THE ENVIRONMENTAL TECHNOLOGY VERIFICATION PROGRAM

ETV JOINT VERIFICATION STATEMENT

TECHNOLOGY TYPE:	**HIGH VOLUME, LOW PRESSURE (HVLP) LIQUID COATING SPRAY APPLICATION EQUIPMENT**
APPLICATION:	**LIQUID ORGANIC COATINGS APPLICATION IN AUTOMOTIVE REFINISHING**
TECHNOLOGY NAME:	**LPH400-LV**

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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 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, with 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. This verification statement provides a summary of the test results for the LPH400-LV HVLP spray gun, manufactured by ANEST IWATA Corporation.

VERIFICATION TEST DESCRIPTION

The ETV CCEP evaluated the pollution prevention capabilities of ANEST IWATA LPH400-LV HVLP liquid spray gun. The test was conducted under representative factory conditions at *CTC*. It was designed to verify the environmental benefit of the high-volume, low-pressure (HVLP) spray gun with specific quality requirements for the resulting finish. If an HVLP spray gun cannot provide an acceptable finish while operating under HVLP conditions, the end users may have a tendency to raise the input air pressure to meet their finishing requirements. However, these adjustments eliminate the environmental benefits of HVLP. These environmental benefits include a significant drop in paint usage and subsequent reduction of volatile organic compound (VOC) and hazardous air pollutant (HAP) emissions and solid waste disposal.

In this test, the LPH400-LV HVLP spray gun was tested under conditions recommended by ANEST IWATA, the gun's manufacturer. Flat cold-rolled steel panels measuring 10.2 cm x 30.5 cm (4 in. x 12 in.) received an automotive refinishing coating selected by ANEST IWATA. The HVLP gun was mounted on a robotic translator to increase accuracy and repeatability of the test. The translator can move the spray gun horizontally and/or vertically. The coating was sprayed with an overlap of 67%. The panels were sprayed in a single row of eight per rack, with three racks coated per run, and a total of five runs per test. Coated test panels were used for transfer efficiency (TE) and finish quality analyses. TE is the percentage of the paint sprayed that lands on the substrate. The TE improvement of the HVLP spray gun over a conventional air spray (CAS) gun baseline (conducted in 1999) was verified using American Society for Testing and Materials (ASTM) method D 5286. The CAS baseline guns were gravity-feed, non-HVLP spray guns. The HVLP panels' finish quality was compared to a reference panel prepared by the coating manufacturer using CAS equipment and to the finish quality of the CAS baseline panels. An equivalent or improved finish quality from the HVLP gun would validate the comparison of the HVLP and CAS baseline TE data.

The details of the test, including a summary of the data and a discussion of results, may be found in Sections 4 and 5 of "Environmental Technology Verification Report – ANEST IWATA Corporation LPH400-LV HVLP Spray Gun," which is available at http://www.epa.gov/etv/verifications/verification-index.html. A more detailed discussion of the test conditions, test results, and data analyses can be found in "Environmental Technology Verification Data Notebook: ANEST IWATA Corporation LPH400-LV HVLP Spray Gun," which is available from *CTC*.

QUALITY ASSURANCE / QUALITY CONTROL (QA/QC)

The ETV CCEP QA officer conducted an internal technical systems audit to assure that testing was conducted in compliance with the approved test plan and a performance evaluation audit to assure that the measurement systems employed were adequate to produce reliable data. Prior to the certification of the data, the ETV CCEP QA officer and the EPA ETV CCEP QA manager both audited at least 10% of the data generated during the LPH400-LV test to assure that the reported data represented the data generated during testing. In addition, the EPA ETV CCEP QA manager has conducted a quality systems audit of the ETV CCEP Quality Management Plan and onsite visits during previous tests.

TECHNOLOGY DESCRIPTION

The LPH400-LV HVLP liquid spray gun was tested, as received from ANEST IWATA, to assess its capabilities. The gun was equipped with an LPH-400-LV4 air cap and a 1.4 mm (0.055 in.) fluid tip, and was set to obtain a fan pattern of 22.9 cm (9 in.). Because this HVLP spray gun is marketed to automotive refinishers, ANEST IWATA selected an exterior coating used on automotive equipment. The coating was PPG Deltron 2000 DBC-4185 automotive basecoat, mixed with equal parts of PPG DT885 reducer.

The LPH400-LV HVLP liquid spray gun is a gravity-feed gun. More information on the spray gun, including recommended air caps and fluid tips for various paint formulations, is available from ANEST IWATA.

