

STATE OF VERMONT
AGENCY OF TRANSPORTATION
MATERIALS & RESEARCH DIVISION

QUICK SET CEMENTS

AND

PATCHING COMPOUNDS

APRIL 1978

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MATERIALS DIVISION - RESEARCH & DEVELOPMENT SUBDIVISION

SUMMARY OF TEST RESULTS ON
QUICK-SET CEMENTS AND PATCHING COMPOUNDS

Product	Compressive Strength (PSI)			Flexural Bond Strength (PSI)	Freeze-Thaw Durability (% Wgt. Loss)				Time Of Set (Min.)		Chloride Intrusion Above Base Level At 200 Days (PPM) 1½-2" Depth	Performance Rating & Comments	
	4 Hrs. PSI	24 Hrs. PSI	3 Days PSI		14 Days PSI	F-T Cycles	3 Days Cured	14 Days Cured	28 Days Cured	60 Days Cured			Init.
Octocrete	4 Hr.	467			25	0	0	0	0				#1 9.2 Rating Recommended For Use
	24 Hr.	2892	1133		50	0	0	1	0	N/A	N/A	0	
	3 Days	5487			75	0	0	1	0	(Wet)			
	14 Days	7567			100	1	0	1					
Set Instant	4 Hr.	591			25	6	0	0	0				#2 8.4 Rating Recommended For Use
	24 Hr.	3441	945		50	8	3	4	2	12	60	38	
	3 Days	5000			75	12	6	6	5				
	14 Days	7779			100								
Roadpatch	4 Hr.	2154			25	15	1	5	5				#3 7.1 Rating Recommended For Use
	24 Hr.	2650	808		50	28	24	5	3	10	20	137	
	3 Days	6830			75	30		8					
	14 Days	8200			100	Stop @ 68							
Fast Set Pre-Krete	4 Hr.	2383			25	3	6	0	3				#4 6.8 Rating
	24 Hr.	3033	662		50	4	27	4	39	8	12	116	
	3 Days	4442			75	4	Stop @ 42	7	Stop @ 39				
	14 Days	5383			100	5							
Tigercrete	4 Hr.	272			25	0	0	0					#5 5.1 Rating
	24 Hr.	2825	163		50	4	3	2		11	22	No Test Conducted	
	3 Days	4200			75	20	16	7					
	14 Days	8638			100	26	26	14					

Product	Compressive Strength (PSI)			Flexural Bond Strength (PSI)	Freeze-Thaw Durability (% Wgt. Loss)	Time Of Set (Min.) Init. Fin.	Chloride Intrusion Above Base Level At 200 Days (PPM) 1½-2" Depth	Performance Rating & Comments
	4 Hr.	24 Hr.	3 Days					
Average of 10 Products	4 Hr.	1436		554	19.8	14 - 57	311	6.0
	24 Hr.	3555						
	3 Days	5246						
	14 Days	6950						
"AA" Concrete Reference Mixes		4225 psi @ 14 days		975 psi	1% Wt Loss @ 100 cycles	-	46	8.6

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RATING SUMMARY ON QUICK-SET CEMENTS AND PATCHING COMPOUNDS

PRODUCT	FREEZE-THAW DURABILITY		FLEXURAL STRENGTH		CHLORIDE INTRUSION		COMP. STRENGTH		RATING	
	Wt. Loss	Rating	PSI	Rating	PPM	Rating	Strength	Points	Total	Ave.
Octocrete	.25	9.9	1133	10.0	0	10.0	4130	7.1	37.0	9.2
Set Instant	4.3	8.5	945	9.5	38	8.5	4202	7.2	33.4	8.4
Roadpatch	11.9	5.9	808	8.0	137	6.6	4459	7.9	28.4	7.1
Fast Set Pre-Krete	9.2	6.9	662	6.5	122	6.8	3810	6.8	27.0	6.8
Tigercrete	9.8	6.7	163	1.6	NA	NA	3893	7.0	15.3	5.1
Exide Maricrete	13.6	5.5	179	1.8	122	6.8	3584	6.5	20.6	5.1
Five Star	25.5	1.5	536	5.4	325	5.4	5264	8.2	20.5	5.1
Set 45	21.5	3.2	150	1.5	NA	NA	6838	9.8	14.5	4.8
Sonopatch	51.5	0.0	619	6.2	738	2.3	2867	5.8	14.3	4.7
Rock Mount Hwy. Patch	60.2	0.0	350	3.5	1010	2.0	3360	6.3	11.8	3.9
"AA" Conc. Reference Mix	1.0	9.7	958	9.6	46	8.1	4029	7.0	34.4	8.6

