

VESUVIUS

Supplier Requirements Manual

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INTRODUCTION.

Vesuvius recognizes that it serves a number of different market sectors with oftentimes differing demands. Vesuvius further recognizes the crucial role that its Suppliers play in creating value in the products and services that Vesuvius ultimately provides to its customers. Vesuvius relies on its Suppliers to provide, in a consistently timely manner, materials, products, and services which are not only of the highest quality, but also meet all of the specific contractual obligations and specifications set out in written agreements.

PURPOSE.

The purpose of this manual is to inform Vesuvius Suppliers of the fundamental expectations we have regarding the Suppliers' quality management systems, design requirements and the manufacturing process controls required to successfully do business with Vesuvius. This manual describes Vesuvius' expectations and sets out the fundamental steps that Suppliers must take to ensure that all Vesuvius requirements and expectations are met. The "Quality Management" standards outlined in this document are designed to both enhance the ability of the Supplier to meet those requirements and expectations and, at the same time, provide adequate assurances to Vesuvius that they are, in fact, being met.

SCOPE

This manual applies to all Suppliers providing Vesuvius with goods or services either used by Vesuvius in its manufacturing or sold directly to Vesuvius' customers, including Tolling and Resale suppliers. Note that, the requirements presented here do not supersede any conflicting requirements that may be specifically set out in Vesuvius contracts or drawings, including applicable engineering specifications and process specifications. IN THE EVENT OF ANY CONFLICT BETWEEN THE PROVISIONS OF THIS MANUAL AND THE TERMS AND CONDITIONS OF A SPECIFIC, WRITTEN AGREEMENT BETWEEN VESUVIUS AND A SUPPLIER, THE TERMS AND CONDITIONS OF SUCH WRITTEN AGREEMENT WILL GOVERN.

QUESTIONS.

Suppliers who have questions concerning this manual or any of their obligations hereunder should direct such enquiries to the appropriate representative within the Vesuvius Purchasing Department.

1. Definitions.

As used in this document, the following terms shall have the following meanings:

(a) The terms “shall” and “must” mean that the described action is mandatory for the Supplier.

(b) The term “should” means that the described action is necessary and expected, with some flexibility allowed in the method of compliance by the Supplier.

(c) The term “may” means that the described action is permissible or discretionary within the Supplier.

(d) The term “Quality Management System” shall mean a system for assuring the highest quality performance of a Suppliers obligations to Vesuvius’ reasonable satisfaction, in accordance with the provisions of Section 4 of this Manual.

(e) The term “SCAR” shall mean a Supplier Corrective Action Request pursuant to which Vesuvius notifies a Supplier that it believes it has received defective products or services or to inform of negative trends (which could result in defective products or services at a later time)

2. Supplier Criteria.

Vesuvius focuses on continuous improvement of our core manufacturing processes and expects that its Suppliers will also seek to develop and perfect their own core competencies. Accordingly, in order to qualify and maintain a long term, successful business relationship with Vesuvius, all Suppliers, at a minimum, must:

(a) Maintain their financial strength and viability.

(b) Continuously focus on improving efficiency.

(c) Share Vesuvius’ commitment to excellence in performance as defined by quality, timeliness, consistency, service, and cost.

(d) Provide products and services that are free of defects in materials and workmanship.

(e) Understand how their products and services can directly benefit Vesuvius and enhance the solutions Vesuvius offers to its customers as well as providing recommendations for improvement where possible.

(f) Consistently deliver products and services in a timely manner.

(g) Adhere to the guidelines described in the Vesuvius Code of Conduct (set forth in Appendix A)

3. Supplier Assessment Process.

Vesuvius' representatives will visit ALL suppliers of materials used in the Vesuvius manufacturing process. Suppliers must allow Vesuvius – or Vesuvius' designated representatives - to conduct an on-site Supplier assessment at such times and at such locations of the Supplier as Vesuvius deems necessary. Vesuvius reserves the right to visit any Supplier who is either deemed critical to the operation or has a number of SCARs issued against them. Communication of intent and agenda, as well as the specific timing thereof, will be sent to the Supplier in advance. In cases of critical issues, advance notice could be limited.

