



SUPPLIER QUALITY REQUIREMENTS MANUAL

COMMERCIAL AUTOMOTIVE

AM GENERAL FM 5184

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AM GENERAL, LLC

SUPPLIER QUALITY REQUIREMENTS MANUAL

AM GENERAL FM 5184

1.0 General Information

This Supplier Quality Requirements Manual (the "Manual") establishes quality requirements for procurement by AM General LLC and its affiliates (together, the "Customer") of goods for commercial automotive programs. This Manual applies to all Suppliers that provide parts or materials to commercial automotive for commercial automotive programs (each a "Supplier"). The purpose of this Manual is to define Supplier responsibilities for ensuring that purchased items conform to customer drawing, specification and procurement requirements.

This document is incorporated by reference into the Customer's purchase orders. Any inconsistencies between this document and the purchase orders will be governed by the purchase orders. Customer reserves all of its rights under the applicable purchase orders. Customer may make changes to this document at any time and in any manner.

It is the Supplier's responsibility to read and comply with the requirements set forth in this document. Please contact your Customer Supply Chain Management representative if you have any questions about this document.

2.0 Quality System

2.1 The Supplier must maintain a Quality System that ensures that all items furnished to the Customer are inspected or tested (prior to shipment) and conform to the Customer's drawing, specification and procurement documents. This Quality System must conform to ISO9001:2008, QS9000 or TS16949 standards. The Supplier must ensure that its sub-tier suppliers also conform to Customer's quality requirements.

2.2 As the basis of its quality plan, the Supplier must have and use written procedures that provide for the control of quality of all parts produced or assembled within the Supplier's plant or procured by the Supplier from other sources. These procedures must include, without limitation: (i) standards defining work quality, process controls, and acceptance-or-rejection criteria, and (ii) a description of the receiving, in-process and final inspections, control of non-conforming material and calibration system in place. All inspection results must be documented. The procedures are subject to review and approval by the Customer's Quality Assurance Representative.

2.3 If the Supplier elects to use a sampling plan for acceptance of any material, at receipt, in process or at final acceptance, such plan must be documented, reviewed and approved by your Customer Quality Assurance Representative. Examples of acceptable sampling plans are MIL-STD-105, zero-based sampling plans, or

American Society for Quality (ASQ) adopted sampling plans.

- 2.4 The Supplier must maintain a documented calibration system in accordance with ISO9001:2008, QS9000 or TS16949 Calibration System Requirements to control the accuracy of devices used to measure, gage, test, inspect or otherwise examine items to verify acceptability of materials or services. All standards used for this calibration system must be traceable to national or international standards.
- 2.5 The Supplier must maintain a measuring-equipment system in accordance with ISO-10012-1 for managing confirmation and use of measuring equipment, including measurement standards, used to demonstrate compliance with specified requirements.
- 2.6 A distributor, at a minimum, must maintain a Quality System that meets Customer FM-5184 and that ensures material supplied to Customer conforms to the requirements of this procurement. Unless otherwise specified, the distributor is responsible for material acceptability and performance.
- 2.7 Regulated or Critical Safety Item Characteristics Requirements.
For any part designated as having Government or Critical Safety Item or Key Product characteristics, the Supplier must submit to Customer Quality Assurance:
- PPAP to the Fourth Edition guidelines dated March 2006. Default level is 3.
 - PPAP Submission will meet the detailed Customer Requirements in section 4.0.
 - Dimensional submission will be based on signed CRT package (see Supplement 1 to this Manual).
- 2.7.1 The Supplier must maintain a First-In/First-Out (FIFO) material rotation system for all parts with Government regulated or safety characteristics for:
- ✓ Finished goods shipment
 - ✓ In-Process material
- 2.7.2 Parts with Government regulated or safety characteristics cannot be changed or modified in any respect without approval of Customer Product Engineering and re-submittal of samples and data for approval by Customer Supplier Quality Assurance prior to delivery of product.
- 2.8 Specific Requirements for Fasteners and Hardware
Fasteners must meet all the requirements of the fastener drawing. These requirements apply to any Supplier furnishing any product with fasteners included as part of the purchased part.
- 2.9 Statistical Process Control (SPC)
The Supplier is encouraged to have a Statistical Process Control (SPC) program in effect in their facilities with applicable procedures developed. Customer's Supplier Quality Group will conduct SPC audits as part of their normal Supplier quality systems technical visit and/or source-control audit, to ensure compliance with Customer procedures should you elect to use an SPC program. Certain characteristics such as major classification characteristics on the assigned CRT /

Control Plan, Critical Safety Items or Regulated items should be considered candidates for SPC.

