# Quality Specification

GE Additive

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| **Document Title** | Supplier Quality Specification | | |
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# 1 SCOPE AND BACKGROUND

## 1.1 Scope

This specification provides the General Quality Requirements for all GE Additive suppliers. This specification applies to all purchased products used in GE Additive with the exception of feedstock materials. Feedstock material suppliers will be approved in accordance with the Additive Manufacturing Feedstock Supplier Qualification Process (GE-ADD_GQP_11.01.002).

The purpose of this Supplier Quality Requirements specification is to establish a set of procedures, practices and expectations pertaining to the quality of items purchased by GE Additive and qualification of Suppliers to GE Additive.

## 1.2 Language

"Shall" is used whenever a requirement expresses a provision that is mandatory.

"Will" is used to describe a task that is performed by an individual or organization not governed by the document. "Will" is not to be used to express a mandatory provision. Use the term "shall".

"Should" and "may" are used when it is necessary to express non-mandatory provisions. When a non-mandatory provision is recommended "should" is used, otherwise "may" is used.

"Must" is not to be used to express a mandatory provision. Use the term "shall". "Must" may be used in explanation to identify an external requirement or regulation that is to be met.

"Is" and "are" are used for descriptive text. No mandatory or non-mandatory requirements are expressed using these terms.

Throughout this specification the term "Purchaser" is intended to mean GE Additive and/or businesses acquired by GE Additive. The term "Supplier" is intended to mean suppliers and/or planned suppliers that will provide raw materials, parts and/or assemblies to GE Additive for consumption, performance of services, or for supply of GE Additive customers applicable documents.

## 1.3 Definitions

Build-to-Print Part – A part that is manufactured according to a GE drawing and associated GE specifications called out on that drawing.

Build-to-Specification (Non-Build-to-Print) Part – A part that is manufactured to meet the requirements of a GE functional specification rather than a GE drawing.

Containment – Actions taken to minimize or eliminate the risk to GE Additive or its customers associated with a nonconformance for product already produced or in process of being produced.

Corrective Action – Actions taken remove the causes of an existing nonconformity or undesirable situation on the next product produced.

Critical for Safety (CTS) – Those Characteristics of a process critical to safety.

Critical to Process Characteristic (CTP) – Those Characteristics of a process that combine to define a Critical to Quality Characteristic; or are deemed essential for quality assurance purposes.

Critical to Quality Characteristic (CTQ) – Those Characteristics of an item which if nonconforming, may prevent or seriously affect the unit performance, reliability, producibility, or customer satisfaction of a product.

Frozen Process – A manufacturing method, process, procedure or control that was approved by the GE Additive Qualification Team and may not be changed by the Supplier without approval of the GE Additive Qualification Team. The Qualification team defines process steps that can be changed without approval as part of the Manufacturing Process Plan review and approval.

Manufacturing Process Plan (MPP) – A detailed, step-by-step sequence of operations and requirements by which products are manufactured.

Non-Destructive Testing (NDT) – Analysis techniques used to evaluate properties of material, component or system without causing damage. Typical methods would include ultrasonic, magnetic-particle, liquid penetrant, radiography, eddy-current testing, etc.

Off-the-Shelf Products – Products are packaged solutions which are then adapted to satisfy the needs of the purchasing organization. Normally products listed in a catalog.

Preventive Action – Action taken to eliminate the cause(s) of a potential non-conformance or undesirable potential situation to prevent occurrence of same or similar situations in the future.

Product Quality Plan (PQP) – A detailed, step-by-step list of operations and requirements in which a supplier identifies a process of how, what, why, when and who will perform tests or inspections and the applicable acceptance criteria. This may also be referred to as an Inspection and Test Plan (I.T.P.).

Product Safety Risk Assessment – Safety risk assessment for any supplier designed product in accordance with the principles defined by ISO 12100. Residual risk information shall be provided to the GE Additive Qualification Team upon request.

Qualification Package – All required documentation for a qualification. This may also be referred as Qualification Book.

Repair – A type of correction performed to a nonconformance that reduces but does not completely eliminate the nonconformance(s) such that the product is determined to be usable for its intended purpose.

Request for Design Change – A document submitted by the Supplier to request GE Additive Engineering's approval prior to implementing a change in design for the Supplier or its sub-tier supplier.

Rework – A type of correction performed to a nonconformance that completely eliminates the nonconformance(s) such that the product is determined to be conforming to specification or requirement in all respects.

Scrap – A disposition for nonconforming product that renders the material not useable for its intended purpose and/or that cannot be economically reworked or repaired in an acceptable manner.

Service Bulletin – Document that GE Additive issues to customers to inform them about nonconformity and recommended action.

Sourcing Representative – GE Additive representative who is authorized to negotiate price, delivery, terms and conditions, and place the Purchase Order for qualification and production. The Sourcing Representative owns communication with the Supplier for all commercial and fulfilment matters.

Supplier Deviation Request (SDR) – A request initiated by the Supplier to deviate from purchase order technical requirements (drawings, specifications, engineering instructions, etc.) or the approved qualification package.

Supplier Quality Engineer (SQE) – GE Additive representative who communicates the qualification requirements and is the key interface with the Supplier relative to qualifications, process improvements, non-conforming material dispositions, corrective actions, and surveillance auditing. SQE owns communication with the Supplier for all technical matters.

## 2 APPLICABLE DOCUMENTS

### 2.1 Issues of Documents

The following documents form a part of this specification to the extent specified herein. Unless otherwise indicated, the latest revision shall apply.

### 2.2 ISO Specifications

ISO 9001 – Quality Management System Requirements

ISO 12100 – Safety of machinery – General principles for design – Risk assessment and risk reduction

## 3 PROCESS

### 3.1 General Guidelines

It is the responsibility of the Supplier to define and implement a detailed quality system that ensures all products supplied to GE Additive are of the highest quality possible by conforming to GE Additive drawings and/or applicable specifications and meeting all the requirements set forth in this document.

