ASSOCIATION CONNECTING
ELECTRONICS INDUSTRIES®

IPC-1710A

OEM Standard for Printed Board Manufacturers' Qualification Profile

Developed by the OEM council of the IPC, the MQP sets the standard for assessing PWB manufacturers capabilities and allows PWB manufacturers to more easily satisfy customer requirements.

IPC-1710A
May 2004

A standard developed by IPC

2215 Sanders Rd, Northbrook, IL

60062-6135

Tel. 847.509.9700 Fax

847.509.9798

www.ipc.org

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The material in this standard was developed by the OEM Council of the Institute for Interconnecting and Packaging Electronic Circuits.

FOREWORD

It is not intended that this Manufacturers' Qualification Profile (MQP) satisfies all the requirements of the customer, however, conscientious maintenance of this document and or registration to ISO 9000 requirements should satisfy the major concerns. Thus, audits should be simpler, required less frequently, and facilitate less paper work as customers and suppliers work closer to meeting each others needs.

ACKNOWLEDGMENTS

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CONTENTS

SECTION 1.1
COMPANY DESCRIPTION

DATE COMPLETED
April 18, 2011

GENERAL INFORMATION

LEGAL NAME Pho-Tronics, Inc.			
PHYSICAL ADDRESS 8701 West Bradley Road			
CITY Milwaukee		STATE WI	ZIP 53224
PROVINCE Milwaukee		COUNTRY USA	
TELEPHONE NUMBER 414-355-5300		FAX NUMBER 414-355-0593	TELEX NUMBER
E-MAIL ADDRESS sales@pho-tronics.com	MODEM NUMBER		DATE FOUNDED 1963 PRIVATE
INTERNET URL www.pho-tronics.com		FTP SITE Pho-Tronics.com or password assigned	

MANAGEMENT

PRESIDENT Paul D Godbout
CHIEF OPERATING OFFICER Paul Godbout
VICE PRESIDENT OF MANUFACTURING Nick Koutsios
VICE PRESIDENT OF QUALITY Donna Deberge
VICE PRESIDENT OF MARKETING/SALES Jeffrey Godbout
VICE PRESIDENT OF CUSTOMER SERVICE
WASTE TREATMENT MANAGER (POLLUTION PREVENTION) Mark Skaros

CORPORATE NUMBER OF EMPLOYEES

DESCRIPTION		CORPORATE	SITE	COMMENTS
DESIGN AND DEVELOPMENT		1		
ENGINEERING		10		
MANUFACTURING CONTROL		1		
MANUFACTURING	DIRECT	45		
	INDIRECT	8		
QUALITY CONTROL	QUALITY ENGINEERS	2		
	INTERNAL AUDITORS			Not dedicated personnel
	GENERAL MANAGEMENT	1		
ADMINISTRATION		4		
TOTAL		72		

SECTION 1.2
SITE DESCRIPTION

(TO BE COMPLETED FOR EACH SITE) DATE COMPLETED April 18, 2011
ATTACH APPROPRIATE CHARTS (OPTIONAL)

MANUFACTURING FACILITY

COMPANY NAME	Pho-Tronics, Inc.		
PHYSICAL ADDRESS	8701 West Bradley Road		
CITY Milwaukee	STATE WI	ZIP 53224	
PROVINCE Milwaukee	COUNTRY USA		
TELEPHONE NUMBER 414-355-5300	FAX NUMBER 414-355-0593	TELEX	
E-MAIL ADDRESS sales@pho-tronics.com	MODEM NUMBER	YEARS IN BUSINESS 51	
INTERNET URL www.pho-tronics.com	FTP pho-tronics.com or assigned password		
PRINCIPLE PRODUCTS/SERVICES/SPECIALTIES Rigid Multi-Layer Printed Circuit Boards thru 24 layers Specialty materials BT, Polyimide, Taconic, Rogers, low DK	BUSINESS CHARACTERIZATION (HIGH VOLUME, QUICK TURN-AROUND, ETC.) High Mix – Prototype through Production		

FACILITY MANAGEMENT	TITLE	REPORTS TO (Function/Job Title)
OVERALL OPERATION RESPONSIBILITY FOR THIS SITE Paul Godbout	COO	President
MANUFACTURING Nick Koutsios	Production Manager	President
TECHNICAL/ENGINEERING Bryan Gahn	Engineering Manager	President
MATERIALS/PRODUCTION CONTROL Judy Thielecke	Production Control/Materials Mgr.	Production Manager
PURCHASING Tim Trier	Purchasing	President
QUALITY Donna Deberge	Quality Manager	President
SALES REPRESENTATIVE Bobbie Rodriguez	Sales Manager	President
WASTE MANAGEMENT Mark Skaros	Chemical Technician	Engineering Manager

