1. **Purpose**
   To identify JLTV A2 program-specific requirements that are above and beyond our Supplier Quality Manual requirements.
2. **Application**
   This attachment applies to suppliers of parts that are to be used in the JLTV A2 program as noted on the purchase order issued by Banks Tech.
3. **References**
   Automotive Industry Action Group PPAP Manual 4th edition
   Automotive Industry Action Group MSA Manual 4th edition
4. **Definitions**
   None
5. **Responsibility**
   The Banks Tech Supply Chain personnel issuing the purchase order (PO) is responsible for ensuring the PO communicates and properly informs the supplier of the applicability of this attachment.
   It is the supplier's responsibility to meet the requirements of this procedure when applicable.
6. **Procedure**

6.1. Production Part Approval Process

The latest AM General PPAP Workbook shall be used for all Production Part Approval Process (PPAP) submissions. The AM General PPAP Workbook can be found at https://www.amgeneral.com/suppliers/supplier-resources/. Supplier forms consistent with AIAG standards can be used but must be reviewed and approved by Banks Tech 30 days (minimum) prior to submission.

6.1.1. Dimensional Results

100%-dimensional inspection is required for a minimum of six (6) parts for each PPAP submittal, including subcomponents if the part or assembly is purchased at a higher level than the lowest level defined in the JLTV Technical Data Package (TDP) and Computer Software Package (CSP). If less than six parts are ordered, all parts shall be subject to 100%-dimensional inspection. For parts produced from more than one cavity, mold, tool, die, pattern or production process, the supplier shall provide a six (6) part sample dimensional evaluation from each.

6.1.2. Measurement Systems Analysis

A Measurement Systems Analysis (MSA) shall be conducted in accordance with the *AIAG Measurement Systems Analysis Manual* for each gage or family of gages used to determine product or process conformance.

6.2. Component First Article Test

The latest AM General Supplier CFAT Test Report Workbook shall be used for all Component First Article Test (CFAT) submissions. The AM General Supplier CFAT Test Report Workbook can be found at https://www.amgeneral.com/suppliers/supplier-resources/.

6.2.1. New Electrical Components

For all new electrical components (not included in JLTV FoV TDP and CSP baseline) that have any water resistance/protection requirement, the supplier shall propose a CFAT test sequence (and order) that includes the following:

1. Initial performance/functional test
2. Durability
   a. Vibration
   b. Shock
   c. Handling drop
3. Electrical
4. Environmental
   a. Storage temperatures
   b. Powered temperature cycles – preconditioning
   c. Powered salt spray
   d. Powered humidity
   e. IP66*
   f. IP67* or IP68*
   g. Powered temperature cycle – lifecycle/extended

Note: for these items, contact SQE for specific (as required) testing criteria.

5. Final performance/functional test
6. Destructive disassembly

For this test sequence the total number of CFAT parts shall increase to four (4). Banks Tech will assess the Supplier proposed CFAT sequence and tests. The Supplier shall determine applicability and tailor the testing as appropriate. Deviations to the proposed sequence and tests shall require Banks Tech approval.

6.3. Special Characteristics

In accordance with the AIAG PPAP Manual (Fourth Edition), special characteristics are defined as product characteristics or manufacturing process parameters which can affect safety or compliance with regulations, fit, function, performance, or subsequent processing of product. There are two types of special characteristics: Critical Characteristics and Significant Characteristics:

Critical Characteristic <CC>: A product characteristic or process parameter that can potentially affect compliance with government regulations, safe vehicle operation, or safe equipment function.

Significant Characteristic <SC>: A product characteristic or manufacturing process parameter which can affect fit, function, performance, or impact subsequent processing of product.

Critical and Significant Characteristics shall be assigned based on the Severity and Occurrence data derived from the Design and/or Process Failure Mode and Effects Analyses (DFMEA and PFMEA). Criteria for assignment of special characteristics shall be in accordance with the below Criticality Matrix (Figure 1). All special characteristics shall be documented on the corresponding control plan.

Critical Characteristics shall be identified, recorded, and implemented when a DFMEA or PFMEA Severity Rank of 9 or 10 is identified regardless of the corresponding Occurrence Rank. All items identified as a Critical Characteristic shall demonstrate a minimum CpK of 1.67, shall demonstrate a robust Government approved error proofing system that ensures product conformance, or be subject to 100% inspection.

Significant Characteristics shall be identified, recorded, and implemented when a DFMEA or PFMEA Severity Rank of 5, 6, 7, or 8 is identified with a corresponding Occurrence Rank of 4, 5, 6, 7, 8, 9, or 10. All items identified as a Significant Characteristic shall demonstrate a minimum CpK of 1.33, shall demonstrate a robust Government-approved error proofing system that ensures product conformance, or be subject to 100% inspection.