VERIFICATION OF PERFORMANCE

The performance characteristics of the LPH400-LV HVLP spray gun include the following:

Environmental Factors

The absolute TE for each gun is a representation of the exact verification test conditions, which includes the paint that was sprayed while the guns were between the panels and outside the boundaries of the racks. The weight of paint sprayed for the calculation of the absolute TE equals the total amount of paint sprayed during each run, as was determined through gravimetric weight measurements. The absolute TE is a representation of the efficiency achievable when coating small parts with distinct separations between the individual parts.

The applied TE for each gun is a normalization of the verification test conditions. The applied TE only includes that amount of the coating that was sprayed while each gun was directly in front of any portion of a standard test panel. This calculation eliminates all coating that was sprayed while the gun was not directly over a test panel. The portion of the coating overspray during the first and last passes was also eliminated. The applied TE is a representation of the efficiency achievable when coating large, contiguous surfaces.

- Relative Transfer Efficiency (TE) Improvement: The LPH400-LV HVLP spray gun provided a 63.9% relative improvement in absolute TE when compared to the CAS baseline. The LPH400-LV HVLP spray gun provided a 52.7% relative improvement in applied TE over the CAS baseline. The applied TE represents what would be expected if one contiguous, 81.3 cm x 30.5 cm (32 in. x 12 in.) panel were coated. The absolute TE standard deviation was 1.1% and the applied TE standard deviation was 2.5%.

- Emissions Reduction: The absolute TE improvement equates to a reduction of volatile emissions of 6.1 kg per kg of solids applied to the substrate when compared to CAS guns, a 41% reduction. The applied TE improvement equates to a reduction of volatile emissions of 2.0 kg per kg of solids applied when compared to CAS guns, a 36% reduction. This value is calculated based on the TE for each gun as well as the solids and VOC contents of the coating. (See Table 2 of the Verification Report.) The specific quantitative reduction in paint usage, VOC or HAP emissions, solid waste, and cost due to increased TE depends on numerous factors such as paint formulation, process line and paint booth design, and the products being coated.

- Cost Savings: The increased TE of the HVLP spray gun provides an economic advantage in terms of reduced paint usage and solid waste generation. In this verification test, the absolute TE improvement equates to a reduction of 8.3 L or 41% of paint used and 2.6 kg or 40% of solid waste generated per kg of solids applied to the substrate when compared to CAS guns. Also, the applied TE improvement equates to a reduction of 2.7 L or 36% of paint used and 0.8 kg or 33% of solid waste generated per kg of solids applied when compared to CAS guns.

- Output Air Pressure: The output air pressure is a function of the spray gun design and depends on the coating being sprayed. The operational pressure of the HVLP gun at the air cap was verified to be <10 psig as specified in the definition of HVLP application equipment. In this verification test, the output air pressure was measured with a pressure gage and test air cap provided by ANEST IWATA and calibrated by *CTC* prior to testing. The dynamic output air pressure was set at 5 psi at the air horns and 9 psi at the center of the air cap by adjusting the input air pressure.

Marketability Factors

- Dry Film Thickness (DFT): Based on their preliminary testing and discussion with PPG, ANEST IWATA recommended the target DFT to be 0.5–1.5 mils. The DFTs for all tests were determined from nine points measured on one random panel selected from each run. The DFT of the HVLP test averaged 0.8 mil with a standard deviation of 0.1 mil. The reference panel was found to have an average DFT of 0.8 mil. The average CAS baseline DFT was 0.7 mil with a standard deviation of 0.2 mil.

- Gloss: The gloss was measured per ASTM D 523 Test Method at three points on one panel per run. The test method has a range of 0–100 gloss units. The target value was based on the results of the reference panel prepared by the coating manufacturer and was found to be 10.4 gloss units measured at a 60° angle. The HVLP test had an average of 16.5 gloss units with a standard deviation of 2.8 gloss units. The average CAS baseline gloss was 13.3 gloss units with a standard deviation of 2.2 gloss units. At 95% confidence interval, there is no separation between the gloss values for the HVLP and CAS baseline (i.e., the upper limit of the CAS baseline is higher than the lower limit of the HVLP data).

- Visual Appearance: *CTC* personnel assessed the visual appearance of all 120 panels sprayed. 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 test results show that the LPH400-LV HVLP spray gun provides significant environmental benefit by reducing VOC/HAP emissions, paint usage rates, and solid waste generated and by producing a comparable finish to conventional paint spray guns when applying an organic coating under HVLP conditions. 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.

Original signed on

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