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RATING SYSTEM FOR QUICK-SET CEMENTS
 AND PATCHING COMPOUNDS

	<u>FREEZE-THAW DURABILITY AVERAGE % WT. LOSS</u>	<u>FLEXURAL BOND STRENGTH PSI</u>	<u>CHLORIDE INTRUSION IN PPM @ 1½"-2" DEPTH @ 200 DAYS</u>	<u>COMPRESSIVE STRENGTH PSI</u>
*10	0	1000	0	7000
9	3	900	25	6000
8	6	800	50	5000
7	9	700	100	4000
6	12	600	200	3000
5	15	500	400	2000
4	18	400	600	1000
3	21	300	800	750
2	24	200	1000	500
1	27	100	1200	250
*0	30	0	1400	0

*do not assign ratings above 10 or below 0

divide total points by the number of tests conducted for final rating

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PRODUCT INFORMATION SUMMARY
QUICK-SET CEMENTS AND PATCHING COMPOUNDS

<u>PRODUCT</u>	<u>MANUFACTURER</u>	<u>DISTRIBUTOR</u>	<u>COST PER 50 LB. BAG</u>
Octocrete	IPA Systems Philadelphia, PA	A. H. Harris & Sons 55 Sicker Road Latham, NY 12110	\$ 14.50
Set Instant	Set Products Inc. 8501 Freeway Drive Macedonia, Ohio 44056	A. H. Harris & Sons 55 Sicker Road Latham, NY 12110	\$ 9.00
Roadpatch	Standard Dry Wall Products 1145 Chestnut Street Manchester, NH 03104	Same As Manufacturer	\$ 6.70
Fast Set Pre-Krete	Pocono Fabricators Inc. Division of Patterson- Kelley Co. Inc. East Stroudsburg, PA 18301	Cutter Fire Brick Co. 54 Emerson Road Box 151 Waltham, MA 02154	\$ 10.00
Tigercrete	Garon Products Inc. Raritan Center Woodbridge Avenue Edison, NJ 08817	Same As Manufacturer	\$ 9.50
Exide Maricrete	Atlas Minerals & Chemicals Division ESB Inc. Mertztown, PA	William L. Jacobs & Sons Inc. 2307 Second Avenue Schenectady, NY 12303	\$ 10.95
Five Star Instant Grout	U.S. Grout Corp. 3 West End Avenue Old Greenwich, Conn. 06870	A. H. Harris & Sons 55 Sicker Avenue Latham, NY 12110	\$ 10.00
Set 45	Set Products Inc. 8501 Freeway Drive Macedonia, Ohio 03104	A. H. Harris & Sons 55 Sicker Avenue Latham, NY 12110	\$ 14.00

<u>PRODUCT</u>	<u>MANUFACTURER</u>	<u>DISTRIBUTOR</u>	<u>COST PER 50 LB. BAG</u>
Sonopath	Sonneborn Contech Sonneborn Building Products Division Minneapolis, Minn. 55435	Sonneborn Building Products 28 Skelton Road Burlington, MA 01803	\$ 9.00
Rock Mount Highway Patch	Rock-Mount Ind. Inc. 493 Delaware Avenue Buffalo, NY 14202	A. H. Harris & Sons 55 Sicker Road Latham, NY 12110	\$ 12.40

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Method Of Test For
Compressive Strength of Quick-Set
Cements and Patching Compounds

VT. A.O.T. - MD 2

1. Scope

To determine the compressive strength of quick-set cements and patching compounds under laboratory conditions at 4 hours, 24 hours, 3 days, and 14 days.

