

1 Purpose

This document establishes basic Rantec Power Systems Inc. Quality Control requirements for the Rantec Suppliers (Seller) necessary to ensure that the supplier/services purchased from the Seller meet required quality levels.

2 Scope

This instruction applies to Rantec Power Systems Inc. procurement activities and Rantec Suppliers.

3 Supplier Responsibility & Applicable Requirements

It is the Seller's responsibility to comply with the requirements stated herein. **Sellers are required to meet both the General requirements in Section 6, and the pertinent specific purchased product requirements section (one of sections 7 thru 12).** The Section (paragraph) pertaining to these requirements are as follows:

Section 6 General Requirements

Section 7 Electronic Components

Section 8 Sub-Assemblies (i.e. Magnetics assemblies, CCAs, etc.)

Section 9 PWBs (PCBs)

Section 10 Hardware and Wire including Custom Metal Fabricated Parts *(Including Rantec design pins or molded pin assemblies)*

Section 11 Chemicals

Section 12 Conformal Coating

4 Reference Documents:

ISO 9001 / AS9100	Quality Standard
J-STD-020	Moisture/Reflow Sensitivity Classification for Non-hermetic Surface Mount Devices
J-STD-033	Standard for Handling, Packing, Shipping, and use of Moisture/Reflow Sensitive Surface-Mount Devices
IPC-6012	Qualification and Performance Specification for Rigid Printed Boards
ISO/IEC 17025	General Requirements for the competence of testing and calibration laboratories
IPC-CC-830	Qualification and Performance of Electrical Insulating Compound for Printed Wiring Assemblies
NAS 412	Foreign Object Damage/Foreign Object Debris (FOD) Prevention
MIL-HDBK-263	ESD Control Handbook for Protection of Electrical and Electronic Parts
ANSI/ESD S20.20	Protection of Electrical and Electronic Part, Assemblies and Equipment
MIL-I-46058C	Insulating Compound (for Coating Printed Circuit Assemblies)

5 Definitions

Seller: means the vendor/supplier or distributor performing the work/supplying materials, parts assemblies, subassemblies, and systems or services pursuant to the purchase order.

Buyer: means Rantec Power Systems Inc. (subsequently referred to as Rantec), issuing the purchase order (physically or electronically) which invokes this document.

FOD: Foreign Object Debris

ESD: Electrostatic Discharge

MSL: Moisture Sensitivity Level. For all non-hermetic SMD packages subject to bulk solder reflow processes during PCB assembly, including plastic encapsulated or moisture permeable packages, a MSL number should be assigned indicating the part's storage needs. Reference J-STD-020 and J-STD-033.

6 General Requirements

The general requirements described in this section apply to Sellers for all Purchase Orders.

6.1 Approval of Products and Services

The supplier shall ensure approval of products, services, methods or processes comply with the requirements of the purchase order including referenced documents, drawings, specifications, standards, and this flow-

down document (OI 742-02). The supplier's quality system shall also ensure release of its products and services are approved after effective verification of conformance to purchase order requirements.

Rantec customer requirements required to be flowed down to Rantec suppliers that are not included in this document (OI-742-02) will be indicated in the "notes" of the Purchase Order.

Where a "Key Characteristic" (KC) is flowed down to the supplier by Rantec drawing or purchase order document, the KC shall be verified by 100% inspection or test, or as specified to the extent allowed by applicable standard (e.g. IPC-6012 for PWBs).

Test or inspection specimens required by "notes" in the P.O. or by sub-paragraphs in this document (such as in sub paragraph 9.5) shall be provided by the supplier (seller).

No repair or rework outside of the specific specification limits shall be allowed without prior approval from Rantec.

The supplier (seller) shall ensure its employees (persons) are aware of their contribution and responsibility for the following:

- Their contribution to product or service conformity to requirements.
- Their contribution to product safety.
- The importance of ethical behavior.

Interactions with Rantec - Conflicting or Unclear Requirements and Verification of Revision Status

The primary point of contact at Rantec is the Rantec buyer. The Rantec buyer shall be included in all communications (emails) regarding cost, schedule and compliance to product quality requirements. The supplier shall notify Rantec buyer to resolve any unclear or conflicting requirement(s) in Rantec Drawings, design data (i.e. Gerber or solid works data), or purchase order. This requirement includes any process incompatibility with specified design criteria. Supplier shall not proceed until clarification or resolution is obtained from Rantec.

Verification of revision status: For purchased product that must meet Rantec specification, drawing, process requirement, or verification instructions, the supplier shall verify the Rantec specification or drawing revision matches the revision indicated in the purchase order (P.O.).

6.1.a Order of Precedence

When a conflict exists between the requirements stated herein (OI 742-02), the rest of the Purchase Order (P.O.), or the Rantec drawing; the order of precedence is as follows:

1. The Rantec Purchase Order (P.O.)
2. The Rantec supplied part number drawing
3. Quality Control Requirements for Rantec Suppliers (OI 742-02)
4. Reference Documents in paragraph 4 above.

6.2 Control and Monitoring of Rantec Suppliers

Rantec monitors supplier quality and delivery performance. Depending on the level of control necessary for the purchased product or service, the supplier may receive from Rantec defect rate and/or on-time delivery performance data for which an expectation of improvement is required.

6.2.1 Change Notification Policy – Manufacturer Specified Product

When Rantec procures from manufacturer with design authority (i.e. Rantec procures to manufacturer's data sheet (specification) or procures "off the shelf" standard product), the manufacturer shall notify Rantec of design, process, material, supplier, or manufacturing facility changes that may affect "form, fit, function" or compatibility with next level processing including industry recognized soldering or cleaning processes. For PWB fabricators, see section 9 for Change Control requirements. For product purchased by Rantec from the supplier's data sheet or catalog, the supplier shall notify Rantec of facility relocation, or major changes that require a change to the supplier's data sheet or catalog for that product.