2.10 Nonconforming Product or Service

2.10.1 The Supplier must have a documented procedure for control of non-conforming material. This procedure must provide for implementation of appropriate action to correct recurring or repetitive nonconformities. The Supplier must take prompt and effective action to correct conditions that have resulted or could reasonably be expected to result in the submission of items in a defective or non-conforming condition.

2.10.2 Report of Discrepancy – Upon discovery of any deviation from drawings, specifications or procurement requirements, Supplier must immediately: (i) notify Customer Supplier Quality and Supply Chain Management; and (ii) implement containment procedures.

2.10.2.1 Disposition of any nonconforming material other than by reworking to conformance with the applicable requirements or by scrapping the nonconforming material at the expense of the Supplier must be approved in writing by Customer.

2.11 Quality Records

The Supplier is responsible for maintaining quality records of inspections and outgoing product quality of all lots of material shipped to Customer. These records include but are not limited to inspection records, certificates of conformance and control test reports. The Supplier is required to maintain these records for ten (10) years after completion of the purchase order (the “Record Retention Period”), unless otherwise relieved by contract. Upon expiration of the Record Retention Period, the Supplier must give written notice to Customer of any intended disposition of such records. The Supplier must impose this requirement on any sub-Suppliers.

2.12 Changes

The Supplier must obtain approval from Customer Supply Chain Management, in writing, by Purchase Order Change (POC), before any change can be made such as those listed in Section 4.2 of this Manual. A PPAP to the AIAG PPAP manual 4th edition must be submitted when any non-record only change is implemented. All change requests must be submitted to Customer Supply Chain Management in writing or via e-mail. Additional testing may be required to ensure changes have no impact on intended use or long-term durability. This testing may be above the technical-data package requirements (drawings and other quality provisions) in your possession but may be deemed necessary to ensure satisfaction of Customer’s customer requirements. These requests could also require submission of parts manufactured to the requested change configuration before production of the parts is implemented.

2.13 Part Identification and Packaging Requirements.

2.13.1 Identification requirements are as follows for shipment: Part Number, Rev. Level, Part Name, Manufacturer's Identification, Lot or Date Code, Material Handling Code, and Quantity. This information must be included on shipping paperwork and package labels. Individual parts are to be identified in accordance with drawing requirements unless exempted by purchase order. The complete details are covered in the Supplier Packaging/Labeling Manual.

2.13.2 Identification of Shelf Life Material

Supplier must identify the shelf life of material for each item, package or container. Such identification must include the standard identification requirements and the cure or manufacture date, expiration date and special storage and handling conditions.

2.13.3 Marking of Tools, Molds and Test Equipment

Supplier must mark Customer-owned tools, molds and test equipment with the applicable part number, dash and revision number as stated on the purchase order. If a mold contains more than one cavity producing the same part number, each cavity must be numbered.

2.13.4 Packing and Packaging

Supplier is responsible to ensure that all items are adequately packed and packaged to prevent damage or contamination.

2.13.4.1 Parts with developed and approved returnable containers must be packed in the returnable container at the full standard pack quantity.

2.13.4.2 Parts should never be packed in a broken or damaged returnable container. Supplier should tag the container as bad and contact Customer for instructions.

2.13.4.3 Parts that have no returnable container will be packed in Customer-approved expendable containers at standard pack quantity.

2.13.4.4 Parts requiring returnable containers that are not available can be packed in an approved back-up expendable container at standard pack quantity. Provided that Supplier obtains Customer permission.

2.13.5 For more detailed packaging and labeling information use the Production Control Supplier Packaging/Labeling Manual.

3.0 Access to Supplier's Facilities

3.1 Each Supplier's Quality System is subject to periodic audits by Customer Quality Assurance Representative(s). The records and documentation described in this Manual must be made available for review by Customer and/or its customer

representatives, as applicable, upon request:

- Evidence of inspection to assure adherence to applicable drawings and/or specifications and revisions thereto.
- Periodic calibration of inspection equipment and control of certification records per ISO9000 Series or QS9000 Series.
- Test data records or all qualifications and acceptance tests performed.
- Certification of personnel and processes such as heat treating, plating, anodizing, magnetic particle inspection, etc., when required by specification or contract.
- Failure analysis and corrective action reports.

