
**MTK 03/2026 – PROCUREMENT OF AN ULTRASONIC SPRAY COATER SYSTEM (RE-
ISSUE)- CLARIFICATION QUESTION**

CLARIFICATION QUESTION

The following items form part of Clarification Question

- Clarifications to tenderers' enquiries,

Part 1: RESPONSE TO TENDER'S ENQUIRIES.

No.	ENQUIRY	RESPONSE
1.	Position accuracy. Does " $\leq 5 \mu\text{m}$ " mean commanded resolution or positional accuracy, and what drives it: edge definition, registration to an existing pattern, or fiducials?	• The $\leq 5 \mu\text{m}$ figure is the motion resolution of the gantry, meaning its step size or encoder resolution, as worded in the specification and in compulsory specification 12. It is not a positional accuracy or repeatability requirement, and the tender does not set one. Bidders should state the accuracy and repeatability of the offered system in their supporting documents. The requirement is driven by coating uniformity. Fine resolution under closed-loop control gives a steady head speed and consistent spacing between passes, which together set the catalyst loading. It also places the edges of the coated area repeatably when many layers are built up on top of one another. Registration to an existing pattern and fiducial alignment are not required.
2.	Speed. Is 500 mm/s a spray-pass speed or a traverse between passes, and what cycle time per part do you need?	• The speed range applies to the programmable X-Y gantry motion, for spray passes as well as traverses. The compliance threshold is compulsory specification 14: a speed range up to 200 mm/s or more, with fine low-speed

		control. A maximum of 500 mm/s is the preferred upper end, because faster passes allow thinner deposits per pass, but it is not the minimum. Most catalyst-layer passes are expected to run at about 30–200 mm/s, and a stable, programmable speed across the coated area matters more than top speed (compulsory specification 15). There is no production cycle-time requirement. The system is for R&D and small-batch MEA fabrication, where each electrode is built up from many thin passes and typically takes 1–15 minutes. The system should run a complete multi-layer recipe unattended.
3.	Nozzle frequency. Is 60 kHz, with 30 to 35 μm droplets ok, we make a 48, 60 and 120Khz. Are you looking for one frequency with different shaping options?	• Yes, 60 kHz with a 30–35 μm median droplet size is acceptable.
4.	Fluids. Solvent, viscosity, solids loading, particle size, and the safety data sheet. Decides Air Knife versus Vortex, whether the stirrer is really needed,	The system will mainly spray catalyst inks for PEM fuel cell and water electrolyser MEAs. Typical properties, for information: • Liquid phase: water with lower alcohols (isopropanol, n-propanol, ethanol) in varying ratios, and occasionally other organic solvents (compulsory specification 8). • Solids: carbon-supported platinum and platinum-alloy catalysts, iridium-oxide-based catalysts, and perfluorosulfonic acid ionomer. • Solids loading: typically 0.5–8 wt%, (compulsory specification 4 covers low and high solids). • Viscosity: low. Dilute spray inks are close to the water/alcohol solvent blend, in the order of a few mPa·s. • Particle size: nanoscale primary particles, with dispersed agglomerates typically 1 μm and occasionally up to 10 μm. • Compatibility: the inks are acidic and contain flammable solvents, so wetted parts must be chemically resistant. • Stirring: required. The particles are dense and settle or re-agglomerate during a coating run, which changes the delivered solids content and therefore

		the loading. A stirring or recirculation system is compulsory specification 9. • Safety data sheets: inks are formulated in-house, so there is no single SDS.
5.	Spray pattern and rotation. How wide a fan, will the vortex work as well. What is the shape of the part(s)?	• Parts are flat, thin sheets held on a flat plate: polymer electrolyte membranes (about 10–180 µm thick), gas diffusion layers (about 0.1–0.4 mm) and transfer films (10 to 250 µm). Other substrates of varying height may be coated from time to time (compulsory specification 19). Coated areas are square or rectangular, typically 5 cm² (about 22 × 22 mm) to 50 cm², and up to the full 300 × 300 mm area for larger sheets or several pieces at once. • A flat, fan-shaped pattern with a width at the substrate adjustable over roughly 5–25 mm suits these areas. It must be narrow enough to coat the smallest areas without excessive overspray of platinum-group-metal inks, and uniform enough across its width to give even loading with overlapping passes. • A vortex (conical) pattern is not excluded, provided it meets compulsory specification 5, can be set to a comparable width and gives uniform thin films. A cone several tens of millimetres across would overspray the smaller areas. A fan-shaped pattern is the closest match to Mintek's established method, so Mintek's preference is for the fan-shaped option as the base offer where both are available. For rotation, see response 8.
6.	Programming. Teach pendant and recipes, or native G-code? Who operates it day to day? Can you run the program from a laptop instead?	• Compulsory specifications 16 and 17 apply: a PC-based graphical user interface communicating over USB or Ethernet, with a teach mode (for example with a laser pointer) and recipe-based or G-code-style programming. Native G-code is therefore not compulsory. A recipe-based interface in which the coating area, path, pass spacing, speed, head height, flow rate and number of layers are entered, saved and recalled meets the requirement. A teach pendant

