

## **Key Elements Procedures # 2**

# **Supplier Quality Requirements**

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## 1.0 FOREWORD

**This document is valid for purchased parts to Volvo CE, Volvo Parts and Volvo Penta.**

The Key Elements Procedures consist of seven modules that, as a group, define the quality expectations for a supplier to Volvo Group companies. This document defines the quality systems required of a partner supplier and the expectations regarding quality performance. This quality mindset shall be used in all activities while working with Volvo, through out the processes of quoting, product development, manufacture, supply, service, warranty and ultimate end use of the product.

Traditionally the focus of Quality Assurance has been on responding to problems and taking effective corrective action. As the expectations of our customer's increase, the role of quality assurance has changed, placing more emphasis on identifying potential problems and taking action to prevent occurrence. Volvo suppliers are expected to apply this approach to their quality system deployment.

Note:

For **Volvo 3P, VPT and VBC** purchased parts, the detailed quality assurance requirements are defined in the Volvo Supplier Quality Assurance Manual (SQAM). The SQAM supersedes this procedure and is available on the supplier portal e-library at: [http://supplierportal.volvo.com/vsp/ap/en/E-Library/Quality/3P\\_SQA\\_Manual/](http://supplierportal.volvo.com/vsp/ap/en/E-Library/Quality/3P_SQA_Manual/)

For **Volvo Aero**, the detailed quality assurance requirements are defined by the Volvo Aero Supplier Quality Assurance Requirements (SQAR). The SQAR supersede this procedure and are available on the supplier portal at: [http://supplierportal.volvo.com/vsp/int/en/E-Library/Quality/Volvo\\_Aero/Pages/Volvo\\_Aero.aspx](http://supplierportal.volvo.com/vsp/int/en/E-Library/Quality/Volvo_Aero/Pages/Volvo_Aero.aspx)

## 2.0 DEFINITIONS AND ACRONYMS

AAR = Appearance Approval Report  
APQP = Advanced Product Quality Planning  
AIAG = Automotive Industry Action Group  
BA/BU = Business Area/Business Unit at Volvo, e.g. Volvo CE, Penta or Parts.  
ECN = Engineering Change Notice  
PAA = Product Application Agreement  
PHR = Part Handling Review  
PPAP = Production Part Approval Process  
PPM = Parts Per Million  
PSW = Part Submission Warrant  
QPM = Quality Performance Measurement  
RTS = Review if Technical Specification  
SQA = Supplier Quality Assurance (SD/SDE/SQE/SQD at some BA/BU))

## 3.0 BASIC QUALITY REQUIREMENTS

### 3.1 QUALITY SYSTEMS

It is expected that suppliers to Volvo Group companies will have a well developed mature quality management system in place and functioning effectively.

As a minimum all suppliers are required to have quality system that has been registered to the latest version of ISO 9001. We encourage suppliers to have or be working towards implementing a quality system compliant to ISO/TS 16949 as many of our requirements are the same as the automotive industry. Suppliers should keep certificate status updated in Volvo Supplier Portal.

### 3.2 GENERAL REQUIREMENTS

In addition to a registered quality system Volvo Group suppliers are required to demonstrate a history of product delivery with a low non-conformance rate (e.g. PPM). Suppliers are expected to have a formal Problem Solving/Corrective Action process in place and functioning that allows for effective response when problems do occur.

### 3.3 TARGET AGREEMENTS

#### 3.3.1 PPM Target Agreement

For certain components, suppliers may be required to sign a PPM Agreement with Volvo. The PPM measures the amount of nonconforming product delivered as a percentage of a million parts delivered. The PPM Agreement is based on the PPM prediction for a commodity or family of parts and establishes specific targets for performance improvements over a multi-year period.

The objective of the PPM agreement is to establish a minimum standard for the supplied quality and to encourage suppliers to develop ways of working towards the prevention of non-conformance's and their underlying causes.

