

GOVERNMENT OF INDIA
DEPARTMENT OF SPACE
ISRO SATELLITE CENTRE (ISAC)
AIRPORT ROAD, VIMANAPURA POST
BANGALORE 560 017

TENDER NOTICE NO. 02 DATED 24.06.2009

On behalf of President of India, Head, Purchase & Stores, ISRO Satellite Centre (ISAC), Bangalore 560 017 invites sealed tenders for the supply of the following items:

SL. NO	TENDER REFERENCE	BRIEF DESCRIPTION	QTY	TENDER FEE INCL OF S.TAX Rs. Ps.
01	ISDO 2009013838	A0 LASER PRINTER, COPIER SCANNER AND SHEET FOLDING UNIT	(as per Document)	Rs. 218/-
02	ISIR 2009013726 (THIS IS A TWO PART TENDER)	WET PROCESSING SYSTEMS FOR HIGH DENSITY INTERCONNECT PCB APPLICATIONS	01 Unit	Rs. 218/-

FOR SUBMISSION OF TENDER : 10TH AUGUST 2009 AT 1600HRS (IST)
OPENING OF TENDER : 11TH AUGUST 2009 AT 1000HRS (IST)

NOTE: TWO PART TENDER SYSTEM IS APPLICABLE FOR SL. NO. 02. INSTRUCTIONS ARE PART OF THE TENDER DOCUMENTS.

NOTE:

1. Tender documents are also available on ISRO Web site of www.isro.gov.in Tender Notice No.02 dtd. 24-06-2009. Interested tenderers may, at their option, download the tender documents from website and

submit offers along with prescribed tender cost (in form of Bank Draft) as per details in the tender notification. The Demand Draft should be sent in a separate cover with a covering letter along with the cover containing the quotation.

2. Tender fee shall be payable only in the form of bank draft drawn in favour of Accounts Officer, ISRO Satellite Centre, payable at Bangalore. No other mode of payment for tender fee is acceptable.
3. Vendors/firms name and tender no. shall be indicated on the reverse side of the Demand Draft.
4. While requesting for tender documents, please do not superscribe tender number and due date on the envelop. Instead indicate "Request for Tender Documents".
5. Detailed specification, terms and conditions are furnished in the tender documents.
6. DD should not be dated prior to the date of advertisement / intimation / website. Separate requests and demand drafts shall be sent for each tender document.
7. ISAC will not be responsible for non-receipt of tender documents/offers due to postal delay / loss in transit.
8. Quotations received without payment of tender fee will be treated as unsolicited.
9. Indian agents while quoting on behalf of their principals are requested to provide necessary authorisation letter from their Principals.
10. The offer should be valid for the period of Ninety days from the date of opening.
11. Quotations received after the due date and time will not be considered.
12. While submitting your offer please superscribe tender no and due date on the envelope. Addressed to Head Purchase & Stores, ISRO Satellite Centre, Airport Road, Vimanapura Post, Bangalore-560 017.
13. If tender opening date happens to be public holiday tender will be opened on the next working day & interested Vendors may depute their Representatives to attend the Public Tender Opening.
14. Request for the extension of the due date will not be considered.
15. Head, Purchase and Stores, ISAC reserves the right to accept or reject any tenders in part or full without assigning any reasons thereof.
16. Those who do not utilise the website shown at clause 01 above can also buy the Tender documents from Purchase Officer, Purchase & Stores Division, ISRO Satellite Centre, Airport Road, Vimanapura Post, Bangalore-560 017, INDIA on payment of Non-refundable tender fee as indicated above, on all working days between **1400Hrs to 1600Hrs**.

PART ONE

This should consist of two sections viz., (a) Technical and
(b) Commercial

(a) Technical : This section should consist of:

- All technical specifications of the items options and accessories offered by you.
- Relevant leaflets and literature and any other technical matter pertaining to the items offered.

(b) Commercial: All the commercial points to be indicated (other than prices) should come in this section for example:
 Delivery terms and delivery period , Payment terms (our standard Terms i.e. 100% Payment within 30 days after receipt and Acceptance)

- Validity period of the offer (120 days required)
- Warranty / Guarantee applicable
- Installation details such as installation is done Free of cost or not
- If not indicate “installation charges indicated in Price part”.
- Whether training is required; if so, free of cost, if not indicate “training charges indicated in price part”/

“Approximate weight of the consignment”.

Note: (1) Part 1 prepared as above should be Enveloped and Superscribed Technical & Commercial part 1

Reference No.....
 Due date

Note (2) Part 1 should not contain any price details

: 2 :

PART II (PRICE PART)

This part should consist of :

- Prices of the unit and total amount for the items offered (with break-up Wherever required):
Price of option and accessories Installation charges & Training (if not free)

Where the quotation is on Ex-works basis Packing forwarding and inland freight charges if any Price part (Part II) thus prepared should be Enveloped separately and superscripted as.

- Price part II
- Reference No:.....
- Due Date.....

Note (3): Both the envelopes (Part 1 and Part II)

Prepared as above should be placed in another envelope and superscribed as follows:

Reference No:.....
Due Date :.....

Part 1 & Part II individually enveloped inside:

TO

THE HEAD, PURCHASE AND STORES
ISRO SATELLITE CENTRE
GOVERNMENT OF INDIA
DEPARTMENT OF SPACE
AIRPORT ROAD
VIMANAPURA POST
BANGALORE-560 017.

Note(4):The above should reach us on or before the due date and time.

Note(5): HEAD, PURCHASE AND STORES, ISRO SATELLITE CENTRE,
GOVERNMENT OF INDIA, DEPARTMENT OF SPACE.
AIRPORT ROAD, VIMANAPURA POST,, BANGALORE-560 N017.
RESERVES THE RIGHT OF ACCEPT OR REJECT ANY OF THE
QUOTATION IN FULL / PART THEREOF WITHOUT ASSIGNING
ANY REASONS

Technical Specification

1) A0 Laser Printer, Copier and Scanner

1.1 Printing Function

- ⇒ Printing Process: Electro photographic (LED) printing
- ⇒ Print speed: Greater than two A0 prints per minute.
- ⇒ Print Size: A4 to A0 (Maximum width 914mm)
- ⇒ Long Plot: 3 M and above.
- ⇒ Printer language: HPGL/HPGL2, PCL5&6, Adobe post script -3
- ⇒ Print resolution: 400x400 dpi or higher
- ⇒ Interface: Ethernet 10/100 Base T, USB2.0
- ⇒ Memory: 512 MB RAM or more , 40GB HDD or higher
- ⇒ Network protocol: TCP/IP
- ⇒ Print Drivers/OS Support: Microsoft Windows ME /2000/XP/ Server 2003

1.2 Copying Function

- ⇒ Copying process: Electro photographic (LED) printing
- ⇒ Copying speed: Greater than two A0 copies per minute
- ⇒ Resolution: 400x400 dpi or higher
- ⇒ Enlargement/Reduction (Zoom): 25% - 400% (in 1% steps)
- ⇒ Should work as stand alone copier also.

