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December 13, 2016

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

CADD-2015-01-060

Final Compliance Report: Fritz-Pak Corporation, Supercizer 5, Type F

ASTM C494/C494M – 13, “Standard Specification for Chemical Admixtures for Concrete”
AASHTO M194/M194 – 12, “Standard Specification for Chemical Admixtures for Concrete”
AET Project No. 29-01968

Dear Ms. Malusky:

American Engineering Testing, Inc. (AET) is pleased to present this report of our compliance verification testing of Fritz-Pak Corp. Supercizer 5. The attached report presents the final test results of the referenced admixture. Three 1.75-lb. bags of the admixture were received on September 28, 2015 and the NTPEP notification to proceed was received on September 23, 2015.

All sample preparation and testing was performed in accordance with the applicable sections of AASHTO M194M/M194M, ASTM C494/C494M – 13, “Standard Specification for Chemical Admixtures for Concrete” and all referenced documents. Based on our results through one year, Supercizer 5, Type F complies with the requirements in AASHTO M194/M194 and Table 1 of ASTM C494 for a Type F, water reducing high range admixture.

Concrete batching and test specimen fabrication was conducted on three consecutive days. One control mixture and one test mixture containing Supercizer 5, 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 Table 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	General Resource Technology	Fritz-Pak Corporation
Brand Name	Vinsol Resin	Supercizer 5
NTPEP CADD Number	--	CADD-2015-01-060
Lot Number	E093014	01150831
Quantity Supplied	1 Quart	Three 1.75-lb. Bags
Total Solids, %	15.01	93.12
Specific Gravity	1.044	Not Required for Powder Admixtures
pH	10.7	8.9
Chloride, %	0.009	0.003

Table 2 Portland Cement Analysis – Chemical and Physical

ASTM C150 Type I/II Cement			
Brand Name	St. Genevieve		
Manufacturer	Holcim (US) Inc.		
Chemical Analysis, %			
Silicon dioxide (SiO ₂)	19.8	Tricalcium silicate (C ₃ S) (%)	61
Aluminum oxide (Al ₂ O ₃)	4.5	Dicalcium silicate (C ₂ S) (%)	8
Iron oxide (Fe ₂ O ₃)	3.2	Tricalcium aluminate (C ₃ A) (%)	6
Magnesium oxide (MgO)	2.7	Tetracalcium alumino ferrite (C ₄ AF) (%)	9
Sulfur trioxide (SO ₃)	3.4	C ₃ S + 4.75C ₃ A (%)	90.7
Calcium oxide (CaO)	64.2		
Insoluble Residue (%)	0.47	Loss on Ignition (%)	2.6
Alkalies as Na ₂ O (%)	0.54		
Physical Analysis			
Fineness, Blaine (m ² /kg)	379	Air Content (%)	7
Vicat Time of Set (Initial), minutes	90	Autoclave Expansion (%)	0.04
Compressive Strength			
3 Day (psi)	4330	7 Day (psi)	5360
Mortar Bar Expansion (%) (C 1038)	0.013		

Table 3 - Properties of Fine and Coarse Aggregates

	Fine Aggregate	Coarse Aggregate
Manufacturer	Aggregate Industries	Aggregate Industries
Aggregate type, ID	Natural Sand, Elk River	River Gravel, Lakeville #57
Specific gravity, SSD	2.675	2.740
Absorption %	0.6	1.1

Table 4 – Gradations of Fine and Coarse Aggregates

ASTM C136, Gradation of fine aggregate

Percent passing		
	Fine Aggregate	ASTM C494/AASHTO M194 Requirements
No. 4 [4.75 mm]	100	100
No. 16 [1.18 mm]	72	65 to 75
No. 50 [300 µm]	13	12 to 20
No. 100 [150 µm]	2	2 to 5

ASTM C136, Gradation of coarse aggregate

Percent passing		
	Coarse Aggregate	ASTM C494 Requirements
1.5 in. [37.5 mm]	100	100
1.0 in. [25.0 mm]	100	95 to 100
0.5 in. [12.5 mm]	58	25 to 60
No. 4 [4.75 mm]	9	0 to 10
No. 8 [2.36 mm]	1	0 to 5

