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THE ENVIRONMENTAL TECHNOLOGY VERIFICATION PROGRAM

ETV JOINT VERIFICATION STATEMENT

TECHNOLOGY TYPE:	**HIGH TRANSFER EFFICIENCY (TE) LIQUID COATING SPRAY APPLICATION EQUIPMENT**
APPLICATION:	**LIQUID ORGANIC COATINGS APPLICATION IN AUTOMOTIVE REFINISHING**
TECHNOLOGY NAME:	**T1-CG**

COMPANY:	**Sharpe Manufacturing**		
POC:	**Mr. John Mazzotta – General Manager**		
ADDRESS:	**344 W. 157th Street** **Gardena, CA 90248**	PHONE: FAX:	**(310) 354-1260** **(310) 523-9315**
EMAIL:	**john@sharpe1.com**		

The United States Environmental Protection Agency (EPA) has created the Environmental Technology Verification Program (ETV) to facilitate the deployment of innovative or improved environmental technologies through performance verification and dissemination of information. The goal of the ETV Program is to further environmental protection by substantially accelerating the acceptance and use of improved, cost-effective technologies. ETV seeks to achieve this goal by providing high-quality, peer-reviewed data on technology performance to those involved in the design, distribution, financing, permitting, purchase, and use of environmental technologies.

ETV works in partnership with recognized standards and testing organizations, stakeholder groups consisting of buyers, vendor organizations, and states, and with the full participation of individual technology developers. The program evaluates the performance of innovative technologies by developing test plans that are responsive to the needs of stakeholders, conducting field or laboratory tests (as appropriate), collecting and analyzing data, and preparing peer-reviewed reports. All evaluations are conducted in accordance with rigorous quality assurance protocols to ensure that data of known and adequate quality are generated and that the results are defensible.

The ETV Coatings and Coating Equipment Program (CCEP), one of seven technology areas under the ETV Program, is operated by Concurrent Technologies Corporation (*CTC*) under the National Defense Center for Environmental Excellence (NDCEE), in cooperation with EPA's National Risk Management Research Laboratory. The ETV CCEP has recently evaluated the performance of high transfer efficiency spray guns for automotive refinishing applications. This verification statement provides a summary of the test results for the T1-CG high TE spray gun, manufactured by Sharpe Manufacturing.

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VERIFICATION TEST DESCRIPTION

The ETV CCEP evaluated the pollution prevention capabilities of a high transfer efficiency (TE) liquid spray gun. The test was conducted under representative factory conditions at *CTC*. It was designed to verify the environmental benefit of the high-TE spray gun with specific quality requirements for the resulting finish. The finish quality applied by the Sharpe T1-CG gun was tested for comparability to the finish quality obtained by two baseline high-volume, low-pressure (HVLP) spray guns. If a high-TE spray gun cannot provide an acceptable finish while operating at efficiencies representative of HVLP spray guns, the end users may have a tendency to raise the input air pressure to meet their finishing requirements. However, these adjustments may reduce the environmental benefits of the high-TE spray gun. These environmental benefits include a reduction in paint usage and a subsequent reduction of VOC/HAP emissions and solid waste disposal costs when compared to traditional low-efficiency air spray guns.

In this test, the T1-CG high-TE spray gun was tested under conditions recommended by Sharpe Manufacturing, the gun's manufacturer. Two groups of targets were used. The first (large target) group consisted of 36 in. x 36 in. steel backboard panels, which were covered with heavy duty aluminum foil and suspended on a stand using magnets, and 12 in. x 18 in. steel finish quality panels. Three foils were coated for each gun and coating combination to determine the gun's TE. Then, the backboards were recovered with foil and three finish quality panels were coated, which were held in place on the surface of the backboards by the same magnets that held the backboards to the stand. The application pattern for all guns did not produce any direct overspray (i.e., there was no lead, lag, or overlap beyond the edges of the backboard. The second (small target) group consisted of 5 in. x 12 in. steel TE/finish quality panels. These panels were also attached to a stand using magnets. Three small panels were coated separately for each gun/coating combination and were used to determine both TE and finish quality. The application pattern for all guns allowed 50% of the first and last passes to be above and below the panel, respectively. The spray guns were mounted on a robotic translator to increase accuracy and repeatability of the test. The translator can move the spray gun horizontally or vertically. The TE improvement of the T1-CG spray gun over a HVLP gun baseline was verified using American Society for Testing and Materials (ASTM) method D 5286. The T1-CG and HVLP baseline guns were all gravity-feed guns. The finish quality data was incorporated to validate the comparison of the T1-CG and HVLP baseline TE data.

The details of the test, including a summary of the data and a discussion of results, may be found in Chapters 4 and 5 of "Environmental Technology Verification Report – Sharpe Manufacturing Titanium T1-CG Spray Gun," published by *CTC*. Contact Robert J. Fisher of *CTC* at (814) 269-2702 to obtain copies of this statement, the Verification Report, or the Data Notebook. The Verification Statement and Report may also be accessed via the Internet at http://www.epa.gov/etv/verifications/verification-index.html.

TECHNOLOGY DESCRIPTION

The T1-CG spray gun was tested, as received from Sharpe Manufacturing, to assess its capabilities. The T1-CG is not an HVLP gun, but is claimed to provide a TE equivalent or better than HVLP spray guns. The gun was equipped with a T1-02 #CG air cap and a 1.4 mm (0.055 in.) fluid tip. Because the T1-CG spray gun is marketed to automotive refinishers, Sharpe Manufacturing selected a three part coating system manufactured by PPG, which included the NCP-280 primer, the DBC-16640 basecoat, and the DCU-2010 clearcoat.

More information on the spray gun, including recommended air caps and fluid tips for various paint formulations, is available from Sharpe Manufacturing. At the time of this verification test, the list price of the T1-CG spray gun was $290.

