

DEFENSE SEGMENT ADDENDUM



Global Supplier Quality Manual

DEFENSE SEGMENT ADDENDUM

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DEFENSE SEGMENT ADDENDUM

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1. Introduction

Thank you for taking time to review this Addendum. The content within is a compilation of key requirements to assist you in meeting Oshkosh Defense expectations. As a Supplier / Partner your organization's Quality is directly related to the Defense Supplier Quality Mission:

“To be a strategic advantage for our corporation and customers by empowering our suppliers to achieve more through mutually beneficial partnerships and by delivering components of the highest possible quality on time and at cost.”

Please endeavor to communicate and apply these requirements throughout your enterprise and join Oshkosh Defense in Pursuing Quality Excellence.

2. Defense Segment Quality Assurance Requirements Introduction

Oshkosh Defense is certified to IATF 16949. Defense Suppliers (servicing JLTV and FMTV A2) shall have a Quality Management System that is registered to ISO 9001-2015. The 3rd party ISO registrar is to be accredited, bearing the accreditation mark of a recognized IAF MLA (International Accreditation Forum Multilateral Recognition Arrangement) member (A2LA, ANSI, and ANAB for example). For a listing of accredited ISO registrars, visit: <https://www.iaf.nu/>

2.1. One condition for Oshkosh Defense IATF 16949 certification is for its suppliers (servicing JLTV and FMTV A2) to demonstrate a Quality Management System that is developed beyond ISO 9001 certification and maturing towards IATF 16949 certification.

Oshkosh Defense periodically assess our suppliers' QMS status and may request suppliers to take formal steps to advance their Quality Management System as deemed necessary.

Steps toward QMS maturation can be achieved:

- a) compliance or certifications to other QMS requirements
- b) compliance to IATF 16949 through second-party audits
- c) certification to IATF 16949 by third-party certification through an IATF recognized certification body

2.2. All suppliers shall have a quality management system that meets the requirements of the Oshkosh GSQM. Suppliers are subject to on-site audits, remote audits, or self-audits by Oshkosh Corporation to assure that a documented quality system is in place which includes development, implementation, and maintenance of Control Plans for all Defense programs and products.

2.3. There are a set of common practices and disciplines that characterize the most successful companies in the marketplace today. The following traits describe the Quality approach that Oshkosh Defense is fully pursuing, and we recommend you do the same. We are using a “Maturity Assessment” to practically evaluate the application of these traits within our organization, and it is available to use within yours also.

2.3.1. Statistical Process Control (SPC)- real-time SPC is used with observed processes in statistical control. Proper specification limits are monitored to address outputs that fall outside of the control limits before producing non-conforming product.

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2.3.2. Work Instructions and Training- Work instructions are up to date and readily available for assembly / operators. Work instructions are thorough, detailed, complete, and align with engineering specifications and the assembly process. Work instructions are linked to applicable tooling within station. Quality aids are posted within station. Training content addresses all required skills and is successfully completed by personnel before being permitted to manufacture product.

2.3.3. Error Proofing- error proofing is commonly used, it is challenged to ensure it is effective, and cannot be defeated. It successfully detects a defect and does not permit it to leave the work-station before corrected.

2.3.4. Supply Chain Management- parts used in production have been approved as conforming before assembly. The part approval process-documents are thorough and establishes that supplier processes are capable to consistently produce conforming product. Supplier performance metrics are used to identify and mitigate risks to manufacturing conforming product.

2.3.5. Tooling / Calibration- tooling is present within the applicable work -stations, and is error proof enabled, and calibrated. There is alignment between the tooling and work instructions. A robust tooling tracking management system is used.

2.3.6. PFMEA / Control Plans exist for each unique assembly process / work cell content. They demonstrate comprehensive thought and consideration for likely failure modes and corresponding mitigating controls. PFMEA's demonstrate linkages to the applicable DFMEA's, engineering drawings, and engineering specifications. PFMEA's demonstrate robust failure mode documentation, proper severity, occurrence, and detection scoring, RPN assignment, proper special characteristic assignment, and failure mode mitigation actions. The post-improvement severity, occurrence, and detection scoring are captured. PFMEA's and Control Plans are observed to be living documents evidenced by updates due to engineering changes, lessons learned, and process improvements over time.

2.3.7. Production Traceability-extensive use of product traceability captures raw material lots and sub-tier supplier components that is retained for future use and enables Oshkosh Defense to link your parts from specific PO's and deliveries onto the finished vehicle serial number.

2.3.8. Control of non-conforming products and defects-The production process identifies and corrects defects in station and does not pass them downstream during the assembly process. There is no opportunity to mix non-conforming product with conforming product during the process. Production processing does not permit the release of product to the customer with defects present.

2.3.9. Control of Special Characteristics- All Special Characteristics are properly controlled using SPC data. SPC metrics demonstrate that the required Cpk is being achieved. All Special Characteristics are conforming prior to releasing product to the customer.

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2.3.10. Production / Quality Metrics- Production processes use extensive metrics which drive process improvements back to the responsible work area. First Pass Yield Metrics or Defects per Unit for internal show evidence of continuous process improvement. Corrective Action Feedback demonstrates that corrective actions prevent issues from recurring.

2.3.11. In-process testing is robust and ensures product is conforming to specifications and is defect free prior to being released to the next operation. Testing is conducted frequently enough (with sufficient Cpk) to ensure conforming product is produced.

2.3.12. Change Control- is robustly managed with sufficient definition of what constitutes a process change and/or a product change. Change Control includes awareness to internal stakeholders that are responsible to communicate externally, and it is supported with documented procedures and systems-enabled checks and balances. Any change (except that which is already PPAP approved) that can have a potential downstream consequence to your customer and/or end users must begin with notification to Oshkosh Defense. See the section on *Supplier Change Requests*.

3. Software / Embedded Software

Oshkosh Defense is registered to IATF 16949 and Defense Suppliers (servicing JLTV and FMTV A2) of product-related software, or products with embedded software, shall implement and maintain a process for software quality assurance. The Quality Assurance methodology shall prioritize and mitigate risks based-upon the potential impact to the customer, and the organization shall retain documented information of the assessments conducted.

4. Record and Documentation Retention Requirements

While in storage, records and documents shall be protected from damage, loss, and deterioration due to environmental conditions. Records shall be maintained for (5) years. At the end of (5) years, the Supplier shall provide Oshkosh Defense with the option of having the records forwarded to Oshkosh Defense for further retention, as required by the contract, or authorizing disposal of the records and documents at the Supplier's location.

Production-related documents (PPAP or Certificates of Conformance) are required to be retained for Current Year (CY) plus 50 years.

Disposition shall be done in a timely and appropriate manner. Oshkosh Defense shall be notified when disposition has taken place.

5. Certificate of Conformance

The Supplier shall establish, implement, and maintain documented procedures, which ensure adherence to the Oshkosh Defense Certificate of Conformance requirement. The supplier shall have an authorized representative certify that the parts ordered have been processed to procedures that ensure the material is conforming and free of counterfeit material. The certificate of conformance will also acknowledge proper adherence to Purchase Orders, drawings, and contract requirements. Suppliers shall utilize the Oshkosh Certificate of Conformance form (QC-0899) located on <http://osn.oshkoshcorp.com/> or another Certificate of Conformance form that at minimum contains all the information required per the Oshkosh Certificate of Conformance form. The supplier shall complete and retain a Certificate of Conformance for each shipment of material. This record shall be retained at the supplier's location for **50 years**. This document must be made available at the request of Oshkosh within 24 hours.

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6. Counterfeit/Used Parts

The Defense Supplier shall establish, implement and maintain documented procedures, which shall preclude and/or detect the use of counterfeit/used parts. All Suppliers providing “electronic parts” (as defined within DFARS 252.246.7007,a) shall have developed and documented **Purchasing procedures** that reduce the risk of purchasing and utilizing counterfeit material. Suppliers shall have defined and documented **Product Verification procedures** that assure the detection of counterfeit parts prior to formal product acceptance. Suppliers shall have developed and documented a **Material Control Procedure** that includes quarantining, reporting, and dispositioning suspect and/or counterfeit components. Reference the Supplier Standard Guide, Section F Counterfeit Parts.

7. 3D Solid Model Specifications

If the product drawing (composites, castings, etc.) relies upon the 3D CAD model to fully define the part, the PPAP shall include evidence that all measured samples conform to the geometry and associated GD&T requirements defined by the 3D CAD model.

The supplier shall:

- a) assure that the correct 3D solid model revision level is utilized
- b) assure that proper tolerances have been applied
- c) assure that the parts surface profile adheres to the model.