TABLE 5 Laboratory Data	Concrete Mixtures and Testing Results									Supercizer 5 added at a rate of 1.7 oz/cwt
	Supercizer 5									ASTM C494, Type F AASHTO M194
	Batch No. Cast Date	Vinsol Resin				Supercizer 5				
	Control #1 10/12/2015	Control #2 10/13/2015	Control #3 10/14/2015	AVER. (Test Value)	Test #1 10/12/2015	Test #2 10/13/2015	Test #3 10/14/2015	AVER. (Test Value)		
Cement, pcy	513	519	516	516	514	514	514	514	517 ± 5	
Sand, pcy	1,289	1,303	1,296	1,296	1,326	1,326	1,326	1,326		
Gravel, pcy	1,774	1,794	1,784	1,784	1,833	1,833	1,833	1,833		
Water, pcy	280	283	281	281	247	247	247	247		
Water Content (Percent of Control)	---	---	---	---	88	87	88	88	88%	
AEAName	Vinsol Resin				Vinsol Resin					
AEA Dosage, oz/cwt	0.5	0.5	0.5	0.5	0.7	0.7	0.7	0.7		
Admixture Name	---				Supercizer 5					
Admixture Dosage, oz/cwt	---				1.7	1.7	1.7	1.7		
WATER CEMENT RATIO	0.55	0.55	0.54	0.55	0.48	0.48	0.48	0.48		
Slump, inches	4.00	4.00	3.50	3.75	3.75	3.75	3.50	3.75	3.5 ± 0.5	
Air Content, %	6.0	6.2	6.0	6.1	5.6	6.0	6.1	5.9	± 0.5	
Density, pcf	142.8	144.4	143.6	143.6	145.2	145.2	145.2	145.2		
SETTING TIME										
Initial, hr:mn	4:01	4:18	4:00	4:06	3:33	3:51	3:34	3:39		
Final, hr:mn	5:36	5:58	5:36	5:43	5:12	5:29	4:54	5:11		
TIME of SETTING (deviation from reference)										
Initial, hr:mn	---	---	---	---	-0:28	-0:27	-0:26	-0:27	Not more than 1:00 earlier nor 1:30 later	
Final, hr:mn	---	---	---	---	-0:24	-0:29	-0:42	-0:32	Not more than 1:00 earlier nor 1:30 later	
COMPRESSIVE STRENGTH										
1 Day, psi	1,520	1,290	1,610	1,470	2,280	1,930	2,350	2,190		
3 Days, psi	3,120	3,260	3,540	3,310	4,180	4,060	4,220	4,150		
7 Days, psi	4,070	4,440	4,360	4,290	5,350	5,250	5,120	5,240		
28 Days, psi	5,220	5,620	5,540	5,460	6,760	6,170	6,720	6,550		
90 Days, psi	5,790	6,180	5,860	5,940	7,860	6,910	7,170	7,310		
6 Months, psi	6,000	6,210	6,520	6,240	7,870	7,380	8,030	7,760		
1 Year, psi	6,290	6,740	6,630	6,550	8,270	7,300	8,230	7,930		
1 Day, % reference	---	---	---	---	150	150	146	149	≥140%	
3 Days, % reference	---	---	---	---	134	125	119	125	≥125%	
7 Days, % reference	---	---	---	---	131	118	117	122	≥115%	
28 Days, % reference	---	---	---	---	130	110	121	120	≥110% (≥120%) ^B	
90 Days, % reference	---	---	---	---	136	112	122	123	(≥117%) ^B	
6 Months, % reference	---	---	---	---	131	119	123	124	≥100% (≥113%) ^B	
1 Year, % reference	---	---	---	---	131	108	124	121	≥100%	
FLEXURAL STRENGTH										
3 Days, psi	590	615	545	585	645	675	680	665		
7 Days, psi	680	650	735	690	765	660	785	735		
28 Days, psi	850	850	760	820	920	955	910	930		
3 Days, % reference	---	---	---	---	109	110	125	114	≥110%	
7 Days, % reference	---	---	---	---	113	102	107	107	≥100%	
28 Days, % reference	---	---	---	---	108	112	120	113	≥100%	
LENGTH CHANGE, %										
Increase over control	-0.019	-0.013	0.000	-0.011	-0.013	-0.008	-0.013	-0.011		
	---	---	---	---	-0.006	-0.005	0.013	0.000	≤0.010 ^A	
RESISTANCE TO FREEZING AND THAWING										
Relative Dynamic Modulus, %										
0	cycles	100/100	100/100	100/100	100	100/100	100/100	100/100	100	
36	cycles	96/94	99/98	99/99	98	99/98	99/99	102/98	99	
72	cycles	98/94	100/99	98/98	98	99/97	94/97	102/98	98	
108	cycles	95/94	99/98	99/96	97	99/97	89/97	103/99	97	
144	cycles	95/93	99/98	99/96	97	98/95	76/90	103/98	93	
180	cycles	94/93	100/99	99/95	97	98/95	63/85	103/99	91	
216	cycles	95/93	100/99	99/95	97	98/95	(C) / 72	103/98	93	
252	cycles	93/90	99/99	99/95	96	99/97	(C) / 68	103/99	93	
288	cycles	89/95	98/98	97/94	95	98/95	(C) / 67	102/98	92	
324	cycles	89/95	99/98	95/91	95	98/97	(C) / 61	102/98	91	
RELATIVE DURABILITY FACTOR									97	min 80

