



September 22, 2021

Ms. Katheryn Malusky
NTPEP
444 N Capitol Street NW
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Washington DC, 20001

CADD-2020-01-056

Final Compliance Report: Fritz-Pak Corp., Slick-Pak, Type S

ASTM C494/C494M – 16, “Standard Specification for Chemical Admixtures for Concrete”
AASHTO M194/M194 – 13(2017), “Standard Specification for Chemical Admixtures for Concrete”
AET Project No. 29-20780

Dear Ms. Malusky:

American Engineering Testing, Inc. (AET) is pleased to present this report of our compliance verification testing of Slick-Pak. The attached report presents the final test results of the referenced admixture. One 20-lb bag of the admixture was received on July 21, 2020 and the NTPEP notification to proceed was received on June 30, 2020.

All sample preparation and testing was performed in accordance with the applicable sections of AASHTO M194M/M194M – 13(2017), ASTM C494/C494M – 16, “Standard Specification for Chemical Admixtures for Concrete” and all referenced documents. Based on our results through one year, Slick-Pak, Type S complies with the requirements in AASHTO M194/M194 and Table 1 of ASTM C494 for a Type S, specific performance admixture.

Concrete batching and test specimen fabrication was conducted on three separate days. One control mixture and one test mixture containing Slick-Pak, both meeting the requirements of AASHTO M194 and ASTM C494 for fresh concrete properties, were produced each day. A commercially available vinsol resin air-entraining admixture was used for the concrete mixtures. Holcim Type I/II portland cement from the St. Genevieve plant was used for all concrete mixtures.

Product information and cement chemical and physical properties are presented in Tables 1 and 2. Aggregate properties and gradations are presented in Tables 3 and 4. Mixture proportions and results of testing are given in Tables 5 and 6.

If there are any questions with regard to this report, please contact me.

Sincerely,
American Engineering Testing, Inc.

A handwritten signature in black ink that reads 'Willy Morrison'.

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TABLE 1. Admixture Information

	Reference Admixture	Test Admixture
Manufacturer	Mapei	Fritz-Pak Corp.
Brand Name	Vinsol Resin	Slick-Pak
NTPEP CADD Number	--	CADD-2020-01-056
Lot Number	E093014	91734
Quantity Supplied	1 Quart	One 20-lb Bag
Total Solids, %	15.01	94.78
Specific Gravity	1.044	N/A
pH	10.7	11.73
Chloride, %	0.009	0.119 ^{note 1}

Note 1: Testing conducted using European Standard EN 480-10, Method 1

TABLE 2. Portland Cement Analysis – Chemical and Physical

ASTM C150 Type I/II Cement			
Brand Name: St. Genevieve		Manufacturer: LafargeHolcim Inc.	
<i>Chemical Analysis, Mass %</i>			
Silicon dioxide (SiO ₂)	19.9	Tricalcium silicate (C ₃ S) (%)	67
Aluminum oxide (Al ₂ O ₃)	4.5	Dicalcium silicate (C ₂ S) (%)	3
Iron oxide (Fe ₂ O ₃)	3.1	Tricalcium aluminate (C ₃ A) (%)	6
Calcium oxide (CaO)	64.0	Tetracalcium alumino ferrite (C ₄ AF) (%)	9
Magnesium oxide (MgO)	2.3	C ₃ S + 4.75C ₃ A (%)	96.1
Sulfur trioxide (SO ₃)	3.3		
Insoluble Residue (%)	0.36	Loss on Ignition (%)	3.1
Alkalies as Na ₂ O _{eq} (%)	0.55		
<i>Physical Analysis</i>			
Fineness, Blaine (m ² /kg)	392	Air Content (%)	6.0
Vicat Time of Set	Initial, minutes	90	Autoclave Expansion (%)
			0.04
Mortar expansion (%) (C1038)	0.005		
Compressive Strength	3 Day (psi)	4,210	7 Day (psi) 5,250

TABLE 3. Properties of Fine and Coarse Aggregates

	Fine Aggregate	Coarse Aggregate
Manufacturer	Aggregate Industries	Martin Marietta
Aggregate type, ID	Natural Sand, Elk River	#57 Crushed Granite
Specific gravity, SSD	2.667	2.698
Absorption %	0.7	0.3