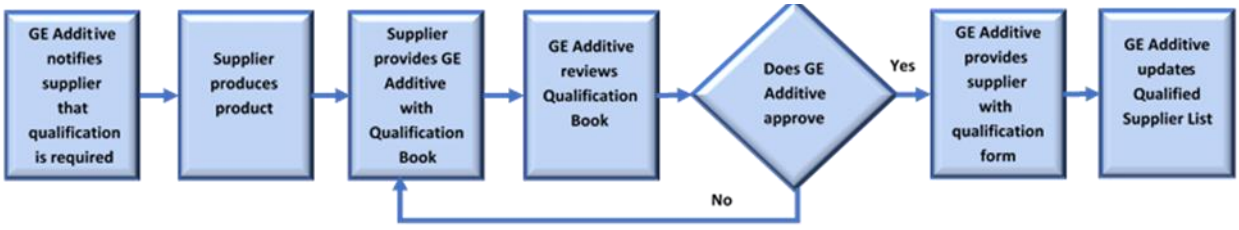
### 3.2 Communication

The GE Additive Purchase Order designates the Sourcing Representative who is the primary contact with the Supplier for commercial and fulfilment issues. The Supplier Quality Engineer (SQE) is the primary quality and technical contact and will be assigned by Supplier Quality management as appropriate.

### 3.3 Supplier Approval

In order to receive a GE Additive production purchase order, the Supplier shall be approved per the Know Your Supplier (KYS) process. Criteria for approval could include, but is not limited to, the following: properly executed confidentiality agreement (Non-Disclosure Agreement (NDA) or Proprietary Information Agreement (PIA)), acknowledgement of compliance with GE Additive Suppliers Integrity Guide, completion and passing of required technical capability assessment, EHS compliance/employment/security practices, financial viability, customer service aptitude, and strategic value. The supplier approval process is performed prior to a qualification purchase order being issued to a supplier.

**Figure 1 – Qualification Process Flow Chart**



### 3.4 Supplier Qualification

After Supplier Approval is granted, GE Additive may require the Supplier to become qualified for each specific process, part or commodity family. If GE Additive requires the Supplier to perform a qualification, the SQE or Sourcing Representative will provide the Supplier with the Supplier Qualification Notification form in Appendix A. Through the qualification process, the Supplier demonstrates ability to provide high quality products on a repeatable basis in accordance with requirements and expectations of the GE Additive business purchasing the material. The qualification process applies to one product at one site and may pertain to certain pieces of equipment.

All Build-to Spec, Build-to-Print and Commercial off-the shelf product suppliers will be required to complete the qualification process, as described in this specification.

## 4 GENERAL REQUIREMENTS

### 4.1 Requirements

This section details the requirements that all Suppliers must meet.

### 4.2 Quality System

The Supplier shall maintain a documented quality system to ensure control and conformance to the requirements of GE Additive's drawings and specifications. The quality management system shall meet the requirements of the current ISO 9001 (Quality management systems – Requirements) standard. Compliance to this requirement shall be demonstrated if requested by GE Additive by either of the following:

- Provision of a copy of a current certification(s) if requested, or
- Successful completion of a quality management systems audit to the current requirements of ISO 9001. GE Additive reserves the right to require this audit to be conducted by a third-party service designated by GE Additive or by a GE Additive representative. The Supplier will be responsible for all costs of the audit directly to the auditing party.

Any applicable industry standards (such as CE, UL, etc.) shall also be incorporated into the system. This system shall be made available to GE Additive for review upon request.

### 4.3 Record Retention

The Supplier shall have a written procedure for the documentation and retention of quality and product records for products supplied to GE Additive. The record retention period shall be a minimum of ten (10) years, from when the product was last shipped to GE Additive, unless otherwise specified by GE Additive or if a longer period is required by any applicable law or regulation. Records shall include, but are not limited to, product quality or inspection and test plans and results, material specifications, qualification documentation and certificates of conformance. Specific component record requirements may be specified in GE Additive purchase orders, contracts or specification. It is the responsibility of the Supplier to determine the appropriate storage means to meet the retention requirement and allow for timely retrieval of records.

### 4.4 Specification Transmittal to Suppliers

It is incumbent upon the Supplier to review with the Sourcing Representative and/or SQE the appropriate document retrieval/sharing methods that may be specific to their business. It is also the responsibility of the Supplier to review specification revisions with the Sourcing Representative and/or SQE on a

continuous basis to ensure that the correct revisions are being worked to. When the Supplier receives a new purchase order, it is the Supplier's responsibility to verify they have the latest revision of the specification called out on the drawings and purchase order.

Unless otherwise notified by GE Additive, suppliers shall implement specification revisions on all existing and future purchase orders except where products have already entered the manufacturing process. Any exceptions to this policy shall be negotiated between the GE sourcing representative and Supplier.

If the Supplier does not have the latest revision of any relevant specification as described in the latest GE Additive purchase order, it is the Supplier's responsibility to request the latest revision of the specification.

### 4.5 Source Inspection and Test Witness

GE Additive and/or its customer may elect to inspect products, and/or witness subassemblies at the Supplier's facility during processing, testing, or at final inspection. All source inspection and test witness requirements will be identified and coordinated through the GE SQE, Quality Assurance, Quality representative or other designated representative.

#### *4.5.1 Timing*

The Supplier shall notify GE Additive in advance, when materials or products will be ready for inspection. The timing of this advance notification shall be at minimum 21 days. GE Additive may decide to visit the Supplier facility.

#### *4.5.2 Additional Requirements*

Additional requirements for GE Additive and/or customer acceptance of product do not relieve the Supplier of its obligations to supply components that meet drawing and Purchase Order requirements.

### 4.6 Supplier Deviation Requests

When a deviation to a requirement including a drawing, specification, MPP, packaging, or a material shortage is known or expected to exist, the Supplier shall submit a Supplier Deviation Request (SDR) as early in the process as possible to the SQE and Sourcing representative using form in Appendix B. If a deviation exists or could potentially exist, an SDR shall be submitted and approved prior to shipping deviated products. The approved SDR applies to only the Purchase Orders listed on the SDR. SDRs shall be submitted by the Supplier for approval of alternate materials, processes, to correct drawing/documentation errors or omissions and other deviations to the PO requirements. SDRs shall be submitted by the primary Supplier (the Seller on the Purchase Order). Any deviations (e.g. drawing changes, material substitutions, etc.) related to a sub-tier supplier's scope shall be submitted through the primary Supplier.

The SDR shall contain detailed description, containment, probable source and proposed remedial action (when business directed) information as part of the initial submittal. Failure to supply all of the information as required may result in the SDR being returned to the Supplier for completion of the required information. If this rejection impacts fulfillment requirements, charges may apply to the Supplier.