A. Increased shrinkage over control.

B. 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 test results are obtained.

TABLE 6
TESTS OF CHEMICAL ADMIXTURES FOR CONCRETE
SUPERCIZER 5
ASTM SPECIFICATION C494 / AASHTO M194
TYPE F, WATER REDUCING HIGH RANGE

MIXTURE DESIGNATION	<u>CONTROL</u>	<u>SUPERCIZER 5</u>	CHANGE vs. <u>CONTROL</u>	<u>SPECIFICATION REQUIREMENT</u>
MIXTURE PROPORTIONS				
CEMENT, pcy	516	514	-2	517 ± 5
SAND, pcy	1,296	1,326		
GRAVEL, pcy	1,784	1,833		
NET WATER, pcy	281	247	88%	88%
AEA (Vinsol Resin), oz/cwt	0.5	0.7		
ADMIXTURE DOSAGE, oz/cwt	---	1.7		
RATIO OF FINE TO TOTAL AGG., %	42	42		
WATER/CEMENT RATIO, lb./lb.	0.55	0.48		
SLUMP, inches	3.75	3.75	0.00	3.5 ± 0.5
ENTRAINED AIR, %	6.1	5.9	-0.2	± 0.5
UNIT WEIGHT, pcf	143.6	145.2		
SET TIME, hr:min				
INITIAL	4:06	3:39	-0:27	Not more than 1:00 earlier nor 1:30 later
FINAL	5:43	5:11	-0:32	Not more than 1:00 earlier nor 1:30 later
COMPRESSIVE STRENGTH, psi				
1 DAY	1,470	2,190	149%	≥140%
3 DAYS	3,310	4,150	125%	≥125%
7 DAYS	4,290	5,240	122%	≥115%
28 DAYS	5,460	6,550	120%	≥110% (≥120%)^B
90 DAYS	5,940	7,310	123%	(≥117%)^B
180 DAYS	6,240	7,760	124%	≥100% (≥113%)^B
365 DAYS	6,550	7,930	121%	≥100%
FLEXURAL STRENGTH, psi				
3 DAYS	585	665	114%	≥110%
7 DAYS	690	735	107%	≥100%
28 DAYS	820	930	113%	≥100%
LENGTH CHANGE				
Increase over control	-0.011	-0.011	0.000	≤0.010^A
RELATIVE DURABILITY FACTOR, %			97	≥80%

A. Increased shrinkage over control.

B. 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 test results are obtained.