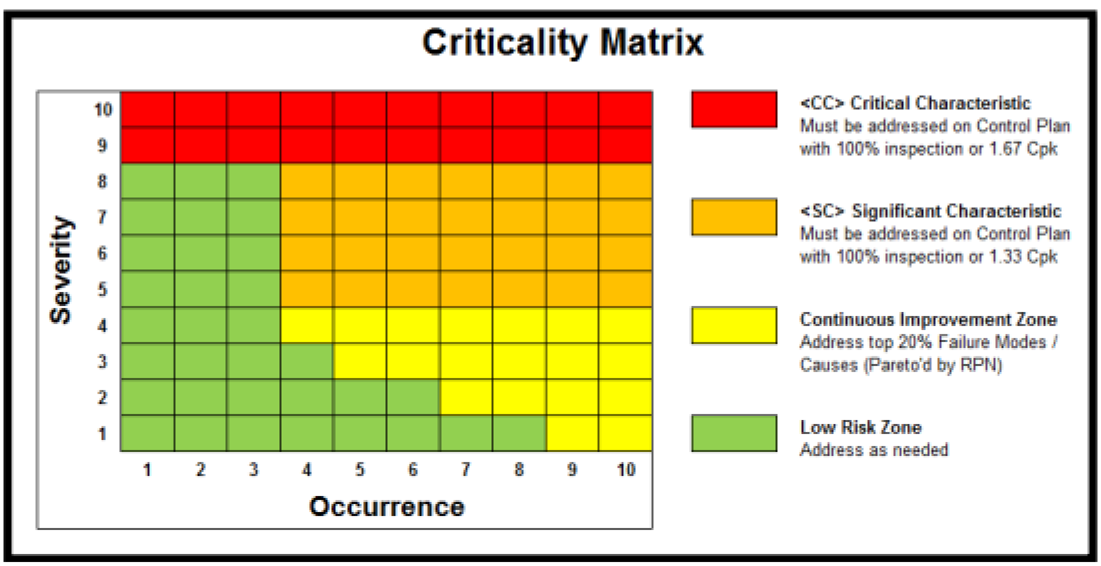


Figure 1 – Criticality Matrix

100% inspection shall be treated as a last resort for the control of special characteristics and shall only be permitted for a period of 6 months from initial implementation. If 100% inspection is employed, the inspection must be performed as a separate inspection task after the specific assembly, manufacturing, or installation task is complete. 100% inspection shall not be performed by the employee performing the initial assembly, manufacturing, or installation task.

6.3.1. Traceability Marking for Components with Special Characteristics

All parts with special characteristics need to be traceable to the lot or date of manufacturing relevant to the special characteristic. They must be marked such that Banks Tech can ensure traceability to the end item produced or installed kit. Marking must include scannable format which could include barcode, QR codes, RFID or agreed upon scanning methodology to ensure Banks Tech can read and store lot or date of manufacturing information.

6.3.2. Assignment of DFMEA & PFMEA Severity Ranks

Assignment of DFMEA and PFMEA Severity Rank values shall be in accordance with Figures 2 and 3 below, respectively. If there is any disagreement between criteria for assignment of Severity Rank in the table, the most severe (highest) rank value shall always be utilized.

The following definitions apply:

Primary Function: A function for which loss or degradation:

incurs a Hardware Mission Failure (HMF) in accordance with the JLTV Failure Definitions and Scoring Criteria (FDSC), or results in a Non-Mission Capable (NMC) status, or results in failure of the vehicle/item to achieve a Tier 1 Requirement identified in the JLTV Purchase Description (Attachment 0101).

Secondary Function: A function for which loss or degradation: incurs Essential Function Failure (EFF) in accordance with the JLTV Failure Definitions and Scoring Criteria (FDSC), or results in failure of the vehicle/item to achieve a Tier 2 Requirement identified in the JLTV Purchase Description (Attachment 0101).