2. Apparatus

As described in AASHTO T 106-72 "Compressive Strength of Hydraulic Cement Mortars" minus weights, sieves, flow table and mold.

3. Procedure

Material will be mixed according to manufacturers recommendations. Test specimens shall be molded and stored as described in AASHTO T 106-72. Three cubes will be removed from moisture cabinet at 4 hours, molds stripped and cubes tested for compressive strength. Remaining cubes will be removed from cabinet at 24 hours, all molds stripped and three cubes tested for compressive strength. Remaining cubes will be placed back in moisture cabinet and three each tested at 3 days and 14 days age.

4. Report

Record compressive strength in p.s.i. at each test and average for each age group. Complete data sheet.

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Data Sheet For
 Compressive Strength of Quick-Set
 Cements and Patching Compounds

(VT. A.O.T. - MD 2)

Product Name:

Manufacturer & Distributor:

Date & Quantity Sample Received:

Lot Number:

Date Mixed:

% Water by Weight:

Temp. Mix Water:

Room Temp.:

Workability:

Compressive Strength

Age	4 hours	24 hours	3 days	14 days
#1				
#2				
#3				
Ave.				

Comments:

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Method Of Test For
Flexural Strength of Bonded Quick-Set
Cements and Patching Compounds
Using Simple Beam with Center Point Loading

VT. A.O.T. - MD 3

1. Scope

To determine the flexural strength of bonded quick-set cements and patching compounds under laboratory conditions.

2. Apparatus

As described in AASHTO T 126-70 "Making and Curing Concrete Test Specimens in the Laboratory" and AASHTO T 177-68 "Flexural Strength of Concrete" [Using Simple Beam with Center Point Loading].

3. Procedure

The test will be conducted by casting a test beam against a precast concrete beam and testing for flexural strength after a 10 day curing period.

The precast concrete beam is made and cured according to AASHTO T 126-70 "Making and Curing Concrete Test Specimens in the Laboratory". Mix design is as follows: 2500 g. cement, 2500 g. dry sand, 790 ml water at 73°F±. After a minimum 7 day curing period, the 2-3/4" x 3" x 12" precast beam is sawed transversely at midspan to make (2) precast concrete beams. Material to be evaluated will be mixed according to manufacturers recommendations. Flexural test beams will be made in steel molds 2-3/4" x 3" x 12". The sawed end of the precast beam is wire brushed underwater and this end is soaked in water to saturate the surface. Once saturated the end is coated with test material and pressed and worked with the ball of the hand to fill voids in the cut end. This will help insure good bond of the test material to precast beam. The precast beam is then placed in one half of the mold with the prepared end facing the empty half of the mold. The remainder of the mold is then filled with test material according to AASHTO T 126-70.

The mold and bonded specimen is placed in the fog room for the initial 24 hours and then the mold is removed. The test specimen is then cured 9 additional days in the fog room prior to determining flexural strength by center point loading. Flexural strength is determined by centering the beam in the testing apparatus as pictured with the top (finished surface) of the beam facing the front and load applied until failure. Compute the modulus of rupture using the formula.

