Supplier Quality Manual

Revision 9.1
31 October 2012
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<tr>
<th>REVISION</th>
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<td>Pre-release</td>
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1 Quality Policy

Danfoss regards quality in a wider perspective - as we are convinced that high quality in everything we do is a fundamental parameter required by our customers for competition in our market place.

Danfoss embraces the following core values, as embedded in respective Divisional Quality Policies:
- Core & Clear strategy
- Value proposition
- Zero defect philosophy
- Customer satisfaction
- ISO/TS 16949 operational compliance

2 Purpose

This Supplier Quality Manual sets the rules, standards, and requirements for Danfoss’ Suppliers, regarding Product quality. The same rules, standards and requirements apply, when Danfoss evaluates potential suppliers’ fitness for qualification as a Danfoss Supplier.

3 General Requirements

All Products shall comply with Danfoss specifications and requirements.

Danfoss has an expectation of ZERO DEFECTS on all Products delivered from the Supplier.
In line with our Zero Defects goal, the Supplier (including its sub-tier suppliers) is required to:
1. Demonstrate compliance with:
   a. Design, performance, reliability, and applicable legal requirements,
   b. Process controls and capability requirements,
   c. All provided specifications and requirements.
2. Explicitly review and understand all requirements provided to the Supplier related to the Products. Ensure resources are available to participate in product quality planning, as requested.
3. Establish a change control system that reacts to changes in a timely and accurate fashion. In all cases, to acquire written approval from Danfoss prior to implementing any change that may impact form, fit, function, quality, reliability, safety, delivery, or service of Products delivered to Danfoss. This shall include, but not limited to, manufacturing processes, quality standards for acceptance, and testing requirements.
4. Have a documented and recognized quality management system in place, including continual quality system improvement, and continuous improvement in Product quality.
5. Maintain process, product and service capabilities to fulfill Danfoss requirements.
6. Deploy Danfoss requirements, expectations and controls throughout the Supplier’s entire supply chain for the respective Products.
7. Possess expertise and resources to perform effective root cause analysis, and to take corrective and preventive actions.
8. Notify Danfoss of any potential or actual Non-conformance in Products supplied to Danfoss that may affect its form, fit, function, quality, reliability, safety, delivery, service or its compliance with regulatory and statutory requirements.

9. Be responsible and accountable for the impact of poor Supplier Product quality on Danfoss, and Danfoss customers (c.f. Section 6.3 Corrective and Preventive Actions).

10. Comply with all its obligations towards Danfoss, including, but not limited to:
    - Danfoss Code of Conduct (CoC)
    - Danfoss Negative List
    - Recognized and certified Quality Management System (QMS)
    - Non-Disclosure obligations
    - Danfoss’ Customer Specific Requirements (CSR)
    - Warranties

Any exception or deviation to the requirements, terms and conditions of this Supplier Quality Manual, including, but not limited to exceptions or deviations to Danfoss expectations, requires Danfoss’ prior written approval.

Any Supplier action that carries cost liability to Danfoss must be authorized by Danfoss Purchasing Organization.

3.1 Communication
All formal communications must be in English, and this general rule shall apply to all documents. Supplier shall pro-actively, directly and effectively involve Danfoss Purchasing Organization in every communication on all matters affecting Danfoss supply chain processes.

4 Supplier Qualification Requirements
Supplier qualification ensures that the Supplier has documented and effective systems in place to produce Products fulfilling all Danfoss specifications and requirements, and be capable of reducing cost over time. It is Danfoss’ expectation that all Suppliers perform the required commitment and responsibility.

4.1 Quality Management System
The Supplier must maintain effective documented quality management system that communicates, identifies, coordinates, and controls all key activities necessary to design (if applicable), develop (if applicable), produce, deliver, and service Products to Danfoss.

The Supplier shall be certified/ registered to one of the following international quality management standards by a recognized, independent, and accredited third party certification/ registration body:

ISO 9001 Quality Management Systems – Requirements
ISO/TS16949 Quality Management Systems – Automotive Requirements
SAE AS9100 Quality Management Systems – Aerospace Requirements
ISO13485 Quality Management Systems – Medical Requirements
Other internationally recognized standard(s), may be accepted, but require written approval from Danfoss

Note: The Supplier must notify Danfoss immediately, if Supplier's third party registration expires, or is revoked. Danfoss reserves the right to access all certification/registration details of Supplier.