1.3 Scanning Function

- ⇒ Scanning Type : Scan to file and Scan to print
- ⇒ Scanning speed: Greater than two A0 originals per minute
- ⇒ Resolution: 400x400 dpi or higher
- ⇒ Original size: A4 – A0 (maximum width 914 mm)
- ⇒ Output formats: PDF and TIFF
- ⇒ Scan Drivers: Network TWAIN
- ⇒ OS Support: Microsoft Windows ME/2000/XP/Server 2003

1.4 Paper Handling

- ⇒ Paper Rolls: Two rolls of 914mm wide and 100 – 150M length and One cut sheet bypass tray
- ⇒ Minimum Paper size: A4
- ⇒ Paper weight: 70 - 150 gsm
- ⇒ Paper Type: Plain paper, Vellum and Films.
- ⇒ Print should not get erased due to folding of sheet.
- ⇒ Print should not get erased from vellum sheet when gum tape is pasted and removed

1.5 Print Quality

- ⇒ Print should not get erased due to folding of sheet.
- ⇒ Print should not get erased from vellum sheet when gum tape is pasted and removed

1.6 General

- ⇒ Single foot print configuration
- ⇒ Operating Environment: Normal Room temperature
- ⇒ Power Supply: Standard Indian 230V, 50Hz

2) Sheet folding Unit

- ⇒ Folder Type : Offline Folder
- ⇒ Folding Method : DIN, Ericson, Fanfold and Cross fold.
- ⇒ Folding Speed : 2 A0 per minute
- ⇒ Paper Width : 297 to 914 mm
- ⇒ Paper Length : 420 – 2000 mm or higher
- ⇒ Paper weight: 70 - 100 gsm

3) Terms and conditions

- ⇒ Enclose the product catalogue of the equipment quoted.
- ⇒ Compliance statement for specifications.
- ⇒ Standard one-year on-site warranty to be provided in case outright purchase.
- ⇒ Quote for Full/Comprehensive Service Maintenance Agreement (FSMA/CSMA) rates. FSMA/CSMA rates to include all kinds of spares, consumables and servicing except paper and power. Print quality is the criteria for deciding the change of spares, consumables.
- ⇒ Hire purchase scheme to include all kinds of spares, consumables and servicing except paper and power. Print quality is the criteria for deciding the change of spares, consumables or equipment itself.
- ⇒ Buy back charges for our existing Xerox 8830 three roll A0 laser printer.

4) Use following format for quoting

Option One: Outright Purchase with FSMA / CSMA

Description	Qty	Unit Cost in Rs	FSMA / CSMA rates per meter
A0 Laser Printer, Copier and Scanner	2 Nos		
Sheet Folding Unit	1 Nos		

Option Two: Hire Purchase for five year term

Description	Qty	Monthly Rent in Rs	Rates per meter
A0 Laser Printer, Copier and Scanner	2 Nos		
Sheet Folding Unit	1 Nos		

For Both options

Description	Qty	Buy back Amount in Rs.	Remarks
Xerox 8830 three roll A0 laser printer, Model 1999	1 No		

Technical Specifications of Wet processing systems

for

**Fine line-fine pitch
high density interconnect
PCB applications**

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Technical Specifications of Wet processing systems for high density interconnect PCB applications

1. Scope

- 1.1. The scope of the supply of Wet processing systems for the fabrication of high-end PCBs for high density interconnect applications with fine line, fine pitch conductive features, blind and buried micro-vias should include the following equipments:
 - 1.1.1. Aqueous photoresist developing system
 - 1.1.2. Acid etching system
 - 1.1.3. Alkaline etching system
- 1.2. Each wet processing system should be separate and independent with separate electronic/electrical control panels so that they can be placed at different locations as per the user's requirement.

2. Mandatory Terms

- 2.1. The bidder should have supplied similar equipments to reputed international high density interconnect PCB manufacturers and should enclose the evidence for the same indicating machine performance for minimum 5 years.
- 2.2. The equipment should have compliance to Euro Standards (CE) and/or any other international standards. The bidder should furnish the compliance certificates for manufacturing high density interconnect PCBs.
- 2.3. The bidder should demonstrate the capability of the machines to manufacture high density interconnect PCBs, by processing the sample PCBs supplied by ISRO.

3. Aqueous photoresist developing system for fine line-fine pitch high density interconnect PCB applications

3.1. Application

- 3.1.1. Aqueous photoresist developing system is intended for the processing of internal and external layer circuits using aqueous chemistry. The aqueous developing system should be compatible for processing dry / liquid film Photoresist of high reliability HDI PCB applications.

- 3.1.2. Aqueous developing system should resolve HDI PCBs with blind, buried micro-vias & fine pitch/fine line conductor features down to 2-mils. It should be compatible for Laser Direct Imaging (LDI) and conventional photolithography.

3.2. **General system features**

- 3.2.1. The Developing system should be specifically designed for processing various types of Rigid, Rigid-Flex and flexible Multilayer Printed Circuit Boards.
- 3.2.2. The system should be self-supporting and should be constructed with chemical proof, corrosion-proof and high temperature withstanding CPVC or better material, with titanium parts/accessories such as rods, bolts, nuts, shafts, conveyor drives, conveyor guides, fasteners, etc, wherever necessary.
- 3.2.3. It should be provided with Horizontal Conveyor drive and thin layer transport & guiding mechanism for safe transportation of rigid and flexible boards down to 2-mil (50 microns) core thickness.
- 3.2.4. The input conveyor module should be supplemented with necessary sensors for automatic detection of the board at entry and exit stages.
- 3.2.5. Conveyor system and drives should be maintenance-free and the Conveyor control mechanism should ensure precise and smooth transfer of all the panels including rigid, flexible and rigid-flex boards.
- 3.2.6. Filter housings should be installed outside of the machine body to enable periodical check up and easy servicing of the filter cartridges.
- 3.2.7. In order to avoid the frequent blockage of spray manifold in the rinse module, pre filter (80 micron) should be provided at the inlet.
- 3.2.8. Separate filter assembly with independent motors should be provided for filtering the developing solution.
- 3.2.9. Only filtered solution should be fed into the spray manifold from the developing chamber.
- 3.2.10. All filter housings; pumps and electrical accessories should be installed outside of the machine body to enable periodical check up and easy maintenance/repair of the total system.
- 3.2.11. The parts needing preventive maintenance, such as spray bar, nozzles and filter cartridges should be easily accessible with quick disconnect option.