3.2 Customer and/or its customers may send a representative to Supplier's facilities to perform any of the following activities:

- Source Inspection (Mechanical or Visual Inspection)
All items are subject to inspection at the Supplier's facility by Customer Quality Assurance personnel before shipment.
- Source Inspection (Test)
All items are subject to test at the Supplier's facility for witnessing by Customer Quality Assurance personnel before shipment.
- Source Surveillance
All items are subject to surveillance by Customer Quality Assurance personnel. This may include review of the Supplier's inspection system, procedures and quality or test records during the production run to ensure conformance to drawing, specification and Supplier procedure requirements.
NOTE: Supplier's proprietary products and processes are not subject to this provision.

4.0 Production Part Approval Process

4.1 PPAP is required for all parts, whether standard or non-standard.

4.2 The guidelines for Production Part Approval Process will be the AIAG PPAP Manual, Fourth Edition (March 2006) (the "PPAP Manual").

4.2.1 Standard parts require Level 1 PPAP per the table in section 4.1 of the PPAP Manual.

4.2.2 Non-Standard parts require full PPAP under the PPAP Manual.

- 4.2.2.1 The default is Level 3 PPAP per the table in section 4.1 of the PPAP manual.
- 4.2.2.2 Customer or its customers have discretion to choose Level 1 or Level 5 PPAP, based on risk assessment.

4.2.3 PPAP Submission Content

- 4.2.3.1 All requirements listed on the Drawings and Purchase Order will be submitted within the guidelines of the PPAP manual. All elements of the PPAP manual will be submitted. Elements that are not applicable will have a page stating not applicable.
 - 4.2.3.2 Dimensional submission is governed by the CRT package. CRT package will be defined by Supplement 1 of this Manual.
 - 4.2.3.2.1 Dimensional on 6 Pieces per CRT package, out of the 100 piece run. Multi -cavity tools will have at least 4 pieces per cavity.
 - 4.2.3.3 Capability studies will be no less than 30 pieces, out of the 100 piece run, for all level 4 points listed in the CRT package (CRT package defined in Supplement 1 or AMG 2AP7001).
 - 4.2.3.3.1 Requirements are 1.67 PPK or greater, or as agreed upon in the signed feasibility agreement.
 - 4.2.3.4 Sectional Layouts are required for interior and exterior trim and suspension castings.
 - 4.2.3.4.1 These are physical sections of the part, representing all sections on the drawing.
 - 4.2.3.4.2 2 sets are required 1 for Supplier retain, 1 handed to AMG for PPAP and retain.
 - 4.2.3.5 Suspension castings may be required to pass radiographic analysis. The evaluation scale and pass criteria be established by the DRE.
- 4.2.4 PPAP submissions will be sent to your AMG Supplier Quality Engineer, 12900 McKinley Hwy, Mishawaka, IN. 46546. Level 5 PPAP will require an AMG full copy on site.

4.3 Seller-Controlled Products

One legible and reproducible copy of applicable approval, specifications and drawings must accompany the PPAP.

4.4 Coating and Other Finish Requirements

Verification that all cleaning and coating requirements specified on drawings, specifications or other documentation must be supplied with the PPAP in accordance with Supplement 4 of this Manual.

4.5 Welding Requirements

The Supplier must meet the requirements of the weld drawing for grouping and location. The quality of the welds will meet a generally accepted automotive-

industry specification. Examples would be GM 14057 for spot, GM 14058 for arc or an equivalent.

The Supplier will have documented evidence of weld validation that was agreed upon with the QCE and PDT.

5.0 PROTO TYPE / PILOT SUBMISSIONS

- 5.1 Prototype and Pilot submissions will have full dimensional data that was agreed upon in the CRT package, level 1 points and above.
- 5.2 Points out of specification should be listed on an Interim Approval worksheet with a work plan for the next build event. The worksheet should have the DRE and Commodity QCEs signature prior to shipment.
- 5.3 Pilot Capability of level 4 points and above should be quantified. CPK of 1.33 or greater is acceptable. Any point less than 1.33 would be listed in the work plan. Capability run size would be limited to what is on release for a particular build event.

6.0 PPAP / Proto Type / Pilot submission timing.

- 6.1 Timing will come from Program Management and Purchasing.
- 6.2 Data availability and submission should be targeted for 30 days prior to build event. Official timing will come from Program Management and Purchasing.

SUPPLEMENT 1 TO AM GENERAL FM-5184

COMPONENT REVIEW TEAM

1.0 SCOPE

This section explains the CRT process within the PDT process for Commercial Automotive.