The supplier shall provide Oshkosh Defense the *3D Model C of C* (certificate of conformance) with their PPAP submittal (provided within the Oshkosh Defense PPAP workbook). Including an excerpt of the actual scanned part as an overlay to the 3D model is recommended as supportive documentation.

8. Ball Studs and Ball Socket Assemblies

Defense suppliers of these components and/or assemblies shall demonstrate product and feature conformance as referenced within SAE J491 and outlined below.

8.1. Definitions

- **Master Gage:** a taper gage that serves as a standard or base, designed to specific dimensions within blueprint specifications
- **Bluing Paste:** a non-drying light paste with a pigment or dye (such as “Prussian Blue”) that colors a contacting surface
- The level of contact must be 60% minimum area of contact when blued (see acceptable patterns below)

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8.2. Instructions for Testing

The following process must be followed when performing taper testing

1. The bore (female) and stud (male) features must be free of rough spots
2. Visually inspect the surfaces for dark spots or areas that are not cleaned-up
3. Check rocking motion of the stud or gage before applying bluing dye. **The gage should not rock when seated within the bore.**
4. Apply bluing - must be distributed completely and evenly with a minimum thickness on the taper surface of the master gage.
5. Warning - excessive bluing will skew the results
6. Insert gage by hand pressure and with a slight twisting motion (1/4 turn clockwise and counter-clockwise)
7. Ensure gage is firmly seated
8. Remove and inspect the bluing pattern
9. Conforming conditions usually exceed the minimum 60% contact, and result in 90% + of contact (use the diagrams shown in Image 6A below for guidance of acceptability)

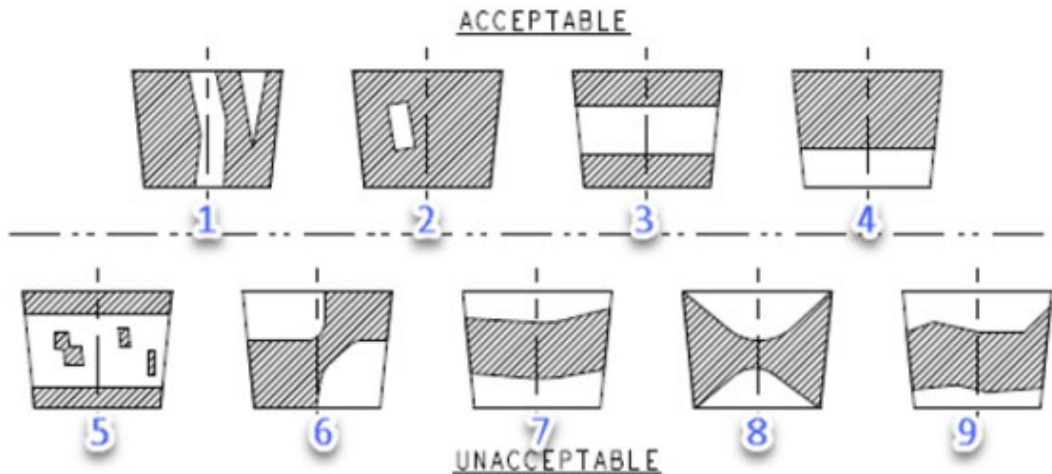


Image 6A - Taper Engagement Acceptability

(suppliers may contact OSK Supplier Quality to borrow the master gauge set for conducting an internal-taper MSA)

9. Source Inspection

During performance on this subcontract, the Supplier's manufacturing and associated processes, products and inspection and/or test data are subject to review, verification, examination, test and/or analysis by authorized Government and/or Oshkosh representatives.

10. Supplier Non-Conforming Material

10.1. Any rejected non-conforming material that has an extended cost less than \$100 per order will be auto-scraped and debited back to the supplier. This is an effort for Oshkosh Defense to reduce and eliminate administrative costs that should be passed along to the supplier.

10.2. Suppliers are encouraged to immediately notify Oshkosh Defense Purchasing or Supplier Quality if non-conforming tickets are erroneously assigned to your organization. We

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strive to keep performance data accurate, and early notification helps to properly reflect your PPM (parts per million) metric.

11. Oshkosh / U.S. Government (USG) returned parts

When a government owned vehicle experiences component failure, these components may be returned for analysis. Oshkosh will receive failure notification from the USG with a Report Control Number (RCN). Oshkosh will then contact the applicable supplier requesting their Return Goods Authorization number (RGA). The supplier shall reference the RCN and their RGA with assurance that parts will not be discarded until authorized by Oshkosh. The supplier shall conduct and submit a root cause analysis and corrective action to Oshkosh Defense in a timely manner. The 8D format is preferred but not required. It is advisable to include evidence(s) of process improvement(s) to substantiate the corrective actions taken.

12. Packaging and Shipping

The Supplier shall provide for adequate facilities and instructions for handling, packaging and shipping to preserve the products and prevent damage during storage and transit. See Section 23 from the Global Supplier Quality Manual and Section J of the Supplier Standards Guide for more detail.

The labeling requirements outlined in Section J are Oshkosh-specific and related to the way Oshkosh purchasing information is transmitted onto box labels for efficient receiving and are a different set of requirements than anything referenced on part-specific drawings.

For part-specific labeling requirements listed on drawings (e.g. MIL-STD-130, Armor Traceability, UID, etc.) refer to this Defense addendum. Section J labeling does not take the place of any other required labels, and each label requirement must be individual and exclusive.

13. Surface Preparation, Painting and Finishing

The Supplier must comply with the Oshkosh finish requirement specified on the drawing. When finish requirements are not specified, suppliers shall reference the Oshkosh Defense PS100 Pretreatment – Paint Specification and/or FM100 Finish Methods. These documents are available within the Reliance Document Control Module.

It remains the responsibility of the tier 1 supplier to ensure that finishing requirements are upheld by the sub tier finish suppliers. Only Oshkosh-approved finishing suppliers shall be utilized. Select government contracts (JLTV and FMTV A2) mandate qualification and sustaining quality requirements, which are specified inside of the pertinent finish requirements drawings (example- 12593834). Additionally, it is highly recommended that tier 1 suppliers mitigate risks by requiring sub tier suppliers to document process flows, Process FMEA, and Process Control Plans in accordance with Oshkosh Defense PPAP format.

Note: Become familiar with and enforce these flow-down requirements to prevent product recalls and product rework. Costs resulting from Supplier product recall and/or rework shall be borne by the Supplier.

Note: The purchase order may contain specific instructions regarding paint applications to facilitate subsequent operations.

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Note: Product shipping in “raw” (unfinished state) shall be provided in accordance with FM100, section R20.

- Reference section 4.1 for cleaning/blasting requirements by substrate
- Reference section 4.3 for a list of allowable rust inhibitors by substrate

As referenced in Section D.32 of the Oshkosh Supplier Standards Guide, the use of any pretreatment, plating, painting, or coating of any kind that contains **Hexavalent Chrome** is strictly prohibited. Any supplier to Oshkosh Corporation shall have systems in place to monitor and control the coating processes used by upstream suppliers when plating requirements are not strictly defined within the Oshkosh design record. Hexavalent Chrome can appear in several forms and can be known by many several nomenclatures. Regardless of the specific nomenclature referenced on the coating certification, usage is strictly prohibited.

Different ways of representing Hexavalent chromium are given below:

- Hexavalent chromium
- Hexavalent chrome
- Hex chrome

Different plating specifications that may contain Hex Chrome (the specifications below may be prohibited. Due diligence is required to verify conformance).

- ASTM B633 (Standard for Electro deposited coatings of Zinc on Iron and Steel)
- ASTM B633 (Coating thickness) Type II
- ASTM B633 (Coating thickness) Type III
- Zn/Fe SC (Coating thickness in micrometers) Type II
- Zn/Fe SC (Coating thickness in micrometers) Type III
- Zinc Yellow
- Zinc Clear
- Chromate
- Chromate conversion coating
- Zinc chromate
- Zinc Dichromate

In addition, Dacromet is not specifically a chromate coating, but a type of Zinc-Rich paint which contains Hex chrome.

14. Part Marking / Identification and Traceability

The Oshkosh drawings provides guidance for part marking identification in accordance with Military Standard 130, but it does not specify the method or location in all cases.

14.1. Location Requirements

Some drawings specify only compliance to Military Standard 130 (MIL-STD-130) and may/may not include the marking method or location on the part. In those instances, it is important to ensure the identification is visible and legible during normal operational use (if it is affixed to the part), and it needs to be permanent through the life cycle of the part.

