



Supplier Quality Manual

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Knowles Supplier Quality Manual

For distribution to all current and prospective suppliers

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1.0 Purpose

This manual serves to inform suppliers of Knowles requirements for qualifying new components and the ongoing activities to assure delivery of product to our specifications and expectations.

2.0 Scope

This procedure manual covers procurement and acceptance of new components for prototyping or production or existing components modifications. This procedure manual excludes component procurement for feasibility studies.

3.0 Definitions

| | |
|------|-------------------------------------------------|
| CM | - Category Manager |
| CMRT | - Conflict Minerals Reporting Template |
| COC | - Certificate of Conformance |
| CSR | - Corporate Social Responsibility |
| Cpk | - Statistical Measurement of Process Capability |
| DRC | - Democratic Republic of the Congo |
| FAI | - First Article Inspection |
| FMEA | - Failure Mode Effect Analysis |
| GR&R | - Gage Repeatability and Reproducibility |
| IQC | - Incoming Quality Control |
| LAR | - Lot Acceptance Rate |
| MSA | - Measurement System Analysis |
| MSDS | - Material Safety Data Sheet |
| NCMR | - Non Conforming Material Report |
| NPI | - New Parts/Products Introduction |
| OTD | - On Time Delivery |
| SCAR | - Supplier Corrective Action Request |
| SQE | - Supplier Quality Engineer |
| PCM | - Process Control Monitor |

4.0 Interface

- 4.1 Supplier Quality Engineer (SQE) is Knowles technical aspect contact window person. SQE works with supplier on New Product/Process Introduction (NPI), communicating Knowles requirements to supplier, and establishing a two-way communication between Knowles' team and supplier. SQE will also take up quality improvement project with supplier, and support other improvement project initiated by Category team. In the event of major material quality issue, SQE will lead issue resolution.
- 4.2 Incoming Quality Control (IQC) performs incoming inspection based on sampling plan to ensure only components meeting specification are released for production. IQC will communicate with supplier on matters related to day to day work, including handling of non-conforming or rejected materials.
- 4.3 Category Manager is responsible for the overall management of the supplier relationship. This includes all commercial discussions and business reviews.

5.0 Expectations & Requirements

Supplier is responsible and expected to deliver components that meet Knowles specifications and comply with international laws & regulations that are outlined in this manual. Suppliers are also required to demonstrate that their manufacturing operation meet Knowles expectations for Quality Assurance.

5.1 Supplier Approval

All suppliers of production materials to Knowles must be approved suppliers. The approval process consists of at least three parts: a business assessment, an audit of the supplier's quality system procedures and compliances, and a technical capability assessment. These audits will typically be conducted by document submittal but may also be followed up with an onsite audit/verification as well. Knowles will assess potential suppliers on the following requirements during approval process;

5.1.1 Supplier Code of Business Conduct

Knowles Corporation and its subsidiaries worldwide (collectively, "Knowles") understand that our success depends on our reputation for ethical business performance and performing our jobs honestly, diligently and with integrity, in compliance with all applicable laws and regulations. Consistent with our commitment to conduct business fairly and honestly, we seek out business partners who share in our culture, values and business practices. Supplier Code of Conduct ("Supplier Code") is an extension of the Knowles Corporate Code of Business Conduct and Ethics (a copy of which may be found at <http://www.knowles.com>, under the Governance section) and establishes the standards for conducting business with Knowles. A key element in the Supplier Code of Conduct is Corporate Social Responsibility (CSR). Knowles' Social Responsibility requirements are aligned with International guidelines in the Electronics Industry Citizenship Coalition (EICC) Code of Conduct. Suppliers are required to have policies and practices in place which support a positive workplace environment.

Supplier is responsible for communicating the contents of the Supplier Code to its officers, directors, employees, agents, subcontractors and sub-tier sources who are involved in the procurement and production process related to products and services provided to Knowles. If a Supplier violates any of the requirements contained in this Supplier Code, Knowles may immediately terminate its supply relationship with that Supplier.

Knowles requires suppliers to self-assess compliance to Knowles Supplier Code on a regular basis to ensure compliance. Knowles may also perform on-site audit.