The Supplier shall not ship any deviated product before SDR is approved in writing by GE Additive. The Supplier shall send a copy of the approved SDR along with the product(s) at the time of shipment. GE has the right to request additional inspections and tests beyond applied drawing and specifications to prove deviated product's form, fit and function prior to SDR disposition. No repair shall be performed on a deviation prior to disposition by GE.

In the case of non-conforming products or escaping defects, SDRs are “one-time” exceptions to GE Additive requirements. Unless the SDR involves a drawing change, GE Additive, expects the non-conformance(s) to be eliminated on subsequent deliveries.

Where appropriate, the Supplier shall provide a complete deviation description to include:

- Drawing/item number with zone of referenced area
- Inspection results
- Samples or photographs where applicable
- Number of defects for the lot(s) of material
- Specific Purchase Order numbers by product grouping
- Serial numbers of the components
- Estimated time to make correction(s)
- Cost related issues

For serialized parts, the serial number(s) shall be identified. For non-serialized parts, the specific Purchase Order(s) and date range shall be identified on the SDR.

#### *4.6.1 Containment*

Containment is expected to be immediate when a non-conformance is discovered, with all products affected being contained. Containment actions apply to products, process and materials in which the non-conformance was detected as well as similar products or product families in which the non-conformance may occur. If the non-conformance is discovered during random audit, all WIP, inventory and shipped but not yet received products shall be evaluated.

Containment at the Supplier is expected to isolate (separate from normal production), insulate (inspect products to sort for defects at the Supplier, in transit for shipment and at the customer site) and aid in control of risk related to the nonconformance. An effective containment process documents the Supplier’s efforts to verify control of its processes, (pre-production, production and post-production). The Supplier shall document and share all containment actions.

#### *4.6.2 Probable Source*

The Supplier shall report the source of the problem considering the following, as applicable:

- Situations involving the same or similar material, product, equipment, instrument or system abnormalities and inconsistencies in the process
- Environmental conditions (e.g., temperature, humidity, light)
- Trends associated with equipment performance or specifications
- Cause code and deviation category

#### *4.6.3 Proposed Remedial Action*

Where applicable, Suppliers to GE Additive shall provide a rework or repair concept plan for all deviating products and services. Where rework or repair is not possible, substantiation shall be provided.

Rework or Repair Concept Plans shall include, as applicable:

- Identified risks that would adversely impact the product
- Planned completion date
- Estimated time (labor) required to complete correction

The Supplier shall have a positive identification plan, which ensures deviations and or corrected and or conforming materials are appropriately identified.

The Supplier shall document and show evidence to GE Additive that the remedial actions have been executed. GE Additive will evaluate whether the remediation execution eliminated the deviating condition or met the disposition requirements.

### 4.7 Corrective Action Procedures

When requested by the GE Additive SQE, the Supplier shall perform a formal root cause analysis (RCA) and identify containment, corrective, and preventive actions using the standard 8D RCA method & forms (or equivalent process). The Supplier shall provide an update on RCA to GE Additive within 2 weeks after it is requested and provide updates at least every 2 weeks until the RCA is completed. Corrective Action Requests that remain open longer than the specified period may result in disqualification of the Supplier.

Corrective action is intended to:

- Prevent the recurrence of the problem
- Avoid creation of further product or process issues

As a minimum, corrective action is necessary when:

- The production process is incapable or inconsistent
- A potential issue exists with machine, tooling, or fixtures

The Supplier shall provide and maintain objective evidence that the actions have been accomplished.

### 4.8 On-going Process Capability Checks

The Supplier shall, as a minimum, measure and record data for all critical to quality (CTQs) and critical to process (CTPs) characteristics identified on the drawings, specifications, through fixed process agreements between the supplier and GE Additive. The Supplier shall regularly analyze the CTQ and CTP data for process capability and supply periodic reports to the SQE. Under the direction of the SQE, the Supplier may be requested to execute improvement projects based on the process capability analysis.

### 4.9 Traceability

The Supplier shall provide a Requirements Traceability Matrix that proves how the Suppler complies with the requirements from all applicable GE Additive specifications.

## 5 QUALIFICATION REQUIREMENTS

### 5.1 Applicability

This section details the requirements that only Suppliers that are required to become Qualified must meet. As stated above, Suppliers that are required to complete qualification will be formally notified by Supplier Qualification Notification Form in Appendix A.

## 5.2 Qualification Book

The Supplier shall provide GE Additive with a qualification book that includes each of the below items. If an item is not applicable to the Supplier's product, please submit a Supplier Deviation Request (Appendix B) to the GE Additive SQE.

### *5.2.1 Sub-tier Suppliers*

If a Supplier that is undergoing the qualification process (or is already qualified) chooses to outsource a critical process or purchase a critical component from another supplier, the Supplier shall perform a qualification and surveillance of all sub-tier suppliers in accordance with the GE Additive requirements listed in this specification. GE Additive reserves the right to 1) review the Supplier's process for selection, qualification, and surveillance of sub-tier suppliers, 2) to approve, or disapprove, sub-tier supplier qualifications, 3) audit and monitor the sub-tier supplier's processes and facilities when deemed necessary. This requirement also applies if the Supplier is a sales representative or distributor that procures products that are supplied to GE Additive.

| No. | Qualify Form Name | Comments |
|---|---|---|
| 1 | GE Purchase Orders | Provide copy of GE Purchase Orders for this project |
| 2 | GE Specifications/GE Drawings | Provide a list of all GE Specifications, and GE Drawings, including revision level. This includes, but not limited to: Ordering spec., Equipment/functional spec., General spec., Outline drawing copy, P&ID drawing copy, Electrical drawing copy. |
| 3 | Supplier Drawings/Specifications | Provide a copy of all Supplier generated drawings and specifications, including revision level. If the supplier chooses to use drawings or specifications published by industry standard organizations, these shall also be provided. |
| 4 | Supplier Manufacturing Process Plan (MPP) | Provide a copy of the Manufacturing Process Plan<br><br>MPP is a detailed, step-by-step sequence of operations and requirements by which components or services are manufactured.<br><br>A MPP shall, at a minimum contain the following information:<br><br>(1) A list of all applicable GE drawings/specifications, ordering sheets, outline drawings, and special process documentation along with the latest revision letter/number. For build-to-specification parts, the Supplier shall provide a list of all Supplier/Industry standard drawings, specifications and revisions.<br><br>(2) Sequential listing of all operations and identification of Special Processes and associated procedures.<br><br>(3) Identification of all component parts and sources.<br><br>(4) Identification of all critical sub-tier suppliers and their manufacturing locations. Critical sub-tier suppliers include but are not limited to Raw Material and any Special Process suppliers.<br><br>(5) A sequence plan of all manufacturing and inspection steps with |