For components that are physically marked (by etching or stamping for example), the identification **MUST** be legible in its final state (after coating). It is the tier one supplier’s responsibility to ensure conformance to this requirement.

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For small components that cannot be marked physically, or tagged, select other alternatives within the standard. It is important that some method be used in part marking identification.

14.2. Lot Traceability / Serialization

It is recommended that the supplier utilize some method of traceability for each order fulfillment such as serialization or your company's CAGE (IAW Military Standard 130).

14.3. Armor

Armor traceability is considered a "CC" (Critical Characteristic) and shall be maintained & linked to the IUID (Item Unique Identification) label. At a minimum the following information shall be tracked and linked: serial number, part number, heat number, lot number, material certification number, materials standard, and MIL CAGE code. For complex weldments or multi-piece assemblies, all material lots utilized for construction for that end item shall be recorded and linked to the IUID label. The process of tracking the information prior to the final IUID label shall be IAW the prime contractor's material traceability requirement (see drawing 3912088).

The supplier's Armor traceability Procedure shall be integrated from supplier's Receiving raw materials, to sub-components (or assembled product), through the supplier's Shipping, and ultimately traceable by the end-user. The supplier shall have a defined traceability procedure that is referenced in the PFEMA and Control Plan.

14.4. Transparent Armor (TA)

Suppliers shall strictly comply with the ATPD 2352 (applicable revision) in all respects and demonstrate compliance utilizing a Quality Plan matrix (Oshkosh Defense format) for each section and sub section outlining supportive evidence. This document shall be included within the PPAP submitted to Oshkosh Defense.

The suppliers PPAP documentation shall include the supplier's TA "Recipe" or design number represented for all testing requirements. This provides continuity for the entire documentation packet and assurance of compliance and accuracy.

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15. Castings Introduction

Castings shall be in accordance with CORP-PROC-ENG002, unless specified otherwise.

15.1. Inspection

Radiographic inspection reports shall be signed by a certified ASNT (American Society for Non-Destructive Testing) inspector, level II minimum.

For the JLTV program (contract #W56HZV15C0095), radiographic reports shall be signed by a NAS 410 certified technician.

Castings produced from Aluminum A206 utilizing a permanent mold production process shall be subject to penetrant inspection IAW SAE-AMS2175A, Table 4. Inspection reports shall be signed by a certified ASNT or NAS-410 inspector.

If the casting / machine drawing relies upon the 3D CAD model to fully define the part, the PPAP shall include evidence that all measured samples conform to the geometry and associated GD&T requirements defined by the 3D CAD model.

The supplier shall:

- a) assure that the correct 3D solid model revision level is utilized
- b) assure that proper tolerances have been applied
- c) assure that the parts surface profile adheres to the model.

The supplier shall provide the Oshkosh Defense *3D Model C of C* (certificate of conformance) with their PPAP submittal (provided within the Oshkosh Defense PPAP workbook). Including an excerpt of the actual scanned part as an overlay to the 3D model is recommended as supportive documentation.

Casting parts with inner passages and/or wall thickness features require verification that minimum thicknesses are maintained during the initial part approval process. The controlling features on the drawing may be expressed as dimensional or as a surface profile (or both). The method for verification may be achieved by sectioning and measuring. Whatever method is used, it is required that photos and measurements be recorded and submitted with the PPAP.

15.2. Inspection Frequency

The first casting shall be radiographed in all routine and random positions described on the position chart (or in the supplier's Control Plan if not detailed on the drawing).

Subsequent castings shall be radiographed in those areas that were defective in the immediately preceding castings, until compliance with the required standard has been obtained. Objective evidence shall be provided by the producer that corrective action has been taken to eliminate the deficiency.

Casting parts with inner passages and/or wall thickness features require verification that minimum thicknesses are maintained throughout the procurement cycle. The controlling features on the drawing may be expressed as dimensional or as a surface profile (or both). The method for verification may be achieved by sectioning and measuring. Unless otherwise stated, re-verification shall be conducted semi-annually (identical as radiography frequency). Whatever method is used, it is required that photos and measurements be recorded, retained, and provided upon request.

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15.2.1. Radiographic Inspection Process

1. **PPAP submission:** One part per mold cavity. PPAP submittals to include:
 - a. Radiographic inspection reports
 - b. Radiographic images (with evidence that IQI's were utilized)
 - c. NAS 410 Certifications / ASNT Certifications
 - d. Laboratory accreditations
2. **Initial Production** (first 10 lots): One part per mold cavity from every 30 molds poured.
3. **Production Sampling:** One part per mold cavity twice per year (minimum). Increased frequency of radiography may be advisable (at the supplier's discretion) to ensure conforming product is being installed on Oshkosh Defense vehicles. If a non-conformance is realized, all costs for repair or replacement of non-conforming parts (since the last successful production sampling schedule) installed onto vehicles or within the supply chain shall be borne by the Oshkosh Defense supplier.

- *Oshkosh reserves the right to conduct process audits to verify conformance to the above requirement.*

15.3. Rework / Repair

Rework is defined as bringing a non-conforming part back into conformance by simply reprocessing a prior sequence. Repairs are defined as bringing a non-conforming part back into conformance using methods outside the original process.

All non-conforming repairs require an approved and qualified repair procedure and must meet the specified standard on applicable position chart. Suppliers shall utilize a Supplier Change Request (RCM- Reliance) form to initiate an Oshkosh approval.

15.4. Radiography Position Requirements

All routine and random positions shall be radiographed for initial production castings except when the total exceeds the established number of radiographs that can be taken in a normal eight-hour day.

When the total number of positions to be radiographed for initial production castings exceeds the maximum capability of facilities, random position shall be selected for radiography by an NAS 410 qualified operator and rotated in such a manner that complete coverage is achieved within a cycle of five castings radiographed.

15.5. Occurrence Reaction

The occurrence of a rejectable defect in any area on a casting shall require the radiographic inspection of each subsequently poured casting in that area until the defective condition is corrected.

- a. In the event of one failed radiograph from a lot, radiograph 3 additional samples (our level 3 PPAP quantity) from the same lot. If those 3 samples pass, scrap (or repair) the non-conforming part, and utilize the remaining lot if the non-conformance is believed to be isolated. Begin initial production radiograph schedule again (1 out of 30 for 10 consecutive lots).

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- b. If more than one part in a lot fails, that entire lot is scrap or 100 percent inspected (whatever makes economic sense). A root cause, correction, and preventative action will be required. Additional radiographs will be required to support the corrective and preventative actions taken. Begin initial production radiograph schedule again (1 out of 30 for 10 consecutive lots).

Objective records must demonstrate justification to advance from Initial Production sampling to Production Sampling.

16. Welding Procedure Introduction

The Supplier shall develop and submit Welding Procedure Specifications (WPS), Procedure Qualification Records (PQRs), and Weld Repair Procedures in accordance with welding standard(s). It is important to include all applicable WPS and PQRs in the PPAP submittal or if requested by Oshkosh Defense. Welder Qualification Records (WQRs) shall also be available upon request.

The Supplier shall follow the appropriate welding standard(s) scope to qualify the welding and weld repair procedures. The Supplier shall prepare weld samples and test the weld procedure for qualification in accordance with the appropriate standard(s). Changes to the Weld Repair Procedures and WPS, or PQR that requires requalification, shall be resubmitted as part of a Supplier Change Request (RCM).

The use of pre-qualified weld joints as specified in American Welding Society (AWS) D1.1 does not preclude submittal of welding procedures. All Welding documentation referenced above and in any subsequent section shall be made available to Oshkosh upon request.

16.1. Armor Welding Procedure Design

Prior to manufacturing, the Supplier shall develop welding procedures for all ballistic weldments in accordance with the applicable welding code for Armor Steels and Armor Aluminum. As a Defense sub-contractor, the welding code is dictated by the code in place during contract award. Adherence to the standard on the drawing is required (Example: Do not supersede the Ground Combat Vehicle Welding Code-12479550 (Steel) or 12472301 (Aluminum) with Military Standards.

Any deviation from the stated requirement is to be submitted and approved by Oshkosh Defense on a Supplier Change Request (RCM) prior to implementing the change.

All welded armor for Oshkosh Corporation shall be routed through a 48-hour hold prior to final inspection. This waiting period helps to visually detect latent defects.

16.2. Structural Welding Procedure Design

Non-armor and structural welding design shall be performed by the Supplier and will ensure that all metallic weldments meet the welding design and fabrication requirements in the prescribed standards listed herein or an approved equivalent. The use of pre-qualified weld joints as specified in AWS D1.1 does not preclude submittal of welding procedures.

16.3. Qualified Weld Repair Procedures

Rework is defined as bringing a non-conforming part back into conformance by simply reprocessing a prior sequence.

