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**Note: 1** Revisions to this document such as spelling, grammar, or numbering may be made without changes to the revision, providing it does not change the effect of the wording.

**Note: 2** - All applicable TSV engineering standards still apply.
1.1. Preface

Textron Specialized Vehicles ("TSV") is a leading global manufacturer of golf cars, utility and personal transportation vehicles, professional turf-care equipment, and ground support equipment. Textron Specialized Vehicles markets products under the E-Z-GO®, Cushman®, Textron Off Road, Jacobsen®, Dixie Chopper®, Ransomes®, TUG™, Douglas™, Premier™, Safeaero™, and Arctic Cat® brands; its vehicles are found in environments ranging from golf courses to factories, airports to planned communities, and theme parks to hunting preserves.

TSV’s continued success is based on quality and reliability of its products as perceived by customers. High levels of quality and reliability help reduce costs, increase productivity and ultimately improve market acceptance and competitive advantage.

Production of a quality, finished product is determined, largely, by the quality of the materials used in a product. As a result, TSV has identified supplier quality as a key element for remaining competitive in the marketplace. Attaining high quality requires teamwork between TSV and its supply base to achieve mutually satisfactory goals. Paramount to achieving the necessary teamwork is an open two-way communication channel.

1.2. Scope

This section defines a general overview of the Supplier Quality Program responsibilities and requirements for TSV and its Production suppliers. Ultimately, the supplier is responsible for the quality, timely delivery, lead-time, and technical services of products sold to TSV. When suppliers have a strong and effective Quality Program, they can assure timely delivery of product at high quality levels at an optimum cost. TSV promotes open lines of communication with its suppliers and makes a concerted effort to thoroughly convey requirements.

The supplier’s Quality Program shall contain at a minimum the following disciplines:

- Quality systems and product realization planning
- Document and data control
- Control of records
- Specification change control
- Control of purchased product
- Control during processing
- Use of statistical methods
- Control of finished goods
- Control of non-conforming product
• Calibration, Gage R & R of measuring and test equipment
• Corrective/preventative action plans
• Employee training

The objective of TSV’s Supplier Quality Program is to get the right product at the right quality level, and at the right cost, on time, every time. The Supplier Quality Program enables us to make the best possible sourcing decisions so that we can establish mutually beneficial long-term supplier relationships that will benefit TSV and our suppliers. The supplier program is designed to improve communication with suppliers resulting in a thorough understanding of TSV’s product/process requirements.

The Supplier Quality Program will increase the supplier’s ability to reduce defects, reduce material handling costs and manufacturing costs that are attributed to losses caused by defective parts. These improvements will lead to the elimination of late shipments, ultimately enabling TSV facilities to reduce inventory and eliminate supplier part problems in our manufacturing facilities and at our customers.

Suppliers will be selected and then consistently evaluated on their ability to meet:

1. Total Cost
2. Capacity
3. Technical Capability
4. Quality System
5. Delivery and Service
6. Financial Stability

By application of the above requirements, TSV and suppliers of TSV will be able to provide the quality products necessary for mutual success. Each supplier must build on these requirements to develop an effective quality system, which will be reviewed by TSV as appropriate. This procedure applies to all new and/or potential suppliers and currently authorized suppliers of parts, products or services to TSV facility.

Once a supplier is approved, supplier performance will be monitored and evaluated on an ongoing basis. Continued supplier approval status shall be based upon complying with quality system requirements outlined throughout this manual, including Production Part Approval Process (PPAP), and a sustained level of acceptable performance.

1.3. Confidentiality

Prior to TSV approval, a formal non-disclosure agreement shall be required. TSV recognizes that its suppliers may be exposed to proprietary or confidential information. The supplier shall treat all data in strict confidence and report any intentional or non-intentional breach of confidentiality to TSV Management immediately.
2.1. **Supplier Approval Review**

The purpose of this section is to define the Supplier Quality Approval Process. The fulfillment of the requirements of suppliers’ quality system is critical to the overall approval process and provides the necessary evidence needed to ensure product and process integrity and continuous improvement. During the approval process, TSV may request conference(s), either face to face and/or via telephone or an on-site audit, etc.

2.1.1 TSV Sourcing Department is responsible for the initiation of supplier approval process.

2.1.2 TSV Quality has overall responsibility for coordinating the approval process. Based upon the results of the evaluation it is determined if a potential supplier is an appropriate candidate to supply TSV with purchased components.