In addition, Danfoss reserves the right to:
- Conduct Danfoss supplier quality assessment in addition to third party verification, as requested by Danfoss,
- Disqualify, demote, and/or adjust Supplier segmentation status, and/or full requalification, prior to resuming business and/or shipment with Danfoss,
- Notify third party certification/registration body used by Supplier, in the case of breach/misuse of quality management system.

4.2 Danfoss Supplier Quality Assessment

1. Quality Management System Assessment
   Danfoss is, at all times, entitled to auditing Supplier’s quality management system. Danfoss will inform Supplier of relevant audit issues and parameters. During the audit, Danfoss shall have access to all facilities, staff and Danfoss requested documents, and this shall apply to the entire supply chain, if needed, as subject to the sole discretion of Danfoss.

2. Danfoss Code of Conduct Assessment
   Initial and follow up Code of Conduct assessments will be conducted, as part of Supplier qualification, by Danfoss or a third party at the Supplier’s expense.

3. Technology/Process and Product Assessment
   Technology, Process and Product assessments will be conducted at the Supplier’s site(s), as well as the entire supply chain, if needed, subject to the sole discretion of Danfoss.

5 Production Part Approval Process (PPAP)

Production Part Approval Process (reference the AIAG manual) ensures that the Product is capable of meeting Danfoss’ technical and performance needs. PPAP ensures that the specific manufacturing processes are in place, and Supplier will produce Products of consistent and required quality expected by Danfoss.

All PPAP parts submission shall be made and approved, before start of production, and shall be scheduled and executed in accordance to a date/timeline, in agreement with Danfoss (the Danfoss factory using the Product).

Suppliers shall not ship any Product, until a Full or Interim Approval is received from Danfoss, through a signed Part Submission Warrant (PSW). In the case, where full approval is not granted,
Danfoss will advise Supplier of the areas of concern. The Supplier shall make corrections accordingly and resubmit the PSW.

Danfoss reserves the right to determine, if any or all of the PPAP items are to be reviewed on-site, and/or at the supplier facility, as part of the PPAP process.

In the case of disagreements, concerns or queries on PPAP, it shall be addressed to Danfoss Purchasing Organization, and subject to the final decision of Danfoss.

All PPAP documentations and records related to the Product or production shall be kept for a minimum of 10 years and/or for the duration specified by relevant regulatory requirements.

The Supplier shall not make any changes to the Product or process, after PPAP approval from Danfoss. In case of such a need for change, the Supplier shall refer to the required process for change request (c.f. Section 8 Change Management).

The Supplier shall submit the specified documentation according to Danfoss requirements (to the authorized Danfoss representative as communicated to the Suppliers). If Danfoss requires a PPAP, level 3 shall be used as the default level unless otherwise specified. PPAP content shall include the PPAP Checklist, and it shall be provided for each part/family in the approval process.

<table>
<thead>
<tr>
<th>Part Approval Documentation</th>
<th>Level 1</th>
<th>Level 2</th>
<th>Level 3 Default Level</th>
<th>Level 4</th>
<th>Level 5</th>
</tr>
</thead>
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<td>Design Record</td>
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<td>R</td>
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<td>S</td>
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<tr>
<td>Control Plans</td>
<td>R</td>
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<td>S</td>
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<td>R</td>
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<tr>
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<td>R</td>
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5.1 Sample Parts and Master Sample Parts

Supplier shall:
1. Provide the required number of sample parts, as specified in the PPAP order;
2. Complete the dimensional and performance test reports as required, along with the required sample parts;
3. Retain master sample parts for the same period as the production part approval records;
4. Identify the master sample parts as such, and with a label or marking of the Danfoss approval date on the sample.

For detailed requirements, Supplier shall take reference to latest revision of PPAP Reference Manual by AIAG, and consultations with Danfoss.

5.2 Dimensional Analysis

The Supplier shall submit all data electronically unless otherwise is agreed. Actual variable data must be provided in terms of measurements, except for attribute data (pass/ fail; go/no go; nominal or ordinal, etc.). All results must be traceable to the specific samples submitted by the Supplier.