TABLE 4. Gradations of Fine and Coarse Aggregates, According to ASTM C136

Fine Aggregate		
	Percent passing	ASTM C494/AASHTO M 194 Requirements
No. 4 [4.75 mm]	100	100
No. 16 [1.18 mm]	72	65 to 75
No. 50 [300 µm]	17	12 to 20
No. 100 [150 µm]	2	2 to 5

Coarse Aggregate		
	Percent passing	ASTM C494/AASHTO M 194 Requirements
1.5 in. [37.5 mm]	100	100
1.0 [25.0 mm]	96	95 to 100
0.50 in. [12.5 mm]	44	25 to 60
0.375 in. [9.5 mm]	6	0 to 10
No. 4 [4.75 mm]	3	0 to 5
No. 8 [2.36 mm]	100	100

TABLE 5. Test Results for Concrete Made with Slick-Pak, Type S, Using 0.02 lb/cwt

Mix Number	Control Mixtures				Test Mixtures				ASTM C494/AASHTO M 194 Requirements, Type S	
	1	2	3	Average	1	2	3	Average		
Cast Date	8/4/2020	8/12/2020	8/18/2020		8/4/2020	8/12/2020	8/18/2020			
Mixture Proportions	Cement, pcy	519	521	520	520	520	521	521	521	517 ± 5
	Fine Aggregate, pcy	1,282	1,289	1,285	1,285	1,285	1,289	1,289	1,288	
	Coarse Aggregate, pcy	1,770	1,780	1,775	1,775	1,775	1,780	1,780	1,778	
	Water, pcy	285	286	286	286	286	286	286	286	
	Water Content, % of Control					100	100	100	100	
	AEA (Vinsol Resin)					Mapei Vinsol Resin				
	AEA dose, oz/cwt	0.8	0.8	0.8	0.8	1.1	1.1	1.1	1.1	
	Test Admixture	--	--	--	--	Slick-Pak				
	Admixture dose, lb/cwt	--	--	--	--	0.02	0.02	0.02	0.02	
	Water-to-Cement Ratio	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	
Plastic Properties	Slump, inches	4.00	3.75	3.75	3.75	4.00	4.00	3.75	4.00	3.50 ± 0.50 ± 0.5
	Air Content, %	6.0	5.9	6.0	6.0	5.6	5.6	6.0	5.7	
	Density, pcf	142.8	143.6	143.2	143.2	143.2	143.6	143.6	143.5	
Setting Time	Initial, hr:min	4:04	3:47	4:31	4:07	4:12	4:13	4:52	4:25	
	Final, hr:min	5:40	5:22	6:21	5:47	5:43	5:48	6:44	6:05	
	Deviation from Reference				Initial, hr:min	0:08	0:26	0:21	0:18	Not More than 1:00 Earlier nor 1:30 Later
					Final, hr:min	0:03	0:26	0:23	0:18	Not More than 1:00 Earlier nor 1:30 Later
Compressive Strength	3 Days, psi	3,220	3,040	2,990	3,080	3,160	3,320	2,730	3,070	
	7 Days, psi	3,630	3,630	3,640	3,630	3,720	3,660	3,540	3,640	
	28 Days, psi	4,980	4,460	4,510	4,650	5,110	4,710	4,520	4,780	
	56 Days, psi	5,210	5,090	5,160	5,150	5,180	4,850	4,970	5,000	
	90 Days, psi	5,420	5,190	5,500	5,370	5,420	5,310	5,210	5,310	
	6 Months, psi	5,890	5,240	5,660	5,600	5,990	5,380	5,270	5,550	
	1 Year, psi	5,910	5,590	5,710	5,740	6,140	5,460	5,270	5,620	
					3 Days	98	109	91	100	≥ 90%
					7 Days	102	101	97	100	≥ 90%
					28 Days	103	106	100	103	≥ 90%
					56 Days	99	95	96	97	N/A
					90 Days	100	102	95	99	N/A
					6 Months	102	103	93	99	≥ 90%
				1 Year	104	98	92	98	≥ 90%	
Flexural Strength	3 Days, psi	605	590	560	585	590	590	515	565	
	7 Days, psi	605	700	580	630	685	655	625	655	
	28 Days, psi	675	730	630	680	715	670	645	675	
	56 Days, psi	700	625	635	655	710	680	710	700	
					3 Days	98	100	92	97	≥ 90%
					7 Days	113	94	108	104	≥ 90%
				28 Days	106	92	102	99	≥ 90%	
				56 Days	101	109	112	107	N/A	
Length Change, %		-0.015	-0.003	0.000	-0.006	-0.008	-0.012	-0.011	-0.010	
		Increase Over Control				-0.007	0.009	0.011	0.004	≤ 0.010^B
Resistance to Freezing and Thawing	Relative Dynamic Modulus, %	0 cycles	100/100	100/100	100/100	100	100/100	100/100	100/100	100
		34 cycles	96/96	95/97	98/99	97	96/96	95/95	98/96	96
		70 cycles	96/96	97/97	98/99	97	96/98	96/96	98/98	97
		103 cycles	98/98	98/97	96/98	98	96/98	98/96	96/98	97
		139 cycles	98/99	99/99	99/100	99	98/98	99/99	96/96	98
		171 cycles	99/99	99/98	98/99	99	96/96	99/98	96/98	97
		207 cycles	99/99	99/99	99/100	99	99/99	99/99	98/99	99
		243 cycles	99/99	100/99	99/100	99	99/100	100/100	98/99	99
		279 cycles	99/98	99/99	99/100	99	98/100	100/100	99/100	99
		300 cycles	99/98	100/100	99/100	99	98/100	99/100	98/100	99
						100				≥ 80%