Unless written approval is provided by Rantec, part substitution is not allowed.

6.3 No Change Policy & Design and Development Configuration Control for Rantec Specified Product

For purchased items that must conform to Rantec design data, (i.e. drawing, SCD, specification, Gerber or solid works data), including product manufactured from supplier assembly documentation developed from Rantec design data; no change to design, processes or material shall be implemented by the supplier without written approval from Rantec Power Systems Inc.

Unless written approval is provided by Rantec, part substitution is not allowed.

6.4 Counterfeit Parts Prevention

All suppliers or distributors shall guard against the use of and delivery of “counterfeit” parts or components to Rantec. The supplier shall ensure that only new materials are used in products ultimately delivered to Rantec Power Systems Inc.

A “counterfeit” part is defined as: A suspect part or material that is found to be a copy or substitute without legal right or authority to do so or one whose material, performance, or characteristics are knowingly misrepresented by a supplier in the supply chain. Parts which have been refinished, up-screened, or up-rated and have been identified as such are not considered counterfeit.

When the supplier discovers counterfeit parts, the supplier shall quarantine the counterfeit parts or suspect counterfeit parts and report the detection. The supplier shall prevent the escape of counterfeit parts delivered to Rantec. When counterfeit parts are discovered to have escaped to Rantec, the supplier shall notify Rantec as soon as possible or within 5 workdays of the discovery.

For product to be delivered to Rantec, the supplier shall only use components, parts and material directly from the Original Component Manufacturer (OCM) or a Franchised Distributor of the OCM. Only the part manufacturer described in the part data sheet or specification shall be selected for delivery to Rantec. Any departure from the manufacturer called out in the part documentation shall require written approval from Rantec prior to delivery.

In addition to certifying product delivered complies with purchasing order or agreements, a certificate of conformance establishing Traceability to the OCM or its Franchised Distributor shall accompany the shipment of electronic parts and assemblies with electronic parts to Rantec.

Electronic parts may not be purchased from Brokers (non-OCM or a non-Franchised Distributor of the OCM) without written consent from Rantec. Written consent will require testing verification that the non-OCM part proposed is equivalent to the part called out by the part data sheet or specification.

To support the avoidance of counterfeit parts, when requested by Rantec suppliers shall support information requests originating from GIDEP Alerts and Advisories.

6.5 Supplier (Seller) Quality System

- As a minimum, the supplier shall maintain a quality system that assures all products and services provided to Rantec conform to contractual requirements. The supplier’s quality system shall perform sufficient inspection and tests to assure conformity to requirements; as well as identify, control and prevent escape of nonconforming product to Rantec.
- Compliance to applicable industry QMS standard such as ISO 9001, AS9100 (aerospace), AS9120 (distributors), ISO/IEC 17025 (calibration services) is desired.
- Rantec Power Systems Inc. reserves the right to review supplier’s quality system by on-site surveillance.

6.5.1 The use of statistical techniques for Product Acceptance

When manufacturing of the supplied product cannot be 100% inspected of tested Statistical Process Control (SPC) techniques to minimize variation in production are required.

6.6 Supplier Personnel Competence

Competence and training level of supplier personnel shall be appropriate to achieve compliance to product requirements as specified in the P.O. including those requirements stated in P.O. referenced drawings, specifications, or standards. If applicable, specific personnel qualification requirements may be included in the purchase order or sub-contract.

The supplier shall have established processes that ensure the employees have the requisite training before undertaking work in support of this P.O.

For special processes the supplier shall maintain records of training and certification and make the records available for review by Rantec quality representative upon request.

6.7 Certificate of Conformance (C of C)

A certificate of conformance (C of C) attesting that product or service provided conform to the P.O. requirements must be delivered with each shipment. The C of C shall state the parts or material delivered comply with the requirements contained in the following, as applicable:

- Purchase order,
- Specification,
- Drawing,
- Supplier Data Sheet as mutually agreed between the supplier and Rantec.

When a Certificate of Conformance is attesting to compliance of requirements found within a Military Specification (MIL-STD, MIL-C, MIL-PRF, etc.) and that specification contains reference to using materials found on the Qualified Products List (QPL), a certification for the raw material must accompany the C of C pertaining to the Military Specification. The QPL is accessible via internet at qpldocs.dla.mil.

While not specifically mentioned in the C of C statement, the supplier's C of C also serves to certify the components, parts or material delivered, are in fact from the Original Component Manufacturer (OCM) or the OCM's Franchised Distributor identifying the OCM as the source of the component, parts or material. When an OCM's Franchised Distributor supplies the parts to Rantec, the Franchised Distributor's C of C must also state the parts delivered are traceable to the Original Component Manufacturer. The C of C must be signed by someone, (typically in the supplier's Quality Assurance department or someone designated by the supplier's organization), authorized to certify compliance.

6.8 Hazardous Material

Components, parts and material delivered to Rantec shall be free of compounds containing mercury, beryllium, cadmium, and chromium.

6.9 Nonconformance Notification

The Seller shall notify the Buyer if there may be a nonconformance to form, fit, function, or issue with usability or reliability problem with product or material that has already been delivered. Seller (supplier) shall not knowingly ship non-conforming material or product without written authorization from Rantec.

6.10 Failure Analysis and Corrective Action Minimum Requirements

The Seller agrees to conduct failure analysis, investigation of root cause and corrective action for parts, materials or assemblies delivered that have failed during Rantec testing or failed at Rantec's customer or field use. Seller shall provide timely replies to Rantec Non-conforming Material Report (NCRM), Corrective Action Request (CAR), or Supplier or Outside Lab Failure Analysis Request (SOLFAR). Non-response or late responses may limit approval status for future business with Rantec Power Systems Inc. As a minimum Root cause and corrective action response submittals should include Containment statement, Root Cause Statement and Corrective Action taken.