#### 3.3.2 Warranty Charter

It is our expectation that suppliers develop and deliver product that is not only fully conforming at time of delivery, but also provides faultless performance during the useful life of the end product. However, it is recognized that some percentage of product may experience early failures. It is our expectation that suppliers will stand behind their products and provide warranty coverage for the components that do not reach the expected life.

For all warrantable parts, Volvo requires suppliers to sign a Warranty Charter that expressly details the recovery guidelines for expenses related to field failures caused by

the supplier's product. The Warranty Charter is typically signed as a stand alone contract, but warranty terms may be included as part of a Purchasing Agreement, or other commercial contract.

The Warranty Charter sets the framework for managing the allocation of costs etc. related to supplier caused warranty issues. If no warranty charter is in place Volvo will still hold the supplier responsible for field failures related to the design or manufacture of their supplied products and costs and liabilities will be managed on a 'case by case' basis.

## 3.4 PARTICIPATION IN RESOLVING QUALITY ISSUES

### 3.4.1 Reliability Concerns

Volvo has established target levels for failures experienced by our customer while the product is in service. While the ultimate target is for the customer to experience "zero" field failures during use of the product, maximum failure rate targets are established for products with a known failure history.

Field Failures are measured by the number of problems identified based on customer complaints as a percentage of units in service. Suppliers are required to take aggressive corrective action for all component issues that exceed the specific targets.

### 3.4.2 Lead Time To Solve Problems

When problems occur that affect our customers; the speed to identify, solve and implement the solution to the problem has a direct impact on customer satisfaction. Correcting these problems requires the involvement and partnership of our suppliers to help in the investigation, perform failure analysis, or make improvements to existing products. Suppliers must react quickly and work aggressively to help in problem resolution. Suppliers are expected to manage time required to develop solutions and maintain an active program to continually reduce time taken to solve problems.

## 4.0 PART SPECIFIC QUALITY REQUIREMENTS

### 4.1 KEY COMPONENTS

All parts delivered to a Volvo Group company should be developed using a comprehensive quality system that ensures conformance to specifications. While rigorous quality practices should be applied to the production process of all parts, certain parts may be selected for closer attention and more extensive tracking of quality assurance activities. These parts are identified as Key Components.

Key Components are selected at the start of a project by a cross functional project team and are generally selected on one or more of the following criteria:

- Components critical to the function of the system or sub-system

- Parts with legal, safety or other regulatory requirements
- Parts with features that are critical to safe, reliable system function
- Parts with extensive or expensive tooling
- Parts that require extensive testing
- Parts with known or potential quality concern
- BA/BU specific criteria

Suppliers of Key Components may be asked to develop and submit a comprehensive product launch plan (APQP-plan or similar). In addition, suppliers of some critical components may be required to report regularly on project status and related quality activity. The supplier's project team may also be requested to participate in regular management steering committee meetings, to review project status and address issues that affect delivery timing or quality.

## 4.2 TECHNICAL DOCUMENTATION

In the Volvo system the top level controlling document may be a drawing or a Part Version Report. A detailed description of the documents that support Volvo product development is available in Key Elements Procedure 3. Please note that if there is any question about the controlling document, suppliers should contact the buyer or SQA at the Volvo business unit placing the purchase order.

To ensure that all product requirements are identified, all documents and standards referenced at each level must be reviewed for references to lower level documents. This must be completed at each level and each succeeding level until all documents have been identified and reviewed.

## 4.3 PRODUCTION TRACEABILITY REQUIREMENTS

It is expected that all suppliers have an established system for an appropriate level of product traceability in terms of batch or lot production and material control. Certain parts may be subjected to specific, defined traceability requirements. Typically this requirement is applied to parts or part features related to safety or legal regulations. Suppliers of parts in this category are required to maintain systems that allow traceability from a part serial number or date code to specific manufacturing, inspection and material records associated with a part and the regulated feature(s). This information must be retained and stored to be readily accessible to Volvo when required.

The SQA assigned to a part may define specific traceability or document requirements. If there are any questions concerning the type of traceability required or level of supporting documents, suppliers are obligated to contact the SQA immediately.