5.3 Material, Performance and Reliability Test Results

The Supplier, or a qualified independent third party, shall provide specific material, performance and/ or durability test results. Actual results must be compared with agreed specifications. For certain parts, Danfoss may require third party testing, as necessary.

All independent laboratories used for inspection, test, or calibration services by Supplier, shall be approved in writing by Danfoss, and shall be accredited to ISO/IEC 17025, or equivalent national requirements, subject to verification by Danfoss.
5.4 Appearance Approval Report (AAR)

Danfoss may require an Appearance Approval Report (AAR) along with representative sample part(s) to be submitted, wherever applicable. An AAR is typically requested for an item, which is exposed to view on the exterior of a finished unit. If an AAR is specified on the PPAP Checklist, the Supplier shall contact Danfoss (only the authorized Danfoss representative, as communicated to Supplier) to ensure the requirements are clearly understood and formally agreed.

5.5 Special Characteristic

A Special Characteristic is any feature of a material, process, part, assembly, or test that has a significant influence on Product fit, form, function or any other expected deliverable, as specified by Danfoss.

Note: Special Characteristics shall include, but are not limited to any relevant regulatory and legislative requirements.
Characteristics will be communicated through various methods, including:

- Notations and/or symbols documented on Danfoss engineering drawings, specifications, and PPAP Checklist.

Note: It is the responsibility of Supplier to ensure all drawings and specifications used to produce the Product are the latest Danfoss revisions.

5.6 Process Capability Studies

For all Special Characteristics, an acceptable level of process capability and performance shall be determined prior to production.

Based on capability study analysis and method for sampling, a minimum value of 1.67 Cpk or Ppk is required. Any exception must be approved by Danfoss (only the authorized Danfoss representative, as communicated to the Supplier) in writing, and subject to the final decision from Danfoss.

If the required process capability/performance is not met prior to the first production, a corrective action plan, and revised Control Plan (Reinforced Control Plan) shall be developed by Supplier, and submitted to Danfoss for approval (only the authorized Danfoss representative, as communicated to Supplier). This Reinforced Control Plan will require 100% inspection, or other means agreed with Danfoss. The corrective actions stipulated in the corrective action plan or the Reinforced Control Plan shall remain in place, until capability can be demonstrated to Danfoss, or Early Production Containment (EPC) exit criteria are fully met and sustained.

For attribute data, Supplier shall propose for Danfoss approval, a method for evaluating process capability, with proper and detailed justification. Danfoss reserves the right to specify the type and nature of the attributes, and the corresponding measurement methodology and instrumentation.

Products used for evaluation of the preliminary process capability study, shall be produced and randomly sampled in the production run for approval parts. The process capability study shall contain a minimum of thirty (30) parts in total, when applicable. The samples shall be collected in production, when the process is stable (i.e., when no adjustments are being performed) during the production run. Products from each unique production process (i.e., each production cell, line, tool or cavity) shall be evaluated separately. No adjustments or maintenance to the process is allowed during the production run.

The number of Products used for preliminary process capability study depends on the number of cavities or units per cycle. In case of Products used for high volume production, Danfoss (only authorized Danfoss representative, as communicated to Supplier) may require one hundred twenty five (125) pieces to be used for the preliminary process capability.

<table>
<thead>
<tr>
<th>No. of Cavities</th>
<th>Random Sample Size (n)</th>
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<tbody>
<tr>
<td>= 1</td>
<td>n ≥ 30 pieces</td>
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</table>
5.7 Measurement System Analysis (MSA)

A Gage Repeatability and Reproducibility (Gage R&R) study measures the total repeatability and reproducibility of a gage system as a percentage of the total specification. Measurement System Analysis (MSA) studies ensure the total system variation (including Gage R&R) of a measuring system as a percentage of the total part and process variation.

Danfoss requires Gage R&R and MSA for all variable gages that are used to monitor Special Characteristics.

NDC is optional and depends on Danfoss and/or Danfoss customers’ demands.

<table>
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<tr>
<th>Acceptance Criteria for MSA Study</th>
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<tr>
<td>Number of Distinct Categories (ndc)</td>
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</tr>
<tr>
<td>ndc &gt;= 5</td>
</tr>
<tr>
<td>2 =&lt; ndc &lt; 5</td>
</tr>
<tr>
<td>ndc &lt; 2</td>
</tr>
</tbody>
</table>

Attribute gages that are used to monitor Special Characteristics must also undergo applicable gage studies. The method used will be formally agreed upon between Danfoss and Supplier.

