



Standard Waterborne Basecoat Purge Equipment Configuration and Test Method

1 Introduction

Note: Nothing in this standard supercedes applicable laws and regulations.

Note: In the event of conflict between the English and domestic language, the English language shall take precedence.

1.1 Purpose. This procedure describes the standard equipment configuration and test method for line purge and bell cup cleaning of waterborne basecoat using low Volatile Organic Compounds (VOC) and low Hazardous Air Pollutants (HAP) purge solvent solutions.

The procedure can also be applied, on an as needed basis, for the cleaning capability testing of solventborne basecoats using higher VOC purge materials per 9984037 and 9984304.

The purpose of a line purge and bell cup wash cycle is to clean out the paint line and the fluid tip and to remove any paint overspray which has collected on the exterior surfaces of the bell cup during the normal paint application process.

This test procedure should be performed during the development of new purge materials prior to submission of proposals to GM.

Note: It should be noted that this test procedure does not represent actual production conditions, but rather represents a screening method that provides a relative comparison of the cleaning effectiveness between a known and/or verified baseline purge material and one or more test materials by comparing the build-up left on an applicator after a given number of test cycles.

1.2 Applicability. Dependent upon the objective of the testing, the baseline purge material can be a solution of butyl cellosolve/amine, as indicated in the Test Equipment section of this test procedure, a solution of a specified concentration of a current production material, or a solution of a given concentration of a material specified by GM responsible engineer.

1.2.1 All proposed purge materials for the cleaning of waterborne basecoat should first be tested by the supplier using the solution of butyl cellosolve/amine as a baseline test to verify that the proposed purge material is at least as effective as a butyl cellosolve/amine solution.

1.2.2 After verification with butyl cellosolve/amine, contact GM responsible engineer for the baseline purge material that has demonstrated process stability for a specific plant for further testing.

1.2.3 More buildup on the applicator after completion of the specified number of spray/purge cycles for the test purge vs. the buildup achieved for the baseline material after the completion of a given number of cycles would indicate that the test purge is not as effective as the baseline purge, while less buildup on the applicator vs. the baseline purge after the completion of a specified number of cycles would indicate that the test purge is more effective than the baseline purge.

1.2.4 The standard equipment configuration is composed of a stationary rotary atomizer mounted vertically within a down draft or side draft spray booth. Because the procedure does not incorporate the use of a bell wash station, cleaning of the bell cup interior and exterior surfaces is accomplished through direct contact of the purge solvent solution with any paint overspray or buildup.

1.2.5 This equipment configuration is required for the evaluation of the cleaning capabilities of new or proposed purge materials relative to a standard baseline solution when tested with approved waterborne or solventborne basecoat technologies specified by GM responsible engineer.

1.2.6 The test procedure can be applied in determining the cleaning capabilities of purge materials relative to a standard baseline solution for both bell and gun cleaning applications.

1.2.6.1 A proposed change in purge formulation or purge supplier at a given facility will require that the current production purge be compared with the proposed test purge according to this test method or that the change be approved by GM responsible engineer.

1.2.6.2 A change in basecoat at a given facility will require that the current production purge be evaluated according to this test method or that the change be approved by GM responsible engineer.

1.2.6.3 A change in applicator at a given facility will require that the current production basecoat and purge system be evaluated under plant specific parameters to verify adequate cleaning capabilities or that the change be approved by GM responsible engineer.

2 References

Note: Only the latest approved standards are applicable unless otherwise specified.

2.1 External Standards/Specifications.

None

2.2 GM Standards/Specifications.

9984037

9984304

9984482

2.3 Additional References. None.

3 Resources

3.1 Facilities. Unless specified, any deviation with respect to this equipment must be approved by GM responsible engineer prior to the start of any testing.

3.1.1 Down draft or Side Draft Spray Booth. Ventilated spray booth capable of collecting atomized basecoat overspray after bell sprayout and capable of collecting purge solvent solution after purge and bell wash cycle.