2.1.3 The next step in the Supplier Quality Approval Process is coordination of the Advanced Product Quality Planning (APQP) and Production Part Approval Process (PPAP) per the AIAG requirements. All PPAP documentation can be obtained by contacting the AIAG group.

> Automotive Industry Action Group
> 26200 Lahser Rd., Suite 200
> Southfield, MI 48033-7100 USA
> [www.aiag.org](http://www.aiag.org)

2.2. **Supplier Quality System Requirements**

It is recommended that all suppliers develop and implement an effective operating Quality Management System (QMS). The QMS should be based on a recognized international quality system standard, such as ISO9001, QS9000, or TS16949. All suppliers are highly encouraged to pursue third party registration. However, where a supplier is assessed to be a Level “A” supplier, third party registration is a requirement. Table “A” represents a ranking process for suppliers which may be used as an assessment tool.
Table “A” Supplier Risk Matrix

<table>
<thead>
<tr>
<th>High Business Risk</th>
<th>Low Business Risk</th>
</tr>
</thead>
<tbody>
<tr>
<td>High Technical Risk</td>
<td>Level A</td>
</tr>
<tr>
<td>Low Technical Risk</td>
<td>Level B</td>
</tr>
</tbody>
</table>

Level A Supplier:
- Complete a Supplier Self-Assessment
- A formal on-site assessment at the Supplier location
- Approval by the Supplier Approval Team
- Must maintain third party registration of ISO9001, QS9000, or TS16949

Level B Supplier:
- Complete a Supplier Self-Assessment
- Complete a Formal on-site assessment at the Supplier location
- Approval by the Supplier Approval Team
- Must maintain a Formal Quality System

Level C Supplier:
- Complete a Supplier Self-Assessment
- Complete a Formal on-site assessment at the Supplier location

2.3. Maintaining and Changing Quality System Approval
Depending on the Supplier level, A, B or C level, periodic re-assessments may be performed to assure that no significant changes have occurred in the supplier’s quality system. Recommended frequency of re-assessment is shown in Table B: Re-assessment Frequency:

<table>
<thead>
<tr>
<th>Supplier Level</th>
<th>Re-assessment Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>2 year on-site</td>
</tr>
<tr>
<td>B</td>
<td>3 year on-site</td>
</tr>
<tr>
<td>C</td>
<td>2 year self-assessment</td>
</tr>
</tbody>
</table>

Note: depending on the supplier’s performance, re-assessment frequency may be extended or shortened.

2.4. APQP (ADVANCED PRODUCT QUALITY PLANNING)
TSV requires that all suppliers should be utilizing the Advanced Product Quality Planning Process (APQP). APQP is a preventative quality-preplanning framework, used in the product/process development process that provides a robust product and process. The purpose of APQP is to produce a product quality plan which will support development of a product or service that is mutually beneficial to both the customer.
and the supplier. All Advanced Product Quality Planning documentation and requirements can be obtained by contacting AIAG:

AIAG Products & Services Understanding and Implementing APQP with PPAP - AIAG Training

APQP (Advanced Product Quality Planning) consists of five major activities:

- Planning
- Product Design and Development
- Process Design and Development
- Product and Process Validation (pre-production PAP)
- Production (PPAP)

The APQP (Advanced Product Quality Planning) process has seven major elements:

- Understanding the needs of the customer
- Proactive feedback and corrective action
- Designing within the process capabilities
- Analyzing and mitigating failure modes
- Verification and validation
- Design reviews
- Control special / critical characteristics

Ongoing feedback assessment and corrective action is an integral part of these phases and activities.

2.5. PPAP Process

When the Supplier’s Quality System has been approved, the parts/materials will be approved using the APQP AIAG Process that culminates with PPAP. This is the documented verification that all TSV’s Engineering Design requirements are met by the Approved Suppliers. The initial PPAP may be performed on-site by an TSV SQE. TSV encourages the suppliers to submit the electronic copy of the PPAP documents to improve the efficiency and to accelerate the approval process.

The purpose of the PPAP process is a prevention-oriented process to determine if the supplier fully understands all TSV engineering design record and specification requirements. In addition, the PPAP process will verify that the manufacturing process used by the supplier has the capability to produce product that will consistently meet TSV’s requirements during production at the quoted production rate.

