



construction managers

general contractors

design builders

SUBMITTAL REVIEW

Project # 417 The Residences at Echelon

Date: November 7, 2017

Submittal Number: 32 1216 02 Asphalt Paving
Type 1 Base

Sequence Number: 16

Subcontractor: Calverts Paving
Rod Calvert

Submit To: NSPJ Architects
Tim Hauschild

SUBMITTAL FOR APPROVAL	
Job Name/No: 417 The Residences at Echelon	
☒ REVIEWED	☐ REVISE & RESUBMIT
☐ REVIEWED& NOTED	☐ REJECTED
Submittal received for general compliance with the Contract Documents. Contractor's review does not relieve sub/vendor of responsibility for dimension, quantities, accuracy or completion of submittals or from any responsibilities required by terms and conditions of Subcontract/PO with Luke Draily Construction Co., Inc.. Sub/Vendors shall follow all manufacturer installation instructions. Installing contractor shall be responsible to coordinate with trades for hookup, supports, routing, etc.	
By: JDW	Date: 11/7/17

Engineering Solutions	Shop Drawing Review
Project: Aldersgate	Date: 11-10-17
Submittal# PVMT 2	By: MJS
☒ APPROVED	☐ REJECTED
☐ APPROVED AS NOTED	



Hot Mix Materials, Inc.
2701 E. 85th Street
Kansas city, MO 64132

Project: Asphaltic Concrete Mix Design
APWA Type 1-01RC

Report #03532442-11-A1

Report date: July 7, 2017

Lab No: 4935 D

The mix design was performed utilizing Marshall design procedures in general accordance with methods in the Asphalt Institute Manual MS-2, AASHTO T245 and ASTM D2041. The Recycled Asphalt Concrete (RAC) is comprised of Reclaimed Asphalt Pavement (RAP) and virgin materials. The master grade limits, job mix formula tolerances and Marshall characteristic requirements comply with Kansas City Metropolitan Chapter of American Public Works Association Standard Specifications, 2017 edition. The VMA is calculated utilizing virgin aggregate bulk, dry specific gravities and RAP aggregate effective specific gravity. The maximum theoretical specific gravity and Marshall specimens were cured 4 hours at compaction temperature prior to testing. Percent binder is reported on a total mix basis except where noted.

It may be necessary to adjust plant settings from designed values due to differences in plant and laboratory produced mixtures or variations in component materials.

Eileen Peterson
Project Manager

Reviewed by
Professional Service Industries, Inc.

Kelly E Rotert, PE, DBIA
Vice President

cc: Mr. Allen Conway

These test results apply only to the specific locations and materials noted and may not represent any other locations or elevations. This report may not be reproduced, except in full, without written permission by Professional Service Industries, Inc. If a non-compliance appears on this report, to the extent that the reported non-compliance impacts the project, the resolution is outside the PSI scope of engagement.

Hot Mix Materials, Inc.
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Lab # 4935 D

SUMMARY OF MIX DATA

MIX COMPOSITION

Component	% Agg	% Total Mix	% Dry Mix
#518	47.0	45.0	46.2
#754 3/4"	10.0	9.6	9.8
#981 DUST	13.0	12.4	12.8
RAP	30.0	30.3	31.2
PG 58-28	2.6 added	2.7 added	

MIX SPECIFIC GRAVITY DATA

Component	Specific Gravity
binder	1.027
calculated bulk of composite mix aggregates	2.605
calculated apparent of composite mix aggregates	2.692
calculated effective of mix aggregates	2.651
calculated maximum theoretical at recommended percent binder	2.484

GRAIN SIZE ANALYSIS - (percent passing)

Sieve Size	1 1/2	1	3/4	1/2	3/8	No 4	No 8	No 16	No 30	No 50	No 100	No 200
Opening, mm	37.5	25.0	19.0	12.5	9.5	4.75	2.36	1.18	0.600	0.300	0.150	0.075
TRIAL MIX SINGLE POINT	100	88	71	53	46	39	28	21	16	11	7	5.3
MASTER GRADE LIMITS	100-	75-100	60-85	-	40-65	30-50	19-36	13-26	-	-	4-12	2-10
JOB-MIX FORMULA TOLERANCE	100-	75-100	66-76	48-58	41-51	34-44	24-32	17-25	12-20	7-15	4-12	3.3-7.3
TOLERANCE (+/-)	0	5	5	5	5	5	4	4	4	4		2
Difference between sieves (25% maximum)		12	17	18	7	7	10	7	5	5	4	