1.1 Definition

Component **R**eview **T**eam is a cross functional group within the PDT. It is lead by the DRE. Participants at a minimum are Tooling Engineer, Quality Control Engineer, Manufacturing Engineer, Supplier Quality Engineer, and at the appropriate time Supplier. This Team reviews and agrees on the measurement points to validate a part through the development process into on going production. This process is fully detailed with examples in procedure 2AP7001.

1.1.1 Level 1 points are measured on base parts to verify design intent. They are the maximum number of points on a subcomponent. They verify design and are used in production tool buy off. They are not for production.

1.1.2 Level 2 points are the minimum points measured to verify design intent. They do not include features not used by end customer or manufacturing. Example stiffening ribs weight reduction holes. They are a subset of Level 1s. They verify the design not process. They are used for percent of points in tolerance.

1.1.3 Level 3 points are the minimum points used to verify capability of the manufacturing / assembly process. These points will be measured ongoing until acceptable capability has been proven. These points are a sub set of level 2s. They verify process not design. They are used to establish and verify capability of a production process.

1.1.4 Level 4 points are the minimum number of points measured to demonstrate process control. Once control of level 3s has been established control plans can downgrade to these points as a minimum ongoing. These points are a subset of level 3s. They are significant features that will be measured ongoing

to demonstrate process control. They are used in PPAP to demonstrate capability.

- 1.1.5 Level 5 points are points measured to give immediate feedback and adjustment in production. They are part features measured with simple hand tools. Control limits could come from level 3 data. Production components only. They monitor process stability. They might be different than points measured earlier.

1.2 Documentation

- 1.2.1 Every non-standard part will have a CRT package. The package has a math data pictorial that shows the part and GD&T.
- 1.2.2 All level 1-4 points will be identified on the pictorial or in specific sections. The points will have an XYZ value. The pertinent direction will be specified and the tolerance included. All points will have an identifier / serial number.
- 1.2.3 There will be a table that lists by identifier all the points grouped by levels. It will have their nominal and tolerance. It will specify whether they are KPCs.
- 1.2.4 The last page will be a signature block. It will list the DRE, QCE, SQE, MFE and supplier.

1.3 CRT Process

The DRE of a given part makes the proposal of the points needed to validate the part/tools, points relevant to capability, points for ongoing SPC. QCE, MFE, SQE review and give input. When the plan is agreeable to these parties they sign the document. This document can be revised during the launch process after which it will be signed by the same parties. Revision can be based on positive or negative build / capability data.

1.4 Supplier Review

- 1.4.1 The supplier can have input on the CRT package through their involvement in the PDT. Input in the package can be during compilation or after agreement.
- 1.4.2 For purposes of early quoting prior completion of the CRT package it should be assumed that Non-Standard parts will have at least 2 ongoing SPC points. This may be adjusted up or down during the component review and based on build events.

SUPPLEMENT 2 TO AM GENERAL FM-5184

FASTENER QUALITY ASSURANCE REQUIREMENTS

1.0 SCOPE

This Supplement delineates the requirements for threaded fasteners.

1.1 This Supplement establishes quality assurance requirements for all threaded steel metric or standard fasteners (as defined by SAE-J1199) that are to be used in assembly for Commercial Automotive and in incoming sub assemblies.

1.2 Fasteners will meet all requirements on the fastener drawing.

1.3 Suppliers subject to this Supplement shall implement and maintain a fastener quality assurance program which:

1.3.1 Assures the homogeneity of fastener lots. A homogeneous fastener lot is defined as a lot in which all of the fasteners are of the same size, type, grade, plating and manufacturer.

1.3.2 Retains objective quality evidence that the fasteners furnished to AM General meet all technical requirements, and can provide this evidence upon request.

1.4. The Supplier is to determine the conformance of the fastener lots with the homogeneity and identification requirements, a sample from each lot of fasteners will be taken in accordance with MIL-STD-105, dated 10 May 89, Inspection Level II, AQL 1.0, or equivalent, except that lots shall be accepted with zero (0) defects (c-0) and rejected with one or more defects. Each sample shall be examined for the following:

1.4.1 The grade and manufacturer symbol (logo) for each bolt in the lot sample shall be the same.

1.4.2 Threads shall be examined to assure conformity to requirements.

1.4.3 Plating (when specified) shall be examined to assure complete coverage.

1.5 Objective quality evidence that fasteners meet all technical requirements shall consist of either:

1.5.1 Favorable chemical, core hardness, plating and tensile test data provided by the manufacturer or supplier of a fastener lot which is directly traceable to that lot. Chemical tests shall include, as a minimum, percent by weight of the following elements: carbon, manganese, phosphorus and sulfur; or

1.5.2 Favorable results of chemical and core hardness tests performed by the contractor or subcontractor on sample(s) taken from the lot. Sampling for

chemical, plating and core hardness testing shall be in accordance with MIL-STD-105, Level S-2, AQL 1.0 or equivalent. Chemical tests shall include, as a minimum, percent by weight of the following elements: carbon, manganese, phosphorus and sulfur.

