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

NOTICE

IPC standards and publications are designed to serve the public interest through eliminating misunderstandings between manufacturers and purchasers, facilitating interchangeability and improvement of products, and assisting the purchaser in selecting and obtaining with minimum delay the proper product for his particular need. Existence of such Standards and Publications shall not in any respect preclude any member or non-member of IPC from manufacturing or selling products not conforming to such Standards and Publications, nor shall the existence of such Standards and Publications preclude their voluntary use by those other than IPC members, whether the standard is to be used either domestically or internationally.

Recommended Standards and Publications are adopted by IPC without regard to whether their adoption may involve patents on articles, materials or processes. By such action, IPC does not assume any liability to any patent owner, nor do they assume any obligation whatever to parties adopting the recommended Standard or Publication. Users are also wholly responsible for protecting themselves against all claims of liabilities for patent infringement.

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

The IPC is indebted to the members of the OEM council who participated in the development of this document. A note of thanks is also expressed to the members of the IPC Presidents Council for their review and critique and construction recommendations in finalizing the principles developed for the MQP.

Although the IPC is grateful for all the involvement and individual contributions made in completing the MQP a special acknowledgment is extended to the following individuals. It was their dedication and foresight that made this publication possible.

Rudolfo Archbold
Digital Equipment Corp

Patrick Bernardi
IBM

Vernon Brown
Motorola, Inc.

Don Holt
Texas Instruments

Rick Iantaffi
Northern Telecom

Sue Jones
Wilcox Electric

Chuck Krzesicki
Honeywell Avionics Division

Thomas Kurtz
Hughes Defense Communications

Don Noel
Harris Corp. - Computer Sys. Div

Rick Smith
Compaq Computer Corp.

Peter Solecky
IBM

Joseph F. Sterba
Honeywell, Inc.

Mario Suarez-Solis
Encore Computer Corp.

Gordon Wolfram
Raytheon Company

Jerald G. Rosser
Hughes Missile Operations Div.

Jamie Zanios
Wellborn Industries Ltd.

CONTENTS

SECTION 1.1
COMPANY DESCRIPTION

DATE COMPLETED: 03/06/2014

GENERAL INFORMATION

LEGAL NAME: Triangle labs, Inc.		
PHYSICAL ADDRESS: 6101 Morgan Mill Road		
CITY: Carson City	STATE: Nevada	ZIP: 89701
PROVINCE:	COUNTRY: USA	
TELEPHONE NUMBER: 775.887.1700	FAX NUMBER: 775.887.1259	TELEX NUMBER:
E-MAIL ADDRESS: sales@trilabs.net	MODEM NUMBER:	DATE FOUNDED 1994 ☐ PUBLIC ☒ PRIVATE
INTERNET URL: www.trilabs.net	FTP SITE:	

MANAGEMENT

PRESIDENT: Bob Gray
CHIEF OPERATING OFFICER: Robert G. Gray
VICE PRESIDENT OF MANUFACTURING: Debrah King
VICE PRESIDENT OF QUALITY: Mark Carmonne
VICE PRESIDENT OF MARKETING/SALES: John-Michael Gray/Cassandra Maxwell
VICE PRESIDENT OF CUSTOMER SERVICE: Cassandra Maxwell
WASTE TREATMENT MANAGER (POLLUTION PREVENTION): Mark Carmonne

CORPORATE DESCRIPTION		NUMBER OF EMPLOYEES CORPORATE	SITE	COMMENTS
DESIGN AND DEVELOPMENT		n/a		
ENGINEERING		2		
MANUFACTURING CONTROL		2		
MANUFACTURING	DIRECT	10		
	INDIRECT			
QUALITY CONTROL	QUALITY ENGINEERS	1		
	INTERNAL AUDITORS			
	GENERAL MANAGEMENT	3		
ADMINISTRATION		2		
TOTAL		20		

SECTION 1.2
SITE DESCRIPTION

(TO BE COMPLETED FOR EACH SITE) DATE COMPLETED 03/06/2014 ATTACH APPROPRIATE CHARTS (OPTIONAL)

MANUFACTURING FACILITY

COMPANY NAME	Triangle Labs, Inc.		
PHYSICAL ADDRESS	6101 Morgan Mill Road		
CITY Carson City	STATE Nevada	ZIP 89701	
PROVINCE	COUNTRY USA		
TELEPHONE NUMBER 775.887.1700	FAX NUMBER 775.887.1259	TELEX	
E-MAIL ADDRESS sales@trilabs.net	MODEM NUMBER	YEARS IN BUSINESS 22 yrs	
INTERNET URL www.trilabs.net	FTP		

PRINCIPLE PRODUCTS/SERVICES/SPECIALTIES	BUSINESS CHARACTERIZATION (HIGH VOLUME, QUICK TURN-AROUND, ETC.)
RF/Microwave printed circuit boards and antenna and large circuit production	Prototype to High Volume production – unique process development

FACILITY MANAGEMENT	TITLE	REPORTS TO (Function/Job Title)
OVERALL OPERATION RESPONSIBILITY FOR THIS SITE Maureen Gray/Bob Gray/John-Michael Gray	President (owner)	
MANUFACTURING Andy Xin	Engineering Manager/Production	President
TECHNICAL/ENGINEERING Bob Gray	Senior Technical Fellow	
MATERIALS/PRODUCTION CONTROL Armando Ibarra	Materials Processing Manager	Engineering Manager
PURCHASING Cassandra Maxwell	Office Manager	VP of Sales and Marketing
QUALITY Mark Carmonne	Quality Assurance Manager	President
SALES REPRESENTATIVE John-Michael Gray	VP of Sales and Marketing	President
WASTE MANAGEMENT Mark Carmonne/Raul Eublera	Plating/Production	QA Manager

BUILDINGS / SYSTEMS (INDICATE % COVERAGE)

	AGE	AREA (Sq. Ft.)	Construction (Wood/Brick)	Power Conditioning	Heating	Ventilation	Air Conditioning	Sprinklers	Waste Treatment	Other
Office	10 yr	2.5K	Concrete	100	100	100	75	100	10	
Manufacturing	10 yr	15K	Concrete	100	100	100	75	100	10	
Storage	10 yr	0	Concrete							
Planned additions	2	6K	Concrete							

SAFETY AND REGULATORY AGENCY REQUIREMENTS

Are fire extinguishers functional and accessible to employees?	☒ YES	☐ NO	What is the distance to the nearest fire station? (in minutes)	5 Minutes
Do you conform to local/federal environment protection agency requirements?	☒ YES	☐ NO	Date of last OSHA visit Date of last EPA visit	n/a December 2015 – local officials
Are you currently operating under a waiver or in violation of local government requirements?	☐ YES	☒ NO	Other Agency Audits, UL, ISO 9000, NECQ, CSA Approval and Number	☐ UL # ____ ☒ ISO 9000# C2014-01422 ☐ CSA # ____ ☒ Other IPC
Do you have a safety program? Describe below.	☒ YES	☐ NO	Hazardous Waste Number Trade Waste Account Number	EPA# NVR000079368

PLANT PERSONNEL (TOTAL EMPLOYEES)

Regular	Contract	Office	Technical/ Engineering	Production	Full-Time QA	Part-Time QA	Union	Non-Union	Union Name	Contract Expires (Date)
20	1	6	2	10	1	0		X		

COMMENTS

SECTION 2.1
PROCESS

DATE COMPLETED
03/06/14

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	☒ Subtractive ☒ Thin Foil Subtractive less than .5 oz. ☒ Semi-Additive ☒Additive (Electro-less) ☐Black Hole ☒ Thick Film Paste and Fire ☐Thin Film Semi-conductor Sputtering ☒ Other: Conductive & filling epoxy	
B	PTH Materials and Processes	☒ Acid Copper ☐Pyro-Phosphate Copper ☒Full Built Electro-Less ☐Gold Paste ☐Copper Paste ☐Gold Conductor Sputtering ☐Nickel Conductor Sputtering ☒Other: Conductive and Non-conductive Hole Fill	Ability to plate onto carbon fiber and closed cell dielectric foam
C	Permanent Over-plating	☒ Tin ☒Tin-Lead ☐Tin-Nickel Alloy ☒ Nickel ☐Nickel Gold (Hard) ☒ Nickel Gold (Soft) ☐Nickel Rhodium ☐Conductive Polymer ☒ Other:	Ability to plate onto carbon fiber and closed cell dielectric foam