MARSHALL CHARACTERISTICS SUMMARY

50 Compaction blows per face		Trial Mix Data	Specification
Cure parameters: 4 hrs @ compaction temperature	Stability, lbs	3610	1500 minimum
(laboratory only)	Flow, 1/100 inch	14	8-16
mixing temperature of 300-310	% Voids total mix	3.1	3-5 design only
compaction temperature of 280-290	% Voids in mineral aggregate (VMA)	11.5	no specification
	% Voids filled with asphalt (VFA)	73.4	--
	Density, pcf / Gmb	149.9 / 2.408	--
	minus 200/effective binder ratio	1.3	--
	% Binder, total mix basis	4.25	aggregate basis 4.4

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COMPONENT MATERIAL IDENTIFICATION

#518	Crushed limestone aggregate delivered to the laboratory March, 2017. Source identified as Martin Marietta Greenwood Quarry Gsb = 2.59, % Absorption = 1.6
#754 3/4"	Crushed limestone aggregate delivered to the laboratory March, 2017. Source identified as Martin Marietta Greenwood Quarry Gsb = 2.59, % Absorption = 1.7
#981 DUST	Crushed limestone aggregate delivered to the laboratory March, 2017. Source identified as Martin Marietta Greenwood Quarry Gsb = 2.53, % Absorption = 2.7
RAP	Reclaimed asphalt product delivered to the laboratory March, 2017. Gse = 2.66, % binder = 5.3
PG 58-28	Asphalt cement binder delivered to the laboratory March, 2017. See certificate of analysis.

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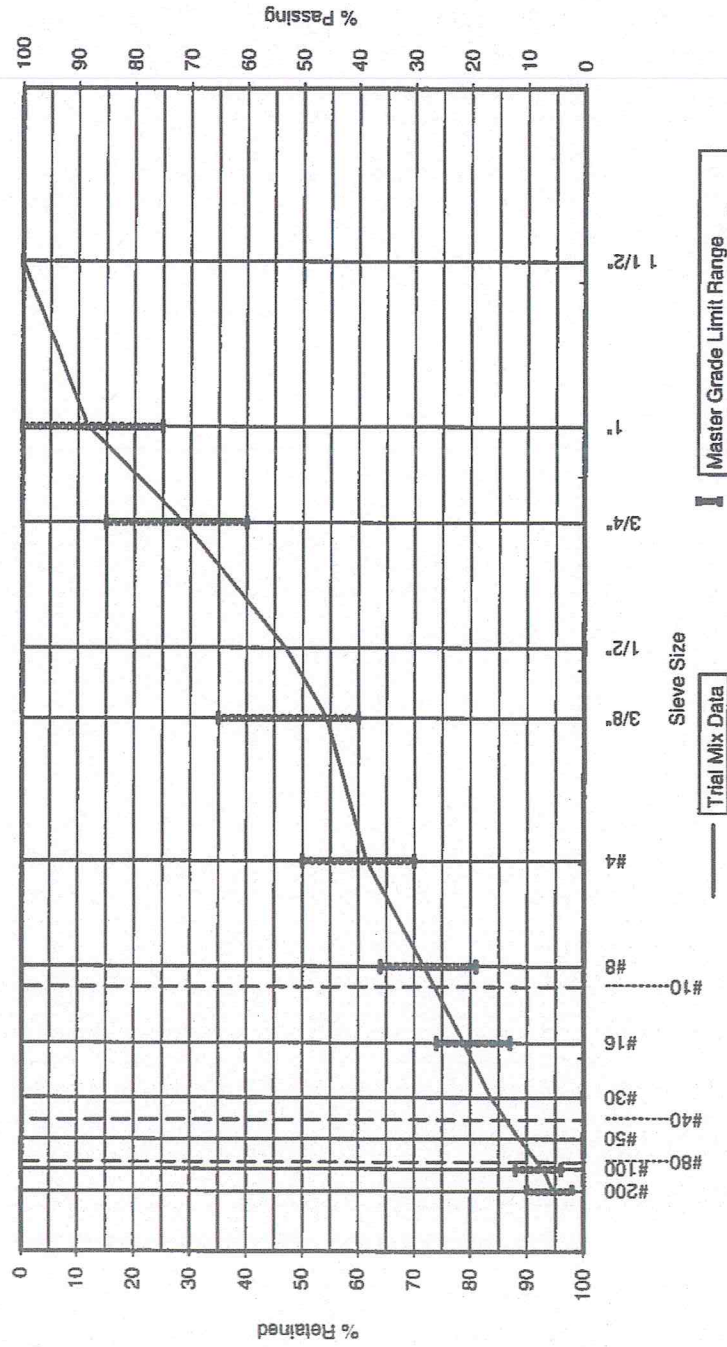
Lab # 4935 D