Corrective action response is required when the Supplier is notified of a product quality issue, typically communicated thru an NCRM. The corrective action is intended to provide Rantec a enough assurance all potential causes/risk have been identified and supported by facts, along with a solution corrective action that prevents recurrence.

Containment

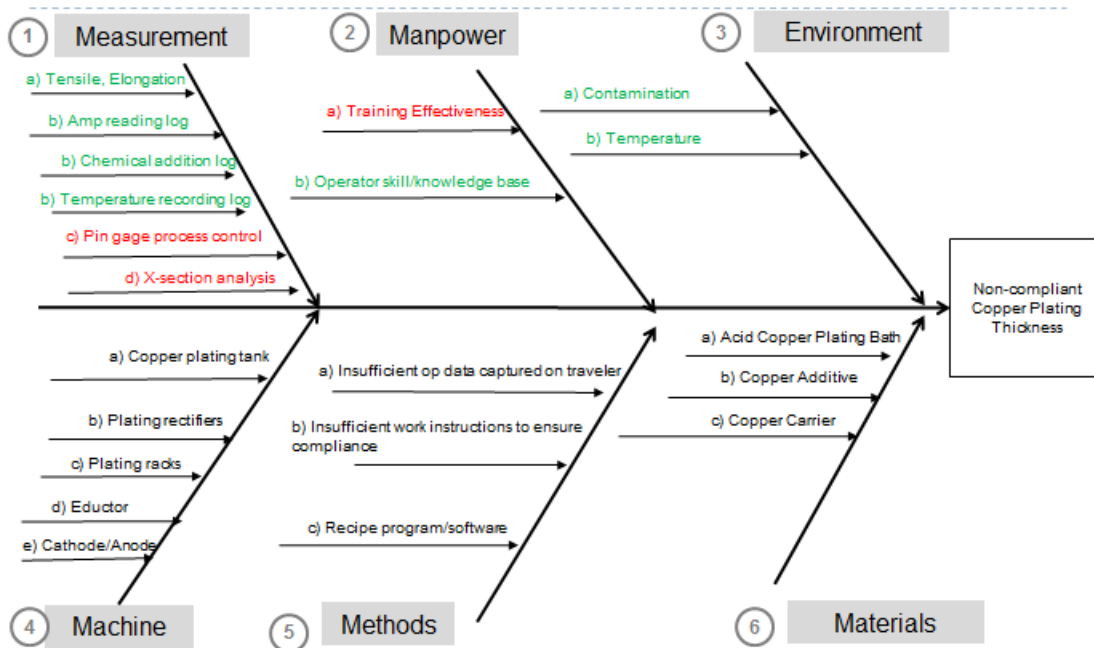
- Verify inventory, stock and WIP to determine if other Rantec product maybe at risk,
- Verify whether any other affected product maybe in transit,
- Quarantine all potential product determine to be at risk,
- When requested provide summary of the above actions.

Root cause analysis Identify all potential causes and attach supporting facts / justification; fishbone diagram, 5 whys, etc., and identify root cause for both:

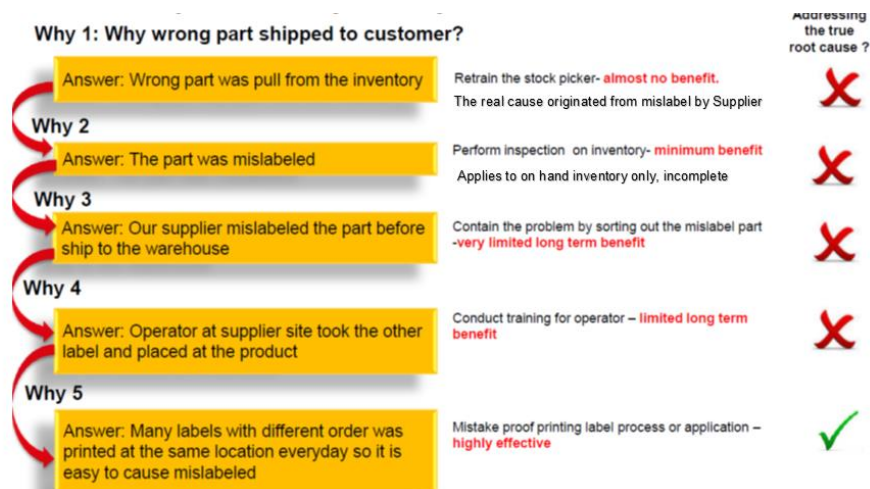
- Occurrence (why it occurred?)
- Detection (Why it was not be detected?)
- Ensure all historical records, data, etc. are reviewed/assessed. Provide root cause analysis statement-

Suggested examples of Root Cause analysis tools are “Cause & Effect” or “Fishbone” Diagram and the “5 – Why” approach. The “Fishbone Diagram” is best for when there are more than 1 contributing causes. 5 Why’s is designed for identifying root cause of a single contributing cause

Example of Fishbone Diagram



Example of 5 Why's



Corrective Action: Provide corrective action statement

6.11 Right of Access - Surveillance

The Buyer, customer, and/or regulatory agencies shall have the right of entry to Seller premises and access to applicable processes and areas of all facilities at any level of the supply chain to perform assessments necessary to ensure conformance to the requirements stated herein. The Buyer may conduct a survey and/or perform surveillance of the Seller's quality control system to evaluate the degree of ability to comply with these and other applicable requirements. When indicated in the P.O. Rantec reserves the right to impose source inspection at Seller's facility prior to shipment.

6.12 Seller Flow – Down Requirements

The Seller is responsible for conformance with all requirements accepted on the PO and these quality requirements. The Seller shall assure proper flow down to Seller's sub-tier suppliers all the applicable requirements contained herein.

6.13 Foreign Object Debris (FOD) Prevention

All parts and materials intended for Buyer shall be delivered free of FOD.