4. Quality Management System Requirements.

All Suppliers shall maintain a Quality Management System ("QM System") suitable to the products and services being provided to Vesuvius. Vesuvius views a Suppliers' QM System as a critical component in assuring that the Supplier can consistently meet its contractual specifications and other obligations.

The QM System should be in writing and should, at a minimum, contain the following elements:

(a) Supplier's quality policy.

(b) Supplier's quality objectives, including, but not limited to, measurements which should address customer expectations and be achievable within a reasonable amount of time.

(c) Supplier's control plans.

(d) Supplier's work instructions. Work instructions must be completed for all operations or processes that affect product quality. These instructions must be kept current and accessible for use at the work station and review by Vesuvius.

(e) Supplier's method of data tracking of critical processes, i.e. those processes that affect product quality.

(f) Control of non-conforming Product. Measures for the control of non-conforming product must be clearly documented. Such documentation must, at a minimum, specify that non-conforming product shall be clearly identified as

such and must be segregated to areas that have been clearly designated for the receipt and holding of non-conforming product so as to avoid its accidental use in the production process.

(g) Supplier's policy on their suppliers or sub-contractors including assessments and corrective action requests.

(h) Suppliers log of all corrective actions.

(i) Supplier's analysis of internal and external corrective actions, including, but not limited to, frequency by reason code.

(j) Suppliers' documentation of Vesuvius' specifications and subsequent revision levels, including on-going review and updating of contractual requirements.

5. Product Approval Process (Trials).

In order to determine that all applicable requirements and specifications are properly understood by the Supplier and that the Suppliers' process has the ability to consistently meet those requirements and specifications, trials are required for ALL new raw materials or component parts used in the Vesuvius manufacturing process as well as for ANY subsequent changes (see Section 6, below) in or to such raw materials or component parts. In addition, trials may also be required for raw materials and component parts that were once tested and approved but have not been used for an extended period of time.

Trial requirements will be based on the Vesuvius operating departments' specific requirements for the particular product. The Supplier must complete and send all appropriate demonstrative documentation to the requesting Vesuvius operating department. Blanket statements of conformance are unacceptable for any test results. The applicable supporting documentation must then be maintained by the Supplier regardless of submission requirements. These documents are to be provided to Vesuvius upon request.

Vesuvius may waive the full trial approval or any part thereof. WHERE TRIALS ARE REQUIRED, THE SUPPLIER MUST NOT PROCEED WITH PRODUCTION FOR VESUVIUS WITHOUT HAVING RECEIVED NOTIFICATION THAT ITS PRODUCT HAS SUCCESSFULLY COMPLETED THE APPLICABLE TRIALS. Any discrepancies discovered during trials will be communicated to the Supplier who must then take corrective actions and submit corrected samples for further verification.

Suppliers are required to ensure that all requirements of specifications (including drawings) are met. If a Supplier is unable to meet any of these

requirements, Vesuvius shall be contacted to determine the appropriate corrective action.

Where the supply chain includes a distributor, the product manufacturer may be required to submit material to Vesuvius for approval. Warehouse distributors are not to initiate shipments to any Vesuvius location without approval first having first been received.

Vesuvius will identify and document specific characteristics as an output of the trial process. The supplier is required to comply with these characteristics by noting them on the applicable documents as shown below:

(a) Purchased Material Requirements.

Ensures the Supplier has the correct documentation (specification, drawing, etc.)

(b) Process Flow Diagram.

Supplier shall provide a process flow diagram that clearly defines the manufacturing steps/sequences, etc.

(c) Failure Modes & Effect Analysis (“FMEA”).

FMEA’s may be required for designated processes identified in the process flow diagram.

The FMEA must be developed by the supplier team before the manufacturing of product and may be required for new or changed products. The FMEA must be updated throughout the product life. At a minimum, the FMEA is required to be reviewed annually.

The FMEA for the Vesuvius purchased material must be available for review, within a reasonable time, after requested by a representative of Vesuvius.

The FMEA must be completed using the latest AIAG FMEA guidelines or Vesuvius mandated guideline.