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Repairs are defined as bringing a non-conforming part back into conformance using methods outside the original process.

All non-conforming repairs require an approved and qualified repair procedure. Suppliers shall utilize a Supplier Change Request (RCM) form to initiate an Oshkosh approval. When a repair is required, the Supplier shall provide written repair procedure as part of the Supplier Change Request, identifying proper technique to correct defective products. The Welding procedures for the repairs shall be in accordance with the applicable welding standard(s).

16.4. Qualified Welding Equipment

The Supplier shall develop and maintain a welding equipment calibration program. This program shall consist of, as a minimum, an annual comparison check of the machine output with instrumentation that has been certified and calibrated using standards traceable to the National Institute of Standards and Technology (NIST).

16.5. Qualified Welding Inspector

Qualified inspectors trained to perform inspection functions shall be used for the verification of weld quality, and shall be in accordance with at least one of the following conditions:
Current certification in accordance with the American Welding Society (AWS), Certified Welding Inspector (CWI) or Senior Certified Welding Inspector (SCWI), qualified and certified in accordance with provisions of AWS QC1.

Current certified welding inspectors qualified by the Canadian Welding Bureau (CWB) to Level II or the Level III requirements of the Canadian Standards Association (CSA) Standard W 178.2 Certification of Welding Inspectors.

16.6. Nondestructive Testing

16.6.1. Visual Inspection

Visual inspections shall be IAW the applicable weld standards. Armor steel(s) and quenched and tempered steel(s) shall be visually inspected after the welds have been completed, cooled to ambient temperature, and after no less than 48-hour hold period.

16.6.2. Nondestructive Critical Weld Joint Identification

The Supplier shall clearly identify in the product drawings, all critical joints required for Non-Destructive Testing (NDT) other than visual inspection.

16.6.3. Qualified Nondestructive Inspectors

When NDT is required, the inspectors shall be qualified IAW the current addition of American Society for Nondestructive Testing Recommended Practice No. SNT-TC-1A. Only individuals qualified for NDT LEVEL I and working under the NDT LEVEL II or individuals qualified for NDT LEVEL II may perform nondestructive testing except visual examination. The NDT personnel need not be an AWS CWI. The Supplier shall make available all NDT personnel qualification records upon request by Oshkosh.

16.6.4. Nondestructive Testing Acceptance Criteria (Armor Material)

NDT is required for armor the procedures and acceptance criteria shall be IAW TACOM Ground Combat Vehicle Welding Code for Steel (drawing number 19207-12479550), and the Ground Combat Vehicle Welding Code for Aluminum (drawing number 19207-12472301).

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Steel Armor materials MIL-DTL-46100, MIL-DTL-12560, or low alloy steels that are 1/8 inch (3mm) or thicker with a minimum specified yield strength greater than 100ksi (600MPa) shall be held for a minimum of 48 hours and inspected after welding is completed and has cooled to an ambient temperature.

16.6.5. Nondestructive Testing Acceptance Criteria (Structural, Non-Armor Material)

When NDT is required for non-armor and structural material(s) the acceptance criteria shall be as stated in the applicable standard. The acceptance criteria differ based on the design loads.

The Supplier shall state what joints are critical load bearing members and clearly identify these weldments for inspection purposes). In the case of critical structures, the acceptance criteria for cyclic loads will be as stated in AWS D1.1 and Class II structures for Aluminum welds IAW AWS D1.2.

17. Component First Article Testing (CFAT)

This addendum is intended to give general details on the Component First Article Test (CFAT) requirements for Defense contracts. Individual Government contracts have unique instructions on timelines for Test Plans, Test Reports, and formal notifications to Oshkosh Defense / Government. Failure to follow the guidelines provided may be grounds for Oshkosh Corporation and/or the government to seek financial compensation for delays to the program. Additional costs to repeat a given CFAT will be borne by the Supplier. A general synopsis of the CFAT requirements is as follows:

The Supplier shall conduct the appropriate CFAT testing as outlined on the Design Record (only applies if Design Record notes indicate requirement).

Oshkosh Defense is required to notify the government within a preset number of days prior to the start of the CFAT testing. Oshkosh / Government Representatives reserve the right to be present at any such testing. Failure to notify Oshkosh / Government within the time limit may, at the Oshkosh / Government discretion, be grounds to reject the test. The Supplier shall work with the designated Oshkosh Defense person in reporting out and planning of these test activities. The Supplier shall conduct the testing at the Supplier's facility or via third party accredited laboratory unless a waiver is signed and approved from Oshkosh Defense. CFAT shall be representative of items to be manufactured using the same process, facilities and procedures as will be used for contract production.

17.1. CFAT Requirements

CFAT test item(s) must be from the first 10 units manufactured (unless otherwise specified). For example, if Oshkosh initially requires 10 components for production, the supplier must make a total of 11 parts, of which 1 of the first 10 is used for the CFAT test. Some CFAT tests may require more than 1 test item to validate all requirements. The CFAT test item(s) must be manufactured at the same location and use the same processes, technical data, and material as the full rate production items. If temporary tooling is required to meet the production deadlines, conditional acceptance of a CFAT can be obtained once the production tooling is in place. The Supplier will need to follow up with a full finalized CFAT as part of the full PPAP submission for approval.

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17.2. CFAT Test Plan Requirements

A CFAT test plan is required within a specific timeframe per the dictating contract. The purchase order will denote CFAT requirements if applicable. The test plan must include an intended schedule, tests to be performed (as noted on the Design Record), test method, test location, and the test authority (whether the supplier or an accredited outside lab). The due date will be provided by Oshkosh Defense Purchasing either via e-mail or on the purchase order for the given parts. The supplier and or test agency shall notify Oshkosh Defense within a specific timeframe per the contract prior to the start of CFAT testing. Failure to notify Oshkosh may be grounds to reject the test. Depending on the vehicle program, form A072 or E002 will be use. These are found at <http://osn.oshkoshcorp.com/>

17.3. CFAT Test Report Requirements

A CFAT Test Report summarizing the test is due to the Oshkosh / Government within a specific timeframe per contractual requirement. A level 3 PPAP package will be required with official submittal of the CFAT report. The CFAT report must contain all documentation test/inspection results, findings, and analysis that will enable Oshkosh / Government to evaluate compliance with system requirements, performance objectives, specifications and corresponding test plan. Such items may include, but are not limited to:

Part number drawings and Quality Assurance Provisions

A matrix summary that tabulates each test/inspection performed, the results of that test (pass/fail), corresponding page where the data is located, and in the event of a failure, the corresponding corrective action plan, if required, shall be included in the report as well as the certification.

Depending on the vehicle program, form A073 or E003 will be used. These are found at <http://osn.oshkoshcorp.com/>

17.4. CFAT Disapproval

If the CFAT is disapproved by Oshkosh / Government, the supplier shall repeat the CFAT. After such repeat testing, the Supplier shall make any necessary changes, modifications or repairs to the First Article or select another First Article for testing. All costs related to these tests shall be borne by the Supplier, including any and all costs for additional tests following disapproval. Oshkosh / Government reserves the right to have all or partial CFAT repeated to clarify missing information or to verify that a corrective action has fixed a previous failure. Oshkosh / Government reserves the right to require equitable adjustment for any delays to the vehicle delivery schedule or for any additional costs related to repeating a CFAT test.

17.5. Changes

If changes are made to the technical data, production processes, facilities, and/or type of material, a subsequent CFAT may be required by Oshkosh / Government. When any of the above conditions occur, the Supplier shall notify Oshkosh. Costs of CFATs resulting from Supplier's production process change or material substitution shall be borne by the Supplier.

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17.6. CFAT Conditional Acceptance

Conditional acceptance of a CFAT will follow the same procedure as applying for interim PPAP approval. Conditional acceptance (Interim PPAP approval) of a CFAT can be granted pending successful completion of a CFAT if the supplier agrees to the following:

To successfully complete all CFAT tests.

To be willing to rectify all deficiencies/discrepancies in each component that is identified during subsequent CFAT testing, regardless of the location of the component at no cost to Oshkosh Corporation and/or the government.

18. Supplier Change Requests

Notifying and attaining authorization for proposed changes is of the highest importance. Suppliers (Tier 1 and Tier 2 suppliers) must notify Oshkosh Defense of any proposed changes in processing or product modifications for any reasons such as; to help reduce cost, improve quality, alleviate constraints, increase reliability and process capability of the product.

ALL proposed design changes or modifications, whether permanent or temporary and including proprietary designs, MUST be approved in writing by Oshkosh Defense prior to implementing.