3.1.2 Calibration. The test facilities and equipment shall be in good working order and shall have a valid calibration label.

3.1.3 Alternatives. Alternative test facilities and equipment may also be used. However, all measuring variables as specified in this standard shall be determined correctly with respect to their physical definition.

3.2 Equipment.

3.2.1 Rotary Atomizer. Behr (Durr) EcoBell rotary atomizer with 65 mm aluminum bell cup and 1.1 mm injector stainless steel fluid tip or equivalent.

3.2.1.1 A rotary atomizer (bell) applicator, with or without electrostatics, must be capable of atomizing waterborne basecoat according to typical production conditions (refer to Figure A1 for an example).

3.2.1.2 Each portion of the test must be conducted with consistent fluid flow rate, bell speed, shaping air, and voltage level, if applicable.

3.2.1.3 If the purge solvent evaluation requires that sprayouts be directed toward a vertical carrier on a conveyor, each portion of the testing must also be conducted with consistent bell to carrier distance and carrier line speed.

3.2.1.4 The recommended rotary atomizer and purge cycle setup are based on the test stand developed by Systems; Auburn Hills, MI (refer to Figure A2). See responsible engineer for details and requirements.

3.2.2 Bell Speed Control. Manually regulated turbine air with speed monitoring or equivalent (refer to Figure A1).

3.2.3 Paint Supply System. Paint pressure pot (19 L minimum) with manual paint regulation and paint flow rate feedback (refer to Figure A1).

3.2.4 Purge Solvent Supply System. The purge solvent supply system should be a solvent tank (19 L) with diaphragm pump for circulating purge solution through a heater and solvent flow meter with display for monitoring purge solvent delivery rates. The pump must be capable of circulating purge materials at temperatures of up to 60 °C (140 °F).

3.3 Test Vehicle/Test Piece.

3.3.1 Control Purge Solution. The control purge solvent shall be a solution of 98% to 99% butyl cellosolve and 1% to 2% amine diluted to a concentration of 10% by volume with deionized water. The purge solution should be maintained at a mix temperature specified by the responsible engineer or, as a starting point, the control solution shall be maintained at a mix temperature of 29 °C (120 °F ± 3 °F) in the solvent tank.

3.3.1.1 If specified by the responsible engineer, a control purge consisting of a lower concentration butyl cellosolve/amine solution or a current production blend shall be used in addition to or in place of the 10% butyl cellosolve/amine solution.

3.3.1.2 For the evaluation of the cleaning capability of solventborne basecoat with conventional higher VOC purge materials, a control purge solution consisting of a current production blend shall be used as the control.

3.3.2 Control Basecoat Material. Production samples of white waterborne basecoats from the current GM basecoat suppliers shall be used as the control material for the purge solution evaluations. Basecoat technology requirements and control material(s) shall be designated by GM responsible engineer based on current production or targeted plants.

For the evaluation of the cleaning capability of solventborne basecoat with conventional higher VOC purge materials, a sample of a (white) current production basecoat technology shall be used as a control.

3.3.3 Test Material. The test material is a low VOC/low HAP purge solvent and/or cap cleaner for waterborne basecoat per 9984482. The material may be supplied as a concentrate, but requirements for cleaning capability are based on ready-to-use solutions in deionized water. The predicted optimum ready-to-use concentration in deionized water, along with solution temperature, shall be specified by the supplier.

For the characterization of solventborne basecoat purge materials, the test material is a purge solvent per 9984304, or as specified by GM responsible engineer.

3.4 Test Time.

Calendar time: 1 day per test

Test hours: 2 hours

Coordination hours: ½ day

3.5 Test Required Information. Not applicable.

3.6 Personnel/Skills. Not applicable.

4 Procedure

4.1 Preparation. See detailed steps from 4.2 through 4.9.

4.2 Conditions.

4.2.1 Environmental Conditions.

4.2.1.1 Booth Parameter Equilibration. Allow the booth conditions to equilibrate to a temperature of $26\text{ }^{\circ}\text{C} \pm 2\text{ }^{\circ}\text{C}$ and a relative humidity of $60\% \pm 3\%$. Set downdraft flow rate to $1.7\text{ m}^3/\text{minute}$ ($60\text{ ft}^3/\text{minute}$).