Product characteristics and process parameters identified on the FMEA will be the key for the development of the control plan.

The supplier must carry out a risk analysis of his production system (including incoming materials) in order to identify and address the potential weaknesses resulting in the manufacture or shipment of non-conforming products.

(d) Control Plan,

The control plan must be developed by the Supplier and indicate designated characteristics and tests/process parameters for the product. All control plans must clearly indicate check frequencies, statistical controls, specification references, evaluation methods, and sample sizes as well as reaction to out of control conditions. Vesuvius reserves the right to review the control plan prior to product submission. Control plans for “product families” are acceptable.

Essential elements included in the control plan are:

- Process steps and description
- Machine and tooling used on each step
- Control procedure including sample size, frequency, specification, and gauging method
- Analysis method and statistical controls used
- Reaction to out of control conditions
- Identification of designated characteristics

(e) Work Instructions.

(f) Dimensional Results.

(g) Material/Performance Test Results.

(h) Capability Studies.

(i) Measurement System Analysis.

The choice of gauging and testing equipment is essential for quality planning. Whenever possible, Suppliers must obtain variable measurement data. Suppliers shall maintain an effective calibration and control system for all gauges and testing equipment. Measurement systems analysis (MSA) studies are required for gauges, measuring and test equipment identified on the control plan. MSA shall include Repeatability, Reproducibility, Bias, Linearity, and Stability studies. Other analytical methods and acceptance criteria may be used if approved by Vesuvius.

6. Product/Process Changes.

VESUVIUS MUST BE NOTIFIED, IN WRITING, AT LEAST ONE HUNDRED TWENTY (120) DAYS IN ADVANCE OR AS SOON AS A CHANGE HAS BEEN DECIDED, OF ANY PRODUCT OR PROCESS CHANGE IN ORDER TO HAVE THE OPPORTUNITY TO EVALUATE THE IMPACT SUCH CHANGE WILL HAVE ON VESUVIUS' OPERATIONS, INCLUDING, BUT NOT LIMITED TO, QUALITY, SAFETY, ON-TIME DELIVERY, OPERATING EFFICIENCIES, COST AND DOWNTIME. BY WAY OF EXAMPLE, SUCH PRODUCT OR PROCESS CHANGES INCLUDE, BUT ARE NOT LIMITED TO, SOURCE OR LOCATION OF FEEDSTOCK PRODUCTS, EQUIPMENT CHANGES, PROCESS MODIFICATIONS OR PACKAGING REVISIONS.

VESUVIUS MUST AGREE/APPROVE ALL PRODUCT/PROCESS CHANGES.

7. Deviation Requirements.

In the case where a deviation is required, the Supplier must immediately notify the applicable Vesuvius Manufacturing Plant, in writing, of the situation with a detailed explanation. The Vesuvius Manufacturing Plant must then advise the Supplier of Acceptance (or not) in writing.

IN ANY EVENT, A SUPPLIER MUST OBTAIN PRIOR WRITTEN ACCEPTANCE OF A DEVIATION AND APPROVAL FROM VESUVIUS BEFORE MAKING SHIPMENT OF ANY PRODUCT.

Corrective actions to prevent reoccurrence must be submitted in a timely manner. Individual authorizations by Vesuvius of deviations are not blanket approvals to make further shipments of non-conforming products. Continuous requests for deviations may ultimately require a change to requirements.

The Supplier must then include a copy of the Vesuvius approval with the shipment of product to the manufacturing site. Failure to follow this procedure may result in a product rejection and reflect on the Supplier's quality performance.

8. Supplier Corrective Action.

A SCAR is a formal, written notification sent by Vesuvius to a Supplier, at Vesuvius' discretion, notifying the Supplier that Vesuvius is dissatisfied with the Suppliers' performance. The issuance of a SCAR can be due to a variety of reasons, including, but not limited to, late deliveries, material which does not meet Vesuvius specifications and requirements, or packaging defects. These SCARs will be sent to Suppliers via a web-based system, will specify the problem and will require action from the Supplier.

