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SUPPLIER QUALITY AGREEMENT



TITLE	APPROVAL SIGNATURE	DATE
Director of Supply Chain Management		11/29/18
Corporate Quality Engineer		11/29/18

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PURPOSE/SCOPE:

The purpose of this document is to describe the criteria for Supplier Performance Review and rating. The document also informs Suppliers and Subcontractors what standards the Suppliers are responsible to meet and how TTM monitors and controls Supplier Performance.

These provisions supplement the existing Terms and Conditions of the Purchasing Agreement and Supplier FAR and DFAR Requirements. Each Supplier or Service Provider listed on the Approved Supplier List shall access this document via the TTM website at http://www.ttmtech.com/support/supplier_req.aspx. The document shall be reviewed to ensure compliance to the below requirements. A Supplier or Service Provider whom is unable to access the TTM website must contact the Purchasing Department to request a copy of this document. Exceptions to a specific provision require that a written request be submitted to the applicable Purchasing Manager.

DEFINITIONS:

Approved Supplier List: A List of Suppliers whom have been given approval status (by TTM and/or our customer) to supply specific materials or services to TTM.

Corrective Action: An action to eliminate the cause of non-conformity or other undesirable situation.


Critical Materials and Services: Materials and/or services falling under the category of “Key Suppliers”.

Discrepant Material Report (DMR): This is where nonconforming material is documented when it does not meet TTMs’ Quality Standards. It is to be separated from inventory stock until a resolution is made with the Supplier.


TTM Quality Assurance Provisions (QAP): Quality Assurance Provisions are determined by TTM regarding specific materials and services. These are written as Request for Proposal (RFP) and/or notes on Purchase Orders.

1.0 SUPPLIER APPROVAL PROCESS

- 1.1 **ISO9001 and AS9100 Certified Suppliers:** ISO 9001 / AS9100 Certified Suppliers are recognized by TTM as having a valid Quality System.
- 1.2 **Calibration Subcontractors:** Are required to maintain a documented calibration program that is in compliance with the requirements of ANSI NCS Z540-3, which includes traceability to the National Institute of Standards and Technology (NIST) or ANSI/ISO/IEC 17025 (latest revision).
- 1.3 **Non-ISO Certified Suppliers:** Non-ISO Certified Suppliers are required to have controls over their production processes, materials, records and documentation. Lists of minimum requirements are as follows:
 - (a) **Configuration Control:** System which maintains control over the interrelated functional and physical characteristics of a product – from the time the initial purchase order is received until the product is delivered to TTM.
 - (b) **Process Documentation:** Supplier processes that can affect product quality shall be documented and followed. This documentation shall also be available for auditing.

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- (c) **Process Flow:** A Process Flow shall be determined for processing work. The flow shall be documented, followed and available for auditing. Travelers are a typical method.
- (d) **Process Control / Monitoring:** Processes that affect the quality of the products shall be controlled. There shall be a monitoring system that measures and records key aspects of the processes (e.g. pressures, temperatures, pH, concentrations, time, and speed). These measurements shall be documented and maintained as quality records and available for review.
- (e) **Identification and Traceability:** Products and materials produced for TTM shall have lot information provided and traceability of all the component materials used in its construction. If TTM discovers a root cause for a quality issue to be from a material purchased by a Supplier that was used in their manufacturing process, the Supplier needs to be able to identify all the lots of material or parts that they shipped to TTM that used the indicated material. The Supplier shall also be able to find and contain all such affected material on their site. **When acceptance authority media are used (e.g., stamps, electronic signatures, passwords), the organization shall establish appropriate controls for the media.**
- (f) **Internal Audits:** Suppliers need to have a schedule that covers all of their processes for internal audits. Processes need to be reviewed for effectiveness, risk assessment and up to date manufacturing and inspection methods. Operations shall also be audited for their conformance to the processes. Documentation of these audits shall be kept as quality records.
- (g) **Continuous Improvement:** Suppliers shall incorporate continuous improvement tools to control processes and prevent defects.
- (h) **First Article Inspection:** A system needs to be in place to do a complete measurement of the first part of a new product. Whatever specifications the part or material are required to meet shall be measured. A report shall be put together with the measurement and analysis information into a First Article Report, which shall be submitted to TTM for approval. An approved First Article Report demonstrates that the Supplier's production process is capable of producing an article compliant to all design requirements.
- (i) **Control of Non-Conforming Product:** A system shall be maintained and controlled to separate defective materials and segregate them so they are not accidentally used.
- (j) **Inspection Records:** Inspections and measurements are required to prove adherence to specifications. These inspections and measurements shall be documented and kept in a form that is retrievable within 48 hours.
- (k) **Sampling Inspection:** In cases where it is not practical or economically feasible to inspect all outgoing material 100%, Suppliers must comply with ANSI NCSL Z540-3 or to the American Society for Quality (ASQ) for sampling methods and sample sizes. The methodology used shall be made available to TTM upon request.
- (l) **Certification of Compliance as an Alternative to Inspection Records:** Certification as a means to prove material conformance to specifications involves receipt of a certificate from the Supplier stating that certain tests and inspections have been implemented at the Supplier's location. If a Supplier is considered reliable and has established a good past history, certification may be used as evidence of product quality