- 1.6. Commercial items, defined as an end item or component of an end item whose sales volume to the general public is greater than 50% of the items produced, will be deemed to meet the requirements of this Supplement if the supplier has a current supplier control policy with regard to fasteners which has been approved by AM General Quality Assurance.
- 1.7 The supplier shall establish written procedures at receiving inspection to verify quality of fasteners, to include:
 - 1.7.1 Review of purchase order-required documentation.
 - 1.7.2 Identification and segregation of received material by homogeneous lots for inspection and test.
 - 1.7.3 Segregation and control of material to preclude use until verification inspection and testing are performed. (NOTE: Verification of fasteners on subassemblies shall be accomplished by documentation review and inspection for manufacturer logo and bolt head markings. (Disassembly is not required.))
 - 1.7.4 Selection of sample size for the Statement of Objective Quality Evidence for each lot, prescribed by the appropriate Appendix Table. The following acceptance criteria shall be utilized: (NOTE: Sample selection shall be randomly drawn from the widest dispersion of containers for each homogeneous lot.)
 - Accept lot with 0 defects
 - Reject lot with 1 defect
- 1.8 Establish methods to periodically audit suppliers to ensure and validate continued credibility.
- 1.9 Require verification of proper head logo and grade markings by supplier's source inspectors.
- 1.10 Ensure the use of an independent accredited laboratory or its equivalent whenever test/inspections are performed to gather objective quality evidence. Laboratory accreditation shall be accomplished by independent evaluation using criteria set forth in recognized industry/Government standard

MANUFACTURER'S IDENTIFICATION SYMBOL LISTING REQUIREMENT

1.0 DEFINITIONS

- 1.1 Manufacturer, as used in this Listing Requirement, means the actual source which substantially makes a product out of raw materials.
- 1.2 Manufacturer's Identification Symbol, as used in this Listing Requirement, means a unique marking or logo normally applied to thread steel fasteners during the manufacturing process that distinguishes such products from similar products of other manufacturers.

2.0 This Listing Requirement establishes requirements to advance the Government's objective that all threaded steel fasteners derived from a Government or contractor-owned technical data package (TDP), as further described herein, be identified by a manufacturer's identification symbol listed by the Defense Supply Center (DSCP).

3.0 This Listing Requirement applies to the following end items:

- 3.1 Where the Government TDP specifies the use of Steel Cap Screws (threaded steel fasteners) in accordance with Federal Specifications FF-S-85C, American National Standards Institute B 18.2.1-1981, and various Military Standard drawings which specify SAE Alloy Steel; or
- 3.2 In which threaded steel fasteners of a supplier or subcontractor design are employed pursuant to a supplier-owned TDP.
- 4.0 The supplier agrees to furnish to the Government end items which contain only threaded steel fasteners procured by a manufacturer whose identification symbol has been listed by DSCP. If the manufacturer's symbol has not been listed by DSCP, the manufacturer should submit its symbol to DCSP at the following address without delay for immediate listing.

This form can be found at http://www.dscp.dla.mil/gi/prod_services/logoreg.html or requested in writing or by phone at:

Defense Supply Center
ATTN: Maxine Curran, DSCP-ITA
700 Robbins Avenue, Bldg. 3B
Philadelphia, PA 19111-5092
Phone (215) 297-3963

5.0 The DSCP list of manufacturer's identification symbols include those manufacturers that were listed with the American Society of Mechanical Engineers (ASME) as of June 20,

1988. Manufacturers listed with ASME as of June 30, 1988 need not apply for listing by DSCP.

6.0 The supplier is responsible for ensuring that all hardware derived from a Government TDP meets the specifications of the TDP, and that all threaded fasteners employed in end items derived from either a Government-or contractor-owned TDP reflect a manufacturer's identification symbol listed by DSCP.