The Seller shall establish and maintain an effective Foreign Object Damage (FOD) Prevention Program to reduce FOD using NAS 412 as a guideline. The Seller's program shall utilize effective FOD prevention practices. The program shall be proportional to the sensitivity of the design of the product(s) to FOD, as well as, to the FOD generating potential of the manufacturing methods. The written procedures or policies developed by the Seller shall be subject to review and audit by Rantec and/or Rantec customer or government representative and disapproval when the Seller's procedures or policies do not accomplish their objectives. The Seller shall establish a FOD prevention program that directs the Seller's organization to ensure the following:

- A written FOD prevention procedure established by the Seller, that includes:
 - With the exception of packing and shipping ferrite cores, styrofoam or packing peanuts shall not be used as packaging for any other item.
 - Daily FOD audits/checks, including the maintaining of records of FOD audit results.
 - FOD metrics (such as FOD audit score tracking) to generate FOD prevention improvement activity.
 - FOD awareness captured in work instructions.
 - FOD awareness and prevention training including regularly scheduled refresher training.

6.14 Preservation and Packaging

All parts and material intended for Buyer shall be protected against the usual hazards of ESD, corrosion, contamination, deterioration, or other spoilage at the Seller's facility and in transit. All material intended for Buyer shall be packed with suitable protection so as to prevent damage through handling, during storage at the Seller, in transit, and during storage at Buyer's facility before use. The Seller's handling, preservation, packaging and delivery processes shall contain provisions to prevent FOD.

6.15 Shipping Method/Carrier

Seller shall use shipping method or carrier as stated in Purchase order. Seller departure from shipping method/carrier as stated in Purchase Order releases Rantec (Buyer) from payment of shipping costs.

6.16 Control of Records

The Supplier shall retain written objective evidence of hardware conformance to Purchase Order requirements for each shipment. All such records are subject to review and/or audit by Rantec. When generated during the build of the part(s) the following written records shall be retained for a minimum of 7 years:

1. Inspection and test records used to determine item conformance
2. Reports/certifications of chemical and/or physical analysis/test records that assure conformance to applicable specifications
3. PWB coupon or actual board cross-sections ("pucks") shall be retained for a minimum of 5 years (Ref: paragraph 9.5)
4. First Article Inspections/Tests (FAITs)
5. Special process certifications
6. Build documentation (i.e. travelers, work order travelers, etc.), parts & material traceability information

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Suppliers shall not destroy any of the records for Rantec product defined above without giving Rantec 30 days prior notice.

6.17 First Article Inspection/Test

When indicated on the Purchase Order, Seller shall perform First Article Inspection (FAI) and furnish a First Article Inspection Report, to include actual dimensions, characteristics, test results, and verification of drawing notes in accordance with the drawing and/or specifications required by the Purchase Order. Material certifications and any special process certifications shall be submitted as part of the FAI documentation package. A copy of the FAI Report is to be included in the shipment and all first article pieces shall be identified as such in the shipment to Rantec.

FAI will be recorded on AS9102 Forms 1, 2 and 3..

FAI will be repeated after a change to Design, Material, Production Location, or Process, which affects product form fit or function. Rantec will order new FAI when Rantec initiates changes.

6.18 Obsolescence

Seller notify Rantec buyer at such time seller becomes aware of a manufacturer's plans to discontinue component(s). Notification shall include recommendations of alternate parts if available and last buy timeline(s).

6.19 Electrostatic Control Plan

Suppliers providing static sensitive items or performing a service to static sensitive items must take necessary precautions to ensure these items are protected from electrostatic charges. Additionally, suppliers are required to have an ESD Control Program available for review. It is recommended the ESD Control Program follow the guidelines of MIL-HDBK-263 (ESD Control Handbook for Protection of Electrical and Electronic Parts) or ANSI/ESD S20.20 (Protection of Electrical and Electronic Parts, Assemblies and Equipment).

6.20 ITAR and Export Control compliance

Technical documents/data provided by Rantec Power Systems Inc. is restricted, and the distribution of technical documents/data shall be controlled. Rantec technical documents/data shall not be furnished, disclosed to, copied or used by non-US persons. Also see: Part II for P.O.s Terms and Conditions for suppliers described in Rantec Power Systems Inc. website www.rantec.com.

6.21 Age Limited Material

The Seller shall maintain a system for age control items where acceptability or usability of the item is limited by maximum age. The system shall include a method of identifying and controlling such items.

Each shipment of material that contains a finite shelf-life shall include documentation that identifies the expiration date of the material. Age limited material shall have at least 75% minimum shelf-life remaining at the date of receipt at Rantec.

6.22 Special Processes

A special process is defined as any process for production or service, where the resulting process output cannot be verified to be compliant by subsequent inspection, testing or measurement and as a consequence, deficiencies become apparent only after the product is in use or the service has been delivered.

Examples of special processes are, but not limited to: chemical processing such as plating, painting, welding, brazing, or heat treating. Special processes are applicable to commodities such as fabricated metal parts (see paragraphs 10.4 and 10.7 for additional requirements).

When the (Seller) or Seller's supplier or sub-tier supplier performs a special process, the special process shall be performed by a NADCAP-accredited chemical processor. Any other processors may only be used per Rantec direction or approval. See also commodity specific requirements in Sec 7.0 – 12.0 of this document.

For Certificate of Conformance (C of C) requirements, refer to section 6.2.2

For special processes the supplier shall maintain records of training and certification and make the records available for review by Rantec quality representative upon request.

6.23 Calibration

Seller shall be responsible for validating the accuracy and stability of tools, gages, and test equipment used to demonstrate that items conform to the Purchase Order. Traceability of calibration equipment and gages shall be to National Institute of Standards and technology (NIST) which is in accordance with ANSI/NCSL-Z-540-1 or ISO 10012:2003 unless otherwise stated in P.O. Upon request, objective evidence of calibrations shall be recorded and made available for Rantec representative review. In addition, shall be ISO/IEC 17025 compliant.