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| | | appropriate sign-off documentation. Supplier proprietary processes/documentation may be available for inspection/review by SQE and GE Engineering. The MPP shall refer to these documents by revision controlled document number in the MPP.<br><br>(6) The manufacturing location.<br><br>(7) MPP shall include a revision history.<br><br>(8) To Step 4: The details of operation shall be provided by using a flow chart<br><br>When the component is qualified, the MPP is considered part of the production Purchase Order requirements and may be frozen based on Qualification requirements. |
| 5 | Product Quality Plan (PQP)/Inspection Test Plan (ITP) | Provide a copy of the Supplier Product Quality Plan (PQP).<br><br>The PQP shall, at a minimum, contain the following information:<br><br>• Clear identification of item, component, or system to which PQP is applicable (Drawing number(s) and product description(s)).<br>• Listing of all technical documents that govern the inspection or test activity (i.e. Supplier documents, specifications, industry codes/standards)<br>• Identification of the test or inspection criteria in an itemized listing. Each line item shall include:<br>  ○ What is to be inspected (to the characteristic level)<br>  ○ How it is to be inspected<br>  ○ What frequency it is to be inspected<br>  ○ When the inspection or test is to be performed (in manufacturing process)<br>  ○ Who is to perform the inspection (e.g., Operator, Inspector, etc.)<br>  ○ Acceptance criteria<br>  ○ Provision for sign off by the party performing the inspection<br>• Sign-off documentation signifying completion of each inspection and test<br>• Clear definition of and customer involvement in the inspection and test activities (i.e. in–process inspections, customer witness and hold points, document reviews and and/or customer release inspections, etc.)<br>• Identification and verification of CTQs and inspection methods. |
| 6 | Characteristic Accountability and Verification Forms (CAV) | Provide a copy of the CAV report.<br><br>The CAV form shall include, at a minimum, the following items:<br><br>(1) Identification of components<br>(2) Characteristics and feature accountability (define critical parameters based on Design FMEA / e.g. dimensions, parallelism, ....) |

| | | |
|---|---|---|
| | | (3) Inspection and test results<br>(4) Production Product Acceptance Criteria<br>Product acceptance criteria shall be established during the qualification process review of the CAV form. Once the level of inspection and product acceptance requirement has been determined and specified on the CAV form, it shall be applied to all production components hereafter to ensure controlled processes for maintaining drawing features and characteristics.<br><br>A CAV form shall be completed and maintained by the Supplier. |
| 7 | Measurement Method Validation | Provide Measurement System Analysis.<br>Provide calibration certificate. |
| 8 | Bill of Materials (BOM) | List to include Item #, description, drawing or specification number, revision, quantity, and serial numbers (in case of assembly of components). |
| 9 | Component Conformance | Include Certificate of Conformance for all critical components purchased from sub tiers. |
| 10 | Design Calculations | Provide a copy of all design calculations for applicable Components/Systems per Domestic and International Codes or regulation standards. This includes, but not limited to: Torque values, Material selection, Heat resistance, Life time, Dimensional fitting in assembly group. |
| 11 | Product Safety Risk Assessment | Safety risk assessment for any Supplier designed product in accordance with the principles defined by ISO 12100. |
| 12 | Code Compliance | Provide a copy of certificate for all Domestic and International Code Compliances that this product meets. Examples:<br><br>• IEC (International Electrotechnical Commission)<br>• CE<br>• ATEX<br>• NEC (National Electrical Code)<br>• UL |
| 13 | Material Test Reports | Provide copies of Material Test Reports for all material used on this qualification/approval to include, but not limited to the following: Piping, Structural Steel, Bolting materials (Bolts, nuts, washers), Tubing, Raw Materials, Welding Consumables. Include all test reports for evaluation specifically called out as requirements or otherwise required for evaluating conformance to the drawings or specifications. |
| 14 | Welding Procedures | Only applicable if Supplier performs welding on GE Additive products. |

| | | |
|---|---|---|
| | | Provide a copy of the Welding/ Brazing Procedure, Specification, inspection, and all welder qualification records used on the Project. |
| 15 | Surface Preparation and Painting | Only applicable if Supplier performs painting on GE Additive products.<br><br>Include all metal preparation for, coating/paint procedures along with QA coating/paint data, signoffs, and coating/paint specifications |
| 16 | Sub-tier Supplier Qualification Documentation | All outsourced processes and purchased products require a qualification by first tier Supplier. Please provide MPP, PQP, MSA/gage R&R, P-FMEA, audit report, etc. for each sub-tier supplier. |
| 17 | Functional Testing | Provide a copy of all Mechanical, Electrical, and Functional Tests performed. This should include testing procedures, documented data of all testing performed and test results.<br><br>Example for one complete assembly (including serial number).<br>SQE may require additional assessments over a lot of 10 or 20 complete assemblies. |
| 18 | Cleanliness | Provide a copy of the cleanliness procedure/work instruction used to verify cleanliness of product. |
| 19 | Preservation and Packaging | Provide packaging proposal that includes how to preserve, crate, mark, and label the product (as applicable).<br><br>Each package shall be labeled with the following information at a minimum (as approved by purchaser):<br><br>• Supplier code<br>• Part number with revision number<br>• Box quantity<br>• Box number<br>• Manufacturing date<br>• PO Number<br>• Manufacturer<br>• Serial Number<br>• Lot Number<br>• Safe Handling Instructions |
| 20 | Repair/Rework | Provide any standard rework procedures that are applicable to the product(s) being supplied |
| 21 | List of non-conformities | Provide a copy of list of production non-conformities (at Supplier or sub tier facility) related to this qualification/approval |
| 22 | Supplier Deviation Record List | Provide a copy or list of all SDRs used in this qualification/approval (Supplier and sub tier SDRs) |
| 23 | Photographs of the product or assembly | Provide photos of the completed product |