Along with new suppliers and new products, PPAP INITIATION IS REQUIRED when any of the events shown on the below Table “C” PPAP Initiation occurs. Both TSV and the Supplier may be responsible for requesting a PPAP initiation, as defined in the PPAP Initiation Table.
<table>
<thead>
<tr>
<th>Item</th>
<th>Area</th>
<th>PPAP Initiator</th>
<th>Events</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Design Change</td>
<td>TSV</td>
<td>• Newly designed part&lt;br&gt;• TSV creates a design change on the product (CN)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Supplier</td>
<td>• Supplier creates a Design Change on the part itself or any change that may affect part performance</td>
</tr>
<tr>
<td>2</td>
<td>New / Change of Supplier</td>
<td>Supplier</td>
<td>• Adding or changing a sub-supplier (companies that supply to TSV’s suppliers)&lt;br&gt;• Changing from in-house production to outside sub-supplier&lt;br&gt;• Change of manufacturing location for the current supplier&lt;br&gt;• Change in materials used by supplier&lt;br&gt;• Change from Sourcing product/material to supplying in-house&lt;br&gt;• Change vendor sources of material&lt;br&gt;• Change in material itself (including anti-rust oil, lubrication oil, etc.)</td>
</tr>
<tr>
<td>3</td>
<td>Material Change</td>
<td>Supplier</td>
<td>• Any change in which TSV product requirements for fit, form, function, durability, or performance are potentially affected</td>
</tr>
<tr>
<td>4</td>
<td>Manufacturing Method Change</td>
<td>Supplier</td>
<td>• Use of another optional process than was used in the previously approved part&lt;br&gt;• Removal of any process used in the previously approved part</td>
</tr>
<tr>
<td>5</td>
<td>Process Change</td>
<td>Supplier</td>
<td>• Use of new machines or assembly equipment&lt;br&gt;• Product re-released after the tooling has been inactive for volume production for twelve months or more</td>
</tr>
<tr>
<td>6</td>
<td>Machine/ Tooling</td>
<td>Supplier</td>
<td>• Replaced Die section or new Die</td>
</tr>
<tr>
<td>7</td>
<td>Die / Mold Change</td>
<td>TSV</td>
<td>• At TSV’s request due to a supplier quality concern</td>
</tr>
</tbody>
</table>

Table “C” PPAP Initiation

Process Capability requirements for PPAP approval will be according to TSV’s Engineering Standard, GS-726-128, Design Engineering Documentation Guidelines.

### 2.5.1 PPAP Approval

**Full Approval:** Indicates that the part or material meets all customer specifications and requirements. The supplier is therefore authorized to ship production quantities of the product subject to releases from TSV scheduling activity.

If a case arises that PPAP is not acceptable, an TSV deviation may be approved once the supplier has:

- Clearly defined the root cause of the non-conformities preventing production approval;
- and,
• Prepare an action plan agreed upon by TSV. Re-submission to obtain “full approval” is required

2.5.2 PPAP Level Requirements

TSV Reserves the right to redefine the submission level required:

New Parts: Level 2 is required for Low Risk Parts (at minimum)
Level 3 is required for Medium and High Risk Parts

Part Changes: Level 3 is required for Parts produced at a new or additional location
Supplier Quality Excellence will define the level required for all other changes

<table>
<thead>
<tr>
<th>Level 1</th>
<th>Production Warrant and Appearance Approval Report (if applicable) submitted to TSV</th>
</tr>
</thead>
<tbody>
<tr>
<td>Level 2</td>
<td>Production Warrant, product samples and dimensional results submitted to TSV</td>
</tr>
<tr>
<td>Level 3</td>
<td>Production Warrant, product samples and complete supporting data submitted to TSV</td>
</tr>
<tr>
<td>Level 4</td>
<td>Production and other requirements as defined by TSV</td>
</tr>
<tr>
<td>Level 5</td>
<td>Production Warrant, product samples and complete supporting data (a review will be conducted at the suppliers manufacturing location)</td>
</tr>
</tbody>
</table>

Table “D” PPAP Submission Levels

Rejected: Means that the submission, the production lot from which it was taken, and accompanying documentation do not meet TSV requirements. Corrected product and documentation shall be submitted and approved before production quantities may be shipped. If the PPAP is rejected, the supplier will be given the reason(s) for the rejection and the supplier must provide the corrective actions to resolve the causes of the rejection.