D	Permanent Selective Plating	☒ Tin ☒ Tin-Lead ☐Tin-Nickel Alloy ☒ Nickel ☐Nickel Gold (Hard) ☒ Nickel Gold (Soft) ☐Nickel Rhodium ☒ Other: Immersion tin, Immersion Silver, Electroless Nickel.Immersion Gold (ENIG)	
E	Permanent Mask or Coating	☒ Photo Dry Film ☒ Photo Liquid ☒ Image Transfer Screen Mask ☒ Conformal Coating Solder Mask ☒Cover Coat ☒Other: LDI	
F	Other Surface Finishes	☐Tin-Lead Fused ☒ Immersion Tin ☐Solder Leveled ☐Roll Soldered ☐Electro-less Solder Fused ☒ Solder Bumped Lands ☐Solder Paste Fused ☐Azole Organic Protective Covering ☐Flux Protective Covering ☐Other:	Solder leveling available through outside contractor

SECTION 2.2
ELECTRICAL TEST EQUIPMENT

DATE COMPLETED
03/06/2014

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 ☒>5000 ☐Other:	Outside contractor used for test
B	Number of Nodes	☐<500 ☐500 ☐1000 ☐2000 ☐3000 ☐4000 ☐5000 ☐6000 ☒>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] ☒<0.20 [.008] ☐Other:	

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

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

SECTION 2.3
PRODUCT TYPE

DATE COMPLETED
03/06/2014

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	☒ Rigid Printed Board ☒ Flex Printed Board ☒ Rigid/Flex Board ☒ Rigid Back Plane ☒Molded Product ☒ Ceramic Printed Board ☐Multichip Module ☐Liminated Multichip Module ☐Deposited Dielectric Multichip Modules ☐Other:	Circuits up to 41” W x 96” L
B	Circuit Mounting Type	☒Single Sided ☒Double Sided ☒Multilayer ☒Single-sided Bonded to Substrate ☒Double-sided Bonded to Substrate ☒Multilayer Bonded to Substrate ☒Constrained Multilayer ☒Distributed Plane Multilayer ☐Other:	
C	Via Technology	☒No-Vias ☒ Thru Hole Vias ☒ Buried Vias ☒ Blind Vias ☒ Thru Hole & Blind Vias] ☒ Thru Hole & Buried Vias ☒ Thru Hole Buried & Blind Vias ☒ Buried & Blind Vias ☒Other: Microvias	

D	Laminate Material	☒ Phenolic ☒ Epoxy Paper ☒ Epoxy Glass ☒ Modified Epoxy Composite ☒ Polyimide Film & Reinforce ☒ Cynanate Ester ☒ Teflon ☒ Ceramic Glass Types ☒ Various Combinations ☒Other:	Carbon fiber, Rohacell foam and Special Application materials
E	Core Material	☒No Core ☒Polymer ☒ Copper ☒ Aluminum ☒ Graphite ☒ Copper Invar/Copper ☒Copper Moly/Copper ☒ Other: As requested by customer	
F	Copper Thickness (Oz.)	☒1/8 Minimum ☒1/4 Minimum ☒3/8 Minimum ☒1/2 Nominal ☒1 Nominal ☒2 Nominal ☒3-5 Max ☒6-9 Max ☒ >10 ☒Other: Copper Core > .450 Copper weight up to 40 Oz.	
G	Construction	☒≤4 Planes ☒ >4 Planes ☐THK to TOL ≤0.2 mm ☒ THK to TOL >0.2 mm ☒Bow/Twist ≤1% ☐ Bow/Twist >1% ☒≤0.3 mm Profile Tolerance ☐ 0.3 mm Profile Tolerance ☐Other:	

H	Coatings and Markings	☐≤0.1 mm Mask Clearance ☒ >0.1 mm Mask Clearance ☒One Side (Legend) ☒ Two Side (Legend) ☐None (Legend) ☐UL Material Logo ☐U.L. V_0 Logo ☐U.L. V_1 Logo ☐U.L. V_2 Logo ☒ Other: MIL-PRF-31032	

SECTION 2.4
PRODUCT COMPLEXITY

DATE COMPLETED
03/06/2014

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] ☐750 [29.50] ☐850 [33.50] ☐>850 [33.50] ☒ Other:	Up to: 41” x 96”
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] ☒6,5 [.250] ☒>6,5 [.250] ☒ Other: 0.450”	
C	Number Conductive Layers	☐1-4 ☐5-6 ☐7-8 ☐9-12 ☐13-16 ☐17-20 ☐21-24 ☐25-28 ☐>28 ☒ Other: 60+ layers	

D	Dia Drilled Holes	☐>0,5 [.020] ☐0,5 [.020] ☐0,4 [.016] ☐0,35 [.014] ☐0,30 [.012] ☐0,25 [.010] ☐0,20 [.008] ☐0,15 [.006] ☒ <0,15 [.006] ☒Other:	.004”
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] ☐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] ☒ <0,10 [.004] ☒Other:	.002”
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] ☐0,075 [.003] ☒ <0,075 [.003] ☒Other:	.002”

H	Internal Layer Conductor Width (Min)	☐>0,250 [.010] ☐0,250 [.010] ☐0,200 [.008] ☐0,150 [.006] ☐0,125 [.005] ☐0,100 [.004] ☐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] ☒<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] ☐0,075 [.003] ☒ <0,075 [.003] ☒Other:	.002”

L	External Layer Conductor Width (Min)	☐>0,250 [.010] ☐0,250 [.010] ☐0,200 [.008] ☐0,150 [.006] ☐0,125 [.005] ☐0,100 [.004] ☐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] ☐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] ☒ 0,10 [.004] ☒<0,10 [.004] ☐Other:	.002”

All Dimensions are in millimeters [inches shown in brackets]

SECTION 2.5
QUALITY DEVELOPMENT

DATE COMPLETED
03/06/2014

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	☐Functional Steering Committee Formed ☒ TQM Plan & Philosophy Established & Published ☒ Documented Quality Progress Review ☒Implementation & review of Project Team Recommendations ☒ TQM Communicated throughout organization ☒Controlled New process Start-up ☒ Management Participates in TQM Audits ☐Employee Recognition Program ☐Total TQM Plan/Involvement Customer Training ☐Other:	
B	Employee Involvement	☒ Certified Training Available ☒ Training of Employee Base ☐TQM Team Trained ☐Design of Experiment Training and Use ☒New Process Implementation Training ☒Support Personnel Training ☐Advanced Statistical Training ☒Quality Functional Deployment ☒ Ongoing Improvement Program for Employees ☐Other:	
C	Quality Manual	☐Quality Manual Started ☐Generic Quality Manual for Facility ☐10% of manufacturing depts. have process specifications ☐25% of manufacturing depts. have process specifications ☐50% of manufacturing depts. have process specifications ☒Non-manufacturing Manuals Developed ☐25% of all departments have quality manuals ☐50% of all departments have quality manuals ☒ All Manufacturing and support depts. have controlled quality manal ☐Other: ISO 9001:2008 Certified	

D	Instructions	☐Work Instructions Started ☐Quality Instructions Started ☐10% Work Instructions Completed ☐10% Quality Instructions Completed ☐25% Work Instructions Competed, Controlled ☐25% Quality Instructions Completed, Controlled ☐50% Work Instructions Completed, Controlled ☐50% Quality Instructions Completed, Controlled ☒ Quality and work Instruct. Completed, Controlled ☐Other:	
E	SPC Implementation IPC-PC-90	☐Plan Exists ☐Training Started ☐Process Data Collected & Analyzed ☐All Employees Trained ☐First Process Stable & Capable ☐Several Major Processes Stable & Capable ☒ Continued Improvement of Stable Processes ☐Additional Mfg Processes under Control ☒All Processes Under Control ☐Other:	
F	Supplier Programs/Controls	☒ Supplier Rating Program ☐Monthly Analysis Program ☒Key Problems Identified ☒ Supplier Reviews Performance Data provided ☐TQM Acceptance by suppliers ☐10% of Suppliers Using SPC ☐25% of Suppliers Using SPC ☐50% of Suppliers Using SPC ☒All Key Suppliers using Certified parts program ☒Other: Annual Supplier Analysis	
G	Third Party IPC-QS-95	☒ Instrument Controls in Place ☒Measurement System in Control IPC-PC-90 ☒ Document Controls in Place ☒ Reduced Lot Sampling ☐10% of Processes Under Audit Control ☒ 50% or Greater of Processes Under Audit Control ☐ISO-9003 Certified ☐ISO-9002 Certified ☒ISO-9001 ☒Other: ISO9001:2008	