- 3.2.12. In case of developing chamber all module bottoms should be sloped to about 10-15 degree to facilitate the cleaning and emptying operations.
- 3.2.13. Lids should be made up of chemical proof, fully transparent toughened glass / PP / any other suitable material and should be seated on chemical resistant and leak proof gaskets.
- 3.2.14. The photoresist developing system should be modular type with the following stand-alone modules:
 - 3.2.14.1. Input conveyor module with lip exhaust
 - 3.2.14.2. Primary developing module
 - 3.2.14.3. Secondary developing module, with specially designed spray manifold (option)
 - 3.2.14.4. Blower module with Air cutter
 - 3.2.14.5. Hot water rinse module (option)
 - 3.2.14.6. Inspection module
 - 3.2.14.7. Two stage cascade water wash module
 - 3.2.14.8. Hot air drying module
 - 3.2.14.9. Output conveyor module
 - 3.2.14.10. Electric/electronic control console

3.3. Technical specifications

Sl.No.	Description	Specification
3.3.1.	Construction material	High temperature withstanding Chlorinated Polyvinyl chloride (CPVC) or better (Similar material should be used for all the three wet process lines) Titanium (wherever necessary)
3.3.2.	Pumps & motors	Chemical resistant, magnetic coupled & with titanium parts wherever necessary.
3.3.3.	Spray pressures	To clear off 2-mil thick photoresist completely (in about 1 to 2 minutes duration). Pressures adjustable in Primary develop, Secondary develop & Water wash modules
3.3.4.	Panel size (approximate)	6-inch X 4-inch to 24-inch X 20-inch
3.3.6.	Conveyor speed range	0.1 to 6.0 meters per minute, continuously variable
3.3.7.	Board thickness	0.050 mm core to 6.0 mm thickness, approximately
3.3.8.	Effective processing width	24-inch (610 mm), minimum, same in all the three wet processing lines
3.3.9.	Working height (approx.)	Not to exceed 1.5 meters, should be same in all the three (develop, acid-etch & alkaline-etch) processing systems.
3.3.10	Nominal power supply	AC; 3-Phase, 415 Volts & 50 Hz.
3.3.11	Finish	Aesthetically good, suitable color

3.4. Description of the individual modules

3.4.1. **Input conveyor module**

- 3.4.1.1. Conveyor should be compatible for safe transportation of thin/flexible layer with dedicated guide mechanism.
- 3.4.1.2. Board sensors should be provided at the panel entry and an audible alarm is preferred at the panel's exit.
- 3.4.1.3. Suitable compact exhaust chamber should be available to drive the fumes from the primary developer module.
- 3.4.1.4. Working Length should be approximately 600 mm.

3.4.2. **Primary developing module**

- 3.4.2.1. Transparent side windows with double seals and safety interlocks should be provided for easy access and maintenance.
- 3.4.2.2. A pair of sponge squeegee rollers should be provided at the entry of the developing chamber.
- 3.4.2.3. Spray banks should be mounted on guides and wheels for quick disconnect and easy maintenance.
- 3.4.2.4. Solution should be filtered with strainer, better than 80 micron.
- 3.4.2.5. Chemical resistant, leak proof, magnetic coupled pumps should be provided.
- 3.4.2.6. Alarms should be provided for minimum and maximum solution levels and for the protection of heaters and motors.
- 3.4.2.7. Temperature sensors should be provided at two different locations and controlled through dedicated PLC with digital displays.
- 3.4.2.8. Titanium heaters and cooling coil with solenoid valve should be provided for heating and cooling respectively.
- 3.4.2.9. Tank capacity should be approximately 300 litres.
- 3.4.2.10. Working length of the Primary developing module should be approximately 750 mm.

3.4.3. **Secondary developing module (specially designed spray bars inline with conveyor direction-Option)**

- 3.4.3.1. Chemical resistant, leak proof, magnetic coupled pumps should be provided.
- 3.4.3.2. The spray bars should be inline with the conveyor movement.

- 3.4.3.3. Each spray bar should have variable pressure controls and fitted with chemical proof pressure gauge for digital display of individual spray bars.
- 3.4.3.4. Alarms should be provided for minimum and maximum levels to ensure the protection of heaters and motors.
- 3.4.3.5. The capacity of the solution tank should be approximately 150 litres.
- 3.4.3.6. Working length of the secondary developing module should be approximately 400mm.

Quote separately for:

- 3.4.3.6.1. Regular standard spray system,
 - 3.4.3.6.2. Turbulence-free spray with staggered jet nozzles on side spray manifolds and
 - 3.4.3.6.3. Combination of both with a provision for operation either one at a time.
- 3.4.4. **Blower module with air cutter**
- 3.4.4.1. A blower with dedicated air knives should be used to blow air for dislodging the chemical solution from the developed panel.
 - 3.4.4.2. The air should be blown against the direction of transport for minimizing the drag out of the developing solution.
 - 3.4.4.3. A suitable silencer should be provided for the lowest noise levels.
 - 3.4.4.4. Working length of the Blower module should be approximately 150mm.
- 3.4.5. **Hot water rinse module**
- 3.4.5.1. A water rinse module with controlled heating provision through PLC should be provided for effective cleaning after the development.
 - 3.4.5.2. Sufficient number of spray bars should be provided for hot water rinsing.
 - 3.4.5.3. Working length of the Hot water rinse module should be about 200mm.
- 3.4.6. **Inspection module**
- 3.4.6.1. An open driven conveyor should be provided after hot water rinse for visual inspection of the developed panel.

- 3.4.6.2. Working length of the Inspection module should be approximately 650mm.
- 3.4.7. **Two stage cascade water spray rinse module**
 - 3.4.7.1. Working length of each stage should be approximately 200mm and water tank capacity of about 75 litres each.
 - 3.4.7.2. Inlet water should be filtered before reaching the spray manifold.
 - 3.4.7.3. Seal less magnetic coupled pump with removable mesh filter unit on pump inlet should be provided.
 - 3.4.7.4. A pair of squeegee rollers at the inlet and outlet should be provided with interlock switches.
- 3.4.8. **Hot air drying module**
 - 3.4.8.1. High Performance air turbine motor with safety thermostat should be provided to remove the moisture from the board.
 - 3.4.8.2. Suitable noise abatement and filter cartridge with pressure dump valve should be provided.
 - 3.4.8.3. Dedicated air knives with suitable exhaust duct should be provided.
 - 3.4.8.4. Suitable manifold and air knives with controlled heating mechanism should be provided with exhaust duct for effective drying.
 - 3.4.8.5. Variable temperature and airflow controls should be provided.
 - 3.4.8.6. Flex/thin layers should be safely transported in the drying module without incurring any physical damages.
- 3.4.9. **Exit conveyor module**
 - 3.4.9.1. A driven conveyor should be left openly either for unloading the processed panels or to attach the further process assemblies with similar type modules.
 - 3.4.9.2. Audible alarm preferred at the exit of panel.
 - 3.4.9.3. The working length of the exit conveyor should be approximately 500mm.
- 3.4.10. **Electrical/electronic control panel**
 - 3.4.10.1. The Electrical/electronic Control Panel should be compact, simple and easy to operate.