SUPPLEMENT 3 TO AM GENERAL FM-5184

AM General, LLC
Supplier Weld Procedure Requirements

1. ARC WELDING PROCEDURE AND WELDER/WELDING OPERATOR QUALIFICATION SUBMITTAL REQUIREMENTS

PRIOR TO PRODUCTION, or when drawing or welding procedure revisions are made, ALL CLASSES and TYPES of welds shall be submitted to the AM General Supplier Quality Manager/designated Quality Control Engineer for **APPROVAL**.

PPAP packages for each part number shall be submitted and shall include the following:

- 1.1. Warrant sheet, including the signature of supplier's Quality or other Authorized Representative. The warrant shall note: part number(s), drawing and revision number(s), applicable qualification standard, and date of submittal. The warrant shall also include a space to indicate welds and weld plan meets requirements. The Quality Control Engineer's signature will indicate acceptance of the Welding Procedure Specification.
- 1.2. Procedure Qualification Record (PQR).
- 1.3. Welding Procedure Specification (WPS). The WPS shall indicate the acceptable ranges for each essential variable of the procedure.
 - * It is preferred that this information be included on a single form, but it is permissible to submit separate forms for each.
- 1.4. Welder/Welding Operator Performance Qualification Record (WPQR) for the individual who welded the sample.
- 1.5. Sample(s) of each type of weld on the part. The sample(s) shall exhibit the minimum acceptable weld quality per the applicable Code such as AWS D1.1, AWS D1.2, MIL-STD-372, MIL-STD-1261, etc., and shall be prepared as specified below.
- 1.6. A written repair procedure.
- 1.7. A drawing of the part showing the removal location(s) for each sample.
- 1.8. A signature block for AM General's designated Quality Control Engineer to indicate visual acceptance of the sample(s), and the date of that examination and acceptance.
- 1.9. Suppliers may use their own forms or those available from AM General's Quality Engineer, as long as they contain all of the information specified in the applicable Code.
2. Samples submitted for welding procedure approval by AM General's designated Quality Control Engineer shall be prepared as follows:
 - 2.1. Samples shall be removed from an actual production part. In cases where the cost of the part(s) is prohibitive, this requirement may be waived if prior approval is granted by AM General.
 - 2.2. As noted above, a drawing showing the exact removal location shall accompany the sample.
 - 2.3. Identification of each sample shall be clearly marked on the sample, on an attached tag or label, or be noted on an envelop or bag containing the sample.
 - 2.4. Each sample shall include a full cross-section of the welded joint, plus at least ¼" of adjacent base metal on each side, if possible.
 - 2.5. The weld cross-section shall be polished and etched with a suitable etchant so that the weld is clearly visible.
 - 2.6. Once prepared and etched, the sample shall be thoroughly dried and coated with a thin layer of clear lacquer or other suitable preservative that will both protect the etched cross-section and permit visual examination by AM General.
 - 2.7. It is recommended that suppliers be capable of preparing any required samples; however, sample removal, sectioning, preparation, and etching may be performed by a qualified outside source.

3. **PRIOR TO PRODUCTION**, or when new welders/welding operators are added, Welder/Welding Operator Performance Qualification Records (WPQRs) shall be submitted for approval by AM General's designated Quality Control Engineer.
4. During AM General Supplier Technical Visits, Source Audits, or at any time when weld quality issues are identified by AM General, the suspect welding procedure(s) or welder(s)/welding operator(s) shall be requalified, as specified by AM General's designated Quality Control Engineer, and a Welding Quality Audit will be performed.

5. EVALUATION OF WELDING PROCEDURE SAMPLES

1. Samples submitted for AM General approval shall be weld cross-sections, as described above.
2. Examination and acceptance of samples shall only be performed by qualified individuals, as determined by AM General – Supplier Quality Assurance.
3. Unless otherwise stipulated, these weld samples shall be examined and interpreted according to the requirements below:
 - 3.1 Steel samples shall be evaluated per the requirements of the applicable standard and requirements of the drawing.
 - 3.2 Aluminum samples shall be evaluated per the requirements of the applicable standard and requirements of the drawing.