SECTION 3

DATE COMPLETED
03/06/2014

EQUIPMENT PROFILE (Pre-Site Audit)

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

3.1 PHOTOTOOL CAPABILITY	YES	NO	EQUIPMENT	QTY	EQUIPMENT LIMITS
A) AOI of phototool	☒	☐	Tamarack Model 161C	1	0.0005”
B) AOI CAD reference (CAM)	☐	☒			
C) Photoplotting	☒	☐	Off-site		
D) Photo reductions	☒	☐	Off-site		
E) Film scan and conversion	☒	☐	Off-site		
F) Film processing ☐ air-dried ☐ force-dried ☐ processed in automatic processor	☐	☒			
G) Media types ☒ silver halide film ☐ glass ☒ diazo	☒	☐	LDI-Laser Direct Imaging .0002” front to back registration. Simultanous front and back imaging		

3.2 DRILLING EQUIPMENT	YES	NO	EQUIPMENT	QTY	EQUIPMENT LIMITS
A) Manual	☐	☒			
B) Optical (single spindle)	☒	☐		1	0.0007”
C) N.C. drill	☒	☐		3	0.0007” 0.0007” 0.0007”

3.3 ROUTING EQUIPMENT	YES	NO	EQUIPMENT	QTY	EQUIPMENT LIMITS
A) Edge beveler	☒	☐		3	
B) Hand router (pin router)	☐	☒			
C) N.C. router	☒	☐			
D) N.C. driller/router	☒	☐		3	0.0007” 0.0007” Can process Sizes up to 41” x 96”
E) Scoring (profile)	☒	☐		2	0.0007” Using precise depth control of router
F) Scoring (straight line)	☒	☐		2	0.0007” Using precise depth control of router

3.4 MECHANICAL EQUIPMENT	YES	NO	EQUIPMENT	QTY	EQUIPMENT LIMITS
A) Punch press	☐	☒			
B) Shear	☒	☐			
C) Milling machine	☒	☐		1	0.4 micron scales in x, y & z ± 0.0002”

3.5 HOLE PREPARATION (DESMEAR)	YES	NO	EQUIPMENT	QTY	EQUIPMENT LIMITS
A) Permagnate	☒	☐			
B) Plasma	☒	☐			
C) Mechanical	☒	☐			
D) Etchback	☒	☐	Chemical bath	1	41” x 96”

3.6 PRIMARY IMAGE APPLICATION	YES	NO	EQUIPMENT	QTY	EQUIPMENT LIMITS
A) Dry film	☒	☐	Lazer Direct Imaging and Dupont Laminators (HRL)	1 1	41” Wide and 24” Wide
B) Hand screening	☒	☐	Custom Silkscreen Frame	1	Up to 42+” x 60+”
C) Machine screening	☒	☐		1	32” x 26”
D) Wet film	☐	☒			
E) Liquid photoimageable	☒	☐		2	36” x 60”

3.7 TYPE OF TREATMENT FOR MULTILAYER INNERLAYERS	YES	NO	EQUIPMENT	QTY	EQUIPMENT LIMITS
A) Black oxide	☒	☐	Chemical bath	1	41” x 96” (Can Accommodate Larger sizes, as needed)
B) Red oxide	☐	☒			
C) Copper scrub	☐	☒			
D) Durabond	☐	☒			
E) Other: Bondfilm Oxide	☒	☐	Atotech	1	

3.8 LAMINATION	YES	NO	MATERIAL	QTY	APPLICATION TECHNIQUE
A) High pressure	☒	☐	Custom TMP Press	1	Hydraulic/Vacuum press: 38” x 28” and Autoclave: 36” x 72”
B) High temperature	☒	☐			
C) Vacuum	☒	☐			
D) Vacuum assist	☒	☐			
E) Foil heat assist	☐	☒			
F) Separate cool-down	☒	☐			

3.9 ELECTROLESS COPPER PLATING	YES	NO	EQUIPMENT	QTY	EQUIPMENT LIMITS
A) Fully additive application	☐	☒			
B) Electroless deposition (semiadditive)	☒	☐			41” x 60”
C) Through-hole and via	☒	☐	Chemical bath	1	41” x 60”

3.10 COPPER ELECTROPLATING	YES	NO	EQUIPMENT	QTY	EQUIPMENT LIMITS
A) Copper sulfate	☒	☐	Chemical bath	1	41” x 96”
B) Pyrophosphate	☐	☒			
C) Copper fluoborate	☐	☒			
D) Other	☐	☒			

3.11 TIN/LEAD SURFACE PLATINGS/COATINGS	YES	NO	EQUIPMENT	QTY	EQUIPMENT LIMITS
A) Tin/lead electroplated	☒	☐	Chemical bath	1	41” x 96”
B) Immersion tin or tin/lead (electroless)	☒	☐	Chemical bath	1	41” x 48”
C) Hot air solder leveled (HASL)	☐	☒			

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

3.13 NICKEL SURFACE PLATING	YES	NO	EQUIPMENT	QTY	EQUIPMENT LIMITS
A) Electroless nickel	☐	☒			
B) Electroplated nickel	☒	☐	Chemical bath	1	41” x 96”

3.14 GOLD SURFACE PLATING	YES	NO	EQUIPMENT	QTY	EQUIPMENT LIMITS
A) Electroless gold	☐	☒			
B) Electroplated gold	☒	☐	Chemical bath	1	41” x 96”

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

3.16 SOLDERMASK	YES	NO	EQUIPMENT	QTY	EQUIPMENT LIMITS
A) Screened deposited image	☒	☐	Custom silkscreen frame	1	48” x 60”
B) Dry film photoimageable	☒	☐			
C) Liquid photoimageable	☒	☐		2	41” x 96”
D) Dry film/liquid combination	☒	☐	Custom silkscreen frame	1	48” x 96”

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

3.18 MICROSECTION CAPABILITY	YES	NO	EQUIPMENT	QTY	EQUIPMENT LIMITS
A) Manual	☒	☐	Buehler	1	0.10, 0.40, 0.65 objective lenses; 10X eyepieces on opical system
B) Single cavity automated	☐	☒			
C) Multiple cavity automated	☐	☒			
D) Plating thickness analysis	☒	☐	SII SFT 9255 XRX Series	2	

3.19 CHEMICAL ANALYSIS	YES	NO	EQUIPMENT	QTY	EQUIPMENT LIMITS
A) Etching chemistry	☒	☐			
B) Plating chemistry	☒	☐	Hull cell Titration		
C) Effluent (PPM) analysis	☒	☐	Heavy Metals		

3.20 ELECTRICAL TEST EQUIPMENT	YES	NO	EQUIPMENT	QTY	EQUIPMENT LIMITS
A) Continuity and shorts	☒	☐	HP Agilent 34401A	1	0.001Ω
B) Fixture development	☐	☒			
C) Flying probe test	☐	☒			Outside Service
D) Impedance control	☒	☐			

DATE COMPLETED
03/06/2014

SECTION 4
TECHNOLOGY PROFILE SPECIFICS

4.1 ADMINISTRATION

4.1.1 CAPACITY PROFILE	EST %	COMMENTS
A) Total annual capacity in square meters (surface area) per month	Approx 25,000 sq m/mo	
B) Presently running at ____ % of capacity	CALL	

4.1.2 PERCENTAGE OF DOLLAR VOLUME	EST %	COMMENTS
A) Single sided (rigid)	5%	
B) Double sided (rigid)	25%	
C) Multilayer (rigid)	55%	
D) Single side (unreinforced-flex)	2%	
E) Double sided (unreinforced-flex)	2%	
F) Multilayer (unreinforced-flex)	2%	
G) Multilayer (rigid/flex)	2%	

4.1.3 PANEL PRODUCTION PROFILE	UNITS PER MONTH
A) Size of a production lot in panels	4-48 Panels (Depending on panel size)
1) Normal	12
2) Smallest	4
B) Number of panels per month	800-1200
1) High Production	1200+
2) Medium Production	300
3) Low Production	20-30
3) Short run	1-10
4) Prototype	1-20