- 3.4.10.2. The system operation parameters should be controlled with programmable logic controller (PLC)
- 3.4.10.3. Every module should be equipped with safety switches for shutting down the system, if opened during operation.
- 3.4.10.4. Suitable visual/digital indicators should be provided for conveyor speed, temperatures, interlocks, emergency stops, phase failure, ELCB, etc with audible alarms wherever necessary.
- 3.4.10.5. The user interface should be easy for operation with necessary Man-machine-interface (MMI) and touch screen interface.
- 3.4.10.6. Various run time process parameters such as conveyor speed, solution temperatures, developing solution conductivity, water flow, etc should be digitally displayed separately and individually.

3.5. Optional system features

- 3.5.1. Auto dosing set-up should be offered based on the conductivity of the developing solution.
- 3.5.2. Conductivity meter (resolution: 0.01 micro-mhos) with digital display should be provided.
- 3.5.3. Unbreakable or protected electrodes should be used for measuring conductivity measurements.
- 3.5.4. Spare conductivity measuring electrodes should be offered along with the meter.

NOTE: The process technology adopted for the optimum fine line developing with 1-mil to 2-mil thick dryfilm as well as liquid photoresist over a panel size of 24-inch X 20-inch using your Aqueous photoresist developing system should be clearly illustrated with relevant drawings and demonstrated (if required) on ISAC supplied Laser Direct Imaged or UV processed PCB panels.

4. Acid etching system for fine line-fine pitch high density interconnect PCB applications

4.1. Application

- 4.1.1. The Acid Etching system under the scope of supply is intended for processing of Fine-line internal and external layer circuits using acid etching chemistry. The system should be compatible for processing both dry / liquid film Photoresist as etch-resist during the fabrication of high reliability HDI PCBs used for High-end electronic packaging applications.
- 4.1.2. The Acid Etching system should ensure the proper etching of fine pitch/fine line conductor features down to 2-mil lines and spacing on thin / flexible inner layers (both buried and non-buried via layers) and external layers with 35 micron (1-oz/sq.ft.) to 52 micron (1½- oz/sq.ft.) copper thickness.

4.2. General system features

- 4.2.1. The Acid Etching system should be modular type with the following independent stand-alone modules.
 - 4.2.1.1. Input conveyor module
 - 4.2.1.2. Main etching module
 - 4.2.1.3. Intermittent spray/etch adjustment module (option)
 - 4.2.1.4. Replenish module
 - 4.2.1.5. Two stage cascade water spray rinse module
 - 4.2.1.6. Fresh water rinse module
 - 4.2.1.7. Hot air Drying module
 - 4.2.1.8. Exit Conveyor module
 - 4.2.1.9. Electrical/electronic control panel
 - 4.2.1.10. Optional system features
- 4.2.2. Acid Etching system should be of modular design concept with self-supporting structure, made up of corrosion-proof and high temperature withstanding Chlorinated polyvinyl chloride [CPVC] or better material and titanium parts/accessories such as rods, bolts, nuts, shafts, conveyor drives, conveyor guides, fasteners, etc, wherever necessary.
- 4.2.3. Acid Etching system should be provided with Horizontal direct gear driven conveyor mechanism for safe transportation of thin and flexible layers down to 2-mils (50-microns) thick.

- 4.2.4. It should be able to realize the fine line circuits, down to 2-mil line/spacing on rigid, flexible and rigid-flex laminates with or without buried via connections, with copper thickness variation of over 10% on a 24-inch X 20-inch size panel.
- 4.2.5. Illuminated light is preferred in main etching and intermittent spray/etch adjustment modules.
- 4.2.6. Top and side lids should be made from chemical resistant and clear transparent material.

4.3. **System feature descriptions**

- 4.3.1. The conveyor system should be driven by a mechanism with internal torque bar and conical gears.
- 4.3.2. A pair of carbon fibre rollers with rubber squeegee should be provided at the entry as well as at the exit in all the etching modules [intermittent spray/etch adjustment and main etching modules]
- 4.3.3. Transport roller shaft should be made up of chemical resistant and high temperature [up to 70°C] withstanding material.
- 4.3.4. All the discs in the conveyor shaft should be non-metallic, chemical proof and high temperature withstanding [up to 70°C] material. It should not induce any defects during safe and smooth transportation of thin/thick rigid and flexible laminates.
- 4.3.5. Side and top lids of all the modules should be constructed with chemical proof, clear transparent material with double seals. Safety interlock switches should be incorporated.
- 4.3.6. All filter housings; pumps and electrical accessories should be installed outside of the machine body to enable periodical check up and easy maintenance/repair of the system.
- 4.3.7. The parts needing preventive maintenance, such as spray bar, nozzles and filter cartridges should be easily accessible with quick disconnect option.
- 4.3.8. The various parameters of the etching system such as conveyor speed adjustment; temperature setting in intermittent and main etchant chamber should be accomplished with a dedicated external electrical console that works on PLC and touch screen operator interface panel.
- 4.3.9. Selective pressure regulation should be provided with necessary valves and pressure gauges on pump outlets to upper and lower spray manifolds in etching section. Pressure

gauges should be placed at an appropriate position for better readability.

- 4.3.10. Alarm for minimum and maximum level of etching solution with protection of heaters and motors at minimum level should be provided.
- 4.3.11. The chemistry of the solution in the main etchant chamber and intermittent spray/etch adjustment module should be controlled using a dedicated specific gravity meter coupled with a dosing pump.
- 4.3.12. Titanium Catch mesh should be provided underneath lower spray manifolds in the etching sections and in the replenisher module.
- 4.3.13. The flow of water should be controlled with the help of a solenoid for minimizing the water consumption in the cascade and water rinse modules.
- 4.3.14. Drying module should consist of a blower with cartridge filter, suitable manifold with dedicated air knives and necessary heating mechanism, exhaust duct etc. The thin/flex layers should be protected in the drying module with conveyor mechanism and alternate switch for drying the rigid board/flex layers.
- 4.3.15. The system's specific modular design should enable for the addition of new modules at a latter stage, if it calls for.