BUILDINGS / SYSTEMS (INDICATE % COVERAGE)

	AGE	AREA (Sq. Ft.)	Construction (Wood/Brick)	Power Conditioning	Heating	Ventilation	Air Conditioning	Sprinklers	Waste Treatment	Other
Office	34	5000	Brick	100	100	100	100	100	0	
Manufacturing	34	55000	Brick	100	100	100	60	100	100	
Storage	34	5000	Brick	100	100	100	5	100	0	
Planned additions	0									

SAFETY AND REGULATORY AGENCY REQUIREMENTS

Are fire extinguishers functional and Accessible to employees?	X YES	☐ NO	What is the distance to the nearest fire station? (in minutes)	2 Minutes {3 city Blocks}
Do you conform to local/federal environment protection agency requirements?	X YES	☐ NO	Date of last OSHA visit Date of last EPA visit	2006 NEVER
Are you currently operating under a waiver or in violation of local government requirements?	YES	X NO	Other Agency Audits, UL, ISO 9000, NECQ, CSA Approval and Number	X UL # E35174 x ISO 9000# 2008 X AS 9100 Rev. C x Other Mil 55110
Do you have a safety program? Describe below.	X YES	☐ NO	Hazardous Waste Number Trade Waste Account Number	

PLANT PERSONNEL (TOTAL EMPLOYEES)

Regular	Contract	Office	Technical/ Engineering	Production	Full-Time QA	Part-Time QA	Union	Non-Union	Union Name	Contract Expires (Date)
72	0	5	10	45	12	0		x		

SECTION 2.1
PROCESS

DATE COMPLETED
4.18.11

This section is intended to provide overview information on the processes used to fabricate printed board products.

Site Capability Snapshot (Please Check all that apply)

	Designators		Remarks
A	Conductor Forming Processes	X Subtractive X Thin Foil Subtractive less than .5 oz. Semi-Additive X Additive (Electro-less) X Direct Metalization MacDermid Eclipse ☐Thick Film Paste and Fire ☐Thin Film Semi-conductor Sputtering ☐Other:	Cupric I/L Etch & Amonia O/L Etch MacDermid Eclipse / Fliud Head Mechanicals
B	PTH Materials and Processes	X Acid Copper ☐Pyro-Phosphate Copper X Full Built Electro-Less ☐Gold Paste ☐Copper Paste ☐Gold Conductor Sputtering ☐Nickel Conductor Sputtering other:	
C	Permanent Over-plating	X Tin ☐Tin-Lead ☐Tin-Nickel Alloy X Nickel X Nickel Gold (Hard) X Nickel Gold (Soft) ☐Nickel Rhodium ☐Conductive Polymer ☐Other:	

D	Permanent Selective Plating	X Tin ☐Tin-Lead ☐Tin-Nickel Alloy X Nickel X Nickel Gold (Hard) X Nickel Gold (Soft) ☐Nickel Rhodium X Other: Immersion Silver	
E	Permanent Mask or Coating	X Photo Dry Film X Photo Liquid X Image Transfer Screen Mask X Conformal Coating Solder Mask ☐Cover Coat ☐Other:	Primary circuitry imaging Soldermask Silkscreened Legend Soldermask
F	Other Surface Finishes	☐Tin-Lead Fused X Immersion Tin X Solder Leveled ☐Roll Soldered ☐Electro-less Solder Fused ☐Solder Bumped Lands ☐Solder Paste Fused X Azole Organic Protective Covering ☐Flux Protective Covering X Other: Immersion Silver X Immersion nickel/gold	

SECTION 2.2
ELECTRICAL TEST EQUIPMENT

DATE COMPLETED
4.18.11

This section is intended to provide overview information on the test equipment and testing capability of the manufacturer.

Site Capability Snapshot (Please Check the column that applies furthest to the right.)