C) Average lead time (delivery) as defined in B)			
1) High Production	6 weeks		
2) Medium Production	3 weeks		
3) Low Production	2 weeks		
3) Short run	1 Week		
4) Prototype Quick turn - No. of days 7.	2-3 Weeks		
D) Product delivered in full panel or array sub-panel format	Customer Directed		
1) Total in panel or array format	1000+ parts per panel for micro circuits		
2) Scored format	1000+		
3) Tab breakaway format	6-10 parts per panel		
4) Other			
5) Total to customer layout			
6) Total to manufacturing layout			
E) Product delivered in board format			
1) Total in board format	500 parts		
2) Extracted: scored to size	500		
3) Extracted: sheared to size	400		
4) Extracted: routed to size	400		
4.1.4 APPROVAL AND CERTIFICATION	**YES**	**NO**	**COMMENTS**
A) Company approvals			
1) UL approval	☐	☒	94V Level V0.
2) Canadian standards	☐	☒	
3) MIL-P-55110	☒	☐	
4) MIL-P-50884	☐	☒	
5) ISO-9002	☐	☒	
6) ISO-9001	☒	☐	ISO 9001-2008 certification completed May 22, 2005

7) ISO-14000	☐	☒	
8) BABT	☐	☒	
9) EEC	☐	☒	
10) Customer satisfaction	☒	☐	Raytheon AO and SRS rating plus GMP audit plus IPC-6018A **Raytheon 4 Star Supplier Excellence Award and Raytheon Preffered Supplier Status (SEAC Team Appointed)**
B) Other certification information			
1)Laminate	☒	☐	C of C and Analysis maintained
2)Quality standards	☐	☐	Raytheon AO certified IPC-6018A, ISO 9001-2008
3)Equipment calibration	☒	☐	Calibration conforms to ANSI / NCSL Z540; ISO 17025:1999; ISO 9001:2008

4.1.5 CUSTOMER INTERFACE PROFILE	**YES**	**NO**	**COMMENTS**
A) Modem capability	☒	☐	
B) Baud rate			Hi-Speed T1
C) Data verification technique	☒	☐	PGP
D) Engineering change order process	☒	☐	Exostar
E) Job status reporting to customers	☒	☐	Exostar

4.1.6 OTHER CAPABILITIES	**YES**	**NO**	**COMMENTS**
A) Facility research and development	☒	☐	Triangle performs manufacturing related 'R&D' only – Triangle is a build-to-print shop offering unique process development. We provide design for manufacurability reviews and recommendations. Beta site for OEM material suppliers
B) (Automated) On-line shop floor control/MRP system	☐	☒	
C) Process control system	☒	☐	Monitoring critical process parameters for compliance within stated tolerances
D) Operator training system	☒	☐	Periodic, recorded training sessions

4.2 PROCESS ORIENTATION

4.2.1 LAMINATE MATERIAL	EST %	COMMENTS
A) Most commonly used laminates (G10, FR4, etc.)	40 40 10 10	Brand name Rogers Type Teflon/FR4 Brand name Arlon Type Teflon/FR4 Brand name Nelco Type Cyanate ester Brand name Rohacell Type Foam
B) Other laminate material		
1) Planar resistor layers		UL approved ☐
2) BT epoxy	2	UL approved ☐
3) Kevlar	2	UL approved ☐
4) Teflon	80	UL approved ☐
5) Polyimide	3	UL approved ☐
6) Cyanate ester	3	UL approved ☐
7) Other	10	UL approved ☐ Foam
C) Specification to which laminate is purchased (check all that apply) ☒MIL-P-13949 ☒IPC-4204 ☒IPC-4101 ☐UL Approved ☒IPC-4103 ☐Other ☒IPC-4202 ☒IPC-4203		
D) Laminate storage ☐ Uncontrolled ☒ Humidity controlled ☒ Temperature controlled ☐ Dry box ☐ JIT inventory		
E) Panel size configurations in X, Y dimesions maximum X 41 in. Y 96 in. minimum X 5 in. Y 5in. other X _____ Y _____mm		

4.2.2 PROCESS PRECISION SPECIFICS	YES	NO	VALUE	COMMENTS
A) Maximum printed board thickness built in volume				
1) Single sided	X		.650”	
2) Double sided	X		.650”	
3) Multilayer	X		.650”	
4) Rigid flex	X		.650”	
B) Printed board electrical performance capability				
1) Impedance control	☐	☒		
2) Capacitance control	☐	☒		
3) Microstrip boards	☒	☐	.650”	
C) Tooling system description				
1) Same holes in panels used for all processes	☒	☐		
2) Optical registration	☒	☐		Process: MicroVu Optical CMM
3) Other	☐	☐		

4.2.3 OTHER PROCESS ORIENTATION SPECIFICS	YES	NO	SYSTEM	COMMENTS
A) Solder mask over bare copper	☒	☐	Custom silkscreen frame	48” x 96”
B) Plating/coating information				
1) Tin/lead reflow	☒	☐		Outside contractor
2) Hot air leveling	☒	☐		Outside contractor
3) Azole organic	☐	☒		
4) Conductive	☒	☐	Buehler cross sectioning equipment	0.10, 0.40, 0.65 objective lenses; 10X eyepieces on opical system
C) Hole formation				
1) Hole cleaning	☒	☐	Buehler cross sectioning equipment MicroVu CMM inspection	0.10, 0.40, 0.65 objective lenses; 10X eyepieces on opical system
2) Hole cleanliness verified	☒	☐	Buehler cross sectioning equipment MicroVu CMM inspection	0.10, 0.40, 0.65 objective lenses; 10X eyepieces on opical system

4.3 PRODUCT DESCRIPTION

***CONSISTENCY IMPLIES YIELDS IN EXCESS OF 80%**

4.3.1. THROUGH HOLE INSERTION	EST %	SIZE (MM) - +/- TOL	COMMENTS
A) Smallest conductor width and tolerance produced with consistency			
1) Outer layers (print and etch)		Size 0.05 mm Tol ± 0.005 .mm	
2) Inner layers (print and etch)		Size 0.05 mm Tol ± 0.005 .mm	
3) Outer layers (plated)		Size 0.05 mm Tol ± 0.005 .mm	
4) Inner layers (plated)		Size 0.075 mm Tol ± 0.0075 .mm	
5) Outer layers (additive plating)		Size 0.075 mm Tol ± 0.0075 .mm	
6) Inner layers (additive plating)		Size 0.075 mm Tol ± 0.0075 .mm	
B) Smallest plated-through hole (PTH) and tolerance consistently produced in 1.5mm thickness material or multilayer board			
1) Minimum PTH diameter		Size 0.15 mm Tol ± 0.015 .mm	
2) Largest panel where this hole can be controlled (across diagonal)		Size 550 mm Tol ± 5 .mm	
C) Largest hole size that can be drilled and plated through in a 1.25mm diameter land while maintaining an annular ring of 0.125mm in large/small boards			
1) Largest board size (across diagonal)		Size 1440 mm	
2) Largest hole diameter		Size 1.52 mm	
3) Smallest board size (across diagonal)		Size 215 mm	
4) Largest hole diameter		Size 1.52 mm	
D) Surface mount land pattern pitch (check all that apply) ☐1.27mm [.050] ☐0.63mm [.025] ☐0.5mm [.020] ☐0.4mm [.016] ☐0.3mm [.012] ☒0.25mm [.010] ☐Other _____ .			

