

Annexure-1

Specifications, Requirements, Acceptance criteria and general conditions

1. Specifications

- 1.1 Substrate : SS316 L flow field plate
- 1.2 Dimensions : As per drawing no. FCPS-02-00-02-01-01-001-006 and FCPS-02-00-02-01-01-001-07
- 1.3 Type of coating : Gold electroplating of SS316 L without intermediate layer
- 1.4 Purity of gold : 99.9 %
- 1.5 Thickness of coating : $0.2 \pm 0.05 \mu\text{m}$

2. Acceptance criteria

2.1 Coupons

- 2.1.1 **Visual Inspection at 4X magnification:** The plating shall be uniform with 100% coverage and without any delaminating, edge build-up, dendrites and other obvious defects, on observation under 4X magnification.
- 2.1.2 **Potentiostatic testing:** Corrosion Current density on +0.8 V (with respect to SCE) static potential with O₂ gas purging at 80°C in 1M H₂SO₄ for 100 hrs shall be less than 1 $\mu\text{A}/\text{cm}^2$. No apparent defects shall form during the test.
- 2.1.3 **Bend test:** Bend the plated substrate (0.5 mm) with the coated surface away over a mandrel (4 mm diameter) until its two legs are parallel. Examine the deformed area visually under 4X magnification. No flaking, blistering or peeling shall be apparent. *Note: Cracks are not indicative of poor adhesion unless the coating can be peeled back with a sharp instrument*
- 2.1.4 **Heat/Quench Test:** Heat the coated article in an oven for a sufficient time for it to reach the temperature of $200 \pm 5 \text{ }^\circ\text{C}$. Then quench the part in water at room temperature. No flaking, blistering or peeling shall be apparent.
Note: If the deposited coating cannot be peeled or lifted from the substrate in an area adjacent to the blister(s), the appearance of blisters should not be interpreted as evidence of inferior adhesion.

2.1.5 **Peel Test:** Adhesive-backed tape shall be pasted on 20 mm wide substrate. The tape shall be pulled off at angle of 90° to the surface. Failure in the coating/substrate interface is evidence of inadequate adhesion.

2.1.6 **Thickness assessment:** Thickness of the gold plating shall be calculated using geometric surface area considering uniform coverage of the surface and weight of gold deposited.

2.1.7 **Summary of coupons required for process qualification at VSSC:**

<i>Sl. No.</i>	<i>Type & Size</i>	<i>Quantity</i>	<i>Test to be performed</i>
1	Plane sheet of 100*25 mm	6 nos.	<ul style="list-style-type: none">• Visual• Thickness measurement• Bend test• Heat/Quench Test• Peel test
2	Etched sheet representing flow field plate : 100*25 mm	4 Nos.	<ul style="list-style-type: none">• Potentiostatic Test

2.2 Flow Field Plates:

2.2.1 **Visual Inspection at 4X magnification** (for all the plates): The plating shall be uniform with 100% coverage and without any delamination, edge build-up, dendrites and other obvious defects.

2.2.2 **Thickness assessment:** Thickness of the gold plating shall be calculated using geometric surface area considering uniform coverage of the surface and weight of gold deposited.

3. General Conditions and requirements

3.1 Gold plating shall be carried out directly on SS-316 L plates, without any intermediate coating.

3.2 Initially gold plating of coupons shall be carried out. Material for coupons shall be provided to party by VSSC for free of cost. No bank guarantee shall be provided for the same since cost of material for coupons is negligible.

3.3 Clearance for gold plating of flow field plates shall be granted only after satisfactory evaluation of gold plating on the coupons.

- 3.4 The flow field plates and material for coupons shall be supplied by VSSC as free issue material (FIM). Fabricated flow field plates, shall be delivered to your site and the plated flow field plate shall be collected from works by VSSC personnel.
- 3.5 The total cost of FIM is Rs. 20000 for 20 nos. of flow field plates. Party shall provide necessary bank guarantee for the same.
- 3.6 Gold plating shall be carried out on 20 nos. of fuel cell flow field plates fabricated from SS316L material as per the drawing no FCPS-02-00-02-01-01-001-006 and FCPS-02-00-02-01-01-001-07
- 3.7 Gold plating of flow field plates shall be carried out using the same process parameters and thickness as for accepted coupons. Additional test coupon (3 nos each) shall be realised in the beginning & end of flow field plate plating.
- 3.8 Plating of flow field plates shall be completed within three weeks from the date of clearance based on evaluation of coupons.
- 3.9 Plates realised shall be free from any residual chemicals. Final cleaning bath shall be reflecting pH 7.0. Record shall be maintained for the same.
- 3.10 Thickness of plated gold shall be in the range 0.150 - 0.250 μm as computed from weight recorded using a balance of resolution of 1 mg with valid calibration.
- 3.11 Party shall provide costing procedures/formula based on the amount of gold deposited on each plate and extant price of gold. This shall include fixed cost as well as variable cost covering the amount of gold deposited on individual plate and the rate of gold.
- 3.12 Plating shall be carried out in the presence of VSSC personnel. Consolidated record of weighing shall be made available for further scrutiny and the same shall form the basis for accounting.
- 3.13 Following documents are required to release payment on completion of the work:
 - Copy of valid calibration certificate of weighing balance used for weighing of gold deposit
 - Record of weighing of flow field plates countersigned by VSSC personnel.
 - SLN bullion gold rate in India as on PO acceptance date shall be provided for cost calculation