If the gage system fails, the Supplier shall take corrective action to make the gage measurements repeatable and reproducible. A gage shall be proven repeatable and reproducible before it can be used in a capability study, or is used to accept or reject Products.

Danfoss reserves the right to specify the MSA study and methodology, and the Supplier shall comply with, and fulfill all Danfoss requirements.

5.8 Process Flow Diagram

The Supplier shall have a process flow diagram that clearly describes the production process steps and sequence beginning at material receipt through packaging and shipping, where process steps include operations performed by outside sources (such as sub-tier suppliers of the Supplier). These
steps need to be identified within the diagram, and are subject to approval/authorization from Danfoss (only authorized Danfoss representative, as communicated to Supplier).

A single process flow diagram may apply to a group or family of Products that are produced by the same processes in the same sequence.

5.9 Failure Mode and Effects Analysis (FMEA)

When specified on the PPAP Checklist, the Supplier is required to develop a Design (Product) FMEA and/or a Process FMEA, and submit to Danfoss for approval. The Supplier may be invited to participate in the preparation of higher level Design FMEA, through participation in a Product development team. Suitable alternative risk analysis means may be used, either in place of, or in addition to the FMEA, as approved by Danfoss.

As a general rule, Severity > 8, along with the top 3 RPN levels, require actions from the Supplier on an annual basis. Danfoss reserves the right to request actions, even if the Severity is not >8, or is not one of the top 3 RPN levels.

The FMEA is a living document, and shall be revised as changes are made to the Product, process or in case of quality issues.

PFMEA includes tooling FMEA if applicable.

5.10 Control Plan (CP)

The Supplier shall prepare a Control Plan, based on the DFMEA and PFMEA for the complete process. The corresponding method details the control and inspection activities that have been implemented to ensure conformity to Danfoss specifications. Special Characteristics will be marked with their respective reference number(s).

The Control Plan is identified by Product number, family, and revision level.

The Supplier shall:
- Monitor actual processing of the Product,
- Compare processing to the CP in all aspects,
- Report to Danfoss any changes/deviations from the CP, and obtain approval from Danfoss, prior to actual implementation.

The Control Plan is a living document, and shall be revised as changes are made to the Product, process or in case of quality issues.
5.11 Process Audit

Danfoss may require a process qualification audit at the Supplier’s manufacturing facility. This audit focuses on the specific process quality controls that the Supplier has put in place for the Products being manufactured for Danfoss, as well as Product/ commodity specific process requirements. In addition, Danfoss reserves the right to conduct such an audit on Supplier’s sub-tier suppliers.

Such audits shall not relieve the Supplier’s responsibility to produce and deliver Zero Defect Products to Danfoss.

5.12 Certifications, Certificates and Code Requirements

Drawings, contracts, and/ or other specifications may require additional quality management system or part certification requirements (e.g., American Society of Mechanical Engineers (ASME) certification for manufacture of pressure vessels (PED), Underwriters Laboratories (UL), European Union (CE mark), etc.) Danfoss reserves the right to choose the standards to be used and applied to the Supplier.

It is the Supplier’s responsibility to ensure these requirements are fulfilled and maintained. Upon request from Danfoss, evidence of compliance to these requirements shall be submitted by the Supplier as part of the PPAP and/ or individual shipment.

The Supplier shall notify Danfoss immediately in writing, if there is a change to its status to one of these requirements.
5.13 Part Approval Requirements
Danfoss has specific part approval requirements. These requirements will be identified as early as possible, and Danfoss reserves the right to revise the requirements throughout the Product Life Cycle.

6 Non-conforming Products
The following sections set out the key requirements that are applicable for the process in case of Non-conforming Products.

6.1 Non-conformances identified after Shipment
If Non-conforming Products are identified after shipment from the Supplier, one or more of the following immediate containment action shall be initiated, based on mutual agreement between Danfoss and the Supplier, and subject to Danfoss´ sole and final decision.

