

646 Permanent Protect 5M

Guidelines for Automated Rotary Bell-Spray Application

APPLICATION BACKGROUND

CCM 646 is intended to form a very thin, uniform functional coating. In initial manual spray trials, only a small quantity of material was required and the target was a fine, evenly distributed mist. When atomization is insufficient, the freshly coated surface can show a visible wet appearance. In production processes where subsequent wiping or polishing is not possible, precise control of atomization and deposited film thickness is therefore essential.

Automated rotary bell application is well suited to this requirement because the key spray parameters can be controlled accurately and reproduced consistently. The reference trials underlying this guideline were carried out with a commercially available rotary bell system (DÜRR EcoBell 2 SL). The values below should be used as validated starting parameters for line trials and then optimized for the specific substrate, geometry and plant configuration.

FILM THICKNESS VERSUS FLOW RATE AND LINE SPEED

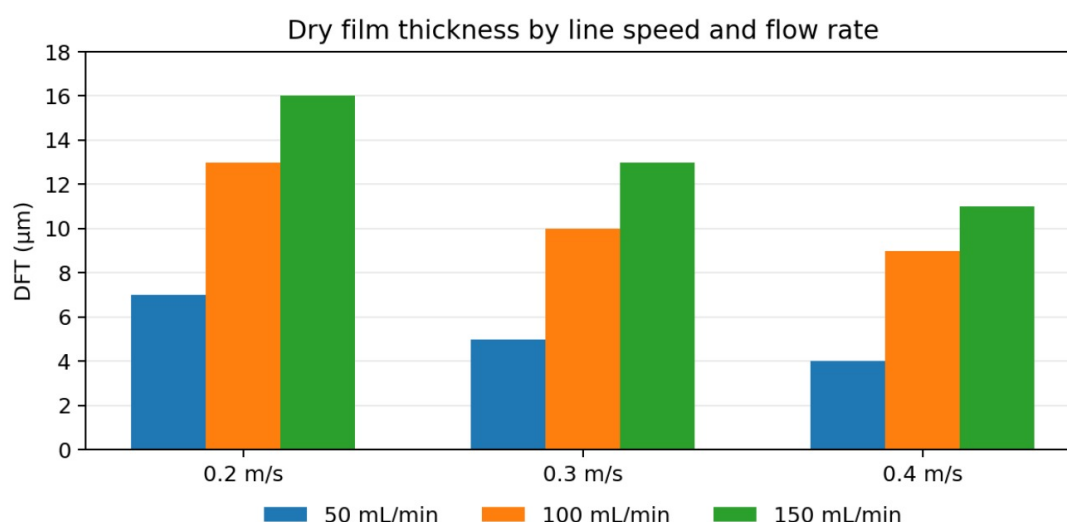


Figure 1. Reference relationship between line speed, flow rate and dry film thickness (DFT). Increasing the material flow raises the deposited film thickness; increasing line speed reduces it.

KEY PROCESS OBSERVATIONS

- Higher material flow results in a higher dry film thickness (DFT).
- Lower line speed results in a higher DFT.
- DFT values below 10 µm are readily achievable within the documented parameter window.

- Film thicknesses of approximately 4 µm can be achieved. For lower values, reduce flow below 50 mL/min and/or increase line speed.

REFERENCE ROTARY BELL OPERATING PARAMETERS

Parameter	Reference value
Bell rotation	3000 rpm
Bell type	Smooth
Dress pressure	2 bar
Vortex pressure	0 bar
Gun distance	20 cm
Line speed	0.2–0.4 m/s
Flow rate	50–150 cm ³ /min
Typical DFT	4–16 µm

APPLICATION RECOMMENDATIONS

- For a very thin, visually unobtrusive coating on glass, aluminium, polymers or other compatible substrates, a target DFT of approximately 2–5 µm is recommended as a trial range.
- The closest documented starting conditions are 50 mL/min material flow and 0.3–0.4 m/s line speed. These settings produced approximately 4–5 µm DFT in the reference setup.
- Substrate compatibility, surface preparation, curing conditions and final performance must be verified under the customer's actual production conditions before series use.

APPROXIMATE CONSUMPTION PER M²

Based on the documented film-thickness targets, the following theoretical wet consumption values can be used for initial process calculations:

Wet film thickness	Approx. dry film thickness	Theoretical CCM 646 consumption
4 µm	2 µm	~4 mL/m ²
7 µm	4 µm	~7 mL/m ²
18 µm	10 µm	~18 mL/m ²

PRACTICAL TRIAL GUIDANCE

For an automated rotary bell trial with CCM 646 on glass, aluminium, polymers or another compatible substrate, use 50 mL/min material flow and a line speed of 0.3–0.4 m/s as the initial reference point. In the documented setup, this combination produced a DFT of approximately 4–5 µm.

If a DFT below 4 µm is required, reduce the material flow below 50 mL/min and/or increase the line speed. Adjust only one main parameter at a time during optimization so that the effect on atomization, appearance and film build can be assessed clearly.

PROCESS VALIDATION BEFORE SERIES PRODUCTION

- Confirm substrate compatibility and cleanliness.
- Verify atomization quality and visual appearance across the complete part geometry.
- Measure actual wet/dry film thickness under plant conditions.
- Determine real material consumption, including overspray and transfer losses.
- Validate curing conditions and required functional performance on finished parts.
- Record the approved machine parameters as the production standard for the specific line.

TECHNICAL NOTE

The consumption figures in this document are theoretical values based on near-100% transfer efficiency and a density close to 1 g/mL. Actual plant consumption will normally be higher because of overspray, transfer losses, part geometry and equipment settings. All parameters are reference values and must be confirmed in the customer's production environment.