VERIFICATION OF PERFORMANCE

The performance characteristics of the T1-CG spray gun included the following:

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Environmental Factors

- Transfer Efficiency (TE): The TE was determined per ASTM D 5286. The following TEs and associated standard deviations were obtained using large foil covered steel backboards:

	Primer		Basecoat		Clearcoat	
	TE (%)	Std. Dev.	TE (%)	Std. Dev.	TE (%)	Std. Dev.
T1-CG	83.3	0.5	56.2	0.5	78.3	0.2
HVLP #1	84.5	0.7	57.0	1.2	77.2	1.6
HVLP #2	83.0	0.7	56.5	1.2	73.5	0.4

The next set of TEs and standard deviations were obtained using small steel panels.

	Primer		Basecoat		Clearcoat	
	TE (%)	Std. Dev.	TE (%)	Std. Dev.	TE (%)	Std. Dev.
T1-CG	27.8	0.2	15.9	0.2	29.3	0.5
HVLP #1	31.4	0.2	15.7	0.1	26.6	0.3
HVLP #2	27.9	0.7	13.7	0.3	27.1	0.4

The T1-CG is statistically equivalent or better than both HVLP spray guns at the 95% confidence interval, with one exception (small primer against HVLP #1). It should be noted that there was a large range in the percent solids data obtained during the primer tests (e.g., 64.1% -76.1%), which was due to the short pot life of the coating and the difference in time between mixing and solids analysis. If the TE data for the primer are normalized (i.e., all calculations use the same percent solids value), then the T1-CG is statistically better than HVLP #1 at the 95% confidence interval.

Marketability Factors

- Dry Film Thickness (DFT): The DFT data was obtained per ASTM B 499. Based on PPG's product data sheets, the following target DFTs were established for the three coatings: Primer, 1.0 – 1.5 mils in one coat; Basecoat, 0.2 – 0.3 mils in one coat; and Clearcoat, 2.0 – 2.5 mils in two coats. DFTs for all tests were determined from multiple points measured on each finish quality panel. The following DFTs and associated standard deviations were obtained during this test:

	Primer		Basecoat		Clearcoat	
	Large	Small	Large	Small	Large	Small
	DFT/Std .Dev. (mils)	DFT/Std. Dev. (mils)	DFT/Std. Dev. (mils)	DFT/Std. Dev. (mils)	DFT/Std. Dev. (mils)	DFT/Std. Dev. (mils)
T1-CG	0.4/0.1	0.8/0.1	0.1/0.0	0.2/0.1	2.5/0.1	1.8/0.1
HVLP #1	0.6/0.1	0.7/0.1	0.3/0.0	0.3/0.0	2.1/0.1	2.2/0.1
HVLP #2	0.6/0.1	0.8/0.1	0.3/0.0	0.3/0.0	1.8/0.1	1.6/0.1

- Gloss: The gloss was measured per ASTM D 523 at multiple points on each finish quality panel. The values range from 0–100 gloss units. The following gloss values and standard deviations were obtained:

	Primer		Basecoat		Clearcoat	
	Large	Small	Large	Small	Large	Small
	Gloss/Std. Dev.	Gloss/Std. Dev.	Gloss/Std. Dev.	Gloss/Std. Dev.	Gloss/Std. Dev.	Gloss/Std. Dev.
T1-CG	10 / 1	37 / 3	22 / 2	21 / 0	96 / 0	95 / 0
HVLP #1	14 / 4	19 / 4	23 / 0	24 / 0	84 / 1	88 / 1
HVLP #2	12 / 3	22 / 3	22 / 1	28 / 0	77 / 1	86 / 0

- Distinctness-Of-Image (DOI): The DOI was measured per ASTM D 5767 Test Method B at one point on each finish quality panel. DOI provides another measure of a coating's finish quality. The DOI analyses were performed by ACT Laboratories, Inc., of Hillsdale, MI. The sliding comb shutter was replaced with an eight-bladed rotating disc. The test method has a range of 0–100 DOI units. The following DOI values and associated standard deviations were obtained during this test:

	Primer		Basecoat		Clearcoat	
	Large	Small	Large	Small	Large	Small
	DOI/Std. Dev.	DOI/Std. Dev.	DOI/Std. Dev.	DOI/Std. Dev.	DOI/Std. Dev.	DOI/Std. Dev.
T1-CG	23 / 1	24 / 0	27 / 0	27 / 0	76 / 5	70 / 1
HVLP #1	23 / 1	23 / 0	27 / 0	27 / 0	62 / 3	72 /3
HVLP #2	24 / 1	23 / 0	26 / 1	28 / 0	36 / 1	67 / 1

- Visual Appearance: *CTC* personnel assessed the visual appearance of all finish quality panels. The intent of this analysis was to identify any obvious coating abnormalities that could be attributed to the application equipment. The visual appearance of the coating was found to be acceptable with no obvious visual abnormalities that would render the coating unacceptable for its intended application.

SUMMARY

The operating conditions used for the three spray guns varied slightly, however, the goal was to obtain a comparable finish quality under representative conditions for each specific gun. The finish quality data indicate that the applied coating characteristics were comparable among the three guns. The test results also show that the T1-CG spray gun provides an environmental benefit comparable to HVLP spray equipment by providing the end user with the same or improved transfer efficiency as HVLP. As with any technology selection, the end user must select appropriate paint spray equipment for a process that can meet the associated environmental restrictions, productivity, and coating quality requirements.

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Lawrence W. Reiter PhD
Acting Director
National Risk Management Research Laboratory
Office of Research and Development
U.S. Environmental Protection Agency

Original signed on
9/30/2004

Brian D. Schweitzer
Manager
ETV CCEP
Concurrent Technologies Corporation

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