E) Solder mask dam between lands (check all that apply) ☐1.27mm [.050] ☐0.63mm [.025] ☐0.5mm [.020] ☐0.4mm [.016] ☐0.3mm [.012] ☒0.25mm [.010] ☐Other _____ .			
F) Flatness tolerance (bow & twist) after reflow or solder coating ☐1.5% ☐1.0% ☐0.5% ☐Other ____	n/a		

4.3.2 PRODUCT QUALITATIVE AND QUANTITATIVE INFORMATION	YES	NO	QUANTITY OF PANELS	NUMBER or DIMENSION	COMMENTS
A) Multilayer layer count					
1) Maximum layers fabricated in volume (Maximum Lot)	☒		52K annual	36	
2) Maximum layers fabricated in prototype (Minimum Lot)	☒		52K annual	47	
B) Buried vias produced consistently in volume	☒	☐	52K annual		
1) Size				0.010”	
2) Number of layers				47	
B) Blind vias produced consistently in volume	☒	☐	52K annual		
1) Size				0.010”	
2) Number of layers				47	
1) Controlled depth drilling	☒	☐	52K annual	0.0007”	
2) Total number of layers				36	

4.4. TESTING CAPABILITY

4.4.1 TEST AND TEST EQUIPMENT CAPABILITY	YES	NO	COMMENTS
A) SMT centerline pitch that can be electrically tested ☐ 0.63mm [.025] ☐ 0.5mm [.020] ☐ 0.4mm [.016] ☐ 0.3mm [.012] ☐ 0.25mm [.010] ☒ Other			n/a - customers perform test functions
B) Double sided simultaneous electrical testing	☐	☐	n/a
1) Equipment type	☐	☐	n/a
2) X-ray fluorescence inspection equipment	☒	☐	
3) TDR equipment	☐	☒	
4) Hi-pot test equipment	☒	☐	Outside contractor
5) Four-wire kelvin tester	☒	☐	

6) Capacitance meter	☐	☒	
7) Cleanliness testing	☒	☐	

4.4.2 AUTOMATED OPTICAL INSPECTION USAGE	EST %	COMMENTS
A) Before etching	10	MicroVu CMM optical measuring machine
B) After etching	10	MicroVu CMM optical measuring machine
C) Internal layers	50	MicroVu CMM optical measuring machine
D) Final inspection	90	MicroVu CMM optical measuring machine
E) Other		n/a
F) Conductor/clearance normally inspected by AOI equipment		MicroVu CMM optical measuring machine
1) ☐ 0.05mm [.002]		MicroVu CMM optical measuring machine
2) ☐ 0.05-.10mm [.002-.004]		MicroVu CMM optical measuring machine
3) ☐ >.10mm [.004]		MicroVu CMM optical measuring machine
4) ☐ Planes		MicroVu CMM optical measuring machine
G) CAD download to AOI		MicroVu CMM optical measuring machine

SECTION 5
QUALITY PROFILE

DATE COMPLETED
03/06/14

GENERAL INFORMATION	
COMPANY NAME Triangle Labs, Inc.	
CONTACT Mark Carmonne	
TELEPHONE NUMBER 775.887.1700	FAX NUMBER 775.887.1259

This section of the Manufacturer's Qualification Profile is intended to describe the Total Quality Management (TQM) activity in place of being implemented at the manufacturing facility identified in the site description of this MQP.

To ease in the task of identifying the TQM program being planned or underway at the manufacturing site, the activities have been divided into twenty sections which when completed, provide the total picture of the posture toward managing quality issues. Each section contains a number of questions with regard to the topic under review.

It is not the intent to have the questions be all encompassing, nor is every question applicable to all manufacturers. However, identification of the status, related to each questions, when considered as a whole will convey an impression of the progress that the company has achieved in adopting the principles of total quality management.

The twenty sections, in order of the occurrence are:

5.1 General Quality Programs
5.2 New Products/Technical Services
5.3 Customer Satisfaction
5.4 Computer Integrated Manufacturing
5.5 Process Documentation
5.6 Quality Records
5.7 Skill, Training & Certification
5.8 Subcontractor Control
5.9 Calibration Control
5.10 Internal Audits
5.11 Statistical Process Control
5.12 Problem Solving
5.13 In-Process Control
5.14 Receiving Inspection
5.15 Material Handling
5.16 Non-Conforming Material Control
5.17 Inspection and Test Plan
5.18 Product Inspection/Final Audit
5.19 Tooling Inspection, Handling, & Storage
5.20 Corrective Action

Each section provides a status report related to each question. The question may not be applicable, no activity has started as yet, or the company may have developed an approach to the issues raised by the questions. An (X) is indicated in the appropriate column. If deployment/implementation has started, the status is reported as percent deployment; this is indicated in column 4. The percentage number closely approximates the status of deployment. If deployment exists, the percentage results that have been achieved is indicated in column 5. Results are based on expected goals. Not providing percent information in either the deployment or results column implies a lack of activity in the particular area.

The quality descriptions requested are completed on the following pages by checking (X) the appropriate column to reflect the status of the manufacturing facility TQM program. Additional information may be provided as comments shown below, or on individual sections, or additional sheets as necessary.

COMMENTS

5.1 GENERAL QUALITY PROGRAMS		STATUS				
	DESCRIPTION OF PROGRAM	Not Applicable	Not Started	Approach Developed	Percent Deployed	Percent Results
1.	Are quality objectives and responsibilities clearly stated, widely distributed and understood through the company?				100	100
2.	Is there a quality function or well defined organization which provides customer advocate guidance to the total organization and is this position fully supported by management?				100	90
3.	Does a quality measurement system exist with clearly defined metrics and is it utilized as a management tool?				100	85
4.	Are work instructions approved and controlled; and are they under revision control?				100	100
5.	Are the quality procedures and policies current and available at the point of application; and are they under revision control?				100	100
6.	Are benchmark and customer satisfaction studies done to determine best in class for all products, services, and administrative functions; and are quality goals set?				100	90
7.	Are Statistical Process Control (SPC) principles understood by all levels of management?				100	100
8.	Are there programs with sufficient resources assigned to support corrective actions and prevention?				100	100
9.	Does management solicit and accept feedback from the work force?				100	100
10.	Is there management support of ongoing training (including quality training), and is it documented by an organizational training plan?				100	100
11.	Are there regular management reviews of elements of the quality improvement process, including feedback for corrective action, and are the results acted upon?				100	100
12.	Are the quality and reliability goals aggressive relative to customer expectations and targeted at continuous improvement?				100	100
13.	Are the people who are responsible for administering the quality assurance function technically informed?				100	100
14.	Does Management have a “defect prevention” attitude to achieve continuous improvement?				100	100

5.2 NEW PRODUCTS/TECHNICAL SERVICES		STATUS				
	DESCRIPTION OF PROGRAM	Not Applicable	Not Started	Approach Developed	Percent Deployed	Percent Results
1.	Do new product/technology/service development policies and procedures exist, and do they result in clearly defined project plans with appropriate measureables and approvals?	X				
2.	Is quantitative benchmarking used to evaluate all new products/technologies/services in comparison to best-in-class offerings?	X				
3.	Does a roadmap exist to ensure continued development of leading edge, best-in-class products/technology/services?	X				
4.	Is the capability of each operation which controls critical-to-function characteristics for new products, fully certified?	X				
5.	Are statistical tools used in the development of robust (high yield) new processes, products, and services?	X				
6.	When new product/technology/service requires a new process, is it developed jointly and concurrently with the customer and/or suppliers?	X				
7.	Are design reviews conducted on a scheduled basis which properly address the process capability indices of critical-to-function and product/service characteristics?	X				
8.	Is the new product/technology/service, as produced by the process, verified to meet all customer satisfaction requirements?	X				

COMMENTS
Triangle does no new product development

5.3 CUSTOMER SATISFACTION		STATUS				
	DESCRIPTION OF PROGRAM	Not Applicable	Not Started	Approach Developed	Percent Deployed	Percent Results
1.	Is there a measurement system in place to assess the customer's perception of complete performance?				60	50
2.	Is an independent (unbiased) customer survey routinely conducted?					
3.	Is there an internal measurement system within the organization which correlates to the level of customer satisfaction?				60	50
4.	Are there specific goals for achieving Total Customer Satisfaction, both internal and external?				60	50
5.	To what extent are customer satisfaction goals disseminated and understood by everyone in the organization?				100	80
6.	Does management regularly review and assess all operating systems to determine if barriers to customer satisfaction exist and are appropriate action plans then implemented?				100	80
7.	Is there a method in place to obtain future customer requirements?				100	75
8.	Are all findings of customer dissatisfaction reported back to the proper organization for analysis and corrective action?				100	100
9.	Are customer satisfaction requirements formally defined and documented, and are they based on customer input?				100	100
10.	Do all support organizations understand their role in achieving total customer satisfaction?				100	100

5.4 COMPUTER INTEGRATED MANUFACTURING		STATUS				
	DESCRIPTION OF PROGRAM	Not Applicable	Not Started	Approach Developed	Percent Deployed	Percent Results
1.	Are systems integrated to allow electronic transfer of information between multiple systems to eliminate redundant data entry?				5	
2.	Can customers electronically transfer CAD/CAM directly into manufacturing?	X				
3.	Can customers electronically transfer order information directly into the business system?	X				
4.	Is data electronically shared between shop floor control and process control systems (i.e., CNC, SPC, Electrical Test, AOI, etc.)?	X				
5.	Are planning systems (MRP, forecasting, capacity planning, financial planning, etc.) electronically integrated with operation systems (order processing, purchasing, inventory management, shop floor control, financial/cost control, etc.)?	X				
6.	Is information available from system processes in real time (vs. batch processing)?	X				
7.	Are processes and procedures documented and available on-line?				100	100
8.	Do all functional departments have system access to key financial, manufacturing, sales, and operational data, as it relates to their functional objectives?	X				
9.	Are computer simulation and design tools used to the maximum extent practicable in the design of new products/technologies/services	X				

COMMENTS

Triangle has not yet implemented an ERP system.