5.1.2 Quality Management System

Supplier is required to maintain an effective quality system that conforms to the current ISO9001 or equivalent standard. Supplier must furnish a copy of their Certificate, Quality Manual and supporting documents / procedures if requested.

5.1.3 Environmental Management System

While Knowles does not impose compliance to ISO 14001 environmental management system, we expect suppliers to have processes in place to comply with all applicable governmental, regulatory and environmental laws.

5.1.4 Conflict Minerals Requirements

In the Democratic Republic of the Congo (DRC) or adjoining countries, the mining of minerals used to produce tantalum, tin, tungsten and gold (known as 3TG minerals) has been linked to funding armed groups engaged in violent conflict in the DRC region.

As part of Knowles's commitment to social responsibility and compliance with Rule 13p-1 under the Securities Exchange Act, it is our goal to only use 3TG minerals in our products that do not directly or indirectly finance or benefit armed groups in the DRC region.

We are taking steps to ensure the use of conflict-free 3TG minerals in our supply chain by expecting our suppliers to:

- Adopt a conflict minerals policy that is consistent with this Policy and require their direct and indirect suppliers to do the same.
- Exercise due diligence with relevant suppliers on the source and chain of custody of 3TG minerals consistent with the OECD Due Diligence Guidance for Responsible Supply Chains of Minerals from Conflict-Affected and High-Risk Areas.
- Identify smelters/refiners associated with the 3TG mineral supply chain for our products.
- Transition to certified conflict-free smelters / refiners.
- Survey their direct suppliers using the CMRT and provide the results to Knowles.
- Assess supplier information for accuracy and completeness and follow-up with suppliers as needed before furnishing information to Knowles.

5.1.5 Audits – System & Process

Knowles performs a System Audit on potential suppliers; this system audit can be an onsite audit or supplier self-assessment. An on-site Process Audit is part of the requirement for qualifying a potential supplier. On-site audit enable Knowles to verify and validate supplier actual process control and capability. Subsequently, Knowles will schedule regular on-site supplier system and process audit.

5.1.6 Material Qualification

Material qualification is a crucial process to verify the new material is fit for mass production, prior to a new supplier is qualified as Knowles approved supplier. Refer to 5.2 below.

5.1.7 Custom Requirements

All participating suppliers must have security policies in place to ensure that they comply with the requirements for importing and exporting. Knowles has a partnership with US Customs-Trade Partnership Against Terrorism (C-TPAT). Suppliers exporting to US must fill out a Supplier Security Questionnaire Form provided by the Category Manager, annually. Supplier must also disclose if they participate in their local countries security program.

5.2 Material Qualification

5.2.1 Hazardous Substances

Knowles requires suppliers to comply with the Hazardous Substance Free Supplier's Handbook. Supplier shall ensure that all homogeneous materials used comply with the Restricted Substances in Products, Process, and Packaging tables. Supplier must provide relevant documents and test reports to demonstrate compliance as requested by Knowles.

5.2.2 First Article Inspection (FAI)

The supplier selects production process representative parts for the Component / Process Qualification activities. Knowles SQE notifies supplier of the quantity and checklist for FAI.

Supplier is required to inspect or test each sample for all dimensions, drawing notes, material cleanliness requirements, packaging requirements, and specifications requirements listed on the current revision of the Knowles drawing. The supplier provides the FAI results on a report format that has been approved by the Knowles SQE. All failures must be clearly indicated.

In addition, supplier must provide material analysis reports as identified by the Knowles SQE. This may include RoHS test reports, MSDS reports, and Conflict Minerals Reporting Template (CMRT).

The component qualification process will not be satisfactorily completed and approved until the component meets print or the print has been changed to match the part and all other component / process qualification requirements have been met.

5.2.3 Control Plan

Supplier must provide a control plan for their manufacturing plan. The plan must include a flow chart for the manufacturing process, the control points, the type of control, and the inspection sample size. Critical characteristics that do not meet a process capability requirements must be inspected 100%, unless the Knowles SQE approves alternate control methods.

5.2.4 Process Capability

Critical dimensions are specified in Knowles' print or drawing. For all critical dimensions, supplier must demonstrate good control to meet minimum 1.33 Cp and 1.00 Cpk during material approval stage; this is a minimum requirement. However if the print or drawing calls for higher Cp / Cpk requirements, drawing / print requirements will supersede the requirement stated in this manual. Sampling plan will be communicated through SQE. Some exception for specific components spelled out in Appendix.