Generally parts or part features where traceability is needed will be identified using one of the following methods. Parts that are controlled by government regulation will have a [2R] or [3R] designation on the drawing next to the applicable features. Parts that are critical or have a feature that is critical will have a designator [1], [2] or [3] next to the

feature. As a general rule, the criticality designation [1] will be applied to safety critical parts. Additional information is available in Volvo Standard 105-0001, “Critical Requirements”.

In addition to features identified as critical in Volvo specifications, suppliers are responsible to identify any and all additional safety or regulatory requirements that are specific to their parts or commodity.

## 5.0 ADVANCED PRODUCT QUALITY PLANNING

### 5.1 DETAILED PROJECT LAUNCH PLANNING

Volvo views project planning as a critical element in delivering a project on time but also to allow adequate time and resources to ensure that all quality requirements related to the part development, process development and product testing can be completed. All suppliers to Volvo organizations are expected to have a formal process for project planning and new part introduction. Suppliers are encouraged to use their existing planning processes and tools; however, Volvo has developed an extensive array of tools to assist suppliers if necessary. These tools are available on the supplier portal. The SQA assigned to a supplier can help in accessing and using the tools available.

Suppliers will develop a detailed plan prior to the start of the project. The timing plan needs to be updated on a regular basis to reflect accurate project status and to highlight any issues that could impact project timing or create risks to product quality. Recovery actions must be developed for all risks identified during the project. The risks must be highlighted to the project team and the recovery actions included as part of the existing project plan.

Suppliers are required to develop a plan using the Advanced Product Quality Plan (APQP) guidelines developed by the Automotive Industry Action Group. In case there are specific requirements from each BA/BU, these can be found in the E-library in the supplier portal.

### 5.2 VOLVO SPECIFIC REQUIREMENTS

In addition to the Project Launch Plan, Volvo has specific activities that the supplier is required to support. A brief description of these is included.

#### 5.2.1 Contract Review or Review of Technical Specifications (RTS)

The purpose of the Review of Technical Specifications is to ensure that all technical information defining a Volvo part is complete, accurate and clearly defined for the supplier prior to the issue of a Purchase Order for Production Part Approval Process (PPAP) launch or in the case of a development supplier, that Volvo clearly agrees with the information defining the part. Also one purpose is that the supplier is capable of

meeting all Volvo technical specifications. This review may include technical information for the part, and also information concerning the surrounding parts, interfaces and functions.

Ideally the RTS will take place in two sessions. The first session is intended to take place early in the development cycle allowing supplier input into the product design and development. It is critical that initial designs are reviewed for compatibility with the supplier's manufacturing capability. At this point the supplier also has opportunity to make design change recommendations that will impact product cost, improve manufacturability and/or quality. The second stage of the RTS occurs after final release of the component documents. The purpose of the late stage RTS is to ensure that all issues from the initial design review are incorporated into the final design and that all technical requirements are understood. This constitutes an agreement between Volvo and the supplier that all technical requirements can be met and maintained.

It is Volvo expectation that an effective RTS is demonstrated by the supplier's ability to produce PPAP samples and subsequent production that is fully conforming to the final design requirements.

To ensure effectiveness of the RTS meetings, the supplier is required to have representatives from their engineering and manufacturing functions. Others may participate but these two areas must be represented as a minimum. The minimum representation from Volvo includes the Volvo design engineer, the responsible buyer and the SQA. Optional Volvo representation includes personnel from logistics/packaging, manufacturing, quality and after market.

Generally the Volvo buyer will contact the supplier to arrange the RTS review. Either the buyer, the design responsible engineer or the Supplier Quality Assurance Engineer may coordinate and run the RTS activities. Any questions concerning RTS planning should be directed to the buyer representing the Volvo entity that will be receiving the parts.

RTS-templates are available at the supplier portal.