5.5 PROCESS DOCUMENTATION		STATUS				
	DESCRIPTION OF PROGRAM	Not Applicable	Not Started	Approach Developed	Percent Deployed	Percent Results
1.	Are manufacturing product, process, and configuration documents under issue control?				100	100
2.	Are “preliminary” and “special product” specifications controlled?				100	100
3.	Does the system ensure that the most current customer specifications are available to the manufacturing personnel?				100	100
4.	Does the system ensure that the most current material specifications are available to the procurement function?				100	100
5.	Are incoming orders reviewed for revisions and issue changes?				100	100
6.	Is conformance to customer specifications assured before an order is accepted?				100	100
7.	Is customer feedback provided when designs do not meet manufacturability requirements?				100	100
8.	Are critical characteristics classified, relative to impact on product performance?				100	100
9.	Are customers informed of changes made to products controlled by customer drawings or specifications?				100	100
10.	Is there an effective internal deviation control procedure and, are customer requested deviations documented and followed?				100	100
11.	Do new product development procedures exist, and are they followed in the design development process? Triangle does not perform product development functions	X				

5.6 QUALITY RECORDS		STATUS				
	DESCRIPTION OF PROGRAM	Not Applicable	Not Started	Approach Developed	Percent Deployed	Percent Results
1.	Are records of inspection and process control maintained and available for review?				100	80
2.	Are records of equipment and equipment maintenance kept?				100	100
3.	Is the record and sample retention program defined?				100	100
4.	Are quality data used as a basis for corrective action?				100	100
5.	Are quality data used in reporting performance and trends to management?				100	100
6.	Are quality data used in supporting certifications of quality furnished to customers?				100	100
7.	Is field information used for corrective action?				100	100
8.	Does a cost of quality measurement system exist?		X			
9.	Are customer reported quality problems responded to, and resolved in the time period requested?				100	100
10.	Is quality information on production material rejects provided to sub-suppliers with required corrective action?				100	100
11.	Are computers used to collect and analyze quality data?		X			

COMMENTS

5.7 SKILLS, TRAINING, & CERTIFICATION	STATUS

	DESCRIPTION OF PROGRAM	Not Applicable	Not Started	Approach Developed	Percent Deployed	Percent Results
1.	Does management ensure that all personnel are trained in their role for achieving Total Customer Satisfaction?				100	100
2.	Do all personnel understand how their performance impacts internal and external customer satisfaction?				100	100
3.	Do all personnel who contact external customers reflect quality improvement programs?				100	100
4.	Do personnel participate in professional societies and growth programs?				75	75
5.	Are all personnel trained in sufficient detail to support key initiatives?				100	100
6.	Are the results of training evaluated and indicated program changes made?				100	100
7.	Does a policy exist which encourages the cross training and rotation of personnel, and is this policy used as the basis of job progression?				100	100
8.	Are performance standards participatively developed, and regularly applied for all personnel?				100	100
9.	Are Total Customer Satisfaction programs and resulting successes publicized to all personnel?				100	100
10.	Do goal setting and reward/incentive programs support the quality improvement process?				100	100

5.8 SUBCONTRACTOR CONTROL

	DESCRIPTION OF PROGRAM	STATUS: Not Applicable	Not Started	Approach Developed	Percent Deployed	Percent Results
1.	Are requirements defined, communicated, and updated to ensure that the supplier understands expectations?				100	100
2.	Does a system exist which measures the performance of the supplier and communicates such information to the supplier? (i.e., supplier rating system)				100	100
3.	Have the organization's processes been characterized to identify the critical requirements for the suppliers products?				100	100
4.	Have the capabilities of the supplier's processes been assessed and considered in the establishment of the requirements?				100	100
5.	Have partnerships been established with suppliers, and is assistance provided to ensure that each supplier has the capability to consistently supply conforming products?				100	100
6.	Have quality and cycle time metrics and improvement goals been established participatively with the supplier?				100	100
7.	Has a system been established with the supplier for identification and verification of corrective action?				100	100
8.	Have the requirements for supplier materials been properly characterized and specified to ensure conformance of the product/service to the customer satisfaction requirements?				100	100
9.	Is there a supplier certification program or equivalent procured material/service continuous quality improvement program?				100	100
10.	Can all personnel who contract suppliers properly reflect appropriate quality improvement programs and status to them?				100	100

COMMENTS

5.9 CALIBRATION CONTROL

DESCRIPTION OF PROGRAM	STATUS: Not Applicable	Not Started	Approach Developed	Percent Deployed	Percent Results

1.	Are calibration and preventative maintenance programs in place and documented?				100	100
2.	Are calibration and maintenance personnel trained? OUTSIDE SERVICE IS USED	X				
3.	Is traceability to NIST maintained?				100	100
4.	Is quality measurement and control equipment current, effective, and sufficiently integrated with production equipment?				100	100
5.	Is the history of quality measurement and control equipment documented?				100	100
6.	Has repeatability of measuring devices and inspection or testing processes been established and monitored; are gauge capability studies conducted and GR&R ratios acceptable(<10%)?		X			
7.	Are calibration and preventative maintenance cycles on schedule?				100	100
8.	Is the use of non-calibrated equipment for design and production purposes prohibited?				100	100
9.	Are tools and fixtures used as criteria or acceptability of product/work fully qualified and identified?				100	100
10.	Are calibration intervals defined in accordance with industry standards or manufacturer's recommendations and the calibration history of the equipment?				100	100

5.10 INTERNAL AUDITS

DESCRIPTION OF PROGRAM		STATUS				
		Not Applicable	Not Started	Approach Developed	Percent Deployed	Percent Results
1.	Are regular reviews of the product/process conducted and are goals/plans established to continually improve?				100	90
2.	Are the processes/products properly documented and controlled? Do they include appropriate customer requirements and are they executed in conformance to the documentation?				100	100
3.	Are the required quality checks built into the operations within the manufacturing, field installation, and service process, and is the resulting data maintained and promptly acted upon?				100	100
4.	Are all pertinent methods of statistical quality control properly, effectively and efficiently used? ALL PERTINENT DATA IS COLLECTED ON A REGULAR BASIS			X	90	90
5.	Does a process change control system exist, and are customers informed of changes made to products and processes with customer approval prior to the change, when required?				100	100
6.	Are the operators within the process provided with written work instructions and are they trained?				100	100
7.	Is the receipt, handling, storage, packaging and release of all material, including customer provided items, at all stages, specified and controlled to prevent damage or deterioration, and to address obsolete material?				100	100
8.	Is there a first in/first out (FIFO) system in place, and is it followed? Most work is prototype and material is ordered for job or customer	X				

COMMENTS

5.11 STATISTICAL PROCESS CONTROL		STATUS				
	DESCRIPTION OF PROGRAM	Not Applicable	Not Started	Approach Developed	Percent Deployed	Percent Results
1.	Have the personnel who will be responsible for guiding the implementation of SPC been designated?				100	100
2.	Are statistical techniques used to reduce variation in the engineering process before the start of production?		X			
3.	Is the quality system dependent upon process rather than product controls?				100	100
4.	Is the capability of critical processes and machines measured and monitored with CPK's >1.5, and targeted with CP of 2.0?		X			
5.	Are incapable processes or machines targeted for improvement or replacement? All processes and equipment used in production is functional and capable	X				
6.	Is SPC implemented for all critical processes? ALL PERTINENT DATA IS BEING COLLECTED				100	90
7.	Are procedures that control the reaction to out-of-control situations adequate and effective?				100	100
8.	Are operators trained in the use of appropriate statistical techniques, and are they properly applying them? Operators regularly collect process control data and apply results to process			X	100	90
9.	Are advanced problem solving techniques used by engineers to solve problems? (Design of Experiments, planned experimentation, advanced diagnostic tools, etc.)				100	100
10.	Are control charts and other process controls properly implemented?				100	100
11.	Is statistical process control being practiced in work centers and are yields being recorded and plotted on a scheduled basis, with respect to upper and lower control limits?			X		