4.4. Technical specifications

S/N	Description	Specification
4.4.1.	Construction Material	High temperature withstanding CPVC (chlorinated polyvinyl chloride) or better and Titanium (wherever necessary)
4.4.2.	Machine preferred dimensions	Not to exceed 5 meter length X 1.5 meter height X 2.0 meter width (approximate)
4.4.3.	Conveyor type (Reversible type preferred)	Horizontal with left to right direction, should support thin core laminate transportation down to 0.05mm thickness
4.4.4.	Spray Pressures	To etch the circuit with 2-mil traces/space Adjustable in Main etch, intermittent spray/etch adjustment module and High pressure water wash modules
4.4.5.	Pumps & Motors	Chemical Resistant, magnetic coupled & with titanium spares wherever necessary.
4.4.6.	Conveyor speed range	0.1 to 6.0 meters per minute, continuously variable

S/N	Description	Specification
4.4.7.	Panel size	6-inch X 4-inch to 24-inch X 20-inch (approximate)
4.4.8.	Board thickness	0.05 mm to 6.0 mm (approx.)
4.4.9.	Effective etching width	24-inch (610 mm), minimum
4.4.10	Nominal power supply	3-Phase AC, 415 Volts and 50 Hz
4.4.11	Finish	Aesthetically good, suitable color

4.5. **Description of the individual modules**

4.5.1. **Input conveyor module**

- 4.5.1.1. Length of input conveyor module should be 450mm approximately with horizontal conveyor type drive.
- 4.5.1.2. One set of carbon fibre rollers with rubber squeegee should be provided at the exit and entrance.
- 4.5.1.3. Sensor with adjustable timer for automatic on/off control of water on the squeegee rollers should be provided.
- 4.5.1.4. Provision for exhaust connections also should be provided with necessary catch tray.

4.5.2. **Main acid etching module**

- 4.5.2.1. Working length of the etching module should be approximately 700 mm.
- 4.5.2.2. Tank capacity should be approximately 300 litres with 10 to 15-degree bottom slope. Two drain valves should be provided at the slope edge.
- 4.5.2.3. Titanium heaters and cooling coil with solenoid valve should be provided for heating and cooling respectively.
- 4.5.2.4. Chemical resistant, leak proof seal less, magnetic coupled pumps should be provided.
- 4.5.2.5. A pair of Squeegee rollers both at the inlet and outlet should be provided.
- 4.5.2.6. Etch chamber should be incorporated with catch mesh made from titanium.
- 4.5.2.7. To avoid the sludge build up in spray frame, external filter units with approximately 80 micron mesh should be provided before the pump input.

4.5.3. **Intermittent spray/etch adjustment module (specially designed spray bars inline with conveyor direction-Option)**

- 4.5.3.1. Working Length should be approximately 750 mm. Module should be preferably fitted with high illuminating light within the chamber.
- 4.5.3.2. The spray bars should be inline with the conveyor movement to etch non-uniform plated copper.
- 4.5.3.3. Each spray bar should have variable pressure controls and fitted with chemical proof pressure gauge for digital display of individual spray bar.
- 4.5.3.4. A pair of squeegee rollers should be provided at the inlet and outlet to prevent drag out.
- 4.5.3.5. Sufficient number of spray bars with high jet nozzles should be provided in intermittent spray/etch adjustment module.
- 4.5.3.6. Selective etching mechanism should be feasible in intermittent spray/etch adjustment module.
- 4.5.3.7. Dedicated in-let tube with manual adjusting valves for spraying etchant solution in the intermittent spray/etch adjustment module should be connected to the main etchant sump. Outlet should be connected to the main etchant sump.
- 4.5.3.8. Valves with pressure gauges should be provided for each spray manifolds in etch adjustment module.
- 4.5.3.9. Filter bag with approx. 80-micron mesh size should be provided between spray pumps & spray bars.
- 4.5.3.10. To avoid the sludge build up in spray frame, polypropylene filter with approximately 80-micron mesh should be installed before the pump input.
- 4.5.3.11. Temperature setting in intermittent/etch adjustment module should be provided through the PLC.
- 4.5.3.12. Titanium heaters and cooling coil with solenoid valve should be provided for heating and cooling respectively.
- 4.5.3.13. Fume exhaust duct both at the inlet and outlet should be provided.
- 4.5.3.14. **Specially designed laterally positioned spray manifolds**

Quote separately for:

- 4.5.3.14.1. Regular standard spray system,

4.5.3.14.2. Turbulence-free spray with staggered jet nozzles on side spray manifolds and

4.5.3.14.3. Combination of both with a provision for operation either one at once.

4.5.4. **Replenisher/neutralizer module**

4.5.4.1. Working length of the Replenisher module should be approximately 400mm.

4.5.4.2. Tank capacity should be around 40 Litres with 10 to 15-degree bottom slope with drain valve.

4.5.4.3. A pair of Squeegee rollers both at the inlet and outlet should be provided.

4.5.4.4. A chemical resistant magnetic coupled fluid pump with Polypropylene filters of 80 microns mesh should be provided at the inlet.

4.5.5. **Two-stage cascade water spray rinse module**

4.5.5.1. Working length should be approximately 200 mm and water tank capacity of about 60 litres each.

4.5.5.2. Inlet water should be filtered before reaching the spray manifold.

4.5.5.3. Seal less magnetic coupled pump with removable mesh filter unit on pump inlet should be provided.

4.5.5.4. A pair of squeegee rollers at the inlet and outlet should be provided with interlock switches.

4.5.5.5. Sufficient number of spray manifolds with suitable nozzles on top and bottom should be provided.

4.5.6. **Fresh water rinse module**

4.5.6.1. Working length of the Rinse module should be approximately 200 mm.

4.5.6.2. Main inlet water should be filtered before reaching the spray manifold.

4.5.6.3. Water sprays should be controlled through solenoid valves and flow meter regulator valves.

4.5.6.4. The rinsed water should flow into the nearby cascade spray module.

4.5.7. **Hot air drying module**

4.5.7.1. High Performance air turbine motor with safety thermostat should be provided to remove the moisture from the board.

4.5.7.2. Suitable noise abatement and filter cartridge with pressure dump valve should be provided.

- 4.5.7.3. Dedicated air knives with suitable exhaust duct should be provided.
- 4.5.7.4. Variable temperature and airflow controls should be provided.
- 4.5.7.5. Suitable manifold and air knives with heating mechanism should be provided with exhaust duct for effective drying.
- 4.5.7.6. Flex/thin layers should be safely transported in the drying module without incurring any physical damages.

4.5.8. **Exit conveyor module**

- 4.5.8.1. Working length should be approximately 400 mm.
- 4.5.8.2. It should enable for the attachment of further assemblies with similar type modules.
- 4.5.8.3. Audible alarm preferred at the exit of panel.
- 4.5.8.4. Provision for exhaust connections should be provided with necessary catch tray.