6. PRODUCTION WELDING QUALITY CONTROL REQUIREMENTS

Once weldment suppliers have been approved by AM General, the following shall be controlled and documentation maintained and made available to AM General upon request:

1. Anyone at the Supplier performing visual examination of production welds is required to be trained and qualified per AWS D1.1, subsection 6.1.4, including paragraph 6.1.4.1(3) (for those performing visual weld examination other than designated welding inspectors) and AWS D1.2, subsection 5.1.3, including paragraph 5.1.3.1(3) (for those performing visual weld examination other than designated welding inspectors). This training/qualification may be performed either in-house or through the use of some recognized visual welding inspector qualification program (such as the AWS Certified Welding Inspector (CWI) program). Welders are expected to perform 100% visual examination of their welds.
 - 1.1 Records of this required training and qualification shall be maintained by the supplier and made available to AM General upon request.
2. Those performing visual welding inspection shall also have their visual acuity checked at intervals of no less than 3 years per AWS D1.1, paragraph 6.1.4.4 and AWS D1.2, paragraph 5.1.3.4.
 - 2.2 Records of these visual acuity examinations shall be maintained by the supplier and made available to AM General upon request.
3. Shielding gas must be weld quality and show the dew point of the gas per AWS D1.1, paragraph 5.1.3.1 and AWS D1.2, Section 4.5. Dew point is a measurement of a gas' moisture content, expressed as a temperature---the lower that temperature, the drier the gas. By specifying "welding grade", supplier is specifying limits for both composition and dew point, and this information shall be made available To AM General upon request. Due to the propensity for porosity in aluminum welds, shielding gas moisture content is a more critical variable. Consequently, the gases for welding aluminum are specified to be drier (lower dew point) than those for welding steel.

- 3.1 Records shall be maintained which show that all shielding gases meet the dew point requirements of AWS D1.1 [welding grade, maximum dew point of -40°F (-40°C) {yes, the two scales are the same at this temperature}, have percentages of gases match that of the WPS] and AWS D1.2 [minimum purity of 99.995% and maximum dew point of -76°F (-60°C) for argon].
4. Welders employed by or working on behalf of supplier shall remain qualified and continue to produce acceptable work product. Suppliers shall maintain documentation to certify that welders had indeed applied the process for which they were qualified within the 6-month Code limitation. AM General requires that its suppliers provide more specific proof of this continued qualification. The following are recommendations for satisfying this AM General requirement:
- 4.1 Query work records, payroll records, etc. to provide a weekly list of those welders qualified for work on AM General contracts
- 4.2 Perform simple welder checks by requiring a welder to produce a simple fillet-welded T-joint similar to Figure 4.36 or 4.38 of AWS D1.1 or Figure 3.32 of AWS D1.2.
- Sample welds shall be visually examined and accepted per AWS D1.1, subsection 4.8.1 or AWS D1.2, subsection 3.6.3
 - Samples can be cut and etched
 - Evaluate per:
 - AWS D1.1, paragraph 4.8.4.1
 - AWS D1.2, subsection 3.6.3
 - In combination, or in place of cutting and etching, perform a fillet break test as shown in Figure 4.34 of AWS D1.1.
 - Fillet break fracture surfaces shall be examined per:
 - AWS D1.1, paragraph 4.30.4.1 or subsection 4.31.2
 - AWS D1.2, paragraph 3.10.3.1
- 4.3 To satisfy this AM General requirement, a suitable production control plan shall be developed, with the types and frequency of actual sampling specified. This documented production control plan shall be submitted to AM General Quality Assurance for approval.

RESISTANCE WELDING PROCEDURE AND WELDING QUALIFICATION SUBMITTAL REQUIREMENTS

1. **PRIOR TO PRODUCTION**, or when drawing or welding procedure revisions are made, ALL CLASSES and TYPES of welds shall be submitted to the AM General Supplier Quality Manager/designated Quality Control Engineer for **APPROVAL**.
2. PPAP packages for each part number shall be submitted and shall include the following:
 - 2.1. Warrant sheet, including the signature of supplier's Quality or other Authorized Representative. The warrant shall note: part number(s), drawing and revision number(s), applicable qualification standard, and date of submittal. The warrant shall also include a space to indicate welds and weld plan meets requirements. The Quality Control Engineer's signature will indicate acceptance of the Welding Procedure Specification.
 - 2.2. Procedure Qualification Record (PQR).
 - 2.3. Welding Procedure Specification (WPS). The WPS shall indicate the acceptable ranges for each essential variable of the procedure.
 - * It is preferred that this information be included on a single form, but it is permissible to submit separate forms for each.
 - Records of final validation, performed on subassemblies build from production parts, on production tooling, with parameters from Welding Procedure Specification. (WPS). Records will consist on Part Number, date, and results of weld destruct test. Samples will be marked and saved for final examination by AM General's QCE and/or Supplier Quality Engineer.
 - 2.4. A written repair procedure based on applicable standards.
 - 2.5. A signature block for AM General's Quality Control Engineer to indicate the date of examination and acceptance of validation documents.
 - 2.6. Suppliers may use their own forms or those available from AM General's designated Quality Control Engineer, as long as they contain all of the information specified in the applicable Code.
3. During AM General Supplier Technical Visits, Source Audits, or at any time when weld quality issues are identified by AM General, the suspect welding procedure(s) shall be requalified, and a Welding Quality Audit will be performed.