SCARs will follow the 8D Methodology (8 Disciplines) in a multi-step approach as described below:

- (a)** D1 – Clarify the problem, i.e. written summary of occurrence. (Vesuvius)
- (b)** D2 – Grasp the current situation and categorize the problem. (Supplier)
- (c)** D3 – Immediately contain the problem and set targets for resolution. (Supplier)
- (d)** D4 – Analyze the causes, i.e. an analysis of non-conformance and the failure to detect prior to receipt by Vesuvius. (Supplier)
- (e)** D5 – Define the corrective action to be taken to remedy both the non-conformance and the failure to detect. (Supplier)
- (f)** D6 – Execute corrective action and track progress. (Supplier)
- (g)** D7 – Review the effectiveness of corrective actions. (Vesuvius)
- (h)** D8 – Closing of SCAR with Lessons Learned from the Supplier. (Vesuvius)

9. Supplier Containment.

Containment requirements may be imposed on any Supplier due to poor quality of performance or products, including, but not limited to, poor delivery record, safety, quality, production, environmental, or sourcing problems caused by the Supplier. Suppliers doing business with Vesuvius must agree to be bound by Level 1 or Level 2 Containment requirements, as set forth below, depending on the individual situation.

(a) Level 1 Containment – Quality.

This additional inspection and testing process is required to be performed by the Supplier’s employees at the Supplier’s location. The Supplier will be notified by Vesuvius that it has been placed on “Level 1 Containment - Quality” status. This communication will be promptly followed by a written notification from Vesuvius including the need for a complete inspection, a containment plan, effective corrective action and the criteria under which the Supplier will be removed from Containment. Suppliers are required to provide Vesuvius with written confirmation of receipt of this notification, including their proposed

containment activities, within twenty-four (24) hours. While on Level 1 Containment, Suppliers will be restricted from bidding on or being granted new business with Vesuvius for the products or services in question.

Suppliers placed on Level 1 Containment-Quality must:

(1) Immediately establish a separate containment activity area at their location.

(2) Initiate the inspection and testing activities and record the results. At a minimum, Suppliers must record the material inspected and tested and the frequency of non-conforming material identified.

(3) Contain all suspect products that are in the supply chain (at Supplier's location, in-transit, at Vesuvius).

(4) Conduct a daily review of the results of the inspection and testing activities and verify that corrective actions are effective or plan required changes.

(5) Communicate the results of the inspection and testing to Vesuvius in the agreed upon time and manner.

(6) Provide key quality documents upon request for Vesuvius' review.

(b) Level 2 Containment – Quality.

“Level 2 Containment – Quality” includes the same process as Level 1 Containment-Quality but with additional inspection and testing requirements through the auspices of an independent third party representing Vesuvius interests. Suppliers will be placed on Level 2 containment if they fail to meet their obligations while on level 1 containment. The use of any such third party will be at the sole discretion of Vesuvius and will be paid for by the Supplier.

As with Level 1, a Supplier will be notified that they have been placed on Level 2 Containment-Quality status. This communication will be promptly followed by a written notification from Vesuvius that will detail the need for a complete inspection, a containment plan, effective corrective action and the criteria under which the Supplier will be removed from Containment. Suppliers are required to provide written confirmation of receipt of this notification, including their proposed containment activities, within twenty-four (24) hours. While on Level 2 Containment Suppliers will be restricted from bidding on or being granted new business with Vesuvius for the products or services in question.

Suppliers placed on Level 2 Containment - Quality must:

(1) Contact and issue a purchase order to a Vesuvius appointed independent third party inspection and testing firm. The Supplier is responsible for providing all necessary information, training and locations for re-inspection activities. Supplier is responsible for all costs and expenses associated with this re-inspection.

(2) Submit data to Vesuvius as agreed upon.

(3) Meet the defined criteria for removal from Level 2 Containment.

(c) Release from Containment – Quality.

Suppliers shall remain on Level 1 Containment – Quality or Level 2 Containment – Quality, as the case may be, until:

(1) The Supplier demonstrates that it meets the removal criteria as defined in the initial Vesuvius notification letter.

(2) The Supplier provides supporting documentation on performance improvements and corrective actions taken.