The supplier must communicate all change requests using the Reliance Change Management (RCM) process within the Oshkosh Defense Supplier Portal at the link below. This should be submitted at least 12 weeks prior to the planned change implementation.

https://osn.oshkoshcorp.com/docs/quality/Global_Supplier_Quality_Manual_Edition_7.pdf

Suppliers shall have a documented procedure that requires all temporary and/or permanent process or product changes to be communicated and approved by their customer prior to implementation.

Once the RCM approval is granted, the supplier shall submit a corresponding PPAP for Oshkosh Defense approval

There are four types of Change Requests:

1. **Temporary Process Change** – A change to the current PPAP approved process such as a tooling move, plant move, improved/new tooling, etc., however it may be functionally acceptable temporarily
 - *Example: You / Your sub-tier supplier wants to use different equipment or parts from another facility to process the product*
2. **Temporary Product Change** – A change to the current PPAP approved product such as part geometry / dimensions, design intent, material change, etc. however it may be functionally acceptable temporarily
 - *Example: You / Your sub-tier supplier wants to use an alternate material due to a supply chain issue*
3. **Permanent Process Change** – A change to the current PPAP approved process, tooling move, plant move, improved/new tooling etc. on a permanent basis
 - *Example: You / Your sub-tier supplier is moving their processing facility to a different state*
4. **Permanent Product Change** – A change to the current product or design such that it meets the current design intent and requires a design change
 - *Example: You / Your supplier have a product Improvement proposal*

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19. PPAP Requirements Overview

The Defense PPAP requirements are primarily based upon the AIAG PPAP Manual 4th edition and Appendix H. Exceptions to AIAG are referenced within this manual, the PPAP workbook (OSK F2000), and the PPAP procedure (OSK P2000). In the event of a conflict, the text of this document and the references cited herein takes precedence. It is expected that Oshkosh Defense Quality requirements flow down to the sub tier suppliers to fully support PPAP fulfillment.

Suppliers shall manage the completion, and submittal of Level 3 PPAP's **7 calendar days (minimum) prior to the Purchase Order due date** (PPAP Levels 1, 2, and 4 are submitted with the product shipment). This time is needed to review / approve / correct the documents for accuracy and completion. Timeliness and thoroughness of the PPAP submittals will impact the supplier PPAP First Pass Yield metric that guides business decisions.

Defense PPAP's are considered "living documents" and are expected to be maintained to represent the current production process. Additionally, it is expected that Corrective and Preventative Actions prompt updates to the PFMEA and Control Plan.

PPAP re-submittals are required when; a part drawing is revised, a supplier process change is made (and approved), or a lapse in order fulfillment occurs. In these instances, the supplier is required to re-submit a completed PPAP (and not the delta information only). Legacy elements of the original PPAP may be utilized, but the PPAP in general needs to be representative of the process and be updated (current material certifications for example).

Oshkosh's **P2000 PPAP Instructions Manual** and **F2000 PPAP Workbook** (located <http://osn.oshkoshcorp.com>) must be adhered to for Approval status to be granted.

Interim Approval may be temporarily granted by the assigned Oshkosh Quality Engineer and must be considered the exception.

Interim PPAP approval will not be granted if the following elements are missing or incomplete.

- Design Record (Bubble Print)
- Engineering Change Documents / Customer Engineering Approval (If applicable)
- Dimensional Results / Print Notes Verification
- Material / Performance test results
- Qualified Lab Documents
- Master Sample Photos
- Part Submission Warrant

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19.1. QC-112 PPAP Check list

This document will assist in ensuring all elements are present and complete. It is available as a reference when completing level 3 PPAP.

19.2. Commercial Off the Shelf (COTS)

Commercial off the Shelf (COTS) Components are items sold in the commercial marketplace. These parts are commercially available (and at times procured through distributors). They cannot be modified, combined, evolved, or “of-a-type” commercial items. They must truly be “as-is”. For further definition, refer to FAR 2.101.

When providing a PPAP for COTS parts, Oshkosh’s suppliers are expected to submit all 18 elements of PPAP. At times, due to the nature of COTS parts, Oshkosh’s suppliers may be unable to obtain all data for all 18 elements for a level 3 PPAP. In these cases, the supplier is expected to demonstrate / affirm conformance with supporting PPAP documents or Certificates of Conformance by supplying the following minimum PPAP elements:

- Design Record (Bubble Print)
- Engineering Change Documents / Customer Engineering Approval (If applicable)
- Dimensional Results / Print Notes Verification
- Master Sample Photos
- Customer Specific Requirements (CFAT- if applicable)
- Parts Submission Warrant
- Catalog Page or equivalent from OEM to demonstrate commerciality (if available)

When the supplier cannot attain all PPAP elements, a Certificate of Conformance (C of C) will be required in addition to the above elements. The C of C letter shall:

- Confirm the article is commercially available
- Be on the supplier’s company letterhead
- Include the Oshkosh part number
- Include the part revision level,
- Be signed by a representative within the contractor’s organization that has decision making authority.
- Positively affirm that the part meets the requirements within the print.

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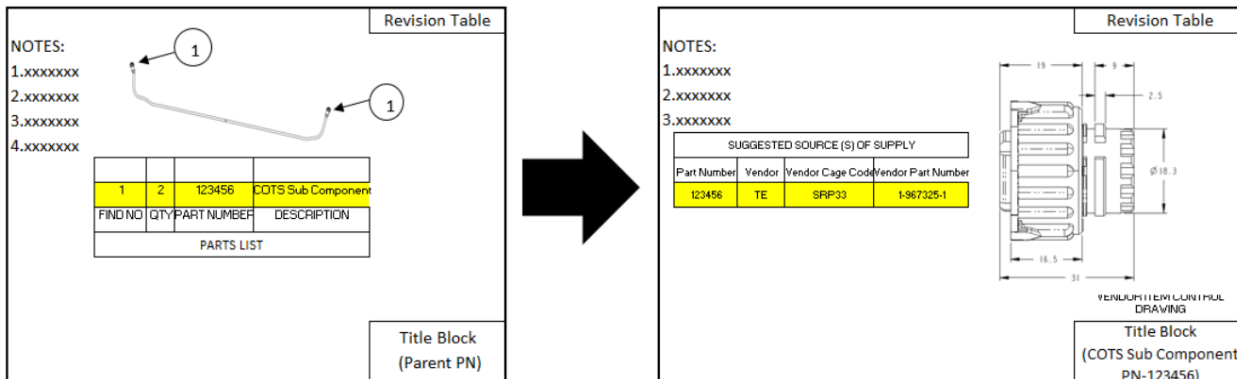
19.2.1. "COTS Plus":

Parts that are Commercial Off the Shelf (as defined above) but have additional print or performance requirements that Oshkosh has deemed important (because of the part's application). If the OEM catalog page or product data sheet that does not include all Oshkosh Defense print specifications, the supplier is responsible to provide objective evidence that the part meets the requirement within the Oshkosh Defense print.

NOTE: Caution is needed when a COTS component is "modified" with additional specifications. Modifications to COTS parts re-classify it as a COTS Plus part. If a modification alters the original specifications, re-testing the part in its entirety is required to demonstrate that no unintended performance shortcoming will occur because of the modification.

19.2.2. COTS subcomponents

For COTS subcomponents within the Purchased Part Level (Parent), only the certificate of conformance and design record are required if COTS Vendor Part Number specified by subcomponent drawing is used. If no Vendor Part Number is specified, a one-piece dimensional result, print note verification, design record, and Supplier Change Request (if applicable) are required.



20. Design Record (AIAG PPAP 2.2.1)

The Supplier shall comply with the Oshkosh Defense Design Record for the product/part referenced on the Purchase Order. This includes sub-components (drawings) associated with Purchased product/part. Where the Design Record is in electronic format, the Supplier shall produce a hard copy. Examples include, but are not limited to pictorial of the parts, GD&T sheets, drawings and identifications of measurements taken. Engineering Drawings (Balloon Prints) shall accompany each PPAP submittal.

Best Practice: Layout the balloon print so the numbering of all features is formatted sequentially in a left-to-right, clockwise pattern on the first page of the drawing, and continues sequentially and clockwise for pages, 2, 3, ... when design records have multiple pages. This pattern expedites the review and approval process.

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21. Authorized Engineering Change Documents (AIAG PPAP 2.2.2).

Only production-released / approved drawings shall be utilized for PPAP submittals.