4. PRODUCTION WELDING QUALITY CONTROL REQUIREMENTS

Once weldment suppliers have been approved by AM General, the following Welding Process Control Procedure shall be maintained and controlled and documentation shall be made available to AM General upon request:

4.1 Weld Tool Verification and Qualification

Each weld tool needs to be qualified and a Weld Verification Procedures is to be utilized to perform the verification and qualification activities. Records of the verification and qualification activity are to be maintained. Once qualified the applicable Weld Tool Data Sheet and robot program are to be placed under change control.

4.1.1 Weld Tool Re-Qualification.

- Each weld tool must be re-qualified whenever a change occurs in the product or process that was part of the original verification and qualification activity. Records of the re-qualification activity are to be maintained.

4.1.2 Equipment Process Monitoring.

- Equipment process monitoring consists of measuring the process parameters established during tool qualification as well as visual evaluation of the equipment functional operation. Parameters identified outside prescribed limits require appropriate corrective action to restore the process to the qualified state. Equipment process monitoring requirements are described in applicable standards.

4.1.3 Equipment Maintenance.

- Each location shall have documented plans for the maintenance of equipment. The equipment maintenance schedule should be consistent with the tool or equipment manufacturers' recommendations.

4.1.4 Product Monitoring and Inspection.

- Product monitoring and inspection consist of evaluating the welded product with the released design and the applicable standards to identify, contain, and repair nonconforming welds. The product monitoring and inspection plan for all welds must be described in written procedures or standardized work.

4.1.5 In-Process Inspection and Test (Resistance Spot Welds).

- The purpose of the in-process inspection is to periodically verify specific weld attributes and detect weld system deficiencies prior to product leaving the weld shop. In-process inspection is not a substitute for the required equipment maintenance or equipment process monitoring. A deformation check of all spot welds (for all styles and all cells) is recommended to occur 4 times per shift at evenly spaced intervals. The minimum required frequency is 1 check per weld gun and metal stack-up, sampled 4 times per shift. When a weld gun installs more than one weld on the same metal stack-up, rotate the in-process inspection (where practical) between the welds. Concurrent with the deformation checks, visually inspect for sealer presence if specified and visually inspect all welds for conformance to the applicable product drawing and standards. This visual inspection is to identify welds containing holes or cracks, welds not installed, edge welds, welds with excessive indentation, distortion, or surface eruptions, and extra welds. In instances where a deformation check of spot welds is not possible or the spot welds

are inaccessible due to being closed out, the following alternative methods of verifying or assuring weld fusion may be utilized;

- ultrasonic weld inspection
- increased equipment process monitoring
- increased weld destruct test frequency
- witness coupons

The use of an alternative method must be documented.

4.1.6 Weld Destruct Test – General.

- The purpose of the weld destruct is to verify the effectiveness of the weld process controls (i.e., equipment process monitoring, equipment maintenance, in-process inspection) implemented. Prior to conducting each weld destruct and as part of a re-qualification activity, weld locations are to be verified. Welds located outside the tolerance are discrepant welds. Nonconforming patterns of welds identified during a destruct test require all suspect products to be contained and repaired conform approved repair procedure or applicable standards or an engineering authorization allowing the product to deviate from specification. Documented corrective actions are required for all nonconforming patterns.

4.1.7 To satisfy this AM General requirement, a suitable production control plan shall be developed, with the types and frequency of actual sampling specified. This documented production control plan shall be submitted to AM General Quality Assurance for approval.

SUPPLEMENT 4 TO AMG FM-5184

**AM General
Supplier Paint Procedure Requirements**

PAINT PROCEDURE GUIDELINE

1.0 SCOPE

This supplement outlines the requirements for all painted parts.

2.0 End item customer visible painted parts will require a 2 stage appearance approval report.

3.0 References

3.1 The customer drawing will be the controlled list of applicable specifications and requirements for painted surfaces for appearance and performance.

3.2 Painted appearance parts will be expected to meet a generally accepted automotive standard, example GM4348M or an equivalent representation of automotive standards.

3.3 Painted parts performance will be expected to meet a generally accepted automotive standard, example GMW3005 or an equivalent representation of automotive performance standards.

3.4 Appearance **zones** will be defined in the VPG Audit standard.