^A Alternative requirement. If any of the measured relative strengths are greater than the requirement in parentheses, the admixture shall be considered provisionally qualified until the 1-year strength results are obtained.

^B Increased shrinkage over control.

**TABLE 6. ASTM C494/AASHTO M 194 Test Results of Chemical Admixtures for Concrete
 Slick-Pak, Type S, 0.02 lb/cwt**

Mixture Designation	Control	Slick-Pak	Change vs. Control	ASTM C494/AASHTO M 194 Requirements, Type S
Mixture Proportions				
Cement, pcy	520	521	1	517 ± 5
Fine Aggregate, pcy	1,285	1,288		
Coarse Aggregate, pcy	1,775	1,778		
Water, pcy	286	286		
AEA (Vinsol Resin), oz/cwt	0.8	1.1		
Test Admixture, lb/cwt	--	0.02		
Ratio of Fine to Total Aggregate, %	42	42		
Water-to-Cement Ratio	0.55	0.55		
Plastic Properties				
Slump, inches	3.75	4.00	0.25	3.50 ± 0.50
Air Content, %	6.0	5.7	-0.3	± 0.5
Density (Unit Weight), pcf	143.2	143.5		
Setting Time				
Initial, hr:min	4:07	4:25	0:18	Not More than 1:00 Earlier nor 1:30 Later
Final, hr:min	5:47	6:05	0:18	Not More than 1:00 Earlier nor 1:30 Later
Compressive Strength, psi				
3 Days, psi	3,080	3,070	100	≥ 90%
7 Days, psi	3,630	3,640	100	≥ 90%
28 Days, psi	4,650	4,780	103	≥ 90%
56 Days, psi	5,150	5,000	97	N/A
90 Days, psi	5,370	5,310	99	N/A
6 Months, psi	5,600	5,550	99	≥ 90%
1 Year, psi	5,740	5,620	98	≥ 90%
Flexural Strength, psi				
3 Days, psi	585	565	97	≥ 90%
7 Days, psi	630	655	104	≥ 90%
28 Days, psi	680	675	99	≥ 90%
56 Days, psi	655	700	107	N/A
Length Change by Drying Shrinkage				
Length Change, %	-0.006	-0.010	0.004	≤ 0.010^B
Resistance to Freezing and Thawing, Procedure A				
Relative Durability Factor, %			100	≥ 80%

^A Alternative requirement. If any of the measured relative strengths are greater than the requirement in parentheses, the admixture shall be considered provisionally qualified until the 1-year strength results are obtained.

^B Increased shrinkage over control.