(3) The Supplier formally requests, in writing, removal from the applicable level of Containment and receives Vesuvius' written approval thereof.

(d) Revocation Process.

Suppliers that do not adequately respond to Level 1 and Level 2 Containment requirements of Vesuvius or fail to meet the exit criteria defined will cause suppliers to be removed from the Vesuvius as an approved supplier and product will be resourced.

10. Non-Conforming Material (in Transit or at Vesuvius location).

Vesuvius expects Suppliers to ship products which are in conformity with the applicable Vesuvius requirements and specifications. If non-conforming product is identified at any Vesuvius site or at a Vesuvius customer location, the Supplier will be immediately notified of such non-conformance. Suppliers have the opportunity to mitigate and dispute the validity of the alleged non-conformance.

However, at a minimum, when non-conforming product is initially communicated to the Supplier by Vesuvius, the Supplier is required, as part of its product containment activities, to notify all Vesuvius sites receiving similar product of the non-conformance problem.

In addition, any product currently being held by such Supplier in anticipation of shipment to Vesuvius is to be completely inspected for the reported non-conformance. Records of the results of such inspection must be maintained and available for review by Vesuvius. Inspection, including any containment restrictions, shall continue until all product has been re-certified as conforming to specification.

For product that is either in-transit or already at Vesuvius location(s), the Supplier shall immediately contact each receiving Vesuvius facility, advise them of the non-conformance and determine the appropriate disposition of such product per the following:

- (a) Return the product to Supplier for inspection
- (b) Inspect the product at Vesuvius location by Supplier personnel
- (c) Inspect the product at Vesuvius location by third party personnel with the Supplier responsible for all attendant costs and expenses
- (d) Inspect product at Vesuvius location by Vesuvius personnel (contact Vesuvius buyer for charges) If a third party source is not available for sorting / development / process improvement activities; contact the receiving Vesuvius facility for assistance
- (e) Accept non-conforming product at the Vesuvius location under deviation

11. Disposition of Confirmed, Non-Conforming Material.

Vesuvius shall contact the Supplier for disposition of suspect material.

In the event of shipment of suspect or non-conforming product to a Vesuvius customer, caused by the Supplier's product, the Supplier will be also debited for associated Vesuvius customer charges. Suppliers are expected to be involved with customer required sorting / on-site review as appropriate.

If Supplier evaluation proves to be ineffective (i.e., Vesuvius continues to receive defective material from shipments), the Supplier will be placed on Containment Level I or Level 2 as defined in Section 9 hereof.

The Supplier will be responsible for all costs incurred by Vesuvius due to nonconforming material, including but not limited to return freight where applicable.

12. Packaging and Labeling.

The Supplier must adequately plan for packaging designed to prevent contamination, deterioration, or loss and to eliminate shipping damage. Suppliers should provide packaging that provides for sufficient density and protection from any likely damage that may occur, including protection against humidity. Packaging must meet local, national and international standards for safe disposal and/or recycling.

13. Product Documentation.

The Supplier shall supply all product documentation as required by Vesuvius, including, but not limited to:

(a) Documentation clearly demonstrating the product's location of origin and that of its component parts or feedstock.

(b) Material Safety Data Sheets.

(c) Documentation relating to the handling and disposal of hazardous materials, if applicable.

14. Control and Release of Vesuvius Documents.

All Suppliers must sign a Non-Disclosure Agreement to prevent sharing of documentation, process information, and other relevant information with other companies or individuals. Documents provided to the Supplier by Vesuvius are furnished solely for the purpose of doing business with Vesuvius. These proprietary documents may be furnished by Vesuvius to the Supplier in hard copy, electronic, or other media. The Supplier is responsible for controlling and maintaining such documents to prevent improper use, loss, damage, alteration and/or deterioration.

15. Business Continuity.

All Suppliers should maintain a business continuity plan that must contain contingency plans to satisfy Vesuvius' requirements in the event of significant utility interruptions, labor shortages and equipment failures. This plan should also allow for the safeguarding, storage and recovery of drawings, specifications, tooling and other critical Vesuvius information and materials in the event of damage or loss.