| | | |
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| 24 | Packing list | Provide a copy of the Packing List |
| 25 | GE-Certificate of Conformance | Provide a copy of Certificate of Conformance of the product. Evidence that the product was built according to current domestic standards |
| 26 | Final Inspection Checklist | Provide a copy of the Final Inspection Checklist. This is the inspection checklist that Supplier will use every time before shipping a product or assembly to GE Additive. The expectation is that this is a live document that gets updated with additional checks based on lessons learned. |
| 27 | P-FMEA<br>(Process Risk Assessment) | Provide a copy of the Process failure modes and effects analysis (P-FMEA).<br><br>The P-FMEA relies on the results of the design FMEA. The P-FMEA focuses on potential weaknesses in the production or performance process.<br><br>When required by the qualification team, the Supplier shall perform a risk assessment of its manufacturing and quality assurance processes to evaluate the effectiveness of these processes to consistently produce the component or provide the qualified service. Failure Modes & Effects Analysis (FMEA) is one example of an accepted process risk assessment format |
| 28 | Preventive Maintenance | Provide a copy of preventive maintenance plan for all equipment needed to manufacture product and that requires maintenance. This includes the calibration plan. |
| 29 | Other Documentation as requested | Any other documentation requested by the SQE |

### 5.3 Qualification Approval Form

Upon successful completion of the qualification program and receipt of the Supplier Qualification Approval Form (see appendix B), or equivalent, the Supplier is released to fulfill subsequent Purchase Orders received from GE Additive. This qualification form indicates that, at the time of qualification and based on data provided by the Supplier, the manufacturing process used to produce the component(s) or perform a process was capable of complying with GE Additive drawing and specification requirements. No shipments are allowed before issuance of this form. Qualification approval does not relieve the Supplier of the full responsibility, on subsequent orders, to assure the manufacturing processes remain in control and the product or process supplied meets all drawing and specification requirements, unless formal, written approval for a deviation is obtained from GE Additive via a Supplier Deviation Request (SDR).

During the qualification, GE Additive and Supplier will define which steps of Manufacturing Process Plan (MPP) cannot be changed without approval of GE Additive. If changes are needed, a 'Supplier Deviation Form' shall be submitted by the Supplier before changes are implemented and wait for approval by GE Additive before implementing changes.

# 6 ADDITIONAL NOTES

## 6.1 Proprietary Nature of Information

As per the applicable confidentiality agreement, all information labelled as supplier proprietary and provided by the Supplier is held in confidence between GE and the respective Supplier and all GE information shall be held in confidence by the Supplier.

## 6.2 Supplier Integrity Guide

Link to the GE Suppliers Integrity Guide referenced in the Supplier Approval section above: http://www.gesupplier.com/html/SuppliersIntegrityGuide.htm

**APPENDIX A – SUPPLIER QUALIFICATION NOTIFICATION FORM**

## Supplier Qualification Notification Form

GE Additive requires the Supplier organization to complete formal supplier qualification in accordance with the requirements listed in P01AD502 for the below product(s). Please contact your Sourcing representative or Supplier Quality Engineering representative to acknowledge that you will comply with this request. Please respond within two weeks of receiving this form.

**Notification**

| Date | Printed Name | Title | Signature and Date |
|---|---|---|---|
| | | | |

**Supplier Information**

| | |
|---|---|
| Supplier Name | |
| Supplier Site/Location | |
| Global Supplier Listing Number | |

**Product(s) Being Supplied**

| | |
|---|---|
| Raw Material/Part/Assembly/Machine Name | |
| Raw Material/Part/Assembly/Machine Number | |
| PO Number | |

**Supplier Acknowledgement**

| Function | Required | Printed Name | Title | Signature and Date |
|---|---|---|---|---|
| Sales | ☐ | | | |
| Engineering | ☐ | | | |
| Quality | ☐ | | | |

**APPENDIX B – SUPPLIER QUALIFICATION FORM**

# Supplier Qualification Form

**Supplier Information**

| | |
|---|---|
| Supplier Name | |
| Supplier Site/Location | |
| Global Supplier Listing Number | |
| Supplier Contact | |
| Supplier Contact Phone | |
| Supplier Contact Email | |

**Product(s) Being Supplied**

| | |
|---|---|
| Raw Material/Part/Assembly/Machine Name | |
| Raw Material/Part/Assembly/Machine Number | |
| PO Number | |

**Additional Information**

| | |
|---|---|
| Qualification Notes | |

**Approvers**

| Function | Required | Printed Name | Signature and Date |
|---|---|---|---|
| Sourcing | ☐ | | |
| Engineering | ☐ | | |
| Materials Engineering | ☐ | | |
| Supplier Quality | ☐ | | |

**APPENDIX C – SUPPLIER DEVIATION REQUEST**

# Supplier Deviation Request

**Supplier Information**

| | |
|---|---|
| Supplier Name | |
| Supplier Site/Location | |
| Global Supplier Listing Number | |

**Product(s) Being Supplied**

| | |
|---|---|
| Raw Material/Part/Assembly/Machine Name | |
| Raw Material/Part/Assembly/Machine Number | |
| PO Number | |

**Deviation Request**

| Specification/Qual Book Chapter | Original Requirement | Requested Requirement | Rationale |
|---|---|---|---|
| | | | |
| | | | |
| | | | |
| | | | |

**Additional Information**

In the case of a non-conformance or escaping defect, provide the following (as applicable): detailed description, containment, probable source and proposed remedial action:

| |
|---|
| |

**Approvers**

| Function | Required | Printed Name | Signature and Date |
|---|---|---|---|
| Sourcing | ☐ | | |
| Engineering | ☐ | | |
| Materials Engineering | ☐ | | |
| Supplier Quality | ☐ | | |

## APPENDIX D – REQUIREMENTS TRACEABILITY MATRIX TEMPLATE

Supplier: Use the Requirements Traceability Matrix template below to cite the Supplier Process, Work Instruction, Drawing, etc. that shows compliance against each given requirement.

| Doc. No. | Doc. Name | Rev. | Section | Requirement Text | Compliance |
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| **P01AD502** | Supplier Quality Specification | 1 | 4.2 Quality System | The Supplier shall maintain a documented quality system to ensure control and conformance to the requirements of GE Additive's drawings and specifications. | |
| **P01AD502** | Supplier Quality Specification | 1 | 4.2 Quality System | The quality management system shall meet the requirements of the current ISO 9001 standard. | |
| **P01AD502** | Supplier Quality Specification | 1 | 4.2 Quality System | Compliance to this requirement shall be demonstrated if requested by GE Additive by either of the following:<br>• Provision of a copy of a current certification(s) if requested, or<br>• Successful completion of a quality management systems audit to the current requirements of ISO 9001. | |
| **P01AD502** | Supplier Quality Specification | 1 | 4.2 Quality System | Any applicable industry standards (such as CE, UL, etc.) shall also be incorporated into the system. This system shall be made available to GE Additive for review upon request. | |