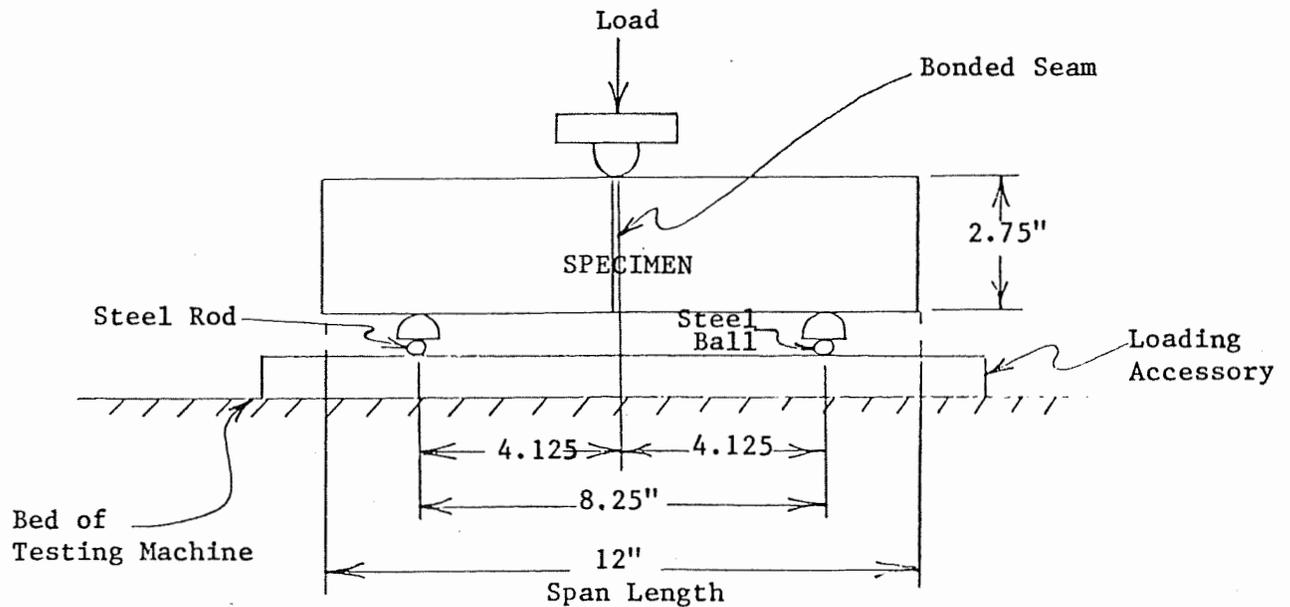
3. Con'd

Calculation:

$$\text{Modulus of Rupture, p.s.i.} = \frac{3 (\text{Max. Applied Load, lb.}) (\text{Span Length, in.})}{2 (\text{Average Width of Spec. in.}) (\text{Avg. Depth, in.})^2}$$

$$\text{Modulus of Rupture, p.s.i.} = \frac{3 (\text{Max. Applied Load, lb.}) (8.25)}{2(3)(2.75)^2}$$

$$\text{Modulus of Rupture, p.s.i.} = 0.545 (\text{Max. Applied Load, lb.})$$



4. Report
 Modulus of Rupture
 Comments

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Data Sheet For
Flexural Strength of Bonded Quick-Set
Cements and Patching Compounds

(VT. A.O.T. - MD 3)

Product Name:

Manufacturer & Distributor:

Date & Quantity Sample Received:

Lot Number:

Date Mixed:

% Water by Weight:

Temp. Mix Water:

Room Temp.:

Workability:

Modulus of Rupture

Beam #1

Beam #2

Comments:

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Method Of Test For
Freeze-Thaw Durability of Quick-Set Cements
and Patching Compounds