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in place of outgoing inspection. Because some customers such as Military and Commercial Aviation have requirements to control all incoming material with statistical sampling, Suppliers who use certification for proof of conformance may still be required to perform inspections.

- (m) **Corrective Action / Preventive Action:** When responding to a quality failure issue, Suppliers need to take both corrective and preventative actions. Examples of corrective actions are: rework of defective product, person who violated a process is coached by a mentor, faulty equipment is repaired. Examples of preventive actions are: process parameters are changed to improve product, new training is written and used for annual re-certification, and new items are added to the equipment maintenance schedule.
- (n) **Training:** Suppliers are responsible to ensure their employees are capable of performing the duties necessary to produce quality product and create adequate records thereof. Any function that requires special knowledge or skills also requires training for the employees. Records shall be retained to verify training efforts and employee competency.
- (o) **Calibration Control:** Measuring devices used to verify product conformance shall be calibrated and traceable to national standards. A sticker indicating the calibration date and expiration date is required. Gage R&R Studies should be performed on equipment. These shall be made available to TTM upon request.
- (p) **Packaging:** TTM shall ensure that product (i.e. panels or printed circuit boards) are properly packaged prior to being transported to a Subcontractor (i.e. Via Fill, ENEPIG, ENIG, HASL). The Subcontractor shall establish and maintain a documented system for the control and monitoring of its packaging and shipping practices with provisions for handling, preservation, storage, packaging and final shipment. The system must be designed to ensure the quality of the deliverable material through prevention of damage, deterioration and degradation. When the packaging requirements are not detailed on the TTM Purchase Order, the method used will be "best commercial practices". All Laminate and Prepreg materials are to have individual boxes/bags with proper separation between each panel to prevent handling damage.

Note: TTM Shipping is responsible for verifying that the Material Supplier or the Subcontractor properly packaged the product. If not, Purchasing and Quality shall be immediately contacted.

- 1.4 **Supplier Self-Assessment Survey (SSAS):** The TTM Supplier Self-Assessment Survey may be sent to the Supplier or Subcontractor as part of the TTM qualification process. The SSAS must be completed by the Supplier or Subcontractor and returned to the TTM individual(s) whom sent the assessment.
- 1.5 **Outside Services (Subcontractors):** Shipping must verify that a Subcontractor is listed on the Approved Supplier List prior to shipping the product. If the Subcontractor is not listed, Purchasing and Quality must be notified before further action is taken.
 - (a) To work on ITAR (International Traffic and Arms Regulations) product, the Supplier shall be registered with the Directorate of Defense Trade Controls (DDTC). The personnel who are within the facility or provide service to TTM products must be either U.S. citizens or permanent residents. Status of ITAR verification is referenced on the Approved Supplier List.

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(b) To verify Supplier ITAR Registration, go to <http://connect.ttmtech.com>; click 'My Intranet'; click 'Compliance'; click 'Supplier ITAR Certifications'

(c) If there are any questions, contact the applicable TTM site's Export Compliance Officer.

1.6 **On-Site Audit:** TTM, our customers and Regulatory Authorities shall be granted right of access to all Supplier and Sub-Tier Supplier Facilities inclusive of all Quality Records involved in fulfilling TTM Purchase Orders. There is more information regarding On-Site Audits detailed in Section 3, Supplier Status & Maintenance.