NOTE: ANY CHANGES IN YOUR PROCESS NEED TO BE COMMUNICATED TO TSV IMMEDIATELY BEFORE CHANGES ARE MADE FOR TSV’S APPROVAL. THIS APPLIES TO ADDITION OF NEW EQUIPMENT, CHANGES IN MATERIAL, CHANGE IN SUB-SUPPLIERS, ELIMINATION OF OR ADDITION TO OPERATIONS IN PROCESS DUE TO IMPROVEMENT WORK AND RE-LOCATION OF PART MANUFACTURING AT DIFFERENT PLANTS.

2.6. Run at Rate Process

The purpose of Run at Rate is to verify that the supplier’s manufacturing process is capable of producing components that meet TSV’s on-going quality requirements at quoted tooling capacity for a specified time-period. Furthermore, that the supplier’s process conforms to the plans submitted by the supplier in the part submission documentation and other required documentation (such as production volumes).

A Run at Rate study is required as listed below:

• New part (may be done by part family)
- New supplier/location (may be done by part family)

The following may also warrant a request for a Run at Rate:
- Change to an alternative material
- Significant tooling/equipment changes that influences product integrity
- Significant changes to the design
- When specified by TSV customer

A TSV representative will evaluate all new part numbers. The supplier will be notified of the need to perform a monitored or supplier monitored Run at Rate as early in the Advanced Product Quality Planning Process as possible. During Run at Rate, production tools have to be in place and run at full production speed, utilizing regular production conditions, direct and indirect personnel, and support systems.

The number of components to be produced during the Run at Rate should be sufficient to demonstrate manufacturing process capability and should be predetermined by the joint agreement between TSV and the supplier. The minimum length of the Run at Rate is dependent on production requirements at full acceleration.

The Run at Rate should be performed during PPAP approval and before start of production acceleration. Although encouraged to be performed as early as possible, a key consideration in establishing the Run at Rate date is the stability of the design (design freeze). The exact date should be predetermined by the procuring plant and the supplier. A representative from TSV should be present for the entire Run at Rate.

The Run at Rate documentation (checklist, worksheets etc.) has to be available to the supplier one week before Run at Rate is carried out. To make effective use of time, the supplier should complete as much as possible of the Run at Rate Worksheets before the official Run at Rate is carried out.

If parts are produced ahead of production schedules, the supplier will hold all parts produced until authorized to ship. The supplier will ensure that sufficient production containers and packaging are available to prevent part damage according to the supplier packaging manual.

The Run at Rate will verify the supplier's actual manufacturing process output, can meet the requirements for on-going quality and quoted tooling capacity. In addition, it will verify that the supplier's actual process complies with documentation presented at PPAP, the Run at Rate, will review the following items for compliance to requirements:

A. Documentation
B. Manufacturing process and results
C. Part quality requirements and results
D. Sub-supplier development activities
E. Packaging
A. Documentation:

At the time of Run at Rate, the following documentation should be available for review:

1) Part submission warrant (or equal documentation)
2) Process flow chart
3) Process control-plan
4) DFMEA / PFMEA
5) Packaging / labeling plan
6) Ramp-up curve

B. Manufacturing process:

All of the following requirements must be met to pass the Run at Rate study:

1) The product is being manufactured at the production site using the production tooling gauging, process, materials, operators, environment, and process settings.
2) The actual process flow agrees with the process flow chart as documented.
3) Operator instructions are available and adhered to each workstation.
4) Visual aids- if required - are available and are in place.
5) All process documents, such as control charts, inspection plans etc. are developed, approved and in place.

C. Manufacturing capacity results:

The following will be verified while the process is running:

1) The net output from each operation can support the quoted capacity.
2) During the Run at Rate, the tooling must meet the quoted up-time requirements.
3) Any unexpected downtime must be documented and corrective actions must be taken.
4) All line changeovers, if any, can be performed within the quoted tooling capacity requirements.
5) The net throughput of good pieces (scrap, allowable rework parts) meets daily quoted capacity.

D. Part quality plan:

All requirements mentioned below must be met to pass Run at Rate study:

1) All production-checking fixtures must be complete with acceptable measurement system studies performed, and operator instructions / visual aids available.
2) All in process gauging and controls must be complete, functional and in place.
3) The process control plan must agree with the actual process.
4) Product parts checks and statistical monitoring must be in place as mentioned on the process control plan.
SECTION III: General Requirements

5) Potential failure modes, as identified in the PFMEA are addressed through error proofing or the control plan.