GRAIN SIZE ANALYSIS

		Sieve Size	1 1/2	1	3/4	1/2	3/8	No 4	No 8	No 16	No 30	No 50	No 100	No 200
		Opening, mm		25.0	19.0	12.5	9.5	4.75	2.36	1.18	0.600	0.300	0.150	0.075
MIX COMPONENT		ORIGINAL GRADATIONS (percent passing)												
#518		100	75	39	8	2	2	1	1	1	1	1	1	0.6
#754 3/4"		100	100	100	66	29	3	2	2	2	1	1	1	1.4
#981 DUST		100	100	100	100	100	100	83	56	40	30	23	19.5	
RAP		100	100	100	99	96	81	56	44	35	23	12	7.9	
MIX COMPONENT	% in Trial	% in Mix	% in trial											
#518	47.0	47.0	47	35	18	4	1	1	0	0	0	0	0	0.3
#754 3/4"	10.0	10.0	10	10	10	7	3	0	0	0	0	0	0	0.1
#981 DUST	13.0	13.0	13	13	13	13	13	13	11	7	5	4	3	2.5
RAP	30.0	30.0	30	30	30	30	29	24	17	13	11	7	4	2.4
TRIAL MIX SINGLE POINT	100.0	100.0	100	88	71	53	46	39	28	21	16	11	7	5.3
MASTER GRADE LIMITS		100-	75-100	60-85	-	40-65	30-50	19-36	13-26	-	-	4-12	2-10	
JOB-MIX FORMULA		100-	75-100	66-76	48-58	41-51	34-44	24-32	17-25	12-20	7-15	4-12	3.3-7.3	
TOLERANCE (+/-)			5	5	5	5	5	4	4	4	4		2	
VIRGIN SINGLE POINT		100	83	59	33	24	20	16	11	8	6	5	4.2	
VIRGIN SINGLE POINT JOB-MIX BAND		100-	78-88	54-64	28-38	19-29	15-25	12-20	7-15	4-12	2-10		2.2-6.2	