	Designators		Remarks
A	Number of Nets	☐<200 ☐200 ☐500 ☐1000 ☐2000 ☐3000 ☐4000 ☐5000 x>5000 ☐Other:	
B	Number of Nodes	☐<500 ☐500 ☐1000 ☐2000 ☐3000 ☐4000 ☐5000 ☐6000 x>6000 ☐Other:	
C	Probe Point Pitch	☐>1.0 [.040] ☐1.0 [.040] ☐0.8 [.032] ☐0.65 [.025] ☐0.50 [.020] 0.40 [.016] ☐0.30 [.012] 0.20 [.008] X <0.20 [.008] ☐Other:	

D	Test % Single Pass	☐None ☐<60% ☐60% ☐70% ☐80% ☐90% ☐95% 99% X 100% ☐Other:	
E	Probe Accuracy (DTP)	☐>0.2 [.008] ☐0.2 [.008] ☐0.15 [.006] ☐0.125 [.005] ☐0.1 [.004] 0.075 [.003] X <0.075 [.003] ☐Other:	
F	Grid Density	Single Side Grid Double Sided Grid ☐Double Density Grid ☐Double Density Double Sided ☐Quad Density ☐Double Sided Quad Density X Flying Probe ☐Other:	
G	Netlist Capability	X Golden Board X IPC-D-356 X Net List Extraction X CAD/CAM Net List Compare ☐Other:	

H	Test Voltage	☐<20 VDC ☐20 VDC ☐40 VDC ☐60 VDC ☐80 VDC X 100 VDC ☐500 VDC ☐1000 VDC ☐>1000 VDC ☐ Other:	
J	Impedance Meas	X Micro Section X Onboard Circuit X Coupon X Manual TDR ☐Automated TDR ☐Other:	
K	Impedance Tolerance	☐None >20% 20% 15% X 10% ☐7% ☐5% ☐2% ☐<2% ☐Other:	

SECTION 2.3
PRODUCT TYPE

DATE COMPLETED
4.18.11

This section is intended to provide overview information on the printed board product types being fabricated by the manufacturer.

Site Capability Snapshot (Please Check all that apply.)

Designators			Remarks
A	Product Type	X Rigid Printed Board ☐Flex Printed Board ☐Rigid/Flex Board X Rigid Back Plane ☐Molded Product X Ceramic Printed Board ☐Multichip Module ☐Liminated Multichip Module ☐Deposited Dielectric Multichip Modules X Other: Taconic, Rogers – low loss materials	
B	Circuit Mounting Type	X Single Sided X Double Sided X Miltilayer X Single-sided Bonded to Substrate X Double-sided Bonded to Substrate X Multilayer Bonded to Substrate X Constrained Multilayer ☐Distributed Plane Multilayer ☐Other:	
C	Via Technology	X No-Vias X Thru Hole Vias X Buried Vias X Blind Vias X Thru Hole & Blind Vias] X Thru Hole & Buried Vias X Thru Hole Buried & Blind Vias X Buried & Blind Vias X Other: Filled Vias	

D	Laminate Material	☐Phenolic ☐Epoxy Paper X Epoxy Glass X Modified Epoxy Composite X Polyimide Film & Reinforce ☐Cynanate Ester X Teflon X Ceramic Glass Types X Various Combinations ☐Other:	Taconic, Rogers Rogers & Epoxy; BT & Epoxy Rogers & BT; Rogers & Epoxy
E	Core Material	X No Core ☐Polymer X Copper X Aluminum ☐Graphite X Copper Invar/Copper X Copper Moly/Copper ☐Other:	
F	Copper Thickness (Oz.)	☐1/8 Minimum X 1/4 Minimum X 3/8 Minimum X 1/2 Nominal X 1 Nominal X 2 Nominal X 3-5 Max X 6-9 Max ☐>10 ☐Other:	
G	Construction	X ≤4 Planes X >4 Planes X THK to TOL ≤0.2 mm X THK to TOL >0.2 mm X Bow/Twist ≤1% X Bow/Twist >1% X ≤0.3 mm Profile Tolerance X>0.3 mm Profile Tolerance ☐Other:	

H	Coatings and Markings	X ≤0.1 mm Mask Clearance >0.1 mm Mask Clearance X One Side (Legend) X Two Side (Legend) ☐None (Legend) X UL Material Logo X U.L. V_0 Logo ☐U.L. V_1 Logo ☐U.L. V_2 Logo ☐ Other:	

SECTION 2.4
PRODUCT COMPLEXITY

DATE COMPLETED
4.28.2011

This section is intended to provide overview information on product complexity being fabricated by the manufacturer.