6) The process control - reaction plan, as well as the supplier's corrective action process to ensure containment and correction, should be available for review.

E. Part quality results:

All requirements mentioned below must be met to pass Run at Rate study:

1) Parts produced off production tooling during the Run at Rate meet the TSV requirements for ongoing quality, as stated in the PPAP documentation.

2) The manufacturing process is under control/demonstrates stability.

3) The manufacturing process demonstrates the required capacity.

4) The process control plan is sufficient to effectively meet the design record requirements (i.e. control points, frequency).

5) Adequate control of non-conformances, if applicable:
   - The non-conformances yielded by the process were identified
   - If the PFMEA does not identify the potential failure modes, the PFMEA needs to be updated to include required corrective action
   - All rework and repair effectively correct the non-conformance(s)
   - All prototype and pilot concerns, if any, have been corrected and validated

F. Subcontractor Requirements:

The subcontractor(s) ability to meet TSV quality and capacity requirements must be confirmed by the supplier prior to the Run at Rate being conducted at the supplier's facility. If the subcontractor cannot demonstrate the required capacity, a contingency plan must be provided to TSV for review.

Note: Any changes in your process must be communicated to the assigned TSV Supplier Quality Engineer (SQE) immediately.

3.1. Supplier or Sub-Contractor Requirements

To maintain integrity of the product throughout the supply chain all purchased product/material must conform to the requirements specified by TSV. It is the supplier’s responsibility to ensure that they have a program in place to select and approve their suppliers (sub-contractors). The supplier must have a program in place that ensures all purchased products comply with the requirements specified by TSV. The supplier shall have a program that is effective in assessing subcontractors on their ability to meet the defined quality
requirements. The supplier must require their subcontractors, at a minimum, meet the requirements of this manual, including PPAP.

3.1.1 Analysis of Quality Data
In the area of continual improvement, the supplier is urged to maintain a program for collection and analysis of quality data. The supplier should have in place a process to target areas contributing to lowered throughput that reduce profits. The program should target processes with the most potential for improving product reliability and customer satisfaction. The data collection may include but not limited to: rework, scrap, customer returns, or customer plant defects (PPM), production throughput yields and premium freight costs.

3.2. TSV Supplier Performance

Quality Performance
TSV’s manufacturing cannot operate effectively and efficiently when there are quality problems with the components. In an effort to maintain high quality levels, every supplier’s quality performance will be monitored. The supplier is expected to maintain a maximum threshold level of Parts per Million Defect Level (PPM) based on type of product or commodity on an ongoing basis. The supplier’s PPM levels will be tracked and made available to our suppliers.

When a supplier’s quality performance rises above the threshold of their PPM goal for three consecutive months or above the threshold for 3 months in a 6-month period, the supplier may be required to perform corrective action to improve their quality performance.

The PPM calculation is the total number of parts rejected per month, divided by the total number of parts received per month, times 1 million. Example for PPM: A facility receives a shipment of five hundred and twenty parts and there are four defects in this lot, the formula for PPM is:

\[(\frac{4}{520}) \times 1,000,000 = 7,692 \text{ PPM}\]

Note: PPM metric based on order receipt quantity (e.g. each, weight) as appropriate.

Lead-Time
The supplier will be monitored on how they meet the defined lead-times agreed upon by the supplier and TSV’s Commodity Manager in the Sourcing contract or supplier agreement. The supplier’s lead-time will be monitored to ensure they are meeting the defined lead-times. In support of continual improvement, the supplier is encouraged to work on reducing lead-time.

3.3. Problem Reporting and Resolution
When the supplier maintains an effective Quality Management System, the system greatly reduces the probability of having defects. However, problems may occur from time to time. In order to reduce the impact on TSV, it is imperative that these issues are resolved immediately.
The supplier will be required to implement corrective action on any sections that do not meet the established criteria set forth in this program, to include, but not limited to the following: defective product not meeting on-time delivery, lead-times, PPAP issues and non-conformances.

When defective product/material is found at TSV, in order to best support the production line, there are several ways TSV may handle the problem. The methods of handling the defective product include, but are not limited to:

1) The product will be returned to the supplier at the supplier’s cost, while verified good product from the supplier is being delivered to TSV.
2) The supplier will be required to sort, screen or rework the product at TSV.
3) TSV may sort, screen or rework the product until the supplier arrives, then charge those costs back to the supplier.
4) TSV will retain the services of a local inspection house, and charge that cost to the supplier.
5) If any vehicles are to be reworked after the build is complete, the supplier will be charged a fee for the rework of the cars. The Sourcing department will define what charges are to be levied.