1. The Supplier shall inspect and sort Products with unidentified status, at any defined places (Danfoss, Supplier, Danfoss’ customer, or others). All costs incurred will be at the Supplier’s expense.
2. The suspected batch/lot/shipment will be retained for one or more of the following actions:
   a. Supplier’s immediate replacement of the Product;
   b. Return of batch/lot/shipment to the Supplier, with the condition of complete replacement, sorting or rework of the Products, and any other charges incurred, at the Supplier’s expense;
   c. Third-party sorting organized at any site specified by Danfoss, at the Supplier’s expense;
   d. Supplier sorting at Danfoss site, at the Supplier’s expense;
   e. Scrap, loss, and any other additional costs incurred by Danfoss, as a result of Non-conforming Products, are at the Supplier’s expense.

It is Supplier’s responsibility to deliver quality Products to Danfoss, which is in line with Danfoss’ goal of Zero Defects.

6.2 Non-conformances identified before Shipment
If Non-conforming Products are identified at the Supplier’s site, relevant actions, such as segregation, quarantine, and marking of the Products shall be initiated. Non-conforming Products shall not be shipped to Danfoss, unless an authorized waiver is granted from Danfoss (only authorized Danfoss representative, as communicated to Supplier).

All waivers issued shall specify a specific time and/or quantity limit, which is subject to the sole and final approval of Danfoss.

In the following situations, the Supplier shall immediately notify Danfoss for waiver requisition:
If the Non-conformance affects form, fit, function, quality, reliability, safety, delivery, service of the Product, or its compliance with regulatory requirements, and/or is a cosmetic defect;

- If there is likelihood that Non-conforming Products have inadvertently leaked-out from the Supplier’s factory;

- If the Non-conforming Products are likely to cause late delivery to Danfoss;

- In all cases, where there is a report of Non-conformance that possibly affecting form, fit, function, quality, reliability, safety, delivery, service of the Product, or its compliance with regulatory or statutory requirements.

If approved, all Products shipped to Danfoss, covered by a waiver, must be accompanied by a copy of the approved waiver requisition.

### 6.3 Corrective and Preventive Actions

In case of Non-conforming Products, the Supplier shall submit a formal written corrective and preventive action report, to address specific defects identified. The general format of the corrective and preventive action will be a Corrective Action Report form (8D), otherwise specified. The Supplier shall submit the 8D for Danfoss’ evaluation and acceptance. The Supplier shall implement the containment action, and submit to Danfoss in writing (steps D1-D3 of the 8D form) within 24 hours (starting from Supplier’s receipt of the 8D form). If Danfoss disagrees with the containment action, Supplier must respond (with a revised containment action) within 24 hours (starting from Danfoss’ receipt of Supplier’s notice).

Failure analysis leading to the root cause determination shall be done within 10 working days, or an alternative time frame agreed with Danfoss. The Supplier shall use appropriate tools such as, but not limited to fishbone diagram, 5W+2H, etc. The 8D form will not be considered complete, until proposed corrective and preventive actions, and an appropriate implementation plan has been approved by Danfoss. Involvement of Danfoss in the approval of remedial action does not change the fact that the Supplier remains liable for any Non-conformances in the Products, including Non-conformances resulting from the implementation of the remedial action. Until the claim has been verified and closed by Danfoss, the Supplier shall adopt all measures to safeguard the interest of Danfoss (and Danfoss’ customers).

### 6.4 Controlled Shipping Level ( CSL1 and CSL2)

Under the circumstances of recurring Non-conformances, where the corrective action plan has failed, Danfoss reserves the right to issue a controlled shipment Product status at the Supplier’s site, and at the Supplier's expense.

Controlled Shipment Level 1 includes, but is not limited to:

- 100% sorting/ inspection on the Products, which can be on every shipment/ part/ lot/ batch, prior to shipment to Danfoss;

- Sorting/ inspection records to be attached to each shipment/ lot/ batch;
• Supply of data and documentation on the Products, upon request from Danfoss;
• Visit/audit by Danfoss, without any prior notification;
• Dialogue with Supplier’s management team, upon request from Danfoss;
• Blocking of shipment, and/or current business, subject to the sole and final decision of Danfoss;
• Appointment of third party agent/sorting personnel, subject to the sole and final decision of Danfoss.