5.2.5 Material Safety Data Sheet (MSDS)

Supplier shall furnish MSDS for all materials shipped to Knowles upon request.

5.2.6 Failure Mode Effect Analysis (FMEA)

A Design FMEA is required for components that are designed by the supplier. The DFMEA must be reviewed and approved by Knowles prior to accepting samples for qualification.

A Process FMEA is required for all components manufactured by the supplier. The PFMEA must be reviewed and approved by Knowles prior to accepting samples for qualification.

5.2.7 Reliability Report

SQE shall notify supplier on requirement for component reliability test. Supplier shall furnish reliability report to Knowles periodically, or upon request.

5.2.8 Measurement System Analysis (MSA)

Knowles will identify key parameters for correlation with supplier. Knowles also expects supplier to perform periodic GR&R study for measurement equipment.

5.3 Mass Production

5.3.1 Data Reporting

Supplier must include Certificate of Conformance (COC) associated with the component in each shipment. Alternatively, the data can be sent electronically, in advance of the shipment for review by Knowles IQC. The data can be from the suppliers' in-process control activities or final outgoing inspection.

Supplier should retain COC data for minimum 3 years, and shall support Knowles traceability requirements if there are any.

Knowles encourage supplier to store all quality records electronically.

5.3.2 Control of Changes

Suppliers must have systems in place to control changes to drawings, specifications, processes, or produced parts. Changes that require approval from Knowles are listed below

Guidelines on Change Details and Categories

| No | Items | Major Change | Minor Change |
|-----|-----------------------------------------------------------------------------|--------------|--------------|
| 1. | New factory location | • | |
| 2. | Manufacturing line relocation within same premise | • | |
| 3. | Manufacturing line re-layout | • | • |
| 4. | Manufacturing / storage condition change | • | • |
| 5. | New tool / machine / die set / Tool parts (2 nd source included) | • | |
| 6. | Approved material change / new material / 2 nd source material | • | • |
| 7. | New supplier | • | |
| 8. | Control Plan/ PCM / Sort Test change | • | • |
| 9. | Process Change | • | • |
| 10. | Inspection Plan / inspection method change | | • |

Note : Rule of thumb, any changes that may affect Form, Fit, Function or Reliability are categorized as major changes.

For proprietary or confidential processes or technologies, suppliers are expected to inform Knowles details of the change, so that change can be adequately verified and approved. Supplier shall utilize Knowles Change Approval Report (KCAR, for general) or SiSonic Supplier Change Request Workbook (for MCE) to notify Knowles of proposed changes. Knowles will approve / reject the change request upon completion of evaluation.

Any unapproved change that impacts Knowles incoming material quality, or finished product quality in term of form, fit, function or reliability, supplier may face the consequences of being disqualified as Knowles' supplier, or a penalty may be imposed.

Knowles may takes approximately 3 months to evaluate the effect of change and another 3 months for Knowles customer notification and approval if the change warrant customer approval.

5.3.3 Hazardous Substances

Knowles requires suppliers to comply with the Hazardous Substance Free Supplier's Handbook. Supplier warrants that deliverables are, and at all times will be, in compliance with the Knowles requirements, and with international regulations regarding restricted substances with environmental impact. Supplier must provide relevant documents and test reports to demonstrate compliance as requested by Knowles.

5.3.4 Process Capability

Critical dimensions are specified in Knowles' print or drawing. For all critical dimensions, supplier must demonstrate good control to meet 1.33 Cpk during mass production stage; this is a minimum requirement. However if the print or drawing calls for higher Cp / Cpk requirements, drawing / print requirements will supersede requirement stated in this manual. Supplier is expected to maintain a good process control that meet or exceed 1.33 Cpk for key process parameters.

5.3.5 Improvement

Continual improvement is the culture of Knowles. Knowles expects supplier to continually work on process / yield / cost / productivity improvement.

