the nearest office.