(Please check the column that applies farthest to the right)

Designators			Remarks
A	Board Size Diagonal	<250 [10.00] 250 [10.00] 350 [14.00] 450[17.50] 550 [21.50] 650 [25.50] X 750 [29.50] ☐850 [33.50] ☐>850 [33.50] ☐Other:	
B	Total Board Thickness	1,0 [.040] 1,0 [.040] 1,6 [.060] 2,0 [.080] 2,5 [.100] 3,5 [.135] 5,0 [.200] X 6,5 [.250] ☐>6,5 [.250] ☐Other:	
C	Number Conductive Layers	1-4 5-6 7-8 9-12 13-16 17-20 X 21-24 ☐25-28 ☐>28 ☐Other:	

D	Dia Drilled Holes	>0,5 [.020] 0,5 [.020] 0,4 [.016] 35 [.014] 30 [.012] 25 [.010] 20 [.008] 0.15 [.006] X <0,15 [.006] ☐Other:	
E	Total PTH TOL (Max-Min)	>0,250 [.010] 0,250 [.010] 0,200 [.008] 0,150 [.006] 0,125 [.005] 0,100 [.004] 0,075 [.003] X 0,050 [.002] ☐<0,050 [.002] ☐Other:	
F	Hole Location TOL DTP	☐>0,50 [.020] ☐0,50 [.020] ☐0,40 [.016] ☐0,30 [.012] ☐0,25 [.010] ☐0,20 [.008] ☐0,15 [.006] 0,10 [.004] x <0,10 [.004] ☐Other:	
G	Internal Layer Clearance (Min)	☐>0,350 [.014] ☐0,350 [.014] ☐0,250 [.010] ☐0,200 [.008] ☐0,150 [.005] ☐0,125 [.005] 0,100 [.004] X 0,075 [.003]	

		☐<0,075 [.003] ☐Other:	
H	Internal Layer Conductor Width (Min)	☐>0,250 [.010] ☐0,250 [.010] ☐0,200 [.008] ☐0,150 [.006] ☐0,125 [.005] ☐0,100 [.004] X 0,075 [.003] ☐0,050 [.002] ☐<0,050 [.002] ☐Other:	
J	Internal Layer Process Allowance	☐>0,100 [.004] ☐0,100 [.004] ☐0,075 [.003] ☐0,050 [.002] ☐0,040 [.0015] ☐0,030 [.0012] ☐0,025 [.001] ☐0,020 [.0008] X <0,020 [.0008] ☐Other:	

K	External Layer Clearance (Min)	☐>0,350 [.014] ☐0,350 [.014] ☐0,250 [.010] ☐0,200 [.008] ☐0,150 [.006] ☐0,125 [.005] ☐0,100 [.004] X 0,075 [.003] ☐<0,075 [.003] ☐Other:	
L	External Layer Conductor Width (Min)	☐>0,250 [.010] ☐0,250 [.010] ☐0,200 [.008] ☐0,150 [.006] ☐0,125 [.005] ☐0,100 [.004] X 0,075 [.003] ☐0,050 [.002] ☐<0,050 [.002] ☐Other:	
M	External Layer Process Allowance	☐>0,100 [.004] ☐0,100 [.004] ☐0,075 [.003] 0,050 [.002] ☐0,040 [.0015] ☐0,030 [.0012] X 0,025 [.001] ☐0,020 [[.0008] ☐<0,020 [.0008] ☐Other:	

N	Feature Location DTP	☐>0,50 [.020] ☐0,50 [.020] ☐0,40 [.016] ☐0,30 [.012] ☐0,25 [.010] ☐0,20 [.008] ☐0,15 [.006] X 0,10 [.004] <0,10 [.004] ☐Other:	

All Dimensions are in millimeters [inches shown in brackets]

SECTION 2.5
QUALITY DEVELOPMENT

DATE COMPLETED
4.28.2011

This section is intended to provide overview information on the quality systems in place in the manufacturing facility.

Site Capability Snapshot (Please Check all that apply.)

Designators			Remarks
A	Strategic Plan	X Functional Steering Committee Formed X TQM Plan & Philosophy Established & Published X Documented Quality Progress Review X Implementation & review of Project Team Recommendations XTQM Communicated throughout organization X Controlled New process Start-up X Management Participates in TQM Audits X Employee Recognition Program ☐Total TQM Plan/Involvement Customer Training ☐Other:	
B	Employee Involvement	X Certified Training Available X Training of Employee Base X TQM Team Trained ☐Design of Experiment Training and Use X New Process Implementation Training X Support Personnel Training X Advanced Statistical Training XQuality Functional Deployment X Ongoing Improvement Program for Employees ☐Other:	
C	Quality Manual	X Quality Manual Started X Generic Quality Manual for Facility X 10% of manufacturing depts. have process specifications X 25% of manufacturing depts. have process specifications X 50% of manufacturing depts. have process specifications X Non-manufacturing Manuals Developed X 25% of all departments have quality manuals X 50% of all departments have quality manuals X All Manufacturing and support depts. have controlled quality manual ☐Other:	