		is acceptable for teaching positions, provided the system is also programmed and run from the PC-based interface. Running the program from a laptop is acceptable. Day-to-day operators are researchers and technicians in Mintek's Advanced Materials Division. They are trained users but not motion-control programmers, so creating and editing recipes should not need specialist programming skills. Training for four personnel is compulsory specification 23. Bidders should state whether the PC or laptop and the software licences are included in the offer.
7.	Fume handling and space. Building exhaust at the bench, duct size, bench space, and door width required for parts, cfm?	- The system will be installed in the HySA Fuel Cell Testing laboratory at Mintek. - Extraction: ducted building extraction is available at the bench, duct diameter 125-150 mm. Bidders must state the extraction port diameter and the exhaust flow their system needs (compulsory specification 21). - Bench space: 730 × 200 mm, clear height 1500 mm. Bidders should give the footprint, height, weight and service clearances of the system. - Access: the narrowest door on the delivery route is 2000mm height, 900mm width. - Services: 240 V AC, 50 Hz (compulsory specification 22). Compressed air at 8 bar and nitrogen at 8 bar are available at the bench. Bidders should state their air or gas pressure and flow requirements.
8.	Do you need 4 axis or will 3 work?	A fourth (θ) axis is required. Compulsory specification 13 calls for a θ-axis with programmable 90° rotation of the spray head or the substrate, so an X-Y-Z-only system would not comply. The rotation keeps a fan-shaped pattern perpendicular to the direction of travel, so that alternate layers can be sprayed at 0° and 90° (cross-hatch) to even out the loading. The requirement is a rotation between two orientations 90° apart, selected from within the program without operator

		intervention. Continuous rotation interpolated with X-Y-Z motion is not required. The requirement applies whichever spray pattern is offered.
9.	Flow Control: Integrated electronic flow control (you mean on the fly change to flow?)	"Integrated electronic flow control" means the liquid flow rate to the spray head is set, metered and switched by the system's own controller and software through the precision metering pump (compulsory specifications 3 and 6). A manual valve, or a stand-alone pump that the coating program does not control, would not meet this. The flow rate must be a programmable recipe parameter, with liquid delivery starting and stopping in step with the motion program. "Manual override" (desirable) means the operator can also start, stop and adjust flow by hand, for example for priming, purging and set-up. Changing the flow rate on the fly within a pass is not required. Being able to assign different flow rates to different steps or layers of a recipe is desirable.
10.	Minimum Dispense Resolution: $\leq 1 \mu\text{L}/\text{pulse}$ (what are you intending to do at 1 ul/pulse?)	The figure is the resolution of the metering pump: the volume displaced per motor step or encoder pulse (compulsory specification 7). It is not a shot size, and Mintek does not intend to dispense discrete 1 μL volumes. The pump runs continuously during a pass at low flow rates, typically 0.2–2 mL/min. At 0.5 mL/min, 1 $\mu\text{L}/\text{pulse}$ is only about 8 pulses per second, or one pulse for every 12 mm of travel at 100 mm/s. A resolution in the tens of nanolitres gives around a hundred pulses per second or more, and a correspondingly steadier flow. Steady flow at these rates gives uniform catalyst loading along each pass and accurate total loading with costly platinum-group-metal inks, which is why the nanolitre range is stated as preferred.
11.	Position accuracy. Does " $\leq 5 \mu\text{m}$ " mean commanded resolution or positional accuracy, and what drives it: edge definition, registration to an existing pattern, or fiducials?	Same as enquiry 1. See response to 1 above.

12.	What is the material you are looking to spray and it's approximate viscosity?	• Material: mainly catalyst inks for PEM fuel cell and water electrolyser MEAs. These are suspensions of carbon-supported platinum or platinum-alloy catalysts, or iridium-oxide-based catalysts, with perfluorosulfonic acid ionomer in water and lower alcohols, typically at 0.5–8 wt% solids. • Viscosity: low. Dilute spray inks are close to the water/alcohol solvent blend, in the order of a few mPa·s. • See response 4 for the full ink properties.
13.	What is the substrate and it's appropriate dimensions?	• Substrate: flat, thin sheets held on a flat plate, namely polymer electrolyte membranes (about 10–180 μm thick), gas diffusion layers (about 0.1–0.4 mm thick) and transfer films (10 to 250 μm thick). • Dimensions: sheet sizes vary, and the system must accept substrates of at least 300 × 300 mm (compulsory specification 18). Coated areas are typically 5 cm^2 (about 22 × 22 mm) to 50 cm^2 (about 71 × 71 mm), and up to the full 300 × 300 mm coating area. • See response 5.
14.	Are you looking for a selective area coating or the entire thing?	• Both. Most coating is of a defined square or rectangular area, typically 5 cm^2 to 50 cm^2. Where the sheet is larger than that area, the rest of the sheet is left uncoated. • Full-area coating, up to 300 × 300 mm, is also used for larger sheets or several pieces at once. • The position and size of the coated area are set in the recipe (see response 6). The coated shapes are simple squares and rectangles, and registration to an existing pattern is not required (see responses 1 and 5).
15.	Is this for R&D or production?	• R&D. The system is for research and small-batch MEA fabrication in Mintek's Advanced Materials Division (see Background & Context in the tender document). It is not for volume production, and there is no production cycle-time requirement (see response 2).