When corrective action is required, the supplier is to respond using the format provided by a TSV SQE or may use their own form with problem solving or 8D content. The form should be returned to the requester within twenty-four (24) hours of notification, with the possible cause(s) of the deficiency and the short-term corrective action documenting the supplier’s containment plan, assuring the production receives acceptable product. The supplier must submit the completed corrective action within fourteen (14) days to the requester. A Supplier Quality Engineer or a Sourcing Representative will follow up with the supplier to verify that the issue has been resolved and effective corrective action is in place.

Below are the 8 steps of a Corrective Action Report:

1) **Use Team Approach**
   Establish a cross-functional group of people with the knowledge, time, authority and skill to solve the problem and implement corrective actions. The group must select a team leader. The team may consist of design, product, manufacturing, and quality engineers, maintenance personnel and, most importantly, the operators.

2) **Describe the Problem**
   Describe the problem in measurable terms. Specify the internal or external customer problem by describing it in specific terms. Such as number or percentage of product found defective, over what time-frame, and who found the problem.

3) **Implement and Verify Short-Term Corrective Actions**
   Define and implement those intermediate or containment actions that will protect the customer from the problem until a permanent corrective action can be implemented. Verify
the effectiveness of these actions with data. Including all product at TSV, any warehouse that may house inventory, what is in transit, inventory at the supplier’s facility and all work in process.

4) **Define and Verify Root Causes**
   Identify all potential causes, which could explain why the problem occurred. Test each potential cause against the problem description and data, using standard quality improvement tools such as Pareto charts, control charts, design of experiments and others that may apply. Identify all possible solutions to eliminate root cause of the defect.

5) **Verify Corrective Actions**
   Confirm that the selected solutions will resolve the problem for the customer and will not cause undesirable side effects. Define other actions, if necessary, based on potential severity of problem.

6) **Implement Permanent Corrective Actions**
   Define and implement the permanent corrective actions needed. Choose on-going controls to ensure the root cause defect is eliminated. Once in production, monitor the long-term effects and implement additional controls as necessary.

7) **Prevent Recurrences**
   Modify specifications, implement work instructions, visual aids, and process controls, update training, and improve practices and procedures to prevent recurrence of this and all similar problems.

8) **Congratulate Your Team**
   Recognize the collective efforts of your team. Publicize your achievement. Share your knowledge and learning.

3.4. **Measurement Systems Analysis**

   In many cases, nonconforming product is found at TSV facilities due to measurement systems error. Inaccurate measurements may result in an incorrect process or product appraisal. This error increases the emphasis for correct measurement systems. Measurement equipment is subject to the same types of variation as production processes.

   To ensure that measurement equipment used in the development and manufacture of products is accurate and repeatable, it must be calibrated at established intervals suitable to the types of gauges used. Equipment to be calibrated includes: gauges, instruments, sensors, test equipment, computer software, manufacturing jigs, fixtures, molds and process instrumentation that can affect the product or process. The calibration frequency should be determined by: the equipment type, frequency of use, function and manufacturer’s recommendation.

   The supplier may be required to perform repeatability and reproducibility (Gauge R&R) studies to determine the uncertainty of the measurements on gauges used to measure KPC dimensions. These dimensions are noted on the part drawings and/or engineering specifications. Included in the Gauge R&R
program are the production tooling and fixtures that are used as a method for inspection. Gauge R&R studies will include Linearity, Bias, and Stability. This will be done during PPAP and process approvals. The Gauge R & R results should be interpreted as follows:

A. The Gauge R&R % Tolerance is < 10%, the gauge is acceptable
B. The Gauge R&R % Tolerance is >10% and < 30%, the gauge is considered marginally acceptable for use
C. The Gage R&R % Tolerance is > 30%, the gauge is not acceptable for use and replacement is recommended. New or different types of gauges should be considered

3.5. Request for Deviation/Supplier Request for Product Change (SRPC)

TSV Suppliers are to make every possible effort to only ship conforming product. If the supplier finds non-conforming product at their facility before shipment, they may request a deviation utilizing the SRPC form in the PPAP workbook. The supplier must contact their Supplier Quality Engineer for these changes. They will meet with design engineering to determine whether the product can be used under a deviation or if the material cannot be used. TSV will review requests for deviation providing the request is combined with immediate corrective action. However, when a request for deviation occurs, TSV is under no obligation to grant the request. A request may only be granted with the approval of design engineering.

