UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

Office of Research and Development
Washington, D.C. 20460

ENVIRONMENTAL TECHNOLOGY VERIFICATION PROGRAM VERIFICATION STATEMENT

TECHNOLOGY TYPE:	**HIGH VOLUME, LOW PRESSURE (HVLP) LIQUID COATING SPRAY APPLICATION EQUIPMENT**
APPLICATION:	**LIQUID ORGANIC COATINGS APPLICATION IN AEROSPACE INDUSTRY**
TECHNOLOGY NAME:	**DeVilbiss JGHV-531-46FF**

COMPANY:	**ITW Industrial Finishing, Binks·DeVilbiss**		
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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 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, which consist 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), 1 of 12 technology areas under ETV, is operated by Concurrent Technologies Corporation (*CTC*), in cooperation with EPA's National Risk Management Research Laboratory. The ETV CCEP has recently evaluated the performance of high-volume, low-pressure (HVLP) spray guns for painting metal and plastic parts. This verification statement provides a summary of the test results for the DeVilbiss JGHV-531-46FF HVLP spray gun, manufactured by ITW Industrial Finishing, Binks·DeVilbiss.

VERIFICATION TEST DESCRIPTION

The ETV CCEP evaluated the pollution prevention capabilities of HVLP liquid spray equipment. The test was conducted under representative factory conditions at *CTC*. It was designed to verify the environmental benefit of the HVLP spray gun with specific quality requirements for the resulting finish. The operational pressure of the HVLP gun at the air cap was verified to be $\leq$10 psig per the definition of HVLP application equipment. The finish quality applied under HVLP conditions was verified to match that of the paint manufacturer's reference panel. 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 VOC/HAP emissions and solid waste disposal.

In this test, the DeVilbiss JGHV-531-46FF HVLP spray gun was tested under conditions recommended by ITW Industrial Finishing, Binks·DeVilbiss, the gun's manufacturer. Flat cold-rolled steel panels, measuring 10.2 cm x 30.5 cm (4 in. x 12 in.), were coated with an aerospace polyurethane selected by ITW Industrial Finishing, Binks·DeVilbiss. 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 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. The TE improvement of the HVLP spray gun over a conventional air spray (CAS) gun baseline was verified using American Society for Testing and Materials (ASTM) method D 5286. The CAS baseline guns were pressure-feed, non-HVLP spray guns. The HVLP panels' finish quality was compared to a reference panel prepared by the coating manufacturer using CAS equipment. The CAS baseline panels' finish quality validated 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 Chapters 4 and 5 of "Environmental Technology Verification Report – HVLP Coating Equipment: ITW Industrial Finishing, Binks·DeVilbiss - DeVilbiss JGHV-531-46FF HVLP Spray Gun," which was 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.

TECHNOLOGY DESCRIPTION

The DeVilbiss JGHV-531-46FF HVLP liquid spray gun was tested, as received from ITW Industrial Finishing, Binks·DeVilbiss, to assess its capabilities. The spray gun was equipped with a #46MP air cap, a FF needle, and a 1.4 mm (0.055 in.) fluid tip, and was set to obtain a fan pattern of 27.94 cm (11 in.). This HVLP spray gun is marketed to industrial applications, including aerospace. ITW Industrial Finishing, Binks·DeVilbiss chose an exterior coating used on aircraft and aerospace equipment. The coating was a Deft, two-component, polyurethane topcoat (Deft Product Code 03-GY-292) that meets MIL-PRF-85285C, Type I, Amendment 2.

The DeVilbiss JGHV-531-46FF HVLP liquid spray gun is a DeVilbiss Standard-Size Maximum Performer manual spray gun. The spray gun tested was a pressure-feed gun with an aluminum body and 400-grade stainless steel fluid passages (300 grade stainless is optional). More information on the spray gun, including recommended air caps and fluid tips for various coatings, is available in the DeVilbiss Technical Bulletin I-2155-B, dated April 1997. At the time of this test, the list price of the DeVilbiss JGHV-531-46FF HVLP spray gun was $395.

VERIFICATION OF PERFORMANCE

The performance characteristics of the DeVilbiss JGHV-531-46FF HVLP liquid spray gun include the following:

Environmental Factors

- Relative Transfer Efficiency (TE): The DeVilbiss JGHV-531-46FF HVLP spray gun provided an 18.9% relative improvement in absolute TE when compared to the CAS baseline. Absolute TE for this test is defined as the actual, unadjusted TE obtained. The DeVilbiss JGHV-531-46FF HVLP spray gun provided a 37.9% relative improvement in applied TE over the CAS baseline. Applied TE for this test is the absolute TE adjusted to discount the dead space between the panels and outside the racks. The applied TE represents what would be expected if the eight panels on a rack were one contiguous, 81.3 cm x 30.5 cm (32 in. x 12 in.) panel. The standard deviation of the DeVilbiss JGHV-531-46FF test was 0.3% for the absolute TE data.

- Emissions Reduction: The absolute TE improvement equates to a reduction of volatile emissions of 0.5 kg per kg of solids applied when compared to CAS guns. The applied TE improvement equates to a volatile emissions reduction of 0.3 kg per kg of solids applied when compared to CAS guns. The specific quantitative reduction in paint usage, volatile organic compound (VOC) or hazardous air pollutant (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 1.2 L of paint used and 0.9 kg of solid waste generated per kg of solids applied when compared to CAS guns. Also, the applied TE improvement equates to a reduction of 0.8 L of paint used and 0.6 kg 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. In this verification test, the output air pressure was measured with the DeVilbiss KK-5033-46-MP Air Cap Test Kit. The dynamic air pressure at the cap was set at 8 psig by adjusting the input air pressure.

Marketability Factors

- Dry Film Thickness (DFT): ITW Industrial Finishing, Binks·DeVilbiss recommended that the target DFT be 1.7–2.3 mils. The DFTs for all tests were determined from nine points measured on 25 random panels (i.e., 5 panels from each run). The DFT of the HVLP test averaged 1.8 mils with a standard deviation of 0.2 mil. The reference panel was found to have an average DFT of 1.5 mils. The average DFT for the CAS baseline was 1.8 mils.

- Distinctness-of-Image (DOI): The DOI was measured per ASTM D 5767 Test Method B (exception: an eight-bladed rotating disc was used rather than a sliding combed shutter) at three points on five panels per run. The target value, based on the results of the reference panel, was determined by ACT Laboratories to be 1 DOI unit with a standard deviation of 0. The average DOI for the HVLP test was 2 DOI units with a standard deviation of 1 DOI unit. This test method has a range of 0–100 DOI units; therefore, the difference between the HVLP panels and the reference panel is 1% of full scale. DOI was not measured on the CAS baseline panels because they were not used as the finish quality reference panels.

- Gloss: The gloss was measured per ASTM D 523 Test Method at three points on five panels per run. The test method has a range of 0–100 gloss units. For military purposes, the maximum allowable gloss value for the coating is 9.0 gloss units at an 85° angle. Deft recommended that the coating should have a target gloss value of 2.4 gloss units. The reference panel had a gloss of 1.6 gloss units. The HVLP test had an average of 2.8 gloss units with a standard deviation of 0.3 gloss unit. The average gloss of the CAS baseline was 2.9 gloss units.

- 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 DeVilbiss JGHV-531-46FF 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.

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