## **Preparation**

Prior to the date of the meeting, the supplier should obtain all of the Volvo technical information and related specifications. It is highly recommended that the supplier assemble a team to review the documentation in preparation for the RTS. All issues, concerns and questions discovered should be documented and be submitted to the responsible SQA and Buyer prior to the RTS.

### 5.2.2 Government and Industry Regulations

Governmental authorities and environmental organizations place demands on manufacturers in the form of requirements, manufacturing controls and production process controls.

Any legal requirements (global or national) that exist for individual components or systems will be stated within the technical specifications issue by Volvo. In cases where the requirements are specific to the supplier's components, the supplier carries the full responsibility for component approval by the appropriate authorization body. When applicable, the implementation and fulfilment of all directives and regulations concerning Type Approval and/or Certification system must be accomplished prior to the submission of the PPAP for approval.

It is the supplier's responsibility to be well acquainted with and educated on all systems and applicable legal requirements which are valid for their supplied components. The supplier must exercise full control of the actions needed to guarantee the accomplishment of the requirements.

Volvo agrees not to introduce changes to a product of an authorized type approval unless new testing and approval is completed. The requirements can be monitored by any combination of inspections during production, by testing or inspection of finished products.

### 5.2.3 Product Application Agreement (PAA)

The Product Application Agreement (PAA) is required when Volvo selects a supplier designed part for use in a Volvo application. The PAA is a written agreement, signed by the supplier and Volvo signifying the supplier's product will meet the documented Customer Specification Requirements when installed and used in the Volvo application. The activities required to complete PAA should be included in the supplier's APQP and Project Assurance Plan (PAP). The PAA must be completed and signed prior to the start of Volvo serial production.

In case there are specific requirements from specific BA/BU, these can be found in the E-library in the supplier portal.

### 5.2.4 Part Handling Review

The purpose of the Part Handling Review is to ensure that the product quality or integrity is not compromised between the time the parts are delivered to Volvo and the time it is received by the final customer. The PHR consists of an on site visit to Volvo using the site to review all handling and installation practices. This audit will usually include review of receiving, material storage, handling, installation, testing and shipping as applied to the supplier's part. Suppliers of Key Components should participate in the PHR when requested. However, any supplier may request a PHR by contacting the assigned SQA or Buyer.

During this audit, all supplier observations, issues or concerns are documented for follow-up actions. If there are no issues or the identified issues have been addressed, the supplier is required to sign the PHR approving the handling and installation processes.



## 6.0 APPROVAL FOR START OF PRODUCTION

### 6.1 PRODUCTION PART APPROVAL

Suppliers to Volvo CE, Volvo Penta and Volvo Parts should use Production Part Approval Process (PPAP) for part approval.

Requests for production part approval must be completed and submitted according to the requirements in the Production Part Approval Process guidelines published by the Automotive Industry Action Group (AIAG). Electronic versions of the Volvo PSW, Dimensional Report Form, Material/Test Results and Appearance Approval Reports (AAR) can be obtained at the following Volvo Group Supplier Portal.

<http://www.volvogroup.com/suppliers>

The purpose of this process is for the supplier's organization to demonstrate that products produced from the intended production process are fully conforming to customer specifications. The trial run, testing, verification activities, and evidence review must be completed by the supplier prior to submitting documentation for the approval by Volvo. Approval is required for all new parts, modified parts, or parts that have not been delivered to Volvo for a period of one year or more or according to BA/BU specific requirements.

Production part approvals are required to demonstrate the supplier's capability to manufacture parts that consistently meet the design requirements during an actual production run at the quoted serial production rate. Samples used for production part approval must be manufactured following the serial production process flow and control plan using the intended tooling, production and measuring equipment, routines, systems and procedures. If the manufacturing of a part is carried out using several different tools or in several cavities of one tool, samples shall be taken from each tool and cavity respectively to verify conformance.

All technical specifications of the drawing and reference documentation must be verified and documented by the supplier.

Suppliers are expected to determine the quantity of parts required to successfully prove out the process during the significant production run. The number of sample parts required for submission with the production part approval will generally be specified in the Sample Purchase Order. Suppliers may request modification to the sample quantity if required to support the prove-out of the production process.