6.24 Conflict Minerals

Rantec expects its suppliers to partner and comply with the reporting requirements set forth in the SEC Conflict Minerals Reporting Rule. Specifically, Rantec expects that its suppliers will:

- Work with their own upstream suppliers to identify the chain of custody for any conflict minerals (Including the smelter, country of origin, mine location and status of any conflict minerals that may be present)
- Cooperate with Rantec in connection with any due diligence (or additional due diligence) that Rantec chooses to perform with respect to its country of origin inquiries
- Provide, upon request by Rantec, reasonable proof of the due diligence performed by the supplier to support any country of origin/sourcing certification provided to Rantec
- And as needed, assist Rantec to identify opportunities to source DRC conflict mineral free materials

Conflict Minerals includes Tantalum, Tin, Tungsten or Gold (3TG) which originates in the Democratic Republic of the Congo (DRC) or an adjoining country. Rantec requires suppliers to be DRC conflict – free. Rantec suppliers whose product contains 3TG are required to conduct a reasonable effort to ensure the sourcing of 3TG be sourced from DRC conflict – free smelters.

6.25 Prohibition on Contracting for Hardware, Software and services developed or provided by Kaspersky and other covered entities.

For parts, material and services provided to Rantec, Seller is prohibited from using Kaspersky Lab and other covered entities. Reference FAR 52.204-23.

6.26 Supplier Control of Work Transfer

Prior to changing location of production, supplier will notify Rantec and provide a plan for the work transfer. Rantec will review and approve the work transfer prior to production move. The work transfer plan will include, but not be limited to, the following topics:

- Material traceability
- Equipment, Materials, Personnel needed
- ESD/Environment, as applicable
- Material handling & product packaging between factories
- Process Control - review of Production Routers
- Quality Control - review of Inspection and Test Gates
- First Article Inspection
-

6.27 Work Order Translation

- Suppliers that have sub-tier suppliers in non-English speaking countries must have work instructions with side-by-side translations in English and the foreign language. As applicable, tables and figures must be translated as well.

7 Electronic Components

Resistors, capacitors, ICs, diodes, transistors, optocoupler, PWMs, controllers, FETs, transorbs, LEDs, fuses connectors, electrical contacts & pins, solid state relays, etc.

7.1 Plating & Tin finishes – Tin Whisker mitigation

When tin-plating with no lead (Pb) is used, only Matte-tin finish, preferably with a nickel underplate is allowed. In the matte tin finish there shall not be bright tin and no brighteners shall be used. When Rantec drawing is specified, the finish requirement specified on the Rantec Drawing takes precedence.

7.2 Solderability

Solderability is the ability of a metal to be wetted (wetted: formation of a relatively uniform, smooth, unbroken and adherent film of solder to a basis metal) by molten solder.

The to-be-soldered-to surfaces of product delivered to Rantec Power Systems Inc. such as components, discrete devices, sub-assemblies, transformers, inductors and PWBs, shall be able to meet appropriate solderability testing as specified in J-STD-002 Category 3.

7.3 Traceability (Date Codes/Lot Numbers)

The Seller shall provide date of manufacture date code(s) and, if applicable, lot numbers on the Seller's component body (when feasible), packing slip, reel, container or packaging.

7.4 Moisture Sensitivity Level (MSL):

For all non-hermetic SMD packages subject to bulk solder reflow processes during PCB assembly, including plastic encapsulated or moisture permeable packages, when the MSL number for the part is known by the Seller, Rantec requests the MSL number be indicated on the reels, packing slip, or packaging container.

8 Sub-assemblies

Transformers, Inductors, chokes, coil/core assemblies, Circuit Card Assemblies (CCAs), pin header assemblies, relay assemblies, connector assemblies, filter assemblies.

8.1 Soldering Assemblies – Tin Whisker Mitigation

When soldering assemblies such as circuit card, magnetic, or filter assemblies to be delivered to Rantec Power Systems Inc., tin/lead solder with Pb content greater than 3% shall be used. Lead free solder shall not be used.

8.2 Solderability

Solderability is the ability of a metal to be wetted (wetted: formation of a relatively uniform, smooth, unbroken and adherent film of solder to a basis metal) by molten solder.

The to-be-soldered-to surfaces of product delivered to Rantec Power Systems Inc. such as components, discrete devices, sub-assemblies, transformers, inductors and PWBs, shall be able to meet appropriate solderability testing as specified in J-STD-002 Category 3.

8.3 Soldering Acceptance Criteria

Soldered assemblies (e.g. Magnetics, Circuit Card Assemblies, connector assemblies, etc.) shall meet the acceptance criteria of IPC-A-610 Class 3.

9 Printed Circuit Boards (PCBs, PWBs)

Printed circuit boards, printed wiring boards, "metal" PWBs, coil boards.

9.1 PWB Design Requirement

PWBs shall be designed to meet the requirements of IPC-2221 Class 3, Level C. In the event of conflict between Rantec Drawing (including related electronic board files), and IPC-6012 requirements, the PWB supplier shall contact Rantec engineering for resolution before proceeding.

In the event of conflict between the Rantec Fab Drawing and the Rantec electronic board files, the Fab drawing takes precedence.

9.2 PWB Fabrication Requirement

For rigid printed wiring boards the qualification and performance requirements shall meet the requirements of IPC-6012 Class 3. Where the requirements of IPC-6012 Class 3 and/or drawing cannot be met, approval by Rantec in the form of an ECN and formal release of the new drawing, gerber data, etc. is required. Emails are unacceptable forms of approval and shall not be used for the purpose of manufacturing or final product acceptance.

- Supplier shall ensure any drawing/gerber tolerance changes required to support manufacturability shall be submitted for review and approval by Rantec's Engineering organization.