Knowles may also work with supplier on "Low Yield" control, where a low yield limit is defined by Knowles, or by statistical method. Supplier is required to monitor all low yield lots, perform failure analysis to identify root cause(s) of low yield, take corrective / preventive action to prevent reoccurrences, and take effective containment action to prevent outflow of non-conforming components.

5.3.6 Control of Non-Conforming Outputs

Supplier must contain non-conforming components. Shipping of non-conforming components to Knowles is not permitted, unless special waiver is granted from SQE. Supplier must adhere to conditions given while shipping non-conforming components to Knowles. When sorting / rework of non-conforming component are inevitable at Knowles, Knowles reserves the right to charge sorting / rework / scrap cost to supplier.

5.3.7 Reliability Report

SQE shall notify supplier of requirement for component reliability test. Supplier shall furnish reliability report to Knowles periodically, or upon request.

5.3.8 Corrective & Preventive Actions

Suppliers must have an effective Corrective Action System, based on the 8D problem solving approach. Corrective action for an issue identified by Knowles must be fast and effective. Timing for action is as follow:

- Verify issue and implement Containment Actions within 24 hours of being notified.
- Define and Verify Root Cause within 5 calendar days of sample receipt.
- Implement Permanent Corrective Actions within 10 calendar days of sample receipt.

5.3.9 Performance Measurement

Knowles will provide feedback on Supplier Quality performance based on several criteria.

- Incoming Lot Acceptance Rate (LAR)
- Number of corrective actions requests for supplier related issues
- Responsiveness to resolving issues

At a minimum, feedback will be provided during Business / Quality Reviews.

5.3.10 Effective Communications

Maintaining a good communication between supplier and Knowles is important to ensure both parties understand each other. Both parties should take initiatives to ensure there is effective and timely communications. It is also important when there is abnormality in the components that are not specified in the print / drawing, supplier is expected to notify and clarify with Knowles before shipping the said component to Knowles.

5.3.11 Exceptions

In the event supplier is unable to meet Knowles' requirements, including requirements in this manual, supplier must notify Knowles' SQE in advance.

Temporary deviations or waivers to the supplier's manufacturing process or the component is allowed with prior approval from Knowles. A supplier is never permitted to knowingly ship product that deviates from the drawing or specification limits or violate requirements in this manual without written authorization from the Knowles SQE.

5.4 Business / Quality Review Meeting

Knowles will host regular Business or Quality Review meeting to review overall business and/or quality status. CM and/or SQE will liaise with supplier to formulate the agenda of the meeting.

6.0 Reference Documents

| | |
|-------------|----------------------------------------------------------------------------|
| 00.07-01 | Supplier Hazardous Substance Free Handbook |
| 06.09-01 | Knowles Supplier System Audit Report and Checklist |
| 06.09-02 | Knowles Supplier Process Audit Report |
| 06.09-10 | Supplier Social Responsibility Self Audit Checklist |
| 06.11-03-CN | Supplier Quality Manual (Chinese) |
| 06.11-03-03 | Piece Part FAI Approval check list |
| 06.11.04 | Knowles Change Approval Report (KCAR) for Supplier Change |
| 06.11-07 | Supplier Security Questionnaire |
| 06.11-08 | SiSonic Supplier Change Request Workbook |
| 06.24 | Supplier Scorecard Procedure |
| 22.01 | Suppliers Corporate Social Responsibility—Knowles Supplier Code of Conduct |

7.0 List of Part Quality Control Instructions

| | |
|-------------|------------------------|
| 06.11-03-04 | IC & OSAT |
| 06.11-03-05 | MEMS |
| 06.11-03-06 | PCB |
| 06.11-03-07 | Carrier Tape & Reel |
| 06.11-03-08 | Epoxy |
| 06.11-03-09 | Solder Paste |
| 06.11-03-10 | Plating |
| 06.11-03-11 | HHT DPC Substrate |
| 06.11-03-12 | HHT FPC |
| 06.11-03-13 | HHT Litz Wire & Cable |
| 06.11-03-14 | HHT Coil |
| 06.11-03-15 | HHT Plastic Rod & Shim |
| 06.11-03-16 | HHT Metal Stamping |
| 06.11-03-17 | HHT Terminal Tab |
| 06.11-03-18 | HHT Magnet |
| 06.11-03-19 | HHT Circuit |