In addition, the Volvo SQA may also confirm and or modify the submission level through direct communications with the organization during the APQP reviews and PPAP scheduling.

Volvo may request to have personnel present during significant production run and may perform a process audit during the trial.

While Volvo does not require all documentation be submitted with each approval, all documents supporting the production part approval must be maintained and available upon request. The Supplier is required to maintain all production part approval documentation during the life of the product plus one year or according to BA/BU specific requirements.

## 6.1.1 PPAP SUBMISSION LEVELS

PPAP submission level 3 is default at Volvo CE and Volvo Parts for Key Components.

PPAP submission level 4 is default at Volvo Penta for all parts and default at Volvo CE and Volvo Parts for Non-Key Components.

The selected PPAP submission level is defined by each BA/BU and communicated to the suppliers at latest through the Sample Purchase order.

All PPAP related documents, regardless of submission level, shall be maintained by the supplier and submitted to Volvo upon request.

## 6.2 CONTROL OF CHANGES

### 6.2.1 Notification of Engineering Changes (initiated by Volvo)

Suppliers may receive a Product Change Request (PCR) intended to provide early notification of potential product changes. Suppliers will receive formal notice of design changes by a Design Change Notice (DCN), or an Engineering Change Notice (ECN). The method of notification is dependent upon changes occurring prior to, or after start of serial production. When a change is required a Product Change Request will be forwarded to the supplier along with an updated drawing for review. The subsequent design change costs and timing should be agreed by Volvo and the supplier.

In line with the extent of the change, suppliers should conduct an appropriate review and update of their supplier's quality assurance system, such as a review of the P-FMEA, Control Plan and Process Flow.

The change must not be applied to product or parts prior to receiving written approval from the respective Volvo Company, through an approved PPAP (PSW).

### 6.2.2 Supplier Request for Engineering Change

Through serial production, Volvo expects initiatives from the supplier to support continuous improvement in quality and efficiency. Supplier suggestions for change of a product or process should be submitted using the Product / Process Change Notification

(PPCN). The electronic form of the PPCN document can be found on the Volvo Supplier Portal.

No changes to form fit or function as detailed in the drawing or specification of any part is allowed without prior written notice and approval by Volvo Engineering.

The intent of this process is to minimize the risk to either supply of product or quality performance of the supplied product. It is requested that any planned change, should be discussed between Volvo and the supplier's quality contact to assess the potential risk and take the appropriate action.

The following types of changes must be documented and approved on a PPCN prior to implementation.

- Use of other material than was used in the previously approved part or product.
- Production from new or modified tools, dies, moulds, patterns, including additional or replacement tooling. Note that this requirement only applies to tools, which due to their unique form or function, can be expected to influence the integrity of the final product.
- Production following upgrade or rearrangement of existing tooling or equipment. Upgrade means the reconstruction and/or modification of a tool or machine to increase capacity, performance, or change its existing function. Rearrangement means changes to the sequence of the product/process flow from that documented in the process flow diagram (including the addition of a new process).
- Production from tooling and equipment transferred to a different plant site or from an additional plant site.
- When 1<sup>st</sup> tier supplier changes the 2<sup>nd</sup> tier supplier for parts or services.
- Change in test/ inspection method – new technique. The supplier should have evidence that the new method has measurement capability equivalent to the old method.
- Product and process changes related to components of the production product manufactured internally or by suppliers.
- Production from machines and/or processes that has been a target for a bigger repair of refurbishing.

Even though these changes are requested to support improvements, the changes must not be applied prior to receiving written approval from the respective Volvo Company, by a signed, approved PSW (PPAP). Risk analysis and validation may be required prior to approval of a change.

If there is any doubt whether notification and approval is required it is strongly recommended that the supplier discusses the planned change **PRIOR** to its application with the SQA, to allow a balanced joint risk evaluation to be established.