9.3 Finish Requirements for Metal-Backed Boards

Unless otherwise directed by drawing or purchase order, Rantec boards with metal backing do not require chemical finish to be performed by a NADCAP- accredited Special Processor.

9.4 Supplier Change(s) Control

The Supplier shall notify Rantec prior to implementation/execution of any of the following changes.

- Plating tank equipment, lamination equipment, Drill/Routing machines, imaging equipment

9.5 PWB First Article Requirements

A listing of PWB data submission requirements are as follows:

- SAE AS9102 First Article Inspection Report (FAIR – Forms 1 thru 3)
- Rantec Cross-Section Analysis Report with coupon samples for all panels X & Y (as specified by paragraph 9.6), plus a cross-section from the center of the panel (coupon or board acceptable)
- Solderability Test Report
- Electrical Test Certificate, Electrical Integrity: Continuity, Open/Short Test
- Material Certificates of Conformance
- Supplier Certificate of Conformance

9.6 Cross-Section / Micro-Section Requirements

The Supplier shall ensure cross section analysis is performed on each PWB lot and includes at minimum an "X" and "Y" sample for each via/hole structure of each panel manufactured. The Supplier shall utilize IPC-6012 Class 3 for coupon/cross section requirements and determining product acceptance, unless otherwise noted on the drawing.

- PCBs shall identify at minimum the associated panel number and preferably the board location within the panel, as defined in IPC-6012. The panel number identification shall be marked on the board in an unpopulated area, unless otherwise designated by Rantec to ensure traceability on the fully assembled board.
- Rantec drawing/notes shall be the primary source for determining acceptability of cross-section results.
- Supplier's C of C and test data shall be included with each shipment.
- Physical samples required for each PWB lot shipped to Rantec shall include one set of coupons and cross-section pucks for all panels. Cross-section samples shall include one set of X & Y at minimum (example: 10 panels manufactured for 1 lot = 20 cross-section samples).
- The Supplier shall utilize the Rantec Cross-Section Report Template for documenting all cross-section measurement results, unless an alternative/comparable Supplier template has been reviewed and approved by Rantec, see Attachment I. Single and double-sided boards shall be the exempt based on no internal layers and low risk.
 - Cross-section report records (Ref: paragraph 6.16 Control of Records) shall include at minimum the following measurement, as stated in IPC-6012 Class 3, and as applicable to each PWB design:
 - Annular Ring Internal & External
 - Thru Hole Plating Thickness

- Blind Via Wall Thickness
 - Copper Wrap Thickness
 - Copper (oz) Thickness for each layer
 - Dielectric Thickness for each layer
 - Base Metal (aluminum, etc.)
- Copper thickness shall be expressed in decimal points (example: 3 oz copper = 0.0036/34 respectively) and comply with IPC-6012, 3.6.2.14 & 3.6.2.15 Table:

Copper Weight in oz.	Minimum Copper Thickness after Plate-up Processing	Minimum Copper Foil Thickness after Processing
½ oz	0.0006	0.0004
1 oz	0.0012	0.0010
2 oz	0.0024	0.0022
3 oz	0.0036	0.0034
4 oz	0.0048	0.0046

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Standard Production Cross-Section Deliverables (after successful First Article):

- All measurement data shall be submitted to Rantec no more than two days after the shipment date, see Attachment II, Example 1.

9.7 PWB Solderability

Solderability testing shall be performed on each PWB lot in accordance with J-STD-003.

9.8 PWB Conductor Width

The finished PWB conductor widths shall meet the Rantec design data (drawing or gerber data).

9.9 PWB Inner layer Thickness

The finished PWB inner layer dielectric thickness shall meet Rantec design data (Gerber data and Drawing).

9.10 PWB Traceability

The finished PWBs shall be marked such that they are traceable to the panel that they came from (“serialization”).

Boards shall be grouped and packaged for shipping by panel number. The internal packaging shall be marked with the appropriate panel number to ensure clear identification and verification against the cross-section report/results.

10 Hardware & Wire (Including Rantec-designed metal fabricated parts, pins and molded pin header assemblies)

10.1 Burrs and Sharp Edges

Fabricated parts shall be free of all burrs and sharp edges.

10.2 Helical Wire Insert Requirements

When using tanged helical wire inserts, after installation of the helical wire insert the tang must be removed. Tangs left inside can be a source of FOD and/or cause interference when installing screws.

10.3 Cleanliness

Parts shall be cleaned adequately to remove any visual evidence of residues or contaminants. All surfaces shall be free of contaminants introduced during deburring, polishing or other processing.

10.4 Rantec Custom-Designed Pins or “Molded Pin-Header Assemblies”:

Parts or assemblies made from or controlled by a Rantec drawing. Includes: Rantec custom pins or “molded pin header assemblies” made from a Rantec drawing.

Tin/lead pin plating or finishing shall be performed by any one of the following:

- Electronic Precision Specialties Inc. (EPSI) in Brea, CA
- Hudson Plating Works, Inc. in Moorpark, CA
- Other Rantec directed processor (directed in writing from Rantec)
- Rantec customer-directed processor (directed via Drawing or Purchase Order)

10.5 Strip & Re-plate

Stripping and re-plating pins is not allowed by Rantec. The supplier shall not use stripped and re-tinned pins.

Screws nuts, bolts, bobbins, insulation/sleeving, spacers, wire.

10.6 Restriction on acquisition of Domestic Specialty Metals

Compliance to Defense FAR Supplement (DFARS) 252.225-7008 and 7009, is required for this purchase order or any delivery to Rantec of product containing “Specialty Metals” as defined by DFAR 252.225-7008 and 7009. This requirement, DFARS 252.225-7008 and 7009; must be flowed down into subcontracts and purchase orders at every tier. Seller shall not knowingly ship non-DFARS conforming material or product without written authorization from Rantec Power Systems Inc.