VT. A.O.T. - MD 4

1. Scope: To determine freeze-thaw durability of quick-set cements and patching compounds in a 3% NaCl solution under laboratory conditions.
2. Apparatus: As described in AASHTO T 106-72 "Compressive Strength of Hydraulic Cement Mortars" minus weights, sieves, flow table and mold.
3. Procedure: Material will be mixed according to manufacturers recommendations. Test specimens shall be molded and stored as described in AASHTO T 106-72. At the end of 24 hours all molds shall be removed and specimens cured in the fog room for 2 additional days. All specimens will be removed from the fog room after the 3 day wet cure and stored in the laboratory at constant 50% humidity. Immediately prior to starting the freeze-thaw cycling, the cubes will be soaked in water a minimum of 2 hours and then weighed in a saturated surface dry condition to determine initial weights. Three each cubes at cured ages of 3 days, 14 days, 28 days and 60 days will be immersed 1" in a 3% NaCl solution and freeze-thaw cycles begun. A record of freeze-thaw cycles will be kept and specimens soaked and weighed surface dry at 25 cycle intervals. The percent weight loss will be computed from original weight of specimens and records kept. Freeze-thaw cycling may be stopped at any time if severe deterioration is noted.
4. Report: Report will consist of percent weight loss at various freeze-thaw cycle intervals as well as comments on visual observations.

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Method Of Test For
Time of Setting of Quick-Set Cements
and Patching Compounds by Gillmore Needles

VT. A.O.T. - MD 5

1. Scope: To determine the time of setting of Quick-Set cements and patching compounds by Gillmore Needles.

2. Apparatus: As described in AASHTO T 154-74 "Time of Setting of Hydraulic Cement by Gillmore Needles".

3. Procedure: Material will be mixed according to manufacturers recommendations. Test procedure will be as described in AASHTO T 154-74.

4. Report: Initial and Final set time and relative comments.

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Method Of Test For
Chloride Content of Concrete, Quick-Set
Cements and Patching Compounds

VT. A.O.T. - MD 20

1. SCOPE

To determine the chloride content of concrete, quick-set cements and patching compounds.

2. APPARATUS

Balance, hot plate, beaker (400 ml), 2 burets, erlenmeyer flask (500 ml), Whatman No. 40 and No. 41 or other filter papers of equivalent porosities, nitric acid (HNO_3) .0140N ammonium thiocyanate (NH_4SCN), .0140N silver nitrate (AgNO_3), distilled water.

3. PROCEDURE

Weigh to the nearest 0.01 gram, 5 grams of the material to be tested and transfer to a 400 ml beaker. Add 100 ml hot distilled water; stir. Add 10 ml nitric acid slowly, with stirring (Caution: spattering). Cover with a ribbed watch glass and boil for two minutes. Add an excess of 0.0140N AgNO_3 slowly from a buret, with stirring; record amount added.¹ Allow slurry to settle a minimum of 15 minutes. Decant the solution into a 500 ml erlenmeyer flask thru a double thickness of filter paper, using a 12.5 cm diameter paper of coarse porosity (Whatman No. 41) inside a paper of medium porosity (Whatman No. 40). Wash residue and paper at least four times with nitric acid (1:99) being sure to wash the entire paper each time. The filtrate should be about 150 ml in volume.²

Titrate the filtrate with 0.0140N NH_4SCN to the first permanent pink color. Titration should be performed in subdued light. If the first drop of NH_4SCN added gives a permanent color change, insufficient AgNO_3 was originally added. More AgNO_3 solution may be added to obtain an approximate chloride content, but benzyl alcohol should be added with vigorous shaking to prevent end point fading.

¹A slight excess of 1-4 mls must be added. Five mls of 0.0140N AgNO_3 is sufficient for 5 gram sample containing less than 0.0200% Cl.

²If filtrate is turbid, add 3 ml benzyl alcohol and shake vigorously. Turbidity due to AgCl will cause fading end points.

$$\begin{aligned} \text{Calculations: } \% \text{ Chloride} &= (V_1N_1 - V_2N_2) 0.03545 \times 100 \div S \\ \text{PPM Chloride} &= \% \text{ Chloride} \times 10^4 \end{aligned}$$

V_1 = Ml. Silver Nitrate Solution used
 N_1 = Normality of silver nitrate solution used
 V_2 = Ml. Ammonium thiocyanate solution used
 N_2 = Normality of ammonium thiocyanate used
 S = Wgt sample in grams
0.03545 = Conversion factor

4. REPORT

Chloride content PPM