5.12 PROBLEM SOLVING		STATUS				
	DESCRIPTION OF PROGRAM	Not Applicable	Not Started	Approach Developed	Percent Deployed	Percent Results
1.	Are employees trained in problem solving techniques, in comparison to the needs of the organization?				100	100
2.	Does the organization utilize participative problem solving techniques to identify, measure and resolve internal and external problems?				100	100
3.	Are problem solving efforts timely and effective?				100	100
4.	Are applied resources sufficient to remove problem solving constraints?				100	100
5.	Are statistical techniques used for problem solving?				100	85
6.	Are quality data used to identify barriers, and to determine the priority of problems?				100	100
7.	Is there a policy/procedure that includes the use of problem solving techniques to systematically drive reduction in variability?				100	75

COMMENTS

5.13 IN-PROCESS CONTROL		STATUS				
	DESCRIPTION OF PROGRAM	Not Applicable	Not Started	Approach Developed	Percent Deployed	Percent Results
1.	Are process capabilities established and maintained on all major processes? (critical parameters) Critical process parameters are identified and tracked				100	90
2.	Are in-process inspections, test operations, and processes properly specified and performed?				100	100
3.	Are in-process inspection facilities and equipment adequate?				100	100
4.	Are the results of in-process inspections used in the promotion of effective preventative action and corrective action?				100	100
5.	Is preventative maintenance performed on the equipment and facilities?				100	100
6.	Are housekeeping procedures adequate and how well are they followed?				100	100
7.	Are process management plans established, and are critical parameters followed?				100	90
8.	Are work areas uncluttered and free of excess work-in-process, supplies, debris, etc? Is the environment conductive to producing quality work? Is proprietary information adequately protected?				100	100
9.	Are certifications and in-process inspection results used in making final acceptance decisions?				100	100
10.	Are methods and procedures for the control of metallurgical, chemical, and other special processes established and followed?				100	100

5.14 RECEIVING INSPECTION		STATUS				
	DESCRIPTION OF PROGRAM	Not Applicable	Not Started	Approach Developed	Percent Deployed	Percent Results
1.	Are receiving inspection facilities and equipment adequately and properly maintained?				100	100
2.	Are receiving inspection procedures documented and followed?				100	100
3.	Are receiving inspection results used for corrective and preventive action?				100	100
4.	Are the procedures for storage and timely disposition of discrepant material in place and followed?				100	100

COMMENTS

5.15 MATERIAL HANDLING		STATUS				
	DESCRIPTION OF PROGRAM	Not Applicable	Not Started	Approach Developed	Percent Deployed	Percent Results
1.	Are procured material releases from receiving inspection clearly identified, as to acceptance status?				100	100
2.	Are procedures to facilitate limited life materials, such as prepreg, in place, properly controlled, and monitored?				100	100
3.	Are procured items identified with some means of traceability (serial number, lot number, date code, etc.)?				100	100
4.	Are procedures and facilities adequate for storage, release and control of materials?				100	100
5.	Are in-store and in-process materials properly identified and controlled?				100	100
6.	Is in-process material protected from corrosion, deteriorization, and damage?				100	100

5.16 NON-CONFORMING MATERIAL CONTROL		STATUS				
	DESCRIPTION OF PROGRAM	Not Applicable	Not Started	Approach Developed	Percent Deployed	Percent Results
1.	Is non-conforming material identified, segregated from regular production material, and properly dispositioned?				100	100
2.	Are non-conforming materials properly identified and controlled to prevent inadvertent use?				100	100
3.	Is the review and disposition of non-conforming materials defined, and are provisions made for inclusion of the customer in disposition decision?				100	100
4.	Are procedures for controlling non-conforming materials, and for ensuing corrective action, in place and followed?				100	100
5.	Do procedures provide for material review by a committee consisting of Quality and Engineering (as a minimum), to determine the disposition of non-conforming materials? (deviating from drawings or specification)				100	100
6.	Do supplier's procedures and controls for corrective action prevent recurrence of non-conformances?				100	100
7.	Is there a system for coordinating necessary corrective action with purchasing personnel?				100	100
8.	Does the corrective action extend to all applicable causes of non-conformance (e.g., design, workmanship, procedures, equipment, etc.)?				100	100

COMMENTS

5.17 INSPECTION AND TEST PLAN		STATUS				
	DESCRIPTION OF PROGRAM	Not Applicable	Not Started	Approach Developed	Percent Deployed	Percent Results
1.	Are statistical techniques used in determining the acceptability of finished goods to customer requirements? AQL INSPECTION; MIL-STD 105E, General Inspection Level II, single sampling plan, normal inspection only.				100	100
2.	Are periodic tests conducted to audit reliability and environmental performance of the final product? Triangle often does not know the use of the product	X				
3.	Is CPK tracking performed for critical characteristics, with plans to achieve CPK = 1.5 with a target of CP of 2.0?		X			
4.	Is root cause failure analysis performed for internal and external failures, and is appropriate corrective action implemented?				100	100
5.	Are test and inspection personnel trained in the procedures of their operations, and are those procedures being followed?				100	100
6.	Is the new product/technology/service, as produced by the processes, verified to meet all customer satisfaction requirements? TRIANGLE DOES NOT PERFORM PRODUCT DEVELOPMENT FUNCTIONS	X				

5.18 PRODUCT INSPECTION/FINAL AUDIT		STATUS				
	DESCRIPTION OF PROGRAM	Not Applicable	Not Started	Approach Developed	Percent Deployed	Percent Results
1.	Are final product acceptance procedures documented and followed?				100	100
2.	Are all specific customer product audits conducted, as required?				100	100
3.	Are inspectors trained for the tasks performed?				100	100
4.	Are flow charts or milestones developed with checkpoints readily available?				100	100
5.	Is a system in place which denotes inspection performed; e.g., use of initials, stamps, labels, bar codes, etc., affixed to production documentation?				100	100
6.	Is a quality system established and maintained for control of product/production documentation?				100	100
7.	Is “accept/reject” criteria defined and available for use?				100	100
8.	Is a final audit performed to ensure that all required verifications and tests, from receipt of materials through point of product completion, have been accomplished?				100	100
9.	Are packing and order checking procedures documented and followed?				100	100

COMMENTS

Production and inspection requirements and steps are listed on and defined by the production Traveler.

MIL-STD 105E based AQL, general inspection level II, single sampling plan, normal inspection only.

5.19 TOOLING INSPECTION, HANDLING, & STORAGE		STATUS				
DESCRIPTION OF PROGRAM		Not Applicable	Not Started	Approach Developed	Percent Deployed	Percent Results
1.	Are temperature, humidity, laminar flow controls in place to prevent contamination, and to assure dimensional stability?				100	100
2.	Do operators use hairnets, gloves & lab coats in all photolab and photoexposure areas?	X				
3.	Are work instructions and related forms in place to control all applicable tooling requirements, as stated in the customer's purchase order? Such requirements are noted on the shop Traveler				100	100
4.	Are customer provided artworks controlled with regard to handling, storage, revision control and relationship to converted production phototools (working films)?				100	100
5.	Are production phototools (working films) controlled with regard to handling, storage, use life, and relationship to customer purchase order?				100	100
6.	Are customer provided artworks and production phototools (working films) inspected, including dimensional checks?				100	100
7.	Are all tools, fixtures, and other devices, used for tooling inspection and control, maintained under the calibration control procedure?				100	100
8.	Are records showing initial acceptance, periodic checks, and any needs for rework and/or modification available?				100	100

5.20 CORRECTIVE ACTION		STATUS				
DESCRIPTION OF PROGRAM		Not Applicable	Not Started	Approach Developed	Percent Deployed	Percent Results
1.	Are final acceptance inspection results used for corrective and preventative action?				100	100
2.	Is root-cause analysis performed for non-conformances? This includes, but is not limited to, non-conformances (problems) caused by suppliers, found/caused "in-house" during processing, or those reported by the customer.				100	100
3.	Is positive action taken to prevent recurrence of problems, and are there documented reports/records of each occasion?				100	100
4.	Do procedures and systems provide for ensuring that replies are made to customer requests for correction action within the time limit specified?				100	100
5.	Is corrective action controlled and documented for all applicable work centers?				100	100
6.	When corrections are made, is their effectiveness subsequently reviewed and monitored?				100	100

COMMENTS

DATE COMPLETED
03/06/2014
Proprietary Information
Not for Disclosure

SECTION 6 (CHECK ONE IN EACH LINE THAT APPLIES)
MANUFACTURING HISTORY (See Section 2 Site Capability)

Please complete as many history profiles so that the total descriptions of products you manufacture account for production orders that reflect 70% of your business. History profiles are for board or board family (board types may be grounded together if they are similar).