## 7.0 PERFORMANCE MEASUREMENT, TRACKING AND CORRECTIVE ACTION

### 7.1 REPORTING OF NON-CONFORMANCES

Defective parts detected in Volvo factories are communicated to the supplier by use of an Inspection Report through mail, fax or over the Internet. The Inspection Report is used by all Volvo plants and spare part hubs to document product non-conformances. An IR may also be issued for shipment of mislabelled parts, over/under shipment or improper packaging.

The format of these reports may vary slightly between the different plants, but the important common requirement is that the problem solving process starts immediately upon receipt of the Inspection Report to contain suspect product and avoid any further production disturbances.

Nonconforming products can be returned to the supplier for rework or analysis depending upon the individual agreement. Depending on the type of non-conformance and the production requirements suppliers may be asked to expedite replacements, or make arrangements for sorting of product at the Volvo facility.

At the supplier's discretion, parts may be scrapped at the Volvo facility to avoid return freight costs. Additional costs associated with the handling and actions taken within Volvo, administrative as well as costs for adjusting, sorting, disassembly etc. may be charged back to the supplier in line with the Volvo Policy.

### 7.2 CORRECTIVE ACTION

Each time a deviation or a defect is found and communicated, suppliers are expected to investigate the causes for the problem, initiate corrective action, and report the results of the corrective action.

The supplier is requested to take containment action within 24 hours of notification, and report plans to contain the non-conformance. Once containment is in place, action must be taken to complete a detailed root cause analysis of the problem.

The 8 Discipline (8D) problem management tool is requested for documenting the investigation and responding to customer returns or major quality issues. Suppliers may use the Volvo 8D form available on the supplier portal for reporting or may use their own report format for response as long as it includes all activities of the 8D process.

### 7.3 PERFORMANCE MEASUREMENT

Supplier performance is measured on a monthly basis and is reported to Purchasing and Supplier Quality Management. Volvo evaluates supplier performance using one or more of the following methods.

- Parts Per Million

- Quality Performance Measurement
- Plant Disturbance
- Corrective Action Response

Supplier performance measurement is updated at the end of every month and is available to suppliers in the Volvo Group Supplier Portal. Suppliers should access the supplier scorecard through the Supplier Portal on a regular basis to monitor their own performance. Poor performance during a month, three month period, or negative trends should be addressed quickly and aggressively with corrective action and process improvement.

### 7.3.1 Parts Per Million (PPM)

PPM is evaluated in two ways, PPM for a single month and as a three month rolling average. Suppliers can access their PPM performance using the Supplier Portal.

### 7.3.2 Quality Performance Measurement (QPM)

QPM is an indicator of a supplier's performance based on a three month window. QPM is developed for each supplier based on the following criteria:

- PPM for the most recent three month period
- Actual number of nonconforming material identified
- The total number of inspection reports issued during the three month evaluation period
- The monetary value of nonconforming product divided by the monetary value of received products during the evaluation period

Points are assigned in each category based on supply performance establishing a total score for quality performance (100 is maximum).

The total number of points for a three month period defines the suppliers QPM score. Performance is evaluated on the following basis. Suppliers with a score higher than **50** are monitored and require a higher level of action to improve performance.

### 7.3.3 Plant Disturbance

In addition to the PPM and QPM measurements, Volvo reserves the right to evaluate supplier's performance based on the impact that supplied nonconforming material has on the day to day operation of the production and assembly operations. Non-conformance's that impact production, requiring sorting on line to support production or that cause Volvo to repair or disassemble finished product require aggressive immediate action by the supplier.

Suppliers are expected take corrective action and submit a completed "8D Corrective Action" for all non-conformances' that result in a plant disturbance.

## 7.3.4 Escalation of problems

If the supplier's performance is not improving, the response is poor or slow or the action plan is not progressing, Volvo will invite the supplier to a management meeting. The purpose is to gain consensus about what to do and how to improve and investigate if supplier has the will, competence and resources to change and improve?

If the supplier's performance is still not improving, future business with the supplier will be put on hold and sourcing activities are started to be prepared to switch supplier.