2.0 **SPECIFICATIONS, STANDARDS & MATERIAL CERTIFICATIONS**

2.1 **IPC Material Specifications:** Suppliers who provide laminates, Prepreg, Foil, or Plating Metal Services shall ensure the quality of their materials meet the quality levels defined by the appropriate IPC Material Specifications (e.g. IPC-4101, IPC-4103, IPC-4562, IPC-4563, and IPC-TM-650).


2.2 **TTM Base Material Specifications:** TTM has a number of Material Specifications in addition to the IPC Material Specifications. TTM will provide these specifications to the Supplier and will refer to them in the Purchase Order.

2.3 **Competence & Awareness:** Suppliers must have evidence that personnel that have contributed to manufacturing and/or processing of their product or service are knowledgeable in their position and have been properly trained.

In addition, Suppliers or Subcontractors must ensure that their employees are aware of their contribution to product and/or service conformance, product safety to which they are contributing to and demonstrate an ethical behavior when working with TTM and TTM's Customers.

Process Control / Quality Control: Key Suppliers shall inform TTM prior to making any changes to material and/or processes, that may impact, form, fit, function; reliability; serviceability; inventory; performance; regulatory compliance; and/or safety. The Notification must be in writing, at a minimum of 60 days in advance of the changes. Formal approval is then required from TTM. Change Notification is also inclusive of the following:

- Material Supply Discontinuance
- Material Sources and/or Parts
- Formulation Change
- Test Methods used to Confirm Product Compliance
- Manufacturing Locations
- Addition/Removal of Equipment
- Raw Materials Suppliers
- Subcontracted Services
- Continuity or Disaster Preparedness Plans


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- 2.5 **Material Certificates of Conformance:** Suppliers who provide critical materials (that become part of TTM products) shall provide TTM with Material Certificates of Conformance (C of C's) for each distinct lot of material provided. A C of C shall accompany every shipment to TTM.
- (a) **Validity:** Measurements and analysis shall be done to assure all materials sent to TTM conform to IPC Materials Specifications and TTM Request for Purchase (RFPs). Measurement methods and schedules are listed in the IPC document tables.
- (b) **Retention:** Suppliers will maintain a copy of the material C of C's for a minimum of 7 years or as stated in the Purchase Order.
- (c) **Availability:** Suppliers shall provide copies of C of C's within 48 hours after a request has been issued by TTM, a TTM customer, or a Regulatory Agency.
- (d) **Certificate Requirements:** All Certificates of Compliance shall have the following items:
- Subcontractor/Suppliers Name
 - Purchase Order Number
 - Lot Number / Batch Number
 - Part / Tool Name
 - Manufacturing Date
 - Distributor Manufacture Date or Cut Date
 - Material Expiration Date (for limited life material) – a minimum of 1 year or 80% of the shelf life is required upon material receipt unless otherwise approved by TTM
 - Quantity
 - Date and signature of the authorized company representative
 - When Special Processes are required by Drawing or Specification, the C of C must clearly state the applicable Military and/or Customer requirement, specification, revision.

Note: In order to sign an inspection certificate or a Certificate of Compliance, the credentials of the signatory shall be such that he/she holds a technical or quality position within that company and is competent to certify that the product delivered is compliant to all drawings, standards, specifications and purchase order requirements outlined on the certificate.


If a Supplier uses a Subcontractor or purchases raw material from another Supplier, the Supplier is responsible to flow down these same requirements to their Vendors and Subcontractors.

- 2.6 **Fraud & Falsification:** Where the External Suppliers Services or Materials are performed or used, directly or indirectly, on products produced under contract, that may affect the national security of the United States and the requirements, these contracts are designed to ensure that essential attributes of the work force and their sub-tier External Suppliers are carefully checked or inspected and that records accurately reflect the results of the work. The External Supplier shall not, in any manner, falsify, conceal or alter any material fact, or provide any false, fraudulent or fictitious statement of representation in connection with the work under

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any contract within the jurisdiction of the Government. Doing so is not only prohibited, but may be punishable under Federal Law.