The Supplier shall maintain copies of any authorized engineering change documents for those changes not yet recorded in the Design Record but incorporated in the product, part or tooling. Marked drawings are acceptable for PPAP submission when a released drawing is not available due to timeline constraints. Any marked drawings from Oshkosh Defense must be signed and approved by Oshkosh Design Engineering, and a copy of the approved Oshkosh Defense Supplier Change Request (RCM) must accompany the PPAP submittal.

22. Customer Engineering Approval (AIAG PPAP 2.2.3)

Where specified by the customer, the organization shall have evidence of customer engineering approval.

23. Design FMEA (AIAG PPAP 2.2.4)

DFMEA is required at the component level for all parts where the Supplier is considered design responsible for all Level 3 PPAP submittals.

23.1. FMEA Special Characteristics Introduction

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 Critical Characteristic is defined as a product characteristic or manufacturing process parameter that can potentially affect compliance with government regulations, safe vehicle operation, or safe equipment function.

Significant Characteristic (SC) - A Significant Characteristic is defined as a product characteristic or manufacturing process parameter which can affect fit, function, performance or impact subsequent processing of product.



Examples of Special Characteristic symbols

23.2. FMEA Characteristic Assignment Process

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 (*see Figure 1 below*). All special characteristics shall be documented on the corresponding control plan.

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Significant Characteristics - 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 or be subject to 100% inspection.

Critical Characteristic - 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 or be subject to 100% inspection.

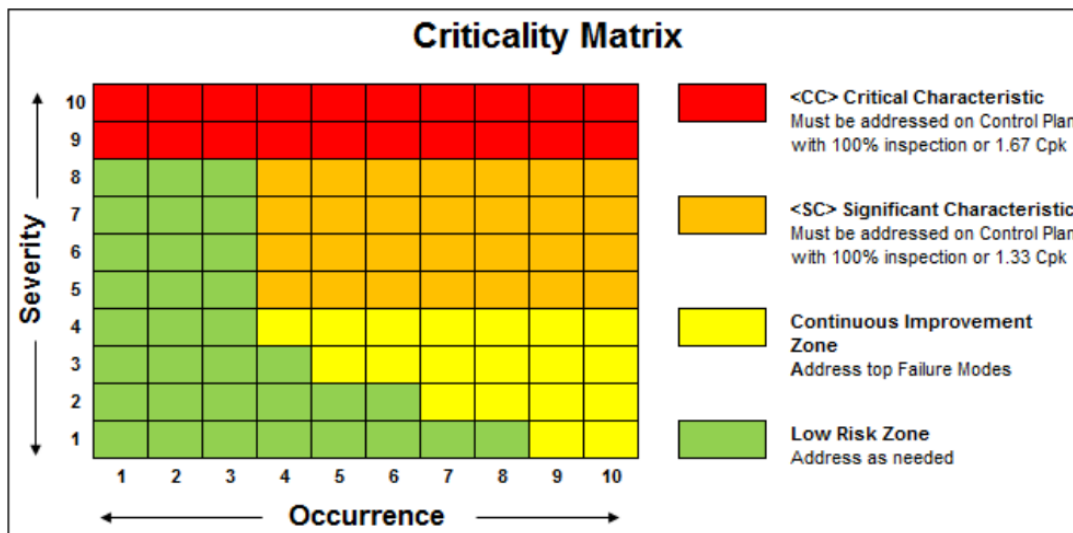


Figure 1: Criticality Matrix to be used for identification and Classification of Special Characteristics

23.3. FMEA Severity Ranking Assignment

Assignment of DFMEA and PFMEA Severity Rank values shall be in accordance with Figure 2 below. If there is any disagreement between criteria for assignment of Severity Rank in the table while performing DFMEA or PFMEA analysis, the more severe (higher) rank value shall always be utilized.

23.4. FMEA Occurrence Ranking Assignment

Assignment of DFMEA and PFMEA Occurrence Rank values shall be in accordance with Figure 3 below. If there is any disagreement between criteria for assignment of an Occurrence Rank in the table while performing DFMEA or PFMEA analysis, the more severe (higher) rank value shall always be utilized. Note that the Occurrence column pertaining to Testing applies to both DFMEA and PFMEA.

23.5. FMEA Detection Ranking Assignment

Detection Ranks are not to be considered in the assignment of special characteristics. However, for the purposes of conducting DFMEA and PFMEA analyses and determining Risk Priority Number (RPN) values, the Oshkosh Defense standard table within the PPAP workbook (Table Cr3 from the AIAG Potential Failure Mode and Effects Analysis Manual Fourth Edition) shall be utilized.

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SEVERITY RATING SCALE				
CUSTOMER EFFECT	SEVERITY OF EFFECT ON PRODUCT	RANK	SEVERITY OF EFFECT ON PROCESS	ASSY EFFECT
Failure to Meet Safety and/or Regulatory Requirements	Potential failure mode affects safe vehicle operation and/or involves noncompliance with government regulation without warning.	10	May endanger operator (machine or assembly) without warning.	Hazardous without warning
	Potential failure mode affects safe vehicle operation and/or involves noncompliance with government regulation with warning	9	May endanger operator (machine or assembly) with warning.	Hazardous with warning
Loss or Degradation of Primary Function	Loss of primary function (vehicle / item inoperable, but does not affect safe operation).	8	100% of production run may have to be scrapped, line shutdown, or stop ship.	Major Disruption
	Degradation of primary function (vehicle / item operable but at a reduced level of performance)	7	A portion of the production run may have to be scrapped, deviation from primary process including decreased line speed or added manpower.	Significant Disruption
Loss or Degradation of Secondary Function	Loss of secondary function (vehicle / item operable, but does not affect safe operation, but secondary functions inoperable)	6	100% of production run may have to be reworked off line and accepted.	Moderate Disruption
	Degradation of secondary function (vehicle / item operable, but secondary functions operate at reduced level of performance)	5	A portion of the production run may have to be reworked off line and accepted.	
Loss or Degradation of Tertiary Function	Condition impacting a tertiary function but vehicle remains operable, appearance or audible noise, or item does not conform and noticed by >75% of customers	4	100% of production run may have to be reworked in station before it is processed.	Minor Disruption
	Condition impacting a tertiary function but vehicle remains operable, appearance or audible noise, or item does not conform and noticed by ~50% of customers	3	A portion of the production run may have to be reworked in station before it is processed.	
	Condition impacting a tertiary function but vehicle remains operable, appearance or audible noise, or item does not conform and noticed by <25% of customers	2	Slight inconvenience to process, operation, or operator.	Annoyance
No effect	No discernible effect	1	No discernible effect.	None

Figure 2: Severity Ranking Criteria for DFMEA and PFMEA

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OCCURRENCE RATING SCALE				
LIKELIHOOD OF FAILURE	OCCURRENCE OF CAUSE FROM TESTING	OCCURRENCE OF CAUSE FOR DFMEA	OCCURRENCE OF CAUSE FOR PFMEA	RANK
Very High	Observed on over 50% of test assets.	New technology/new design with no history.	One occurrence per part/machine	10
High	Observed on >25-50% of test assets.	Failure is inevitable with new design, new application, or change in duty cycle/operating conditions.	One occurrence per shift <i>*(>1 in 5)</i>	9
		Failure is likely with new design, new application, or change in duty cycle/operating conditions.	One occurrence per day <i>*(1 in 5)</i>	8
		Failure is uncertain with new design, new application, or change in duty cycle/operating conditions.	One occurrence per week <i>*(1 in 25)</i>	7
Moderate	Observed on >12.5-25% of test assets.	Frequent failures associated with similar designs or in design simulation and testing.	One occurrence every 2 weeks <i>*(1 in 50)</i>	6
		Occasional failures associated with similar designs or in design simulation and testing.	One occurrence per month <i>*(1 in 100)</i>	5
		Isolated Failures associated with similar design or in design simulation and testing.	One occurrence per 3 months <i>*(1 in 300)</i>	4
Low	Observed on up to 12.5% of test assets.	Only isolated failures associated with almost identical design or in design simulation and testing.	One occurrence per 6 months <i>*(1 in 600)</i>	3
	No occurrences observed during testing.	No observed failures associated with almost identical design or in design simulation and testing.	One occurrence per year <i>*(1 in 1200)</i>	2
Very Low			Failure is eliminated through preventive control.	Less than one occurrence per year <i>*(<1 in 1200)</i>

**Occurrence frequency for PFMEA should be calculated based upon yearly production volumes (for example, if 1,200 units are produced each year, one occurrence per month equals 1 in 100 units produced)*