In order to safeguard Danfoss’ interest, failure to achieve Level 1 protection to Danfoss, will automatically escalate to CSL 2.

Controlled Shipment Level 2 includes, but is not limited to:

• All Control Shipment Level 1 measures (including multiple actions (either by Danfoss and/or Danfoss-designated third party);
• Notification to AIAG/Registration Office on Control Shipment 2, upon request from Danfoss;
• Blocking of new business, subject to the sole and final decision of Danfoss.

The Supplier will be notified on additional requirements as and when needed, upon request from Danfoss.

Exit of Control Shipment Levels 1 & 2 will be given by Danfoss, when criteria are met, and corrective actions are implemented, and validated.

6.5 Warranty
In addition to Supplier’s obligations under this Section 6, the Supplier is liable for Non-conformances according to the terms and conditions of the supply agreement entered between Danfoss and the Supplier, covering the Non-conforming Products.

7 Supplier Monitoring
Danfoss will monitor Supplier’s performance, based on, but not limited to, the following five areas:

• Quality Performance (PPM);
• Delivery Performance (On Time Delivery);
• Service Performance (8D, PPAP, response time etc.);
• Claims Performance (Number and type of claims);
• Savings Performance (Monetary).

The Supplier will continually be monitored. Unsatisfactory performance will require corrective and preventive actions.
This monitoring is closely tied to promoting and demoting of supplier status within Danfoss’ supplier system. Supplier’s failure to fulfill Danfoss’ performance requirement can result in, but is not limited to, new business hold and/or phase-out.

The Supplier should be recognized, if all proactive measures are being taken to safeguard the interest of Danfoss (and Danfoss customers). This is an important consideration in Danfoss supplier monitoring.

Danfoss reserves the right to request an 8D report from the Supplier, in order to address non-conformance to any of Supplier’s performance indicators.

8 Change Management

After the initial Product approval from Danfoss, the Supplier shall not make any changes, without prior written notification and agreement with Danfoss. Such notification shall be submitted to Danfoss 6 month in advance, or as otherwise specified by Danfoss. The Supplier shall follow this requirement across its entire supply chain.

Changes include, but are not limited to:

1. Any Product changes;
2. Any material changes;
3. Any manufacturing process changes:
   - Moving production equipment internally;
   - Moving production equipment to other locations;
   - Change of production process;
   - Change of process parameters;
   - New production equipment;
   - Moving products or parts to other supplier(s);
   - New or changed parts purchased by Supplier.

Supplier’s non-compliance with the above requirements is considered a material breach of the supply agreement between Danfoss and the Supplier.

For any change, Danfoss reserves the right to re-qualify the Product, with an appropriate PPAP.

Suppliers Change Request (SCR form) shall be used to communicate all requests for any changes, both temporary and permanent, and subject to the sole and final decision from Danfoss.

9 Traceability & Quality Records

Items requiring traceability shall be identified during the development phase of a project. Where traceability is required, Danfoss will work with the Supplier to develop an acceptable system. The requirements for traceability of relevant items will be communicated to Suppliers through specification and drawings.
Supplier’s certification, process, test and/or inspection data shall be provided to Danfoss, upon request, and shall be retained by the Supplier for up to 15 years, based on Danfoss and/or Danfoss customer requirements, after delivery of the relevant Products. This requirement does not supersede any governmental or regulatory requirements for records retention.

Any exceptions should be brought to the attention of Danfoss in writing, for prior approval by Danfoss.

Certain data may be required to be included with Product shipment. This will be agreed in detail with Danfoss.

10 Environmental Requirements

The Supplier shall identify all activities that are needed in order to ensure that all Products, (as well as the corresponding Production) processes are in conformance with both legal requirements and requirements specified by Danfoss.

Environmental Management System

The Supplier is expected to deploy, and maintain an Environmental Management System, based on ISO 14001, or equivalent (e.g. EMAS).

Danfoss reserves the right to audit the Supplier’s environmental system. Danfoss will inform the Supplier of relevant audit issues and parameters. During the audit, Danfoss shall have access to all facilities, staff and Danfoss related documents. The Supplier shall submit to Danfoss a comprehensive action plan for agreed deviations identified/ found by Danfoss during the audit. The Supplier must execute and manage the improvements.

11 Code of Conduct (CoC)