10.7 Metal-Fabricated Parts

Examples of fabricated metal parts include (but are not limited to) chassis, baseplates, heatsinks, covers, enclosures, assembly tools and fixtures which are made from a Rantec drawing.

Suppliers of fabricated metal parts shall ensure that materials and chemicals used, including those from their sub-tier suppliers of primer, paint and/or chem-film services, use only primer, paint and/or chem-film that is from, and clearly listed on, the applicable Qualified Parts List (QPL) or listed in the applicable Qualified Parts Database (QPD).

Primer, paint and/or chem-film from sub-tier suppliers that are pending or still waiting to be added to the applicable QPL or be listed in the applicable QPD, are not allowed to be used on products for Rantec.

Deviation from the above requirement requires written approval from Rantec representative.

11 Chemicals

Adhesives, Coatings, Encapsulant, epoxies, bonding/staking material, solvents, alcohol, cleaning agents, chromate coatings, etc.

11.1 Shelf Life – Age Controlled Material

The supplier shall identify all materials that have definite characteristics of quality degradation with age and/or environment. The supplier shall affix this information directly on the material container and include it on the certification (C of C) document. This information shall indicate the date useful life was initiated and the date at which life will be expended. When environment is a factor in determining useful life, the identification shall include storage conditions or requirements. A minimum of 75% of the applicable shelf life shall remain upon receipt of the material by Rantec or the material is subject to rejection and return to the supplier for replacement.

11.2 PentaBDE and OctaBDE

Products delivered to Rantec Power Systems Inc. shall not contain concentrations of Pentabromodiphenyl ether (PentaBDE) or Octabromodiphenyl ether (OctaBDE) higher than 0.1% by mass. The supplier shall disclose to Rantec the existence of these materials contained in the product prior to actual delivery.

11.3 European Union Restriction on Hazardous Substances (RoHS) Listed Materials

Unless explicitly described in purchase order, the following requirement does not apply to solder or soldered assemblies. Products delivered to Rantec Power Systems Inc. shall not contain materials listed in the European Union (EU) Directive 2002/95/EC (RoHS) in concentrations beyond allowable de minimus amounts including 0.1% by weight in homogeneous materials for lead, mercury, hexavalent chromium, polybrominated biphenyls (PBB) and polybrominated diphenyl ethers (PBDE) and 0.01% by weight in homogeneous materials for cadmium. Homogeneous material means a material that cannot be mechanically disjointed into different materials. This requirement applies to all materials listed in the EU directive as amended.

11.4 European Union Registration, Evaluation, Authorization and Restriction of Chemicals (REACH)

Unless explicitly described in purchase order, the following requirement does not apply to solder or soldered assemblies. Products delivered to Rantec Power Systems Inc. shall not contain materials identified as Substances of Very High Concern (SVHC) by the European Chemicals Agency pursuant to EU Regulation (EC) No. 1907/2006 in concentrations above 0.1% by weight in homogeneous materials. Because of the evolving nature of that regulation, suppliers are advised to consult the current SVHC list at www.echa.europa.eu.

12 Conformal Coating

Type XY Paraxylylene (parylene) conformal coating.

Conformal Coating shall be performed in accordance with the requirements of J-STD-001 and compliant with IPC-CC-830 and meet acceptance criteria of IPC-A-610, class 3 and MIL-I-46058C.

12.1 Cleanliness Testing

For all printed circuit board assemblies that do not contain Thermstrate thermal interface material, periodic testing of ionic residues prior to conformal coating shall be conducted on a random sample basis to ensure the adequacy of the cleaning process(es). Ionic residue shall be evaluated using Zero-Ion ionic contamination tester and contamination shall be less than 37 micrograms/in² sodium chloride (NaCl) equivalent ionic residue.

Attachment I Cross Section Template Example 1

Rantec Coupon Sample Microsection Report

Chart Sample	Annular Ring (internal)	Annular Ring (external)	Hole Copper Plating	Copper Wrap	Blind Via Wall Thickness	Layer1		Layer2		Layer3		Aluminum	Pass / Fail	
#	Sample					3 OZ Copper	Dielectric	2 OZ Copper	Dielectric	1 OZ Copper	Dielectric			
1	Panel 1	0.01950	0.01800	0.00180	0.00360	0.00380	0.00560	0.00500	0.00300	0.00680	0.00750	0.00680	0.03600	Pass
2	Panel 2	0.02520	0.01720	0.00180	0.00360	0.00390	0.00620	0.00590	0.00270	0.00740	0.00750	0.00630	0.03600	Pass
3	Panel 3	0.02370	0.01800	0.00200	0.00360	0.00380	0.00630	0.00500	0.00440	0.00650	0.00750	0.00600	0.03600	Pass
4	Panel 4	0.02570	0.01930	0.00200	0.00360	0.00230	0.00680	0.00700	0.00650	0.00590	0.00210	0.00660	0.03600	Pass
5	Panel 5	0.02600	0.01800	0.00160	0.00360	0.00410	0.00440	0.00560	0.00380	0.00530	0.00180	0.00690	0.03600	Pass
6	Panel 6	0.02280	0.01630	0.00180	0.00360	0.00320	0.00590	0.00500	0.00330	0.00620	0.00270	0.00830	0.03600	Pass
7	Panel 7	0.02250	0.01630	0.00180	0.00360	0.00300	0.00590	0.00560	0.00300	0.00650	0.00210	0.00660	0.03600	Pass
8	Panel 8	0.02130	0.01950	0.00240	0.00360	0.00380	0.00650	0.00530	0.00300	0.00590	0.00240	0.00890	0.03600	Pass
9	Panel 9	0.02220	0.01950	0.00440	0.00360	0.00300	0.00740	0.00530	0.00330	0.00650	0.00440	0.00680	0.03600	Pass
10	Panel 10	0.01923	0.02219	0.00444	0.00360	0.00325	0.00621	0.00592	0.00410	0.00592	0.00355	0.00829	0.03600	Pass
11	Panel 11	0.01509	0.02012	0.00296	0.00360	0.00325	0.00503	0.00621	0.00325	0.00621	0.00296	0.00829	0.03600	Pass
12	Panel 12	0.01775	0.02160	0.00237	0.00360	0.00237	0.00385	0.00562	0.00325	0.00562	0.00148	0.00799	0.03600	Pass
	Std Dev	0.00335	0.00196	0.00099	0.00003	0.00096	0.00100	0.00059	0.00102	0.00056	0.00093	0.00073	0.00000	
	Average	0.02368	0.01771	0.00223	0.00360	0.00334	0.00618	0.00559	0.00379	0.00628	0.00231	0.00843	0.03600	
	Rantec Tolerance	0.00100	0.00200	0.00120	0.00047	0.00120	0.00365	0.00500	0.00243	0.00400	0.00122	0.00500	0.03500	