Tertiary Function: A function for which loss or degradation: incurs a Non-Essential Function Failure (NEFF) in accordance with the JLTV Failure Definitions and Scoring Criteria (FDSC), or results in failure of the vehicle/item to achieve a Tier 3-5 Requirement identified in the JLTV Purchase Description (Attachment 0101), or results in on-condition maintenance actions of consumable items (tires, filters, etc.

| DFMEA SEVERITY RATING SCALE | |
|---|---|
| **SEVERITY OF EFFECT** | **RANK** |
| Affects safe operation of the vehicle and/or other vehicles, the health of the driver or passenger(s) or road users or pedestrians. | **10** |
| Noncompliance with government regulation(s). | **9** |
| Loss of a primary vehicle function at any time during the expected service life. | **8** |
| Degradation of a primary vehicle function at any time during the expected service life. | **7** |
| Loss of a secondary vehicle function at any time during the expected service life. | **6** |
| Degradation of a secondary vehicle function at any time during the expected service life. | **5** |
| Condition impacting a tertiary function but vehicle remains operable, or a very objectionable appearance, sound, vibration, harshness, or haptics. | **4** |
| Condition impacting a tertiary function but vehicle remains operable, or a moderately objectionable appearance, sound, vibration, harshness, or haptics. | **3** |
| Condition impacting a tertiary function but vehicle remains operable, or a slightly objectionable appearance, sound, vibration, harshness, or haptics. | **2** |
| No discernible effect | **1** |

Figure 2 – DFMEA Severity Rating Scale

| PFMEA SEVERITY RATING SCALE | | | |
|---|---|---|---|
| **SEVERITY OF EFFECT: IMPACT TO PRODUCTION** | **SEVERITY OF EFFECT: IMPACT TO SHIP PRODUCT** | **SEVERITY OF EFFECT: IMPACT TO END USER** | **RANK** |
| Failure may result in an acute health and/or safety risk for the manufacturing and assembly worker | Failure may result in an acute health and/or safety risk for the manufacturing and assembly worker | Affects safe operation of the vehicle and/or other vehicles, the health of the driver or passenger(s) or road users or pedestrians. | **10** |
| Failure may result in in-plant regulatory noncompliance | Failure may result in in-plant regulatory noncompliance | Noncompliance with regulations. | **9** |
| 100% of production run affected may have to scrapped. Failure may result in in-plant regulatory noncompliance or may have a chronic health and/or safety risk for the Manufacturing working or assembly worker | Line shutdown greater than full production shift; stop shipment possible; field repair or replacement required (Assembly to End User) other than for regulatory noncompliance. Failure may result in in-plant regulatory noncompliance or may have a chronic health and/or safety risk for the manufacturing or assembly worker | Loss of primary vehicle function at any time during expected service life. | **8** |
| Product may have to be sorted and a portion (less than 100%) scrapped; deviation from primary process; decreased line speed or added manpower | Line shutdown from 1 hour up to full production shift; stop shipment possible; field repair or replacement required (Assembly to End User) other than for regulatory noncompliance | Degradation of primary vehicle function at any time during expected service life. | **7** |
| 100% of production run may have to be reworked offline and accepted | Line shutdown up to one hour | Loss of secondary vehicle function. | **6** |
| A portion of the production run may have to be reworked off line and accepted | Less than 100% of product affected; strong possibility of defective product; sort required; no line shutdown | Degradation of secondary vehicle function. | **5** |
| 100% of production run may have to be reworked in station before it is processed | Defective product triggers significant reaction plan; additional defective products not likely; sort not required | Very objectionable appearance, sound, vibration, harshness, or haptics. | **4** |
| A portion of the production run may have to be reworked in-station before it is processed | Defective product triggers minor reaction plan; additional defective products not likely; sort not required | Moderately objectionable appearance, sound, vibration, harshness, or haptics. | **3** |
| Slight inconvenience to process, operation, or operator | Defective product triggers no reaction plan; additional defective products not likely; sort not required; requires feedback to supplier | Slightly objectionable appearance, sound, vibration, harshness, or haptics. | **2** |
| No discernible effect | No discernible effect or no effect | No discernible effect. | **1** |

Figure 3 – PFMEA Severity Rating Scale

6.3.3. Assignment of DFMEA & PFMEA Occurrence Ranks

Assignment of DFMEA and PFMEA Occurrence Rank values shall be in accordance with Figures 4 and 5 below, respectively. If there is any disagreement between criteria for assignment of an Occurrence Rank in the table, the most severe (highest) rank value shall always be utilized. When determining occurrence scores, data from all sources shall be considered, including but not limited to the following items:

1. Test failures and Test Incident Reports (TIR’s)
2. Defects identified in the production process
3. Defects identified during inspection for Government acceptance
4. Defects identified after the product has been delivered to the field

| DFMEA OCCURRENCE RATING SCALE | | |
|---|---|---|
| **PREDICTION OF FAILURE CAUSE OCCURRING** | **OCCURRENCE CRITERIA FOR DFMEA** | **RANK** |
| **Extremely High** | -First application of new technology anywhere without operating experience and/or under uncontrolled operating conditions. No product verification and/or validation experience.<br>-Standards do not exist and best practices have not yet been determined. Prevention controls not able to predict field performance or do not exist. | **10** |
| **Very High** | -First use of design with technical innovations or materials within the company. New application or change in duty cycle / operating conditions. No product verification and/or validation experience.<br>-Prevention controls not targeted to identify performance to specific requirements. | **9** |
| | -First use of design with technical innovations or materials on a new application. New application or change in duty cycle / operating conditions. No product verification and/or validation experience.<br>-Few existing standards and best practices, not directly applicable for this design. Prevention controls not a reliable indicator of field performance. | **8** |
| **High** | -New design based on similar technology and materials. New application or change in duty cycle / operating conditions. No product verification and/or validation experience.<br>-Standards, best practices, and design rules apply to the baseline design, but not the innovations. Prevention controls provide limited indication of performance. | **7** |
| | -Similar to previous designs, using existing technology and materials. Similar application, with changes in duty cycle or operating conditions. Previous testing or field experience.<br>-Standards and design rules exist but are insufficient to ensure that the failed cause will occur. Prevention controls provide some ability to prevent a failure cause. | **6** |
| **Moderate** | -Detail changes to previous design, using proven technology and materials. Similar application, duty cycle or operating conditions. Previous testing or field experience, or new design with some test experience related to the failure.<br>-Design addresses lessons learned from previous designs. Best practices re-evaluated for this design but have not yet been proven. Prevention controls capable of finding deficiencies in the product related to the failure cause and provide some indication of performance | **5** |
| | -Almost identical design with short-term field exposure. Similar application, with minor change in duty cycle or operating conditions. Previous testing and field experience.<br>-Predecessor design and changes for new design conform to best practices, standards, and specifications. Prevention controls capable of finding deficiencies in the product related to the failure cause and indicate likely design conformance. | **4** |
| **Low** | -Detail changes to known design (same application, with minor change in duty cycle or operating conditions) and testing or field experience under comparable operating conditions, or new design with successfully completed test procedure.<br>-Design expected to conform to Standards and Best Practices, considering Lessons Learned from previous designs. Prevention controls capable of finding deficiencies in the product related to the failure cause and predict conformance of production design. | **3** |
| **Very Low** | -Almost identical mature design with long term field exposure. Same application, with comparable duty cycle and operating conditions. Testing or field experience under comparable operating conditions.<br>-Design expected to conform to standards and best practices, considering Lessons Learned from previous designs, with significant margin of confidence. Prevention controls capable of finding deficiencies in the product related to the failure cause and indicate confidence in design conformance. | **2** |
| **Extremely Low** | Failure eliminated through prevention control and failure cause is not possible by design. | **1** |
| **Product experience: History of product usage within the company (Novelty of design, application or use case). Results of already completed detection controls provide experience with the design.**<br><br>**Prevention Controls: Use of Best Practices for product design, Design Rules, Company Standards, Lessons Learned, Industry Standards, Material Specifications, Government Regulations and effectiveness of prevention orientated analytical tools including Computer Aided Engineering, Math Modeling, Simulation Studies, Tolerance Stacks and Design Safety Margins** | | |

Figure 4 – DFMEA Occurrence Rating Scale

| PFMEA OCCURRENCE RATING SCALE | | | |
|---|---|---|---|
| **PREDICTION OF FAILURE CAUSE OCCURRING** | **PREVENTION CONTROL** | **TYPE OF CONTROL** | **RANK** |
| **Extremely High** | No prevention controls. | None | **10** |
| **Very High** | Prevention controls will have little effect in preventing failure cause. | Behavioral | **9** |
| | | | **8** |
| **High** | Prevention controls somewhat effective in preventing failure cause. | Behavioral or Technical | **7** |
| | | | **6** |
| **Moderate** | Prevention controls are effective in preventing failure cause. | | **5** |
| | | | **4** |
| **Low** | Prevention controls are highly effective in preventing failure cause. | Best Practices: Behavioral or Technical | **3** |
| **Very Low** | | | **2** |
| **Extremely Low** | Prevention controls are extremely effective in preventing failure cause from occurring due to design (e.g. part geometry) or process (e.g. fixture or tooling design). The Failure Mode cannot be physically produced due to the Failure Cause. | Technical | **1** |
| **Prevention Control Effectiveness: Consider if prevention controls are technical (rely on machines, tool life, tool material, etc.), or use best practices (fixtures, tool design, calibration procedures, error-proofing verification, preventative maintenance, work instructions, statistical process control charting, process monitoring, product design, etc.) or behavioral (rely on certified or non-certified operators, skilled trades, team leaders, etc.) when determining how effective the prevention controls will be.** | | | |