- 2.7 **Foreign Object Elimination:** The Supplier / Subcontractor shall establish and maintain an effective Foreign Object Debris (FOD) Prevention Program to reduce the potential of FOD. The Material shall be manufactured in an environment that is free of foreign objects (debris), utilizing effective FOD Prevention practices proportional to the sensitivity of the design of the product(s) or processes to FOD.
- 2.8 **Continuity or Disaster Preparedness Plan:** The Supplier shall establish a Continuity or Disaster Preparedness Plan in the event of a major Natural Disaster, Pandemic, or any unexpected occurrence forcing emergency shutdown of the manufacturing of goods, delivery of materials or provision of service, to minimize the impact on TTM. A copy of the Plan must be available upon request.
- 2.9 **Conflict Mineral Reporting:** The following statements apply to those Suppliers that are required to provide Conflict Mineral Reports:
- (a) Please access the TTM Supplier Website at http://www.ttmtech.com/support/supplier_req.aspx
 - (b) Click on: Conflict Materials Requirements for Suppliers TTMTCP400
 - (c) External Suppliers shall annually submit the latest version of a completed and accurate conflict minerals reporting template (CMRT) issued by the Conflict Free Sourcing Initiative (CFSI). The CMRT Report shall be completed in English and submitted in Excel format.
 - (d) External Suppliers shall utilize source smelters that are validated as conflict free smelters (CFS) by a 3rd Party Organizations (e CFSI, LBMA, RJC).
 - (e) External Suppliers shall notify TTM Technologies at least 90 days prior to any changes in source smelters and shall confirm such changes in a revised CMRT.
- 2.10 **Counterfeit Parts Policy:** TTM only accepts raw materials that are accompanied by the lot specific material Certificate of Conformance from the Original Material Manufacturer. Counterfeit parts prevention is governed by the requirements and guidelines of the Industry Standard SAE AS5553, SAE AS6496 and SAE AS6174.
- (a) Please access the TTM Supplier Website http://www.ttmtech.com/support/supplier_req.aspx
 - (b) Click on: Supplier Counterfeit Parts Requirements
 - (c) TTM Technologies is a registered member of GIDEP (Government Industry Data Exchange Program), which is monitored across all TTM sites for any quality issues, inclusive of any known counterfeit parts issues identified through the industry.
 - (d) The TTM GIDEP Representatives will notify Purchasing and Quality if a GIDEP Alert has been released. If an Alert is received, TTM Management will notify the appropriate external parties, as detailed in SAE Counterfeit Parts Standards.

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- (e) TTM also monitors Suppliers and Incoming Material and takes appropriate action when suspect or confirmed fraudulent/counterfeit parts are detected.

3.0 SUPPLIER STATUS & MAINTENANCE

- 3.1 **Quality Records Retention:** Supplier will retain quality records for products, equipment or services provided to TTM for a minimum of 7 years, after the requirements of the procurement action have been fulfilled – or as stated on the Purchase Order.
- 3.2 **Records Format & Availability:** Copies of quality records or documents may be saved in electronic or paper format, but shall be available to TTM, TTM customers, or Regulatory Authorities within 48 hours of request.
- 3.3 **Self-Evaluations:** Suppliers may periodically be asked to complete a self-evaluation form (i.e. Supplier Self-Assessment Survey). Exceptions to this requirement are those Suppliers that are managed through performance meetings. The performance meetings may be held on a month, semi-annual or annual basis.
- 3.4 **Scorecards:** Supplier may be measured periodically with Scorecards. The selection of these Suppliers is determined by Purchasing and/or Quality. The purpose of the Scorecards is for TTM to be readily able to review the Supplier’s Performance. Scorecards can have a significant influence on Procurement decisions that do not have ‘Performance Metric’ meetings, as described in section 3.3 of this procedure.

- (a) **Performance Categories:** TTM Supplier Scorecards are broken into 4 categories / subgroups:

Quality

- DPPM Review
- Corrective Actions

Cost

- Reductions

Delivery


- To Promise
- To Request

Technology

- Roadmap Alignment

- (b) **Scoring:** Each of these categories is scored on a weighted scale. The weighting of each category and criteria for scoring is detailed in TTM Documentation.
- (c) **Performance Targets and Thresholds:** Targets and thresholds will be determined and set by Purchasing on a Supplier by Supplier basis, as deemed necessary.

- 3.5 **On-site Audits & Right of Access:** As detailed in Section 1.0, TTM, TTM Customers, and Regulatory Authorities shall be granted the right of access to all Suppliers and Sub-tier Supplier facilities and records

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involved in fulfilling TTM Purchase Orders. The Sub-tier Suppliers shall be informed by the Supplier of these conditions. A record of these Notifications shall be documented and retained (e.g. Purchase Orders, Contracts, and Condition of Purchase).