Appendix A

Vesuvius Supplier Code of Conduct

Supplier Code of Conduct.

Suppliers must ensure operations are being performed in a manner that is appropriate, as it applies to their ethical, legal, environmental, and social responsibilities. Below is a listing of the basic requirements:

(a) Compliance with Local Laws and Regulations.

Suppliers must adhere to the laws and regulations in the locality in which they operate. This includes all local, state, and federal laws and regulations in the country of origin.

(b) Compliance with Environmental, Health and Safety Laws.

The Supplier must maintain and operate its manufacturing/production facilities and processes in accordance with local, state, and federal laws and regulations in the country of origin. No Vesuvius or Vesuvius Customer personnel should be exposed to hazardous materials or unsafe conditions as a result of Supplier shipments to a Vesuvius (or Vesuvius customer) location or while visiting a Supplier's location. For items with inherent hazards, safety notices must be clearly visible. As applicable, documented safety handling and protection information must be provided.

(c) Product Safety.

In all instances where a product is manufactured to a new design, for a new system or for a new application, it is important that Supplier and Vesuvius allocate responsibility for assuring that all performance, endurance, maintenance, safety and warning requirements are met. It is preferred that this allocation of responsibility is in writing.

(d) Contractor Safety.

In instances where a contractor (or service provider) is at a Vesuvius facility, it is the Contractor's responsibility to provide valid proof of insurance which is currently effective for the Contractors' employees that will be on-site at a Vesuvius facility. They also must sign an Agreement of Release of Liability.

(e) Non-Discrimination.

Suppliers shall not discriminate against race, color, sex, religion, age, physical disability, political affiliation, or other defining characteristics as

prohibited by local, state, and federal laws and regulations in the country of origin.

(f) Labor.

(1) Child Labor.

Suppliers shall employ workers of minimum legal age in accordance with local, state and federal laws and regulations in the country of origin. Child labor laws must be followed.

(2) Forced Labor.

Suppliers shall not practice the use of any form of forced labor.

(3) Work Hours and Days.

Suppliers shall not exceed the daily and weekly working hours as permitted by local, state, and federal laws/regulations in the country of origin.

(4) Wages and Benefits.

Suppliers shall compensate workers in accordance with local, state, and federal laws/regulations in the country of origin. This includes minimum legal wage, overtime wages and benefits as required by law.

(g) Ethics.

Evidence of corruption, bribes, improper advantage, or any other form of illegal practice made by the Supplier or its associated agents or sources will terminate all relations with Vesuvius. Gifts and entertainment will only be allowed in accordance with the Vesuvius Purchasing Policy for Gifts and Entertainment (Appendix B). Suppliers will conduct their business in a manner that meets the Code of Ethics policy of Vesuvius.

(h) Code of Conduct and Policy Enforcement.

This policy applies to Suppliers and their sub-contractors. It is the responsibility of the Supplier to verify and monitor compliance of this code at their operations and sub-contractor source operations.

Appendix B

Vesuvius Purchasing Policy for Gifts and Entertainment

Business courtesies are provided by or to persons or firms with whom Vesuvius maintains or may establish business relationships and for which fair market value is not paid by the recipient. A business courtesy may be a tangible or intangible benefit, including but not limited to, such items as cash, non-monetary gifts, meals, drinks, entertainment, hospitality, recreation, door prizes, and transportation, meals, lodging, discounts, tickets, passes, conference fees, loans or use of a donor's time, materials, or equipment.

(Purchasing) employees must act lawfully, reasonably, and with moderation in connection with business courtesies (gifts, entertainment, or other benefits). Employees must exercise good judgment and avoid even the appearance of impropriety or illegality.

(Purchasing) employees may accept or provide business courtesy gifts only if: They are lawful, they are of nominal value (below 50 USD – or other currency equivalent – or approved by the recipient's manager), they are not cash, they are not solicited, they do not obligate the recipient in any manner, they do not create even the appearance of impropriety or illegality, they are in accordance with the ordinary and proper course of business, and they are not exchanged on a regular or frequent basis.