4.5.9. **Electrical/electronic control panel**

- 4.5.9.1. The Electrical/electronic Control Panel should be compact, simple and easy to operate.
- 4.5.9.2. The system operation parameters should be controlled with programmable logic controller (PLC)
- 4.5.9.3. Every module should be equipped with safety switches for shutting down the system, if opened during operation.
- 4.5.9.4. Suitable visual/digital indicators should be provided for conveyor speed, temperatures, interlocks, emergency stops, phase failure, ELCB, etc with audible alarms wherever necessary.
- 4.5.9.5. The user interface should be easy for operation with necessary Man-machine-interface (MMI) and touch screen interface.
- 4.5.9.6. Various run time process parameters such as conveyor speed, solution temperatures, etching solution specific gravity, etc should be digitally displayed separately and individually

4.6. **Optional system features**

4.6.1. **In-built chemistry control system**

- 4.6.1.1. To maintain the copper concentration in main etchant chamber a digital specific gravity meter should be provided.
- 4.6.1.2. The resolution of the digital specific gravity meter should be 0.001.
- 4.6.2. **Auto-dosing system** Based on the pre-set specific gravity value, a dosing pump should be provided for pumping the fresh etchant to the etchant tank.
 - 4.6.2.1. Actual specific gravity value should be digitally displayed online.
- 4.6.3. **Online recovery of copper with Regeneration module**
 - 4.6.3.1. Independent closed electrolytic regeneration module based on the copper content should be provided for the etching system.
 - 4.6.3.2. The regeneration module should be compact and simple to operate and easy to maintain.
 - 4.6.3.3. Oxidation-reduction potential [ORP] control should be provided to the regeneration module to activate the etchant chemistry.
 - 4.6.3.4. Technical specifications for Electrolytic cell should be as follows:
 - 4.6.3.4.1. Minimum rate of deposition should be approximately 1 to 2 kg per hour
 - 4.6.3.4.2. Operating current density should be up to 10 amps/sq dm
 - 4.6.3.4.3. Operating voltage should be 30 Volts, maximum

NOTE: The process technology adopted for the optimum fine line etching of 1-oz/sft (35-micron) and 1½-oz/sft (52-micron) inner layer copper thickness with 1 to 2-mil thickness dry or liquid photo-film as etch-resist over a panel size of 24-inch X 20-inch using your acid etching system, should be clearly illustrated with relevant drawings and demonstrated (if required) on ISAC supplied PCB panels.

5. Alkaline Etching system for fine line-fine pitch high density interconnect PCB applications

5.1. Application

- 5.1.1. The Alkaline etching system under the scope of supply is intended for the processing of Fine-line internal and external layer circuits using alkaline etching chemistry. The system should be compatible for processing dry film photoresist, tin, tin-lead, gold etch-resists during the fabrication of high reliability HDI PCBs.
- 5.1.2. Most important application of Alkaline Etching system is to realize the fine line circuits, down to 2-mils on thin / flexible inner and external layers (buried/non-buried and blind-vias) for all types of PCBs using dedicated spray mechanism with up to 60-micron copper and thickness variation of over 10% on 24-inch X 20-inch size panel.

5.2. General system features

- 5.2.1. Alkaline Etching system should be of modular design concept with self-supporting structure, made up of corrosion-proof and high temperature withstanding Chlorinated polyvinyl chloride [CPVC] or better material and titanium parts/accessories such as rods, bolts, nuts, shafts, conveyor drives, conveyor guides, fasteners, etc, wherever necessary.
- 5.2.2. The Alkaline etching system should be provided with Horizontal direct gear driven conveyor mechanism for safe transportation of thin core and flexible layers down to 2-mil (50-microns) thick.
- 5.2.3. Illuminated light is preferred in main etching and intermittent spray/etch adjustment modules.
- 5.2.4. The Alkaline Etching system should be modular type with the following independent stand-alone modules:
 - 5.2.4.1. Input conveyor module
 - 5.2.4.2. Main etching module
 - 5.2.4.3. Intermittent spray/etch adjustment module
 - 5.2.4.4. Replenish module
 - 5.2.4.5. Two stage cascade water wash module
 - 5.2.4.6. Fresh water spray module
 - 5.2.4.7. Hot air drying module
 - 5.2.4.8. Output conveyor module
 - 5.2.4.9. Electric/electronic control panel

- 5.2.5. Optional system features
 - 5.2.5.1. In built measurement system
 - 5.2.5.2. Online copper recovery system with Regeneration module
- 5.2.6. All the stand-alone modules of the Alkaline etching system should be able to integrate to form a complete single horizontal conveyorised etching line.

5.3. **System feature descriptions**

- 5.3.1. All the body of the module should be self-standing rigid construction made up of CPVC or better material. Modules such as intermittent/etch adjustment and main etching chamber should be incorporated with high illuminated light.
- 5.3.2. In all the modules side and top lid should be constructed with clear transparent material with proper double seals to ensure leak proof and safety interlock switches should be incorporated.
- 5.3.3. Conveyor gear system should be chemical proof and easily detachable for the better maintenance
- 5.3.4. Conveyor speed should be continuously variable.
- 5.3.5. All the discs in the conveyor shaft should be non-metallic, chemical proof and high temperature withstanding [up to 70°C] material. It should not induce any defects during safe and smooth transportation of thin/thick rigid and flexible laminates.
- 5.3.6. Transport roller shaft should be made up of chemical resistant high temperature withstanding [up to 70°C] material preferably fiber reinforced glass with chemical resistant coat.
- 5.3.7. Profile of all the discs in the conveyor shaft should have minimal board contact for better etching action.
- 5.3.8. A pair of carbon fibre rollers with rubber squeegee should be provided at the entry as well as at the exit in all etching modules [intermittent spray, etch adjustment and main etching module]
- 5.3.9. Auto rinse should be provided at input-output rollers for intermittent spray/etch adjustment module and main etching module.
- 5.3.10. The auto-rinse system should automatically operate with pre-set timer, when the main power is switched-on.

- 5.3.11. All filter housings, pumps and electrical accessories should be installed outside of the machine body to enable periodical check up and easy maintenance /repair of the system.
- 5.3.12. The parts needing preventive maintenance, such as spray bar, nozzles and filter cartridges should be easily accessible with quick disconnect option.
- 5.3.13. The various parameters of the etching system such as conveyor speed adjustment temperature setting in intermittent and main etchant chamber should be accomplished with a dedicated external electrical console that works on PLC and touch screen operator interface panel.
- 5.3.14. Selective pressure regulation should be provided with necessary valves and pressure gauges on pump outlets to upper and lower spray manifolds in etching section. Pressure gauges should be placed at an appropriate position for better readable.
- 5.3.15. Alarm for minimum and maximum level of etching solution with protection of heaters at minimum level should be provided.
- 5.3.16. The replenishing solution in the replenishing module should be re-circulated through pump.
- 5.3.17. The chemistry of the fresh solution and solution level in the main etchant chamber and intermittent/etch adjustment module should be controlled by a dedicated specific gravity meter coupled with a dosing pump.
- 5.3.18. Titanium Catch mesh should be provided underneath lower spray manifolds in the etching sections and in the replenish module.
- 5.3.19. Consumption of water in the spray and water rinse modules should be minimized by linking the water flow meter with the board sensor on making use of a solenoid.
- 5.3.20. Drying module should consist of blower with a cartridge filter, suitable manifold with air knives, exhaust duct etc. The thin/flex layers should be protected from physical damages in the drying module with dedicated conveyor mechanism and alternate switch for drying the rigid board/flex layers.