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| **P01AD502** | Supplier Quality Specification | 1 | 4.3 Record Retention | The Supplier shall have a written procedure for the documentation and retention of quality and product records for products supplied to GE Additive. | |
| **P01AD502** | Supplier Quality Specification | 1 | 4.3 Record Retention | The record retention period shall be a minimum of ten (10) years, from when the product was last shipped to GE Additive, unless otherwise specified by GE Additive or if a longer period is required by any applicable law or regulation. | |
| **P01AD502** | Supplier Quality Specification | 1 | 4.3 Record Retention | Records shall include, but are not limited to, product quality or inspection and test plans and results, material specifications, qualification documentation and certificates of conformance. | |
| **P01AD502** | Supplier Quality Specification | 1 | 4.4.1 | Unless otherwise notified by GE Additive, suppliers shall implement specification revisions on all existing and future purchase orders except where products have already entered the manufacturing process. | |
| **P01AD502** | Supplier Quality Specification | 1 | 4.4.1 | Any exceptions to this policy shall be negotiated between the GE sourcing representative and Supplier. | |
| **P01AD502** | Supplier Quality Specification | 1 | 4.5.1 | The Supplier shall notify GE Additive in advance, when materials or products will be ready for inspection. | |

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| **P01AD502** | Supplier Quality Specification | 1 | 4.5.1 | The timing of this advance notification shall be at minimum 21 days. | |
| **P01AD502** | Supplier Quality Specification | 1 | 4.6 Supplier Deviation Requests | When a deviation to a requirement including a drawing, specification, MPP, packaging, or a material shortage is known or expected to exist, the Supplier shall submit a Supplier Deviation Request (SDR) as early in the process as possible to the SQE and Sourcing representative using form in Appendix B. | |
| **P01AD502** | Supplier Quality Specification | 1 | 4.6 Supplier Deviation Requests | If a deviation exists or could potentially exist, an SDR shall be submitted and approved prior to shipping deviated products. | |
| **P01AD502** | Supplier Quality Specification | 1 | 4.6 Supplier Deviation Requests | SDRs shall be submitted by the Supplier for approval of alternate materials, processes, to correct drawing/documentation errors or omissions and other deviations to the PO requirements. | |
| **P01AD502** | Supplier Quality Specification | 1 | 4.6 Supplier Deviation Requests | SDRs shall be submitted by the primary Supplier (the Seller on the Purchase Order). | |
| **P01AD502** | Supplier Quality Specification | 1 | 4.6 Supplier Deviation Requests | Any deviations (e.g. drawing changes, material substitutions, etc.) related to a sub-tier supplier's scope shall be submitted through the primary Supplier. | |

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| **P01AD502** | Supplier Quality Specification | 1 | 4.6 Supplier Deviation Requests | The SDR shall contain detailed description, containment, probable source and proposed remedial action (when business directed) information as part of the initial submittal. | |
| **P01AD502** | Supplier Quality Specification | 1 | 4.6 Supplier Deviation Requests | The Supplier shall not ship any deviated product before SDR is approved in writing by GE Additive. | |
| **P01AD502** | Supplier Quality Specification | 1 | 4.6 Supplier Deviation Requests | The Supplier shall send a copy of the approved SDR along with the product(s) at the time of shipment. | |
| **P01AD502** | Supplier Quality Specification | 1 | 4.6 Supplier Deviation Requests | No repair shall be performed on a deviation prior to disposition by GE. | |

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| **P01AD502** | Supplier Quality Specification | 1 | 4.6 Supplier Deviation Requests | Where appropriate, the Supplier shall provide a complete deviation description to include:<br>• Drawing/item number with zone of referenced area<br>• Inspection results<br>• Samples or photographs where applicable<br>• Number of defects for the lot(s) of material<br>• Specific Purchase Order numbers by product grouping<br>• Serial numbers of the components<br>• Estimated time to make correction(s)<br>• Cost related issues | |
| **P01AD502** | Supplier Quality Specification | 1 | 4.6 Supplier Deviation Requests | For serialized parts, the serial number(s) shall be identified. | |
| **P01AD502** | Supplier Quality Specification | 1 | 4.6 Supplier Deviation Requests | For non-serialized parts, the specific Purchase Order(s) shall be identified on the SDR. | |
| **P01AD502** | Supplier Quality Specification | 1 | 4.6.1 Containment | If the non-conformance is discovered during random audit, all inventory shall be evaluated. | |
| **P01AD502** | Supplier Quality Specification | 1 | 4.6.1 Containment | The Supplier shall document and share all containment actions. | |

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| **P01AD502** | Supplier Quality Specification | 1 | 4.6.2 Probable Source | The Supplier shall report the source of the problem considering the following, as applicable:<br>• Situations involving the same or similar material, product, equipment, instrument or system abnormalities and inconsistencies in the process<br>• Environmental conditions (e.g., temperature, humidity, light)<br>• Trends associated with equipment performance or specifications<br>• Cause code and deviation category | |
| **P01AD502** | Supplier Quality Specification | 1 | 4.6.3 Proposed Remedial Action | Where applicable, Suppliers to GE Additive shall provide a rework or repair concept plan for all deviating products and services. | |
| **P01AD502** | Supplier Quality Specification | 1 | 4.6.3 Proposed Remedial Action | Where rework or repair is not possible, substantiation shall be provided. | |
| **P01AD502** | Supplier Quality Specification | 1 | 4.6.3 Proposed Remedial Action | Rework or Repair Concept Plans shall include, as applicable:<br>• Identified risks that would adversely impact the product<br>• Planned completion date<br>• Estimated time (labor) required to complete correction | |