D	Instructions	X Work Instructions Started X Quality Instructions Started X 10% Work Instructions Completed X 10% Quality Instructions Completed X 25% Work Instructions Competed, Controlled X 25% Quality Instructions Completed, Controlled X 50% Work Instructions Completed, Controlled X 50% Quality Instructions Completed, Controlled X Quality and work Instruct. Completed, Controlled ☐Other:	
E	SPC Implementation IPC-PC-90	X Plan Exists X Training Started X Process Data Collected & Analyzed ☐All Employees Trained X First Process Stable & Capable X Several Major Processes Stable & Capable XContinued Improvement of Stable Processes XAdditional Mfg Processes under Control ☐All Processes Under Control ☐Other:	
F	Supplier Programs/Controls	X Supplier Rating Program X Monthly Analysis Program X Key Problems Identified X Supplier Reviews Performance Data provided ☐TQM Acceptance by suppliers ☐10% of Suppliers Using SPC ☐25% of Suppliers Using SPC X 50% of Suppliers Using SPC ☐All Key Suppliers using Certified parts program ☐Other:	
G	Third Party IPC-QS-95	X Instrument Controls in Place X Measurement System in Control IPC-PC-90 X Document Controls in Place X Reduced Lot Sampling X 10% of Processes Under Audit Control X 50% or Greater of Processes Under Audit Control ☐ISO-9003 Certified ☐ISO-9002 Certified	

		X ISO-9001 X Other: AS9100	

SECTION 3
EQUIPMENT PROFILE (Pre-Site Audit)

DATE COMPLETED
4.28.2011

* Examples of equipment limitations include: min/max board size & min/max working area

3.1 PHOTOTOOL CAPABILITY	YES	NO	EQUIPMENT	QTY	EQUIPMENT UNITS
A) AOI of phototool	X	☐	Camtek	1	
B) AOI CAD reference (CAM)	X	☐	Camtek		
C) Photoplotting	X	☐	Barco	1	
D) Photo reductions	X	☐	Barco	1	
E) Film scan and conversion	X	☐	Outsourced		
F) Film processing ☐ air-dried ☐ force-dried X processed in automatic processor	x	☐	DuPont		
G) Media types X silver halide film ☐ glass X diazo	x	☐			

3.2 DRILLING EQUIPMENT	YES	NO	EQUIPMENT	QTY	EQUIPMENT UNITS
A) Manual	☐	X			
B) Optical (single spindle)	☐	X			
C) N.C. drill	X	☐	Excellon POSALUX	5 2	250k Spindle speed; contact drilling/ control depth

3.3 ROUTING EQUIPMENT	YES	NO	EQUIPMENT	QTY	EQUIPMENT UNITS
A) Edge beveler	X	☐		2	
B) Hand router (pin router)	X	☐		1	
C) N.C. router	X	☐	Excellon	2	
D) N.C. driller/router	X	☐	Excellon	1	

E) Scoring (profile)	X	☐	Accuscore	1	
F) Scoring (straight line)	X	☐	Accuscore		

3.4 MECHANICAL EQUIPMENT	YES	NO	EQUIPMENT	QTY	EQUIPMENT UNITS
A) Punch press	☐	X			
B) Shear	X	☐			
C) Milling machine	X	☐	Bridgeport	1	

3.5 HOLE PREPARATION (DESMEAR)	YES	NO	EQUIPMENT	QTY	EQUIPMENT UNITS
A) Permagnate	X	☐		1	
B) Plasma	X	☐	Plasm-Etch	1	
C) Mechanical	☐	X			
D) Etchback	X	☐	Plasma -Etch		

3.6 PRIMARY IMAGE APPLICATION	YES	NO	EQUIPMENT	QTY	EQUIPMENT UNITS
A) Dry film	x	☐	Haukuto; DuPont ASL	3	
B) Hand screening	x		S/M & legend	2	
C) Machine screening	x		Sveca – S/M & legend	1	
D) Wet film	x				
E) Liquid photoimageable	x		Circuit Automation – S/M DP 1500	1	