5.4. **Technical specifications**

S/N	Description	Specification
5.4.1.	Construction Material	High temperature withstanding CPVC (chlorinated polyvinyl chloride) or better and Titanium (wherever necessary)

S/N	Description	Specification
5.4.2.	Conveyor type (Reversible type preferred)	Horizontal with left to right direction, should support thin & flexible layer transportation
5.4.3.	Machine preferred dimensions	Not to exceed 5 meter length X 1.5 meter height X 2 meter width [approximate]
5.4.4.	Pumps & Motors	Chemical Resistant, magnetic coupled & with titanium spares wherever necessary
5.4.5.	Conveyor speed range	0.1 to 6.0 meters per minute, continuously variable
5.4.6.	Board thickness	Minimum 0.05 mm to 6.0 mm (overall), approximately
5.4.7.	Panel size	4-inch X 6-inch to 20-inch X 24-inch, approximately
5.4.8.	Effective etching width	24-inch (610 mm), minimum
5.4.9.	Power Supply	3-Phase AC, 50 Hz, 415 Volts
5.4.10.	Finish	Aesthetically good, suitable color

5.5. Description of individual modules

5.5.1. Input conveyor module

- 5.5.1.1. The length of input conveyor should be approximately 450mm with horizontal conveyor.
- 5.5.1.2. One set of carbon fibre rollers with squeegee should be provided at the exit and entrance.
- 5.5.1.3. Sensor with adjustable timer for automatic on/off control of water on the squeeze rollers should be provided.
- 5.5.1.4. Provision for exhaust connections should also be provided with necessary catch tray.

5.5.2. Main etching module

- 5.5.2.1. Working length should be 800 mm approximately.
- 5.5.2.2. Tank capacity should be approximately 300 litres with 10 to 15 degree bottom slope. Two drain valves should be provided at the slope edge.
- 5.5.2.3. Clear transparent leak proof lid with illuminating light should be provided.

- 5.5.2.4. Titanium heaters and cooling coil with solenoid valve should be provided for heating and cooling respectively.
- 5.5.2.5. Chemical resistant, seal less, magnetic coupled pumps should be provided for main etchant chamber.
- 5.5.2.6. Audible alarm should be provided for minimum and maximum levels of solutions with protection of heaters and motors at minimum solution level.
- 5.5.2.7. Manual spray pressure adjustment should be feasible for lower and upper spray bars.
- 5.5.2.8. A pair of squeegee rollers should be provided both at the inlet and outlet. Etch chamber should be incorporated with titanium catch mesh.
- 5.5.2.9. To avoid the sludge build up in spray frame, external filter units with 80 micron mesh should be installed before the pump input.
- 5.5.2.10. A suitable mechanism for minimizing/removal of sludge should be provided at the tank bottom

5.5.3. **Intermittent spray/etch adjustment module (specially designed spray bars inline with conveyor direction-Option)**

- 5.5.3.1. Working Length should be approximately 750 mm. Module should be preferably fitted with high illuminating light.
- 5.5.3.2. The spray bars should be inline with the conveyor movement to etch non-uniform plated copper.
- 5.5.3.3. Each spray bar should have variable pressure controls and fitted with chemical proof pressure gauge for digital display of individual spray bar.
- 5.5.3.4. A pair of squeegee rollers should be provided at the inlet and outlet to prevent drag out
- 5.5.3.5. Specially designed turbulence free spray system with vertical side spray bars should be provided to take care of non-uniform plated copper thickness
- 5.5.3.6. Sufficient number of spray bars with high jet nozzles should be provided in intermittent spray/etch adjustment module.
- 5.5.3.7. Selective etching mechanism should be feasible in intermittent /etch adjustable module.
- 5.5.3.8. Dedicated in-let tube with manual adjusting valves for spraying etchant solution in the intermittent/

etch adjustment module should be connected to the main etchant sump. Outlet from the intermittent/ etch adjustment module should be connected to the main etchant sump.

- 5.5.3.9. Nozzles in the spray bars should be properly positioned to avoid puddling effect during etching.
- 5.5.3.10. Valves with pressure gauges should be provided for each spray manifolds in etch adjustment module.
- 5.5.3.11. Filter bag with approximately 80 microns mesh size should be provided between spray pumps and spray bars.
- 5.5.3.12. To avoid the sludge build up in spray frame, polypropylene filter with 80 microns mesh should be installed before the pump input.
- 5.5.3.13. Temperature setting in intermittent/etch adjustment module should be provided through the PLC control.
- 5.5.3.14. Titanium heaters and cooling coil with solenoid valve should be provided for heating and cooling respectively.
- 5.5.3.15. Fume exhaust duct both at the inlet and outlet should be provided.
- 5.5.3.16. **Specially designed spray manifolds**

Quote separately for:

- 5.5.3.17. Regular standard spray system,
- 5.5.3.18. Turbulence-free spray with staggered jet nozzles on side spray manifolds and
- 5.5.3.19. Combination of both with a provision for operation either one at once

5.5.4. **Replenisher/neutralizer module**

- 5.5.4.1. Fume exhaust duct both at the inlet and outlet should be provided.
- 5.5.4.2. Working length of the Replenisher module should be approximately 400mm.
- 5.5.4.3. Tank capacity should be 40 Litres with 15-degree bottom slope with drain valve.
- 5.5.4.4. A pair of Squeegee rollers should be provided both at the inlet and outlet.
- 5.5.4.5. Chemical resistant pump with polypropylene filters of 80-micron mesh should be provided at the inlet.

- 5.5.5. **Two-stage cascade water spray rinse module**
 - 5.5.5.1. A pair of Squeegee rollers both at the inlet and outlet should be provided.
 - 5.5.5.2. Working length should be approximately 200 mm and water tank capacity of about 60 litres each.
 - 5.5.5.3. Inlet water should be filtered before reaching the spray manifold.
 - 5.5.5.4. Seal less magnetic coupled pump with removable mesh filter unit on pump inlet should be provided.
 - 5.5.5.5. A pair of squeegee rollers at the inlet and outlet should be provided with interlock switches.

- 5.5.6. **Fresh water rinse module**
 - 5.5.6.1. Working length of the Rinse module should be approximately 200 mm
 - 5.5.6.2. Main inlet water should be filtered before reaching the spray manifold.
 - 5.5.6.3. Water sprays should be controlled through solenoid valves and flow meter regulator valves.
 - 5.5.6.4. The rinsed water should flow into the nearby cascade spray module.

- 5.5.7. **Hot air drying module**
 - 5.5.7.1. High Performance air turbine motor with safety thermostat should be provided to remove the moisture from the board.
 - 5.5.7.2. Suitable noise abatement filter cartridge and silencer with pressure dump valve should be provided.
 - 5.5.7.3. Dedicated air knives with suitable exhaust duct should be provided.
 - 5.5.7.4. Suitable manifold and air knives with heating mechanism should be provided with exhaust duct for effective drying.
 - 5.5.7.5. Variable temperature and airflow controls should be provided.
 - 5.5.7.6. Flex/thin layers should be safely transported in the drying module without incurring any physical damages.