Figure 3: Occurrence Ranking Criteria for DFMEA and PFMEA

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Detection Rating Scale		
Rank	DETECTION PROBABILITY	CRITERIA
10	No detection opportunity	No current process control; Cannot detect or is not analyzed.
9	Not likely to detect at any stage	Failure Mode and/or Error (Cause) is not easily detected (e.g. random audits)
8	Problem Detection Post Processing	Failure Mode detection post-processing by operator through visual/tactile/audible means.
7	Problem Detection at Source	Failure Mode detection in-station by operator through visual/tactile/audible means or post-processing through use of attribute gauging (go/no go, manual torque check/clicker wrench, etc.)
6	Problem Detection Post Processing	Failure Mode detection post-processing by operator through use of variable gauging or in-station by operator through use of attribute gauging (go/no go, manual torque check/clicker wrench, etc.)
5	Problem Detection at Source	Failure Mode or Error (Cause) detection in-station by operator through use of variable gauging or by automated controls in-station that will detect discrepant part and notify operator (light, buzzer, etc.). Gauging performed on setup and first-piece check (for set-up causes only).
4	Problem Detection Post Processing	Failure Mode detection post-processing by automated controls that will detect discrepant part and lock part to prevent further processing.
3	Problem Detection at Source	Failure Mode detection in-station by automated controls that will detect discrepant part and prevent automatically lock part in station to prevent further processing.
2	Error Detection and/or Problem Prevention	Error (Cause) detection in-station by automated controls that will detect error and prevent discrepant part from being made.
1	Detection not applicable; Failure Prevention	Error (Cause) prevention as a result of fixture design, machine design or part design. Discrepant parts cannot be made because item has been error-proofed by process/product design.

This scale was adapted from the AIAG FMEA Manual (4th Edition)

23.6. Process Flow Diagram (AIAG PPAP 2.2.5)

Process Flow Diagrams are required for all Level 3 PPAP submittals.

23.7. Process FMEA (AIAG PPAP 2.2.6)

PFMEAs are required for all Level 3 PPAP submittals. Additional FMEA requirements are outline in section 13.6

23.8. Control Plan (AIAG PPAP 2.2.7)

Control Plans are required for all Level 3 PPAP submittals.

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24. Measurement Systems Analysis (MSA) Studies (AIAG PPAP 2.2.8)

For all Level 3 PPAP submittals, Oshkosh requires separate GR&R's be submitted for each measurement gage or device family gage that is used to validate Special (Significant, Critical, Major or CSI) Characteristics identified on the Design Record or listed in the Control Plan.

Note: not all product and process characteristics listed in the Control Plan are expected to require extensive measurement systems analysis scrutiny. Suppliers are encouraged to use a risk-based approach when evaluating whether GR&R's should be required for any non-Special Characteristic measurements listed in the Control Plan. However, where no Special Characteristics are identified in the Design Record or in the Control Plan, Oshkosh reserves the right to require MSAs and/or demonstration of Initial Process Capability on any characteristics.

24.1. Definitions

- **Measurement Systems** are the collection of instruments or gages, standards, operations, methods, fixtures, software, personnel, environment and assumptions used to quantify a unit of measure or fix assessment to the feature characteristic being measured.
- **Gages** are any devices used to obtain measurements or data (includes go/no-go devices).
- **Device Family Gages** are standard non-precision gages and measurement tools (such as micrometers or calipers) that are of the same make and model.
- **Measurement System Analysis (MSA)** is a mathematical method of determining how much the variation within the measurement process contributes to overall process variability. MSA is used to ensure the use of the right measurement system for running production. Oshkosh requires suppliers to perform MSA in accordance with AIAG MSA Manual 4th edition. Additional training, analysis instruction, and worksheets are available within the PPAP workbook, and on the Oshkosh portal <https://osn.oshkoshcorp.com/>
- **Gage Repeatability and Reproducibility (GR&R)** is used to ensure that measurements used in the manufacturing process are reasonably consistent regardless of how many times they are performed, or by who they are performed. GR&R can be useful to suppliers in that they can identify equipment that needs service, or operators who need additional training on the equipment. In addition to repeatability and reproducibility (GR&R), MSA studies must also address bias, linearity and stability.

24.1.1. GR&R Requirements:

The minimum number of appraisers, trials and parts when performing GR&R's are as follows:

- Variable data - 3 appraisers, 3 trials, 10 parts
- Attribute data - 3 appraisers, 3 trials, 30 parts

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Parts used in the study should represent the entire range of the tolerance. Whenever possible, the appraisers used to conduct the study should be the ones who normally perform the measurements in production. Measurements should be taken in the normal production location utilizing the production measuring equipment for the entire study.

Assessment of the measurement system should be based on the Total Tolerance of the feature being measured (i.e. %GRR to TOLERANCE). Guidelines for measurement system acceptability are as follows (reference Table VIII-A):

- The percent GRR should be less than 10% for gages used to measure Special Characteristics
- Gages whose percent GRR is between 10% to 30% may be acceptable for some applications, but use of the gage must be approved by Oshkosh Defense Quality Engineering
- Gages whose percent GRR is over 30% are considered unacceptable for the application and cannot be used

GRR	Decision
Less than 10 percent	Gage considered to be acceptable for application
10 percent to 30 percent	Gage may be acceptable for some applications. Use of gage must be approved by OSK
Over 30 percent	Gage considered to be unacceptable for application

Table VIII-A: GR&R Criteria

25. Dimensional Results (AIAG PPAP 2.2.9)

100%-dimensional inspection is required for a minimum of three (3) parts for each Level 3 PPAP submittal. 100%-dimensional inspection is required for a minimum of one (1) part for each Level 2 PPAP submittal. One (1) piece dimensional results are required for any subcomponent outlined on the drawing being purchased for each Level 2 or Level 3 PPAP submittal.

Dimensional results for PPAP must be taken from production parts. For production parts that are produced from more than one die, mold, tooling, pattern, cavity or production process, the Supplier shall complete full dimensional layouts from each.

Measuring equipment should have a discrimination of at least one-tenth of the total tolerance being measured (AIAG MSA, chapter 1 sect. E)

A.) Best Practice: *it is permissible to add additional tabs to the Excel PPAP workbook to facilitate better organization of the PPAP submittal. Example- separate dimensions and print notes worksheets preceded by the applicable bubbled print for multiple components of an assembly / weldment. Be careful that the embedded formulas also are copied if you add worksheets.*

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B.) Best Practice: True Position specifications. To facilitate better understanding, and standardize documentation, it is recommended to list both the “x” and “y” basic dimensions, the hole/feature size, and true position tolerance zone as shown below. Also, express “Bonus Tolerances” as a separate line item within the dimensional PPAP worksheet. The example below expresses the allowable bonus tolerance that can be added to the True Position feature frame when a maximum material condition (MMC) exists.

ITEM	DIMENSION / SPECIFICATION	TOLERANCE		SPECIFICATION / LIMITS		GAGE TYPE*	QTY. TESTED	ORGANIZATION MEASUREMENT RESULTS (DATA)			OK	NOT OK
		-	+	MIN	MAX			Piece 1	Piece 2	Piece 3		
88	60.33	Basic	Basic	Basic	Basic	CMM	1	60.266			X	
89	22.23	Basic	Basic	Basic	Basic	CMM	1	22.220			X	
90	9.53	0.500	0.500	9.030	10.030	CMM	1	9.526			X	
91		GD&T	GD&T	0	0.500	CMM	1	0.130			X	
	Bonus Tol	GD&T	GD&T	GD&T	GD&T	CMM	1	0.496			X	

26. Records of Material / Performance Test Results (AIAG PPAP 2.2.10)

26.1. Material Test Results

It is the Supplier’s responsibility to confirm the conformance of their material to applicable standards for PPAP submission. The Supplier shall perform all chemical, physical, metallurgical, or mechanical property tests for all parts and product materials when chemical, physical, metallurgical or mechanical property requirements are specified by the Design Record or Control Plan.

Examples of Material Test Results that are required for all PPAP submittals include: raw material certifications, painting, plating, heat-treating, welding (documentation necessary to demonstrate conformance to specified weld requirements such as Weld Procedure Qualification Requirements), etc.

When the supplier maintains “design record authority” for the part (and sub-component parts), and material details are not documented on the design record, Oshkosh Defense requires all material test results (with Qualified Lab documentation) to be maintained by the supplier and made available to Oshkosh Defense upon request.

Material test results may be presented on any AIAG compliant form (the Oshkosh Defense PPAP workbook also includes a template). Raw material composition results are to be presented in a Certificate of Analysis (COA) form. Qualified Lab documentation must accompany each material test result form (reference the Qualified Lab Documents section of this Addendum).