3.7 TYPE OF TREATMENT FOR MULTILAYER INNERLAYERS	YES	NO	EQUIPMENT	QTY	EQUIPMENT UNITS
A) Black oxide	☐	☐			
B) Red oxide	☐	☐			
C) Copper scrub	x	☐	Schmid – Jet Pumice Scubber	1	
D) Durabond	☐	☐			
E) Alternative oxide	X	☐	Horiozontal MacDermid	1	

3.8 LAMINATION	YES	NO	MATERIAL	QTY	APPLICATION/TECHNIQUE
A) High pressure	X	☐	Accudyne 6 opening opening	1	
B) High temperature	X	☐	Accudyne		
C) Vacuum	X	☐	Accudyne	1	
D) Vacuum assist		☐	PHI		
E) Foil heat assist	X	☐	Accudyne		
F) Separate cool-down	X	☐	Accudyne	1	

3.9 ELECTROLESS COPPER PLATING	YES	NO	EQUIPMENT	QTY	EQUIPMENT UNITS
A) Fully additive application	X	☐	ME Baker Programmable Automated Hoist	1	
B) Electroless deposition (semiadditive)		x			
C) Through-hole and via	X	☐	ME Baker Automated		

3.10 COPPER ELECTROPLATING	YES	NO	EQUIPMENT	QTY	EQUIPMENT UNITS
A) Copper sulfate	X	☐	Manual 1200 gal	3	
B) Pyrophosphate	☐	X			
C) Copper fluoborate	☐	X			
D) Other		☐			

3.11 TIN/LEAD SURFACE PLATINGS/COATINGS	YES	NO	EQUIPMENT	QTY	EQUIPMENT UNITS
A) Tin/lead electroplated	x		1000 gal. Electro-plated Pure Tin	1	
B) Immersion tin or tin/lead (electroless)	x				Out-Sourced
C) Hot air solder leveled (HASL)	X	☐	Argus HASL Vertical	1	

3.12 FUSING PROCESSES	YES	NO	EQUIPMENT	QTY	EQUIPMENT UNITS
A) I.R. reflow	☐	X			
B) Hot oil reflow	X	☐		1	
C) Horizontal (hot air level)	☐	X			
D) Vertical (hot air level)	X	☐	Argus	1	

3.13 NICKEL SURFACE PLATING	YES	NO	EQUIPMENT	QTY	EQUIPMENT UNITS
A) Electroless nickel	X	☐		1	
B) Electroplated nickel	X	☐			Out-Sourced

3.14 GOLD SURFACE PLATING	YES	NO	EQUIPMENT	QTY	EQUIPMENT UNITS
A) Electroless gold	X	☐		1	
B) Electroplated gold	X	☐			Out-Sourced Full panel – Tabs Internal

3.15 PALLADIUM SURFACE PLATING	YES	NO	EQUIPMENT	QTY	EQUIPMENT UNITS
A) Electroless palladium (immersion)	☐	X			
B) Electroplated palladium	☐	X			

3.16 SOLDERMASK	YES	NO	EQUIPMENT	QTY	EQUIPMENT UNITS
A) Screened deposited image	X	☐		1	
B) Dry film photoimageable	X	☐	Dynachem - Conformask	1	
C) Liquid photoimageable	X	☐	Circuit Automation DP 1500	1	
D) Dry film/liquid combination	X	☐			

3.17 ORGANIC SURFACE PROTECTION	YES	NO	EQUIPMENT	QTY	EQUIPMENT UNITS
A) Benzotriazole	☐	X			
B) Imidazole	☐	X			
C) Benzimidazole	☐	X			

3.18 MICROSECTION CAPABILITY	YES	NO	EQUIPMENT	QTY	EQUIPMENT UNITS
A) Manual	X	☐	Buehler	1	
B) Single cavity automated	X	☐	Buhler	1	
C) Multiple cavity automated	X	☐	Buehler	1	
D) Plating thickness analysis	X	☐	Nikon Micro-scope – Fisher X-Ray	1	

3.19 CHEMICAL ANALYSIS	YES	NO	EQUIPMENT	QTY	EQUIPMENT UNITS
A) Etching chemistry	☐	x			
B) Plating chemistry	x	☐	Hull Cell – CVS-		
C) Effluent (PPM) analysis	x	☐	AA		

3.20 ELECTRICAL TEST EQUIPMENT	YES	NO	EQUIPMENT	QTY	EQUIPMENT UNITS
A) Continuity and shorts	X	☐	TTI - MicroCraft Emma	2	
B) Fixture development	X	☐	Barco	1	
C) Flying probe test	X	☐	MicroCraft Emma	2	
D) Impedance control	X	☐	Polar	1	