TTM will inform Suppliers of On-Site Audits in advance. If the Audit is performed due to nonconforming product, the Supplier will segregate and keep such product for the inspection of the coming auditor(s). Upon Audit completion, conforming product may be shipped according to customary methods in accordance with the current TTM Purchase Orders.

- 3.6 **3rd Party Auditors:** TTM may determine that a qualified 3rd Party Auditor(s) is required due to business conditions or staffing availability. The Auditor(s) will be acting on behalf of TTM. They will require the same access granted to TTMs' employees (e.g. SQA Services).
- 3.7 **Supplier Monitoring:** All Suppliers are reviewed on an ongoing basis. Quality discrepancies may results in issuance of a Supplier Corrective Action Request (SCAR), which will be recorded in the Supplier's File. Ongoing Approval Status of Suppliers constitutes the record of Suppliers' conformance to TTM requirements.

4.0 SUPPLIER QUALITY CONCERNS

- 4.1 **Supplier Notification to TTM of Discrepant Materials:** When a Supplier becomes aware that they have shipped nonconforming materials or will miss a delivery due to nonconforming material TTM shall be notified within 24 hours.
- 4.2 **Quality Control Measures:** Dependent upon the risk to TTM, product quality, and the availability of replacement Suppliers / Subcontractors, TTM will determine the level of response required for non-conforming product. Below are examples of control mechanisms TTM may utilize:
 - (a) **Supplier Corrective Action Request (SCAR):** A formally issued complaint regarding the Supplier's Quality.
 - (b) **Rejection of Material:** TTM Quality or Engineering Representatives may reject incoming materials or services that do not meet the specifications provided to the Suppliers. 3rd Party Inspectors may also reject Supplier Products or Services based on quality that doesn't meet the specifications provided to the Suppliers.
 - (c) **Outgoing Inspection Levels:** May be increased. For example, if a Supplier is having a high rate of nonconforming escapes and they are using a 4% AQL Sampling Level, TTM may request they move to a 1% AQL Sampling Level, thus increasing the number of samples inspected per each lot of material.
 - (d) **3rd Party Inspections:** May be required. At TTM's discretion, quality verification may be required by a qualified 3rd Party or by TTM's Quality or Engineering Team. 3rd Party Inspections will be at the expense of the Supplier. If TTM performs the additional inspection services, the Supplier may be invoiced for these services.
 - (e) **Corrective Action:** When a Corrective Action request is issued; the Supplier is expected, at a minimum, to comply with the following actions:

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- Contain the defective material and report status to the TTM Supplier Quality Representative within 48 hours from the Date of Notification.
- Provide a Corrective Action Plan and expected completion date within 2 weeks from the Date of Notification – or as stated in the CA request (refer to Appendix 2).
- Complete the Action Plan and Verify Effectiveness, and then inform the TTM Supplier Representative when completed.
- Supplier is required to use a team oriented approach to discover the root cause of the problem and develop a solution.

(g) **Performance Improvement Plan (PIP):** Supplier is required to develop a Performance Improvement Plan (refer to Appendix 1). A PIP includes:


- Identify and Rank Risks / Weaknesses in their Process
- Choose Target Areas for Improvement
- Develop Improvement Plans
- Set Goals / Ownership / Timelines
- Develop Measurement & Control Plans
- Verify Effectiveness

(h) **Supplier Waiver Request:** Suppliers may request a waiver from TTM for nonconforming materials. The waiver request shall be approved by TTM Site Quality Leader, or delegate before any nonconforming material is shipped to TTM. If approved, instructions for identifying the nonconforming product and shipping instructions will be detailed on a Supplier Waiver Request for Nonconforming Product Form.

(i) **Rework & Repair:** When rework and/or repair is required in order to meet the product and/or material specifications – it is ONLY permitted after the Supplier has submitted a Rework Plan and the Plan is approved by TTM.

4.3 **Supplier Chargeback Process:** The following steps are an outline of steps TTM may take to recover costs incurred due to nonconforming materials from our Suppliers. It is solely at TTM discretion whether or not we will pursue these actions. Alternative charge-back steps will be taken if prearrangements are made with TTM.