Example 2 (Center Cross Section)

Rantec "Board" Sample Microsection Report

Item #	Sample	Layer 1		Layer 2		Layer 3		Pass / Fail
		3 OZ Copper	Dielectric	2 OZ Copper	Dielectric	1 OZ Copper	Dielectric	
1	Panel x Left Top	0.00590	0.00560	0.00330	0.00740	0.00360	0.00890	Pass
2	Panel x Right Top	0.00650	0.00560	0.00300	0.00770	0.00360	0.00860	Pass
3	Panel x Center	0.00580	0.00590	0.00300	0.00620	0.00240	0.00800	Pass
4	Panel x Left Bottom	0.00500	0.00560	0.00300	0.00680	0.00300	0.00890	Pass
5	Panel x Right Bottom	0.00590	0.00590	0.00300	0.00680	0.00300	0.00830	Pass
	Board Average	0.00582	0.00572	0.00306	0.00698	0.00312	0.00854	
	Coupon Average	0.00611	0.00552	0.00370	0.00633	0.00222	0.00824	
	Variance from Coupon	-5.00%	3.46%	-20.92%	9.26%	28.77%	3.46%	
	Minimum Spec Rantec	0.00365	0.00500	0.00243	0.00400	0.00122	0.00500	



Power Systems Inc.

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Revision:

AF

Title: **Quality Control Requirements For Rantec Suppliers**

Sheet: 15 of 15

Revision History

Rev	Description of Change	Author	Effective Date
A	Initial Release	P. Ryan	6/28/07
B	Amend Appendix A, edit section 12.2, add sections 12.3 and 12.4		
C	Added Cleanliness Clause 10.3	M. Freiwald	7/9/09
D	Added Control of Records Clause 6.15. Amended Change Notification Policy Clause 6.2 to include "supplier or manufacturing facility". Amended Right of Access Clause 6.11 to include "and areas of all facilities at any level of the supply chain". Added First Article Inspection/Test Clause 6.16.	M. Freiwald	11/11/09
E	ADDING OBSOLETE PART NOTIFICATION REQUIREMENTS	M Holmes	6/11/11
F	Added ESD requirements.	S Stack	8/16/11
G	Added FOD requirements.	B Tackett	3/26/12
H	Added Conformal Coat cleanliness testing requirements	B Tackett	12/21/12
J	Added revision verification in 6.1 and added clarification to PWB coupon micro-section examination review in 9.5	P. Ryan	9/16/13
K	Update paragraph 6.16 to add 30 day notice to Rantec before supplier destroys records for Rantec product.	P. Ryan	10/16/2013
L	Updated paragraph 6.4 and 6.7 to clarify supplier counterfeit part prevention requirements and updated paragraph 9.5 for PWB cross-section requirements.	P. Ryan	5/5/2014
M	Add calibration flow-down requirement (6.20). Clarify pure tin requirements not for solder or soldered assemblies. Ref: ECN 14-0737)	P. Ryan	10/13/2014
N	Add paragraphs 6.4 Counterfeit Parts Prevention; 6.22 for special processes and 10.4 for custom pin plating suppliers.	P. Ryan	3/16/2015
P	Updated para 6.1.a (order of precedence); Add para 6.24 Conflict Minerals clause; Update para 9.5 Cross section requirements; Add para 9.8 PWB traceability; Add para 10.5 Strip & Re-plate; Removed Appendix A	P. Ryan	5/2/2017
R	Updated Change Control para 6.2, add Corrective Requirements para 6.7, delete copper thru hole plating thickness para 9.2, complete rewrite cross section requirements para 9, add attachment 1, 2 & 3.	D. Chambers	11/7/2017
T	Update to include AS9100D clause 8.4.3 a.-m requirements and clarify rqmts for paragraphs 6.1 thru 6.6. Change 9.5 regarding qualification yields (ECN 18-0353)	P. Ryan	4/23/2018
U	Clarify PWB x-section retention periods (ECN 19-0859)	D. Martin	10/23/2019
V	ECN #19-0906, add section 6.25, update logo	P. Ryan	11/6/19
W	ECN #20-0333, Change section 6.20 to address ITAR and add section 25 re: Kaspersky Lab & 10.6 Specialty Metals	P. Ryan	5/13/20
Y	ECN #20-0582	P. Ryan	9/1/2020
AA	ECN #20-0764	P. Ryan	12/2/2020
AB	ECN #21-0256	D. Cortella	5/14/2021
AC	ECN #21-0338	D. Cortella	6/15/2021
AD	ECN #21-0629	K. Aban	11/03/2021
AE	ECN #22-0679	T. Harris	11/14/2022
AF	ECN# 23-074 Section 6.27 Added requirement that vendors with sub-tier suppliers in non-English speaking countries must have work instructions with side-by-side translations in English and native language.	T. Harris	2/13/23