Figure 5 – PFMEA Occurrence Rating Scale

6.3.4. Assignment of DFMEA and PFMEA Detection Potential Ranks

Assignment of DFMEA and PFMEA Detection Potential Ranks shall be in accordance with Figures 6 and 7 below, respectively. Detection Potential Ranks are not considered in the assignment of special characteristics, but shall be utilized in determining Risk Priority Number (RPN) values.

| DFMEA DETECTION POTENTIAL RATING SCALE | | | |
|---|---|---|---|
| **ABILITY TO DETECT** | **DETECTION METHOD MATURITY** | **OPPORTUNITY FOR DETECTION** | **RANK** |
| **Very Low** | Test procedure yet to be developed. | Test method not defined | **10** |
| | Test method not designed specifically to detect failure mode or cause. | Pass-Fail, Test-to-Fail, Degradation Testing | **9** |
| **Low** | New test method; not proven. | Pass-Fail, Test-to-Fail, Degradation Testing | **8** |
| | Proven test method for verification of functionality or validation of performance, quality, reliability and durability; planned timing is later in the product development cycle such that test failures may result in production delays or re-design and/or re-tooling. | Pass-Fail Testing | **7** |
| **Moderate** | | Test-to-Failure | **6** |
| | | Degradation Testing | **5** |
| **High** | Proven test method for verification of functionality or validation of performance, quality, reliability and durability; planned timing is sufficient to modify production tools before release for production. | Pass-Fail Testing | **4** |
| | | Test-to-Failure | **3** |
| | | Degradation Testing | **2** |
| **Very High** | Prior testing confirmed that failure mode or cause cannot occur, or detection methods proven to always detect the failure mode or failure cause. | | **1** |

Figure 6 – DFMEA Detection Potential Rating Scale

| PFMEA DETECTION POTENTIAL RATING SCALE | | | |
|---|---|---|---|
| **ABILITY TO DETECT** | **DETECTION METHOD MATURITY** | **OPPORTUNITY FOR DETECTION** | **RANK** |
| **Very Low** | No testing or inspection method has been established or is known. | The failure mode will not or cannot be detected. | **10** |
| | It is unlikely that the testing or inspection method will detect the failure mode. | The failure mode is not easily detected through random or sporadic audits. | **9** |
| **Low** | Test or inspection method has not been proven to be effective and reliable (e.g. plant has little or no experience with method, gauge R&R results marginal on comparable process or this application etc.) | Human inspection (visual, tactile, audible) or use of manual gauging (attribute or variable) that should detect the failure mode or failure cause. | **8** |
| | | Machine-based detection (automated, semi-automated with notification by light, buzzer, etc.) or use of inspection equipment such as coordinate measuring machine that should detect failure mode or failure cause. | **7** |
| **Moderate** | Test or inspection method has been proven to be effective and reliable (e.g. plant has experience with method; gauge R&R results are acceptable on comparable process or this application etc.). | Human inspection (visual, tactile, audible) or use of manual gauging (attribute or variable) that will detect the failure mode or failure cause (including product sample checks). | **6** |
| | | Machine-based detection (automated, semi-automated with notification by light, buzzer, etc.) or use of inspection equipment such as coordinate measuring machine that will detect failure mode or failure cause (including product sample checks). | **5** |
| **High** | System has been proven to be effective and reliable (e.g. plant has experience with method on identical process or this application), gauge R&R results are acceptable, etc. | Machine-based automated detection method that will detect the failure mode downstream, prevent further processing or system will identify the product as discrepant and allow it to automatically move forward in the process until the designated reject unload area. Discrepant product will be controlled by a robust system that will prevent outflow of the product from the facility. | **4** |
| | | Machine-based automated detection method that will detect the failure mode in-station, prevent further processing or system will identify the product as discrepant and allow it to automatically move forward in the process until the designated reject unload area. Discrepant product will be controlled by a robust system that will prevent outflow of the product from the facility. | **3** |
| | Detection method has been proven to be effective and reliable (e.g. plant has experience with method, error-proofing, verifications, etc.). | Machine-based detection method will detect the cause and prevent the failure mode (discrepant part) from being produced. | **2** |
| **Very High** | Failure mode cannot be physically produced as-designed or processed, or detection method proven to always detect the failure mode or failure cause. | | **1** |

Figure 7 - PFMEA Detection Potential Rating Scale

**7. Records / Forms**

None

**8. Attachments**

None

## Revision History

| Revision | Change(s) | Date | Authored by | Approved by |
|---|---|---|---|---|
| A | Initial release | 2/12/2024 | KM | MH |
| B | Removed Section 6.1.3 | 2/14/2024 | KM | MH |