4.2.2 Test Conditions. Deviations from the requirements of this standard shall have been agreed upon. Such requirements shall be specified on component drawings, test certificates, reports, etc.

4.3 Instructions. Purge Solvent Equilibration. Allow the control or test purge solvent to equilibrate to the specified or recommended temperature in the solvent tank.

4.4 Bell Parameter Settings. Adjust bell parameters to the following settings for the flow of the specified basecoat through the system:

- Conveyor: 4 m (12 ft)/minute.
- Flow Rate: 60 cc/minute.
- Shape Air: 60 standard L/minute.
- Bell Turbine Speed: 30 000 rpm.
- Target Distance (Bell to Conveyor): 25.4 cm (10 in), if applicable.
- Electrostatics: 300 μA ($\sim 70\text{ kV}$), if applicable.

4.5 Purge Cycle Settings. Program the purge and bell wash according to the following cycle:

4.5.1 Total Cycle (0 to 1050).

4.5.1.1 10.5 s (0 to 1050).

4.5.2 Solvent/Air Chop (0 to 900).

4.5.2.1 1.5 s Solvent (1 to 150).

4.5.2.2 1.5 s Air (170 to 320).

4.5.2.3 1.0 s Solvent (340 to 440).

4.5.2.4 1.5 s Air (460 to 610).

4.5.2.5 1.0 s Solvent (630 to 730).

4.5.2.6 1.5 s Air (750 to 900).

4.5.3 Recovery (0 to 770).

4.5.4 Main Needle Open (700 to 900).

4.5.5 Bell Wash (900 to 1050).

4.5.5.1 One and a half seconds (1.5 s) (900 to 1050).

4.5.6 The bell parameter settings or the purge cycle settings may be modified, as required, in order to produce an appropriate signal with the baseline material (i.e., the bell parameters may be increased or decreased or the cycle may be shortened or lengthened in order to provide buildup with the baseline material so that this buildup can be compared to the test material when evaluated at the same settings).

4.5.6.1 Figure 1 indicates a cup tested with the baseline purge and a purge cycle that is too severe. There is no residual buildup on the cup following the 15 cycles. In order to produce a signal, the purge cycle should be shortened (the solvent on time should be reduced) in order to produce more residual buildup on the cup tested with the baseline purge. A signal is required with the baseline purge so that it can be compared with the test purge. See Figure 1.



**Figure 1: Cup Tested with Baseline Purge:
No Residual Buildup
(No Signal, Cleaning Cycle is too Severe)**

4.5.6.2 Figure 2 indicates a cup tested with the baseline purge and a purge cycle that is not severe enough. There is excessive residual buildup on the cup following the 15 cycles. The purge cycle should be increased (the solvent on time should be increased) in order to produce less residual buildup on the cup tested with the baseline purge. A signal is required with the baseline purge so that it can be compared with the test purge. The amount of buildup on this cup, however, is excessive. See Figure 2



**Figure 2: Cup Tested with Baseline Purge:
Excessive Residual Buildup
(No Signal) Cleaning Cycle is not Severe Enough**

4.5.6.3 Figures 3 through 5 indicate cups tested with the baseline purge and purge cycles that are acceptable. There is noticeable, but not excessive, residual buildup on the cup following the 15 cycles that can be compared with a test purge in order to determine the relative effectiveness of the test purge vs. the baseline purge.



**Figure 3: Cup Tested with Baseline Purge:
Noticeable, but Not Excessive
Residual Buildup**



**Figure 4: Cup Tested with Baseline Purge:
Noticeable, but Not Excessive
Residual Buildup**