Materials test results shall indicate and include:

- The design record change level of the parts tested
- Any authorized engineering changes that have not yet been incorporated into the design record (if applicable)
- The number, date, and change level of the specifications to which the part was tested
- The date on which the testing took place (rule of thumb is <= 18 months old)
- The quantity tested
- The specified parameters and actual results
- The material supplier’s name

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26.2. Performance Test Results

The Supplier shall perform tests for all part(s) or product material(s) when performance or functional requirements are specified by the Design Record or Control Plan. A performance test (unlike in-process checks, which do not require qualified laboratory documentation) is the process of verifying the functionality of the Product (Finished Part) when exposed to the conditions that they will be used in.

The Supplier shall use the performance test form provided in the Oshkosh Defense PPAP workbook to document and submit the performance test results. Qualified Lab documentation must accompany each performance test result form (reference the Qualified Lab Documents section of this Addendum).

Performance test results shall indicate and include the following:

- The design record change level of the parts tested
- Any authorized engineering changes that have not yet been incorporated into the design record (if applicable)
- The number, date, and change level of the specifications to which the part was tested
- The date on which the testing took place
- The quantity tested
- The specified parameters and actual results

Welding Procedure Specifications (WPS), and Procedure Qualification Records (PQRs) shall be included within the PPAP submittal when applicable, and shall be stamped / signed, dated as “approved” by a Qualified Welding Inspector (see section 12).

26.2.1. On-going Testing

It is the Supplier’s responsibility to plan for ongoing material and performance testing and to identify these as separate line items in the Control Plan. This ensures that the Supplier has a plan for continuous verification of the performance and materials requirements. The interval of inspection is to be recommended by the Supplier, however, Oshkosh reserves the right to request a change in the frequency of this inspection

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27. Initial Process Studies (AIAG PPAP 2.2.11)

Initial Process Studies are required for all Level 3 PPAP submittals where Special (Significant, Critical, Major or CSI) Characteristics identified on the Design Record or listed in the Control Plan. 100% inspection is required until Cpk minimums are achieved.

- All Major or Critical Characteristics shall demonstrate a minimum Cpk of 1.67.
- All Significant Characteristics shall demonstrate a minimum Cpk of 1.33.
- 100% inspection to be conducted until Cpk thresholds met.
 - Inspections to be reflected within the supplier's Process Control Plan
 - Records as evidence of 100% inspection to be maintained, and submitted upon request

The requirements for Significant Production Runs and Quality Indices shall be in accordance with PPAP Manual (Fourth Edition) Appendix H. All other PPAP Manual 2.2.11 requirements apply as written in the PPAP Manual (Fourth Edition).

Where no Special Characteristics are identified in the Design Record or in the Control Plan, Oshkosh reserves the right to require demonstration of Initial Process Capability on any other characteristics.

28. Qualified Laboratory Documentation (AIAG PPAP 2.2.12)

Material or Performance Tests for PPAP shall be performed by a qualified laboratory.

After Market (GIPS) order quantities of ≤ 2 within a calendar year will require Material / Performance Certifications, but will not require Qualified Laboratory Documents

If Material or Performance Tests are performed by an Internal or External Lab that: **IS NOT** accredited, the Supplier must provide:

- The name of the laboratory that performed the test
- Documentation (work instruction) for each type of test conducted.
- Training records / certifications of personnel who performed the testing (to show competency)
- List of all test equipment used to perform testing
- Calibration records of all test equipment used
- The date on which the testing took place

IS accredited, the Supplier shall submit the test results on the laboratory letterhead or in the normal laboratory report format. The laboratory report must include:

- The name of the laboratory that performed the test
- The laboratory's accreditation standard (and accreditation number and/or name of the 3rd party organization that provided accreditation)
 - *Note: Oshkosh Defense expects that all accredited labs be accredited to a known lab accreditation standard such as ISO 17025*
- List of standards used for testing
- The date on which the testing took place

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29. Appearance Approval Report (AAR) (AIAG PPAP 2.2.13)

AAR's are only required when requested by Oshkosh Quality Engineering representative. Note: Paint and/or Coating requirements are covered by section 13.10 Material Test Results.

30. Sample Production Parts (AIAG PPAP 2.2.14)

The Supplier shall ensure that the "PPAP Parts Label" is filled out and attached appropriately to the outside of each package. Label should be in plain view of a fork lift / material handler / operator. In the event parts are "Loose" shipped, a label should be placed on each part (this would also apply to parts lying on pallets). Label on a painted part must be wire tied or attached in a way such that the painted surface is protected from label adhesion.

31. Master Sample (AIAG PPAP 2.2.15)

A master sample is not required to be retained by the supplier unless specifically requested by Oshkosh Defense, however, the Supplier is required to photo document a Master Sample for all PPAP submittals. Photo documentation should illustrate how the parts will look like in the final state in which they are provided to Oshkosh. Specific focus of photo documentation should be on part labeling (to include any date codes, vendor codes, etc. if applicable), no paint zones if applicable.

32. Checking Aids (AIAG PPAP 2.2.16)

Checking aids include all **dedicated** instruments, templates, attribute and variable gages, fixtures, or jigs that are used to determine acceptance/rejection of a product characteristic.

If a device is specifically made for the part being verified, and the part is not available as a catalog item, it is a "checking aid".

The Supplier shall certify that all aspects of the checking aid agree with part dimensional requirements.

The supplier shall document all released engineering design changes that have been incorporated in the checking aid at the time of PPAP submission.

The supplier shall provide for preventative maintenance of any checking aids for the life of the part.

If a checking aid is used to verify a Special Characteristic, the Supplier shall conduct the appropriate MSA activities including Gage R&R (see section 14).

33. Customer Specific Requirements (AIAG PPAP 2.2.17)

If Component First Article Test (CFAT) is required per the Design Record, CFAT testing documentation shall be included with the PPAP submission.

34. Part Submission Warrant (PSW) (AIAG PPAP 2.2.18)

PSW's are required for all PPAP submissions. It is recommended that suppliers utilize the Oshkosh Defense version of the PSW. Equivalent forms may be considered.

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35. Revision Control Table

Version	Change Detail	Changed By	Change Date
1.1	Total revision of Defense Addendum	Scott Ball	11-14-2016
1.2	Sect. 3 changed record retention to 5 years, Sect. 4 changed counterfeit avoidance & detection, Sect. 9.1 added part marking legible after coating, Sect. 9.3 added armor traceability, Sect. 10 revised radiography requirements, Sect. 13 changed PPAP submittal to 7 days, Sect.13.1 & 13.2 replaced QC-116 with COTS, 13.11 ten-to-one rule added, 13.11 added 100% inspection, Section 13.13 added 100% inspection,	Scott Ball	11-01-2017
1.3	Sect. 1 added ISO registrar verbiage, Sect. 2 added Embedded Software, Sect. 8 added armor traceability and UID verbiage, Sect. 9 added qualification and sustaining verbiage, Sect. 11 added 11.5 a & b, Sect 12. 1 amended, Sect 14.2 amended, Sect. 14.2.2 added.	Scott Ball	04-01-2019
1.4	Revised / New: section 1.1 (new), 1.2, 10.3, 10.4 (new)11.1, 11.2, 11.2.1.3, 12, 14, 14.2.1 (new), 14.11B (new),	Scott Ball	10/120
1.5	(blue text) Added introduction (1). Added common practices summary list (2.3 and subsections 2.3.2 - 2.3.12). PPAP retaining requirement added (4). 3D Solid Model Specification requirements added (7). Supplier Non-Conforming material handling added (10 and subsections 10.1-10.2). Oshkosh/USG returned parts added (11). Casting requirements for aluminum castings and 3D model based casting added (15.1). Supplier change requests and appropriate handling added (17.7). Commercial off the shelf definition added (18.2). Demonstration requirements for COTS modified parts added (18.2.1). Bonus tolerance addition allowed onto true position when maximum material condition exists defined (24.B). Checking aid definition added (31). Revision table updated (34). Table of Contents updated. Section headings reformatted for consistency.	Scott Ball	3/11/22
1.6	Section 6- Revised Supplier Standard Guide Section F, Removed "Attachment 2", Removed hyperlink. Section 19- Removed QC-112, Combined Engineering Change Documents with Customer Engineering Approval, Removed Sample Production parts Section 19.1 – Revised language so it is not required but is available for reference Section 19.2- Combined Engineering Change	Paula Roehrick	3/12/26

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	Documents with Customer Engineering Approval, Removed Sample Production parts		
1.7	Updated Section 13 to remove "silent" and add "not specified". PS100 and FM100 are available in Reliance, not on OSN. Added "Oshkosh-approved finishing suppliers shall be utilized."	Paula Roehrick	5/22/26