3.6. Statistical Process Control

TSV is committed to the application of statistical techniques in all manufacturing processes. Statistical Process Control (SPC) measures the ability to consistently produce product within specification. TSV recommends the supplier apply the proper SPC techniques to verify the capability of their processes and products.

When control charts are used, real time trend analysis should be done and actions taken when adverse trends appear, according to published rules to identify special cause variation. Control charts should also be analyzed for process shifts and improvements. When the cause can be identified, control limits should be adjusted accordingly. It is highly recommended that when statistical process control charts are used, they be maintained by adequately trained operators who are responsible for the quality of their own work.

In the purchase order or other documents, a supplier may be requested to provide real time SPC data, control charts, inspection data, or other form of certified test reports with each shipment. There are several reasons for submittal of SPC data, the reasons include but are not limited to: the criticality of the product produced; a decline in the supplier’s quality performance; process changes; product changes; or when special studies are being conducted.
3.7. Equipment Preventative Maintenance

With today’s just-in-time delivery and shorter lead times becoming the norm, suppliers must have a regular planned equipment preventive maintenance program (PM). The supplier shall maintain the equipment to ensure that it is performing optimally. A well-designed PM plan eliminates interruptions to the process flow, allowing the supplier to plan for equipment downtime. The majority of maintenance time should be spent on preventive activities instead of firefighting. A PM plan should include at a minimum: schedules for planned downtime; documented maintenance procedures or work instructions; identification of key equipment; availability of key replacement parts; and records indicating that the planned maintenance has been completed as required.

3.8. Tooling Requirements

In the effort to keep tooling costs at a minimum, the supplier must maintain all tooling in proper condition. The following are guidelines the supplier is expected to follow concerning TSV owned tooling and tooling fixtures. The maintenance and repair of tooling is the responsibility of the supplier unless otherwise negotiated. TSV reserves the right to review and inspect TSV owned tooling and applicable tooling records at the supplier’s facility. The supplier will have a PM program for all tooling used to produce TSV product whether the tooling is owned by TSV or the supplier.

To assure continuity of supply, the supplier must notify TSV Sourcing, in advance when possible, that the condition of the tooling will not allow product that conforms to specifications to be produced. A capability study may be required to validate tooling performance.

**TOOLING POLICY**

Tooling purchased by TSV or by a TSV customer, for use at a supplier facility shall be used exclusively for production of TSV requirements as authorized by Purchase Orders, Blanket Purchase Order Releases, and/or Forecasts furnished to suppliers. Products produced from such tooling may not be sold or furnished to other parties without the express, written authorization of TSV.

Each article of tooling must be clearly marked (stamped, stenciled, or permanently tagged) identifying the item as "Property of TSV" or if applicable, "Property of TSV (customer)" and the part number, which it produces. TSV will reimburse suppliers for only unique, dedicated production tools, and may request evidence of supplier’s actual cost for such tooling prior to final payment. Unless specifically negotiated, TSV will not reimburse suppliers for Capital Equipment or tooling that is shared (used in production of products for other customers), or not returned to TSV upon demand. Likewise, unless specifically agreed, TSV will not reimburse suppliers for nonrecurring engineering (NRE) costs.

Tooling purchased by TSV is the property of TSV and held by suppliers pursuant to the terms and conditions of purchase. The Supplier may not move TSV tooling to alternate locations without advance
written approval. TSV reserves the right to demand surrender of any TSV-owned tooling upon reasonable notice. TSV reserves the right to carry out an audit of TSV owned tooling at the suppliers’ premises.

Tooling must be maintained in satisfactory working condition, capable of production that meets all governing drawings and specifications, and at the capitalized planning volumes/rates. Suppliers may not change/modify tooling owned by TSV without advance notification and approval in writing of such changes. Tooling must be fully covered by insurance against damage, loss, or theft and free from all liens and encumbrances at all times without expense to TSV.