- (a) Nonconforming Supplier parts are identified through TTM receiving inspection, on-line rejects, customer returns, alerts or Supplier recalls.
- (b) Suppliers will be notified of nonconforming products through the SCAR process or request for failure analysis.
- (c) An account is initiated by accounting to collect all costs incurred by TTM, as a result of the nonconforming product.

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Costs incurred may include, but are not limited, to the following items:

- Rework by TTM's Costs
- Return for Rework Costs
- Replacement of Material Costs
- Recall of Material Costs
- Customers Charges for Removal/Return/Replacement
- Delivery Penalties from TTM's Customer
- Travel Expense
- Source Inspection Costs as a Result of Nonconformance
- Containment Costs
- Additional Inspection Costs at TTM


- (d) A letter is sent to the Supplier summarizing the costs incurred and TTM's intent to recover such costs.
- (e) A detailed report of the costs is available for review and verification by the Supplier.
- (f) For minor issues the charge will be a \$250.00 flat rate to cover administrative costs.
- (g) The Supplier has 5 working days to respond to questions or review.

Note: The preferred method of cost recovery is to debit the Suppliers account, unless an alternative agreement is reached through review with the Supplier. The charge back will be initiated after 10 working days or completion of the review process.

- 4.4 **Supplier Responsibility:** It is the Supplier's Responsibility to provide parts / processes that conform to all specifications and reliability requirements and to accept liability for all escapes caused by their quality discrepancies.
- 4.5 **TTM Responsibility:** It is TTM's Responsibility to notify the Supplier of all nonconforming Materials in a timely manner and to provide an accurate and fair system to collect data for all applicable costs incurred. TTM will hold the defective Materials for Supplier review.

Appendix 1: PIP Outline**PERFORMANCE IMPROVEMENT PLAN****Supplier Actions:**

1. Gather/compile nonconformance data from the following sources:
 - a. Customer returns
 - b. Customer notifications
 - c. Internal nonconformance data
 - i. MRB records
 - ii. Scrap and rework data
 - iii. Interviews
 - d. Other sources
2. Assemble data in a manageable format(s), Analyze, Evaluate data as necessary to focus on areas with the most opportunities for improvement initiatives.
 - a. DPM (Defects Per Million) Pareto Analysis:
 - i. Part Number
 - ii. Process
 - iii. Department
 - iv. Characteristic (dimensional, technology, processing, paperwork, etc.)
 - v. Most likely cause/s
 1. Machinery
 2. Procedures/work instructions
 3. Process/process controls
 4. Training
 5. Tooling
 6. Materials/input chemistries
 7. Other causes
 - vi. Other categories
 - b. Other evaluation tools or methods
3. Establish containment plans for the major drivers of product and system deficiencies.
4. Perform 8D analyses against the top drivers to develop comprehensive and systemic improvement action plans.
 - a. Where appropriate, use Process Maps, Failure Modes and Effects Analysis (FMEA), and establish/implement through the deployment of Control Plans.
 - b. Document actions and timing, track through implementation and effectiveness validation. (Planned Milestones).
5. Report on the management review process that is being utilized by your company to drive continuous improvement actions required to reach/exceed TTM goals.
6. Establish the rate of improvement and timing.
7. Verify effectiveness of PIP actions.

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Appendix 2: Supplier Corrective Actions Timetable

TTM Request	Supplier Action	Due by*
Containment of Suspect Material	Contain all suspect material and notify the SCAR issuer.	48 hours
Corrective Action	Determine the root cause of the nonconformance, Eliminate the cause and notify the SCAR Issuer.	2 weeks
8D – or equivalent problem solving methodology	Perform an 8D event to find and eliminate the root cause of the nonconformance. When complete, notify the SCAR Issuer.	3 weeks
Supplier to increase AQL Sampling Level	Change sampling plan as requested and notify the SCAR Issuer when compliant.	24 hours
3 rd Party Inspection of Material	TTM will indicate timeframe at the time the request is made.	As requested
Performance Improvement Plan (PIP)	Define a Performance Improvement Plan to drive improvement. TTM may request progress reports. When completed, notify the SCAR issuer.	4 weeks

* Due dates may be specified on the SCAR that differ from this outline. If the supplier is unable to meet the deadlines, please notify the SCAR issuer.