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| **P01AD502** | Supplier Quality Specification | 1 | 4.6.3 Proposed Remedial Action | The Supplier shall have a positive identification plan, which ensures deviations and or corrected and or conforming materials are appropriately identified. | |
| **P01AD502** | Supplier Quality Specification | 1 | 4.6.3 Proposed Remedial Action | The Supplier shall document and show evidence to GE Additive that the remedial actions have been executed. | |
| **P01AD502** | Supplier Quality Specification | 1 | 4.7 Corrective Action Procedures | When requested by the GE Additive SQE, the Supplier shall perform a formal root cause analysis (RCA) and identify containment, corrective, and preventive actions using the standard 8D RCA method & forms (or equivalent process). | |
| **P01AD502** | Supplier Quality Specification | 1 | 4.7 Corrective Action Procedures | The Supplier shall provide an update on RCA to GE Additive within 2 weeks after it is requested. | |
| **P01AD502** | Supplier Quality Specification | 1 | 4.7 Corrective Action Procedures | The Supplier shall provide and maintain objective evidence that the actions have been accomplished. | |
| **P01AD502** | Supplier Quality Specification | 1 | 4.8 On-going Process Capability Checks | The Supplier shall, as a minimum, measure and record data for all critical to quality (CTQs) and critical to process (CTPs) characteristics identified on the drawings, specifications and by GE Additive representatives. | |

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| **P01AD502** | Supplier Quality Specification | 1 | 4.8 On-going Process Capability Checks | The Supplier shall regularly analyze the CTQ and CTP data for process capability and supply periodic reports to the SQE. | |
| **P01AD502** | Supplier Quality Specification | 1 | 4.9 Traceability | The Supplier shall provide a Requirements Traceability Matrix that proves how the Suppler complies with the requirements from all applicable GE Additive specifications. | |
| **P01AD502** | Supplier Quality Specification | 1 | 5.2 Qualification Book | The Supplier shall provide GE Additive with a qualification book that includes every one of the below items. (Table 1) | |
| **P01AD502** | Supplier Quality Specification | 1 | 5.2 Qualification Book | Sub-tier Suppliers - If a Supplier that is undergoing the qualification process (or is already qualified) chooses to outsource a process or purchase a component from another supplier, the Supplier shall perform a qualification and surveillance of all sub-tier suppliers in accordance with the GE Additive requirements listed in this specification. | |
| **P01AD502** | Supplier Quality Specification | 1 | Chapter 1 GE Purchase Orders | Provide copy of GE Purchase Orders for this project | |

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| **P01AD502** | Supplier Quality Specification | 1 | Chapter 2 GE Specifications/GE Drawings | Provide a list of all GE Specifications, and GE Drawings, including revision level. This includes, but not limited to: Ordering spec., Equipment/functional spec., General spec., Outline drawing copy, P&ID drawing copy, Electrical drawing copy. | |
| **P01AD502** | Supplier Quality Specification | 1 | Chapter 3 Supplier Drawings/Specifications | Provide a copy of all Supplier generated drawings, including revision level. | |

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| **P01AD502** | Supplier Quality Specification | 1 | Chapter 4 Supplier Manufacturing Process Plan | Provide a copy of the Manufacturing Process Plan<br><br>MPP is a detailed, step-by-step sequence of operations and requirements by which components or services are manufactured.<br><br>A MPP shall, at a minimum contain the following information:<br>(1) A list of all applicable GE drawings/specifications, ordering sheets, outline drawings, and special process documentation along with the latest revision letter/number. For build-to-specification parts, the Supplier shall provide a list of all Supplier drawings and revisions.<br>(2) Sequential listing of all operations and identification of Special Processes and associated procedures.<br>(3) Identification of all component parts and sources.<br>(4) Identification of all critical sub-tier suppliers and their manufacturing locations. Critical sub-tier suppliers include but are not limited to Raw Material and any special process suppliers.<br>(5) A sequence plan of all | |

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| | | | | manufacturing and inspection steps with appropriate sign-off documentation. Supplier proprietary processes/documentation may be available for inspection/review by SQE and GE Engineering.<br>(6) The manufacturing location.<br>(7) MPP shall include a revision history.<br>8) To Step 4: The details of operation shall be provided by using a flow chart | |

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| **P01AD502** | Supplier Quality Specification | 1 | Chapter 5 Product Quality Plan (PQP)/Inspection Test Plan (ITP) | Provide a copy of the Supplier Product Quality Plan (PQP).<br>The PQP shall, at a minimum, contain the following information:<br>• Clear identification of item, component, or system to which PQP is applicable (Drawing number(s) and product description(s)).<br>• Listing of all technical documents that govern the inspection or test activity (i.e. Supplier documents, specifications, industry codes/standards)<br>• Identification of the test or inspection criteria in an itemized listing.<br>Each line item shall include:<br>- What is to be inspected (to the characteristic level)<br>- How it is to be inspected<br>- What frequency it is to be inspected<br>- When the inspection or test is to be performed (in manufacturing process)<br>- Who is to perform the inspection (e.g., Operator, Inspector, etc.)<br>- Acceptance criteria<br>- Provision for sign off by the party performing the inspection | |

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| | | | | • Sign-off documentation signifying completion of each inspection and test<br>• Clear definition of and customer involvement in the inspection and test activities (i.e. in–process inspections, customer witness and hold points, document reviews and and/or customer release inspections, etc.)<br>• Identification and verification of CTQs and inspection methods. | |

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| **P01AD502** | Supplier Quality Specification | 1 | Chapter 6 Characteristic Accountability and Verification Forms (CAV) | Provide a copy of the CAV report. The CAV form shall include, at a minimum, the following items:<br>(1) Identification of components<br>(2) Characteristics and feature accountability (define critical parameters based on Design FMEA / e.g. dimensions, parallelism, ....)<br>(3) Inspection and test results<br>(4) Production Product Acceptance Criteria<br>Product acceptance criteria shall be established during the qualification process review of the CAV form. Once the level of inspection and product acceptance requirement has been determined and specified on the CAV form, it shall be applied to all production components hereafter to ensure controlled processes for maintaining drawing features and characteristics.<br>A CAV form shall be completed and maintained by the Supplier. | |
| **P01AD502** | Supplier Quality Specification | 1 | Chapter 7 Measurement Method Validation | Provide Measurement System Analysis.<br>Provide calibration certificate. | |