Upon final payment, ownership of tooling is granted to TSV. Payment for tooling will be made, at agreed upon terms, following Initial Sample Approval. Suppliers when requested must furnish complete tooling drawings, including all details, inserts, consumables, etc. to TSV as part of the Initial Sample Approval submission. Invoices for tooling must show exact physical location by City, State or Province, and Country where tools will be used in production.
4.1. Glossary

APQP Process – Process that uses tools to offer the opportunity to get ahead of problems and solve them before the problems affect the customer.

Bias - The difference of the observed value of a measurement compared to a reference standard (bias is sometimes referred to as accuracy).

Characteristic – A distinguishing feature, dimension, or property of a process or its output (product) on which variable or attribute data can be collected. Visual aids can be used to specify or describe characteristics.

Design FMEA (Failure Mode and Effects Analysis) – An analytical technique used by Design Engineering and a cross functional team as a means to ensure that, to the extent possible, potential design failure modes, their associated causes, and effects have been considered and addressed.

Design Review – A process in which Design Engineering, Quality and/or Manufacturing Engineering and the supplier representatives (Quality, Engineering, and/or Sales), review the intended design of a product or component. The review will include: design for manufacturability, tolerance review, critical dimension reviews, and cosmetic requirements to provide a product that meets the customer’s needs.

Gage Calibration – A method to determine the accuracy and precision of a gage or measuring equipment to specified operational standards. The calibration of the equipment should be traceable to NIST (National Institute of Standards and Technology) whenever possible.

Gage R&R (Gage Repeatability and Reproducibility Study) – A method of determining how much of the measurement process and its variation contribute to the overall process variation.

ISO – a set of international standards that focuses on process based quality management developed to help companies effectively implement the quality system to help maintain an efficient and effective quality business system.

Linearity - The gage variation measured over the full operating range of the gage.

Material Certifications – Verification that a given material meets required specifications by performing chemical and/or metallurgical analysis. (I.e. hardness, yield strength, elongation, chemical content, etc.)

Non-conformance – A feature or action that fails to meet the requirements specified in a contract, specification, blueprint, international standard, or any other approved document.

Poka - Yoke – Mistake proofing methodology.

PPAP (Production Part Approval Process) – Defines generic requirements for production part approval. The purpose is to determine if the supplier properly understands all engineering design specifications/product requirements. Also if the process has the potential to produce product consistently meeting these requirements during an actual production run at the quoted production rate.
**Pre-Launch** – A description of the dimensional measurements, material and performance tests that occur after prototype and before normal production build.

**Preventative Action** – An action taken to eliminate the possibility of a nonconformance.

**Process Control Plans** – A written description of a process or system for controlling the production of parts and/or the process. It includes information about what characteristics are checked, frequency of checks, and evaluation method.

**Process Documentation** – Written documentation used to control a process. An established set of operational definitions written to clearly communicate the what, when, where and how of a process operation.

**Process Flow Diagram** – A controlled document with a graphical view and brief description depicting the steps in a process.

**Process FMEA (Failure Mode and Effects Analysis)** – An analytical technique used by Manufacturing Engineering and a cross functional team as a means to ensure that, to the extent possible, potential process failure modes, their associated causes, and effects have been considered and addressed.

**Product Audits** – Auditing of finished product to established specifications.

**Production Pilot Run** – A production run conducted on TSV’s or the supplier’s standard production tooling and equipment. The production run is one continuous run to establish part and/or process capability levels (Cpk). A production trial run can also be used to verify and validate new equipment.

**Production Process** – A comprehensive documentation of product/process characteristics, process controls, tests, and measurement systems occurring during normal production.

**QFD (Quality Function Deployment)** – The translation of customer expectations into specific engineering and quality characteristics.

**Quality Systems Self Evaluation** – An audit done by the supplier on their quality program based on TSV’s requirements or ISO 9001:2008/ISO 9001:2015, also referred to as a first party audit.

**Repeatability** - The average variation obtained by one operator when using the same measuring device measuring the same characteristic multiple times.

**Reproducibility** - The average variation obtained when different operators measure the same characteristic multiple times using the same measuring device.

**Stability** - The total variation in a gage using the same master or parts, over a period of time, demonstrates the reliability of the gage.

**Traceability and Lot Control** – 1) The ability to trace the date code or lot number of a particular lot(s) of product at the supplier’s facility from raw materials, through production, inventory and transit to TSV. 2) The ability to trace the history of a product after shipment by means of recorded information and/or identification after the product has been assembled and in use at the end user’s facility.