- 5.5.8. **Exit conveyor module**
 - 5.5.8.1. Working length should be approximately 400 mm.

- 5.5.8.2. Audible alarm should be provided at the exit of panel.
- 5.5.8.3. It should enable for the attachment of further assemblies with similar type modules.
- 5.5.8.4. Provision for exhaust connections should be provided with necessary catch tray.

5.5.9. **Electrical/electronic control panel**

- 5.5.9.1. The Electrical/electronic Control Panel should be compact, simple and easy to operate.
- 5.5.9.2. The system operation parameters should be controlled with programmable Logic controller (PLC) and touch screen.
- 5.5.9.3. Complete ladder diagram should be provided for the PLC program, Provision should be available for editing, updating and saving the program in to the PLC and necessary hardware including dongle and cables should be provided.
- 5.5.9.4. Every module should be equipped with safety switches for shutting down the system, if opened during operation.
- 5.5.9.5. Suitable visual/digital indicators should be provided for conveyor speed, temperatures, interlocks, emergency stops, phase failure, ELCB, etc with audible alarms wherever necessary.
- 5.5.9.6. The user interface should be easy for operation with necessary Man-machine-interface (MMI) and touch screen interface.
- 5.5.9.7. Various run time process parameters such as conveyor speed, solution temperatures, water flow, etc should be digitally displayed separately and individually.

5.6. **Optional system features**

5.6.1. **In-built measurement system**

- 5.6.1.1. PH meter (resolution: ± 0.01) should be provided in main, intermittent etchant modules & replenisher module separately.
- 5.6.1.2. Digital Specific gravity meter should be provided in main etchant & intermittent spray/etch adjustment modules for maintaining the optimum copper concentration

5.6.1.3. The resolution of the digital Specific gravity Meter should be better than ± 0.001 unit.

5.6.2. **Auto-dosing system**

5.6.2.1. Based on the pre-set specific gravity value, a dosing pump should be provided for pumping the fresh etchant to the main etchant chamber.

5.6.2.2. Actual specific gravity value should be digitally displayed online.

5.6.3. **De-mister system**

5.6.3.1. De-mister should be provided at the exhaust system for the condensation of the vapor back to the etchant chamber.

5.6.4. **Online recovery of copper with Regeneration module:**

5.6.4.1. The copper recovery and regeneration of the etchant should be for the removal of excess copper and re-use of the solution.

5.6.4.2. Independent closed electrolytic copper regeneration module based on the copper content should be offered.

5.6.4.3. Technical specifications for Electrolytic cell should be as follows:

5.6.4.3.1. Rate of deposition should be approximately 1 to 2 Kg per hour

5.6.4.3.2. Operating current density should be up to 10-amps/sq. dm.

5.6.4.3.3. Operating voltage should be up to 30 Volts

NOTE: The process technology adopted for the optimum fine line etching of basic ½-oz/sft (18-micron) and up to 60-micron total copper thickness over a panel size of 24-inch X 20-inch using your alkaline etching system, should be clearly illustrated with relevant drawings and demonstrated (if required) on ISAC supplied PCB panels.

6. Safety features (Mandatory) for all the wet process systems

6.1. All the modules of the developing, acid etching and alkaline etching systems should be chemically, mechanically and electrically safe.

- 6.2. Multiple emergency switches should be provided at dangerous locations.
- 6.3. Suitable protection including earth leakage relay for heaters and breakable items should be provided.
- 6.4. It is mandatory that all the materials used for the manufacture of the complete equipment should be flame-retardant/fire-proof/combustion-proof.
- 6.5. Each and every system should be fitted with fire/smoke detecting sensors and an audible hooter/blinker should be provided with battery back-up to alert the concerned personnel.
- 6.6. The complete equipment should meet the international safety regulations in all respects.

7. Offering features for Aqueous photoresist developing, Acid etching and Alkaline etching systems.

- 7.1. It is a two-part bid. Technical and commercial parts of the quotation should be offered separately in sealed covers for both.
- 7.2. The offer should be valid for twelve months from the due date of enquiry.
- 7.3. Separate illustrative drawings & schematics of the Photoresist developer, Acid Etching system and Alkaline Etching system should be enclosed, highlighting each and every part of the equipment in detail.
- 7.4. Complete information should be enclosed to describe every part and mechanisms including optional items offered.
- 7.5. Original catalogs (in English only) & photographs of the system must be enclosed.
- 7.6. A DVD illustrating the actual working and maintenance part of all wet process systems should be sent along with the offer.
- 7.7. Ready-to-install backup of complete machine software and system software to be provided in DVD/CDs for disaster management.
- 7.8. A soft copy should also be sent to support the equipments' specifications. If necessary, technical demonstration of the equipment shall be arranged by the party.
- 7.9. Technical capability and conformance to SPACE/ONBOARD specifications should be demonstrated on samples supplied and production lots to the satisfaction of ISRO Satellite Centre engineers.
- 7.10. The offer should be complete with compliance statement for each of our specifications. The figures like length of conveyor module, main processing module, etc, are indicative only. Exact design figures should be indicated in the compliance statement and the drawings supplied along with the quote.
- 7.11. The offer should be complete in all respects and the details of the prices break up for independent modules must be furnished.

- 7.12. The offer should include all modules, options and accessories indicating the prices separately to meet complete specifications highlighted above.
- 7.13. Detailed catalogs, mechanical, electrical, electronics schematics, drawings, instruction manuals (in English only) and other details must be supplied for all individual modules, accessories used on the system for installation, operation, trouble-shooting, maintenance & service.
- 7.14. Separate quotations for installation, training, post warranty maintenance and service contracts should be offered. Offer should be made for both comprehensive and labour-only maintenance.
- 7.15. The total wet processing systems should be offered for Pre-dispatch inspection before shipment at manufacturer's site with full performance to our specs. Inspection matrix should be furnished along with the quote.
- 7.16. The offer should include electronic/electrical spares, spray bars, nozzles, conveyor special parts, filters, special gadgets, plumbing connections & other relevant items for two years of operation.
- 7.17. The complete system should be field/design proven for long term, continuous and reliable operation.
- 7.18. The wet process systems must be guaranteed for two-year operation after the successful commissioning.
- 7.19. Two sets of operating and instruction manuals, electrical and electronic drawings, PLC ladder/operating system manuals and bootable operating system should be supplied.
- 7.20. Spares/technical support must be available for minimum ten years.
- 7.21. Customer list both in India and abroad, especially supplied to departments of space/defense or to the manufacturers of space quality HDI PCBs should be enclosed along with the technical quote.
- 7.22. Quote for the complete spare parts necessary for the trouble free and continuous operation of the system should be enclosed.
- 7.23. Recommended to stock & consumable spares for at least 5-years continuous operation shall be indicated separately.
- 7.24. All the points mentioned above should be addressed in the quote. Otherwise bids are liable for rejection.