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| **P01AD502** | Supplier Quality Specification | 1 | Chapter 8 Bill of Materials (BOM) | List to include Item #, description, drawing or spec number, revision, quantity, and serial numbers (in case of assembly of components). | |
| **P01AD502** | Supplier Quality Specification | 1 | Chapter 9 Component Conformance | Include Certificate of Conformance for all critical components purchased from sub tiers. | |
| **P01AD502** | Supplier Quality Specification | 1 | Chapter 10 Design Calculations | Provide a copy of all design calculations for applicable Components/Systems per Domestic and International Codes or regulation standards. This includes, but not limited to: Torque values, Material selection, Heat resistance, Life time, Dimensional fitting in assembly group. | |
| **P01AD502** | Supplier Quality Specification | 1 | Chapter 11 Product Safety Risk Assessment | Safety risk assessment for any Supplier designed product in accordance with the principles defined by ISO 12100. | |
| **P01AD502** | Supplier Quality Specification | 1 | Chapter 12 Code of Compliance | Provide a copy of certificate for all Domestic and International Code Compliances that this product meets. Examples:<br>* IEC (International Electrotechnical Commission)<br>*CE<br>* ATEX<br>* NEC (National Electrical Code)<br>* UL | |

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| **P01AD502** | Supplier Quality Specification | 1 | Chapter 13 Material Test Reports | Provide copies of Material Test Reports for all material used on this qualification/approval to include, but not limited to the following: Piping, Structural Steel, Bolting materials (Bolts, nuts, washers), Tubing, Raw Materials, Welding Consumables. | |
| **P01AD502** | Supplier Quality Specification | 1 | Chapter 14 Welding Procedures | <Only applicable if Supplier performs welding on GE Additive products><br>Provide a copy of the Welding/ Brazing Procedure, Specification, and all welder qualification records used on the Project. | |
| **P01AD502** | Supplier Quality Specification | 1 | Chapter 15 Surface Preparation and Painting | <Only applicable if Supplier performs welding on GE Additive products><br>Include all Metal Preparation, Prep for paint, paint procedures along with QA Paint data, signoffs, and paint specifications | |
| **P01AD502** | Supplier Quality Specification | 1 | Chapter 16 Sub-tier Supplier Qualification Documentation | All outsourced processes and purchased products require a qualification by first tier Supplier. Please provide MPP, PQP, MSA/gage R&R, P-FMEA, audit report, etc. for each subtier. | |

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| **P01AD502** | Supplier Quality Specification | 1 | Chapter 17 Functional Testing | Provide a copy of all Mechanical, Electrical, and Functional Tests performed. This should include testing procedures, documented data of all testing performed and test results.<br><br>Example for one complete assembly (including serial number). SQE might challenge a lot of 10 or 20 complete assemblies. | |
| **P01AD502** | Supplier Quality Specification | 1 | Chapter 18 Cleanliness | Provide a copy of the cleanliness procedure/work instruction used to verify cleanliness of product. | |
| **P01AD502** | Supplier Quality Specification | 1 | Chapter 19 Preservation and Packaging | Provide packaging proposal that includes how to preserve, crate, mark, and label the product (as applicable).<br>Each package shall be labeled with the following information at a minimum:<br>• Supplier code<br>• Part number with revision number<br>• Box quantity<br>• Box number<br>• Manufacturing date<br>• PO Number<br>• Manufacturer<br>• Serial Number<br>• Lot Number<br>• Safe Handling Instructions | |

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| **P01AD502** | Supplier Quality Specification | 1 | Chapter 20 Repair/Rework | Provide any rework procedures that are applicable to the product(s) being supplied | |
| **P01AD502** | Supplier Quality Specification | 1 | Chapter 21 List of non-conformities | Provide a copy of list of production non-conformities (at Supplier or sub tier facility) related to this qualification/approval | |
| **P01AD502** | Supplier Quality Specification | 1 | Chapter 22 Supplier Deviation Record List | Provide a copy or list of all SDRs used in this qualification/approval (Supplier and sub tier SDRs) | |
| **P01AD502** | Supplier Quality Specification | 1 | Chapter 23 Photographs of the product or assembly | Provide photos of the completed product | |
| **P01AD502** | Supplier Quality Specification | 1 | Chapter 24 Packing list | Provide a copy of the Packing List | |
| **P01AD502** | Supplier Quality Specification | 1 | Chapter 25 GE-Certificate of Conformance | Provide a copy of Certificate of Conformance of the product. Evidence that the product was built according to current domestic standards | |
| **P01AD502** | Supplier Quality Specification | 1 | Chapter 26 Final Inspection Checklist | Provide a copy of the Final Inspection Checklist. This is the inspection checklist that Supplier will use every time before shipping a product or assembly to GE Additive. The expectation is that this is a live document that gets updated with additional checks based on lessons learned. | |

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| **P01AD502** | Supplier Quality Specification | 1 | Chapter 27 P-FMEA (Process Risk Assessment) | Provide a copy of the Process FMEA.<br>The process FMEA (P-FMEA) relies on the results of the design FMEA. The P-FMEA focuses on potential weaknesses in the production or performance process.<br>When required by the qualification team, the Supplier shall perform a risk assessment of its manufacturing and quality assurance processes to evaluate the effectiveness of these processes to consistently produce the component or provide the qualified service. Failure Modes & Effects Analysis (FMEA) is one example of an accepted process risk assessment format | |
| **P01AD502** | Supplier Quality Specification | 1 | Chapter 28 Preventive Maintenance | Provide a copy of preventive maintenance plan for all equipment needed to manufacture product and that requires maintenance. This includes the calibration plan. | |
| **P01AD502** | Supplier Quality Specification | 1 | Chapter 29 Other Documentation as requested | Any other documentation requested by the SQE | |

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| **P01AD502** | Supplier Quality Specification | 1 | 5.3 Qualification Approval Form | During the qualification, GE Additive and Supplier will define which steps of Manufacturing Process Plan (MPP) cannot be changed without approval of GE Additive. If changes are needed, a 'Supplier Deviation Form' shall be submitted by the Supplier before changes are implemented and wait for approval by GE Additive before implementing changes. | |
| **P01AD502** | Supplier Quality Specification | 1 | 6 Additional Notes | As per the applicable confidentiality agreement, all information provided by the Supplier is held in confidence between GE and the respective Supplier and all GE information shall be held in confidence by the Supplier. | |

**VERSION HISTORY**

| Version | Date (YYYY-MM-DD) | Issue Authority | Author |
|---|---|---|---|
| 1 | 2020-02-12 | AdEng-100233.A | A. Sprague |