BOARD TYPE	DATE OF ORDER	MATERIAL	HISTORY #
VIA TYPE	PRODUCTION QUANTITY	TOTAL YEARLY PRODUCTION %	

Dimensions in millimeters (inches in brackets)

BOARD			HOLES		
BOARD SIZE DIAGONAL	TOTAL BOARD THICKNESS	NUMBER CONDUCTIVE LAYERS	DIA DRILLED HOLES	TOTAL PTH TOL (MAX-MIN)	LOCATION TOL DTP
☐<250 [<10.00]	☐<1,0 [<.040]	☐1-4 [1-4]	☐>0,5 [>.020]	☐>0,250 [> .010]	☐**>0,50 [>.020]**
☐250 [10.00]	☐1,0 [.040]	☐5-6 [5-6]	☐0,5 [.020]	☐0,250 [.010]	☐**0,50 [.020]**
☐350 [14.00]	☐1,6 [.060]	☐7-8 [7-8]	☐0,4 [.016]	☐0,200 [.008]	☐**0,40 [.016]**
☐450[17.50]	☐2,0 [.080]	☐9-12 [9-12]	☐0,35 [.014]	☐0,150 [.006]	☐**0,30 [.012]**
☐550 [21.50]	☐2,5 [.100]	☐13-16 [13-16]	☐0,30 [.012]	☐0,125 [.005]	☐**0,25 [.010]**
☐650 [25.50]	☐3,5 [.135]	☐17-20 [17-20]	☐0,25 [.010]	☐0,100 [.004]	☐**0,20 [.008]**
☐750 [29.50]	☐5,0 [.200]	☐21-24 [21-24]	☐0,20 [.008]	☐0,075 [.003]	☐**0,15 [.006]**
☐850 [33.50]	☐6,5 [.250]	☐25-28 [25-28]	☐0,15 [.006]	☐0,050 [.002]	☐**0,10 [.004]**
☐>850 [>33.50]	☐>6,5 [>.250]	☐>28 [>28]	☐<0,15 [.006]	☒<0,050 [<.002]	☐**<0,10 [<.004]**
☒Other: 1524 [60”]	☒Other: 25.4 [1”]	☒Other: 47+	☒Other: .004”	☐Other:	☒**Other:** <.002”

CONDUCTORS						
INTERNAL ELEC CLEARANCE (MIN)	INTERNAL COND WIDTH (MIN)	INTERNAL PROCESS ALLOWANCE	EXTERNAL ELEC CLEARANCE (MIN)	EXTERNAL COND WIDTH (MIN)	EXTERNAL PROCESS ALLOWANCE	FEATURE LOCATION DTP
☐>0,350 [>.014]	☐>0,250 [>.010]	☐>0,100 [>.004]	☐>0,350 [>.014]	☐>0,250 [>.010]	☐>0,100 [>.004]	☐>0,50 [>.020]
☐0,350 [.014]	☐0,250 [.010]	☐0,100 [.004]	☐0,350 [.014]	☐0,250 [.010]	☐0,100 [.004]	☐0,50 [.020]
☐0,250 [.010]	☐0,200 [.008]	☐0,075 [.003]	☐0,250 [.010]	☐0,200 [.008]	☐0,075 [.003]	☐0,40 [.016]
☐0,200 [.008]	☐0,150 [.006]	☐0,050 [.002]	☐0,200 [.008]	☐0,150 [.006]	☐0,050 [.002]	☐0,30 [.012]
☐0,150 [.005]	☐0,125 [.005]	☐0,040 [.0015]	☐0,150 [.006]	☐0,125 [.005]	☐0,040 [.0015]	☐0,25 [.010]
☐0,125 [.005]	☐0,100 [.004]	☐0,030 [.0012]	☐0,125 [.005]	☐0,100 [.004]	☐0,030 [.0012]	☐0,20 [.008]
☐0,100 [.004]	☐0,075 [.003]	☐0,025 [.001]	☐0,100 [.004]	☐0,075 [.003]	☐0,025 [.001]	☐0,15 [.006]
☐0,075 [.003]	☐0,050 [.002]	☐0,020 [.0008]	☐0,075 [.003]	☐0,050 [.002]	☒0,020 [.0008]	☐0,10 [.004]
☐<0,075 [<.003]	☒<0,050 [<.002]	☒<0,020 [<.0008]	☒<0,075 [<.003]	☒<0,050 [<.002]	☐<0,020 [<.008]	☐<0,10 [<.004]
☒Other: .002”	☐Other:	☐Other:	☐Other:	☐Other:	☐Other:	☒Other: .002”

DATE COMPLETED
03/06/2013

SECTION 7

IDENTIFICATION OF PREVIOUS AUDITS (Optional)

Please complete as many forms as you feel reflect the intensity of your customer visits.

COMPANY AUDITORS	DATE OF AUDIT
AUDIT TEAM MEMBERS	AUDITOR REMARKS
	SPECIFICATIONS USED IN AUDIT
LENGHT OF AUDIT	
TEAM MEMBERS MAY BE CONTACTED AT	

COMPANY AUDITORS	DATE OF AUDIT
AUDIT TEAM MEMBERS	AUDITOR REMARKS
	SPECIFICATIONS USED IN AUDIT
LENGHT OF AUDIT	
TEAM MEMBERS MAY BE CONTACTED AT	

COMPANY AUDITORS	DATE OF AUDIT
AUDIT TEAM MEMBERS	AUDITOR REMARKS
	SPECIFICATIONS USED IN AUDIT
LENGHT OF AUDIT	
TEAM MEMBERS MAY BE CONTACT AT	

*REPEAT THIS FORM AS NECESSARY

SECTION 8

DATE COMPLETED
03/06/2014
Proprietary Information
Not for Disclosure

FINANCIAL REVIEW (OPTIONAL)

Please complete the following financial information that coincides with the company description and site information provided in section 1.

COMPANY FINANCIAL DESCRIPTION

LEGAL NAME Triangle Labs, Inc.		
TAXPAYER ID NUMBER Ask	Business License NUMBER Ask	TRADING SYMBOL n/a
ANNUAL SALES	PRIOR YEAR	YEAR-TO-DATE
FISCAL YEAR Coincides with calendar year		
BANK	ACCOUNT NUMBER	
BANK ADDRESS	STATE	ZIP
PROVINCE	COUNTRY	
BANK TELEPHONE NUMBER	FAX NUMBER	
COMMENTS		

SITE FINANCIAL DESCRIPTION

SITE NAME Same as above		
TAXPAYER ID NUMBER	DUNS NUMBER	TRADING SYMBOL
ANNUAL SALES	PRIOR YEAR	YEAR-TO-DATE
FISCAL YEAR		
BANK	ACCOUNT NUMBER	
BANK ADDRESS	STATE	ZIP
PROVINCE	COUNTRY	
BANK TELEPHONE NUMBER	FAX NUMBER	
COMMENTS		

SECTION 9
MQP ELECTRONIC EDITING

This MS Word template comes with editable fields. IPC has made this electronic document available for ease of completing, updating, and filing the MQP, as well as to give the laminate manufacturer and customer a common interface. Using the template enables laminate manufacturers to maintain several customer specific files without the endless stream of paperwork.

Editable fields are highlighted in gray. To complete the fields in the template, use the TAB key to toggle from field to field, entering the information as instructed in the introductory text for each section.

The developers of this MQP strongly suggest the person at the laminate manufacturing facility responsible for creating and maintaining the MQP write protect the file to be sent.