Lab # 4935 D

0.45 POWER GRAPH OF GRAIN SIZE ANALYSIS





Phillips 66
Certificate of Analysis
Apex Granite City IL Terminal

12/21/2016 7:37

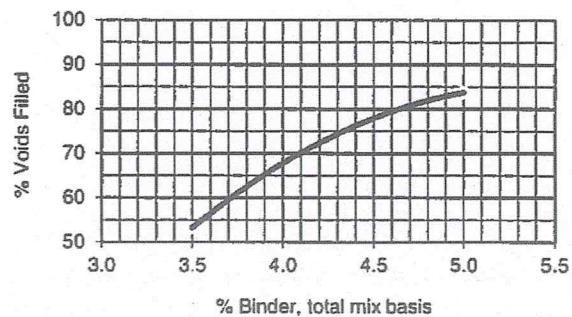
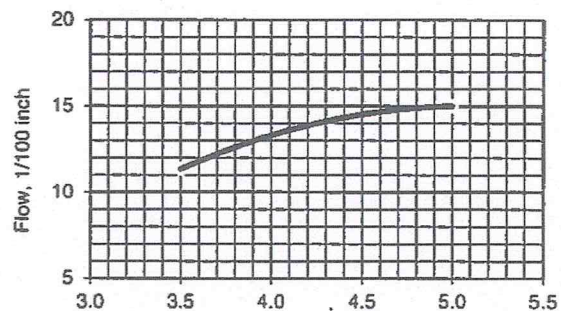
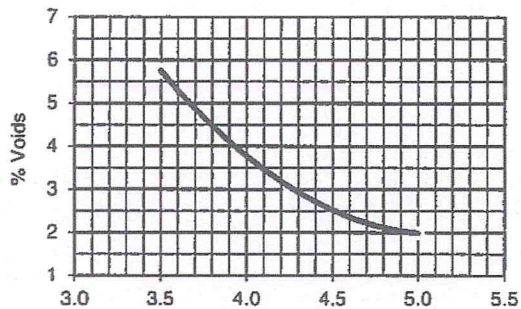
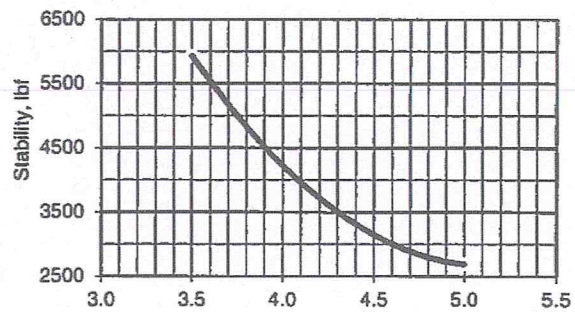
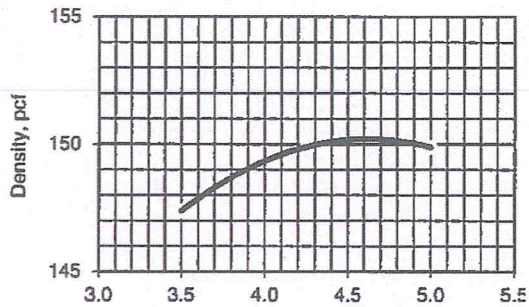
Ship Date:		Customer:	
Product Name:	PG58-28	Destination:	
Product Code:		Transport ID:	
Lablynx Log ID		Trip Number:	
Report Date:	12/14/2016	PINS NO:	
Date Sampled:	12/13/2016	Carrier:	
Centerpoint Terminal Sample ID	2016869	Rail Car Number:	
Tank :	80-5		

Method	Determinate	Results	Units
T228 Sp. Gravity. @ 15.6 °C	Specific Gravity	1.027	
API @ 15.6 °C	API	6.280	
T48 COC Flash, °C	Flash Point	280	°C
T202 Vacuum Visc. @ 60.0 °C	Absolute Viscosity	NA	Pa-s
T316 Viscosity @ 135 °C	Rotational Viscosity	0.256	Pa-s
T49 Penetration	Penetration	NA	dmm
T53 Softening Point	Softening Point	NA	°C
Original			
T315-DSR @ 58° C	G*	1.08	kPa
T315-Phase Angle @	Phase Angle @ Orig	87.4	Degrees
T315-DSR @ 58° C	G*/sin D	1.08	kPa
Rolling Thin Film Oven			
T240 RTFO	Mass Loss	-0.147	Wt %
T315-RTFO DSR @ 58° C	G*	3.21	kPa
T315-Phase angle on RTFO	Phase Angle on RTFO	83.1	Degrees
T315-RTFO DSR @ 58° C	G*/sin D RTFO	3.24	kPa
PAV aging temperature		100 °C	
T315-PAV DSR @ 19.0° C	G*	6329	
T315-Phase angle on PAV	Phase Angle on PAV	43.5	Degrees
T315-PAV DSR @ 19.0° C	G*/sin D PAV	4354	kPa
T313-BBR Stiffness @ -18.0° C	S	189	MPa
T313-BBR m-Value @ -18.0° C	m-Value	0.312	
T301 -Elastic Recovery	ER on RTFO	NA	Percent

Material was found to meet AASHTO M320 Table 1 unless otherwise noted
Material analyzed by AMRL certified Center Point Terminal Company in Granite City, IL
T202 performed by Phillips 66

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Summary Trial Mix Data

% Binder	3.50	4.25	5.00		
Effective % binder	2.83	3.59	4.34		
Bulk specific gravity	2.368	2.408	2.408		
Maximum theoretical specific gravity	2.512	2.484	2.457		
Density, pcf	147.4	149.9	149.9		
% Voids	5.7	3.1	2.0		
% Voids in mineral aggregate (VMA)	12.3	11.5	12.2		
% Voids filled with asphalt (VFA)	53.2	73.4	83.7		
Stability, lbf	5930	3610	2690		
Flow, 1/100 inch	11	14	15		
Dust/Binder ratio	1.9	1.5	1.2		

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MARSHALL CHARACTERISTIC DATA

	% Binder	Trial 1	Trial 2	Trial 3	Average	% Binder	Trial 1	Trial 2	Trial 3	Average
Weight in air, g	3.50	1227.4	1211.8	1220.9		4.25	1222.7	1213.9	1221.8	
SSD weight in air, g		1239.3	1223.7	1233.8			1228.8	1219.6	1229.2	
Weight in water, g		721.5	711.9	717.6			721.5	716.5	720.5	
Volume, cc		517.8	511.8	516.2			507.3	503.1	508.7	
Bulk specific gravity		2.370	2.368	2.365	2.368		2.410	2.413	2.402	2.408
Theoretical specific gravity		2.512	2.512	2.512			2.484	2.484	2.484	
Density, pcf		147.5	147.4	147.2	147.4		150.0	150.2	149.5	149.9
% Voids		5.6	5.8	5.9	5.7		3.0	2.9	3.3	3.1
% VMA		12.2	12.3	12.4	12.3		11.4	11.3	11.7	11.5
% VEA		6.5	6.5	6.5			8.4	8.4	8.4	
% Voids filled with asphalt		53.7	53.2	52.7	53.2		73.9	74.6	71.7	73.4
Stability dial reading		663	551	679			339	400	369	
Corrected Stability, lbf		6228	5176	6379	5930		3312	3908	3605	3610
Thickness, inch		2 1/2	2 1/2	2 1/2			2 7/16	2 7/16	2 7/16	
Flow, 1/100 inch		11	11	12	11		14	13	15	14
Weight in air, g	5.00	1210.2	1206.2	1208.8						
SSD weight in air, g		1214.2	1209.7	1212.0						
Weight in water, g		710.4	710.3	709.8						
Volume, cc		503.8	499.4	502.2						
Bulk specific gravity		2.402	2.415	2.407	2.408					
Theoretical specific gravity		2.457	2.457	2.457						
Density, pcf		149.5	150.3	149.8	149.9					
% Voids		2.2	1.7	2.0	2.0					
% VMA		12.4	11.9	12.2	12.2					
% VEA		10.2	10.2	10.2						
% Voids filled with asphalt		82.0	85.8	83.4	83.7					
Stability dial reading		278	273	274						
Corrected Stability, lbf		2716	2667	2677	2690					
Thickness, inch		2 7/16	2 7/16	2 7/16						
Flow, 1/100 inch		15	15	15	15					

RESISTANCE TO MOISUTRE DAMAGE OF PAVEMENT - AASHTO T283

Date:		6/14/2017									
Report #		3532442-8-A1									
Mix Type:		APWA Type 1-01RC									
Asphalt Grade:		PG58-28									
Asphalt %:		4.16									
% Saturation based on Dry Wt. (Y/N)		Y									
	SAMPLE #	H01	H02	H03	H04	H05	H06	H07	H08	H09	H10
* 1	Diameter, mm	D	150.06	150.09	150.04	150.01	150.09	150.06	150.14	150.04	150.04
* 2	Thickness, mm	t	94.34	94.36	94.34	94.46	94.69	94.56	94.54	94.56	94.54
* 3	Dry mass, g	A	3675.2	3747.8	3716.1	3669.2	3669.1	3672.7	3674.9	3674.0	3675.3
* 4	Mass in Water, g	B	2154.5	2204.4	2177.0	2160.7	2170.0	2158.8	2156.5	2168.5	2164.1
* 5	SSD mass, g	C	3747.1	3795.7	3770.5	3744.9	3747.0	3740.1	3741.8	3742.1	3746.2
6	Volume, mL (C-B)	E	1592.6	1591.3	1593.5	1584.2	1577.0	1581.3	1585.3	1573.6	1582.1
7	Bulk Sp Gravity (A/E)	F	2.308	2.355	2.332	2.316	2.327	2.323	2.318	2.335	2.323
* 8	Max Sp Gravity	G	2.496	2.496	2.496	2.496	2.496	2.496	2.496	2.496	2.496
9	% Air Voids (100(G-F)/G)	H	7.5	5.7	6.6	7.2	6.8	6.9	7.1	6.5	6.9

Conditioned Plugs #		H03	H04	H07	
* 1	Diameter, mm	D	150.04	150.01	150.14
* 2	Thickness, mm	t	94.34	94.46	94.54
* 3	Dry mass, g	A	3716.1	3669.2	3674.9
* 4	Mass in Water, g	B	2177.0	2160.7	2156.5
* 5	SSD mass, g	C	3770.5	3744.9	3741.8
6	Volume, mL (C-B)	E	1593.5	1584.2	1585.3
7	Bulk Sp Gravity (A/E)	F	2.332	2.316	2.318
* 8	Max Sp Gravity	G	2.496	2.496	2.496
9	% Air Voids (100(G-F)/G)	H	6.57	7.21	7.13
10	Vol Air Voids (HE/100)	I	104.7	114.2	113.0

Unconditioned Plugs		H02	H06	H08
	Diameter, mm	150.09	150.06	150.04
	Thickness, mm	94.36	94.56	94.56
	Dry mass, g	3747.8	3672.7	3674.0
	Mass in Water, g	2204.4	2158.8	2168.5
	SSD mass, g	3795.7	3740.1	3742.1
	Volume, mL (C-B)	1591.3	1581.3	1573.6
	Bulk Sp Gravity (A/E)	2.355	2.323	2.335
	Max Sp Gravity	2.496	2.496	2.496
	% Air Voids (100(G-F)/G)	5.65	6.93	6.45

Saturating Plugs					
Date Saturated:		06/15/2017	H03	H04	H07
* 12	SSD mass, g	B'	3793.3	3752.0	3758.1
* 13	Mass in water, g	C'	2183.2	2162.4	2154.9
14	Volume, mL (B'-C')	E'	1610.1	1589.6	1603.2
15	Vol Abs Water, mL (B'-A)	J'	77.2	82.8	83.2
16	% Saturation (100J'/I)		73.7	72.5	73.6
17	% Swell (100(E'-E)/E)		1.0	0.3	1.1

Conditioned Plugs					
Date Broke:		06/19/2017	H03	H04	H07
* 18	Diameter, mm	d"	150.27	150.24	150.39
* 19	Thickness, mm	t"	94.46	94.54	94.64
* 20	SSD mass, g	B"	3782.1	3728.0	3738.5
* 21	Mass in water, g	C"	2195.4	2180.2	2183.8
22	Volume, mL (B"-C")	E"	1586.7	1547.8	1554.7
23	Vol Abs Water, mL (B"-A)	J"	66.0	58.8	63.6
24	% Saturation (100J"/I)		63.0	51.5	56.3
25	% Swell (100(E"-E)/E)		-0.4	-2.3	-1.9
*26A	Load (Pound Force)		4349	4310	4399
*26B	Load, N (Conditioned)	P"	19345	19172	19568
27	Wet Str. (2000P"/(t"Dp))	Stm	867.63	859.30	875.22
28					

Unconditioned Plugs					
Date Broke:		06/19/2017	H02	H06	H08
	Diameter, mm	150.09	150.06	150.04	
	Thickness, mm	94.36	94.56	94.56	

Load (Pound Force)				5446	5190	4315
Load, N (Uncond. plugs)				24225	23086	19194
Dry Str. (2000P"/(tDp))				1088.94	1035.70	861.23

29	Avg. Dry Strength (kPa)	995
30	Avg. Wet Strength (kPa)	867
31	% TSR	87.1 Pass

* - represents information required for spreadsheet.	3 plugs per set
Average % Saturation(Cond):	73.3
Average % Voids(Cond):	6.97
Average Bulk SpGr(Cond):	2.322
Average % Voids(Uncond):	6.34
Average Bulk SpGr(Uncond):	2.338
T-Test(Uncond.):	Pass
T-Test(Cond.):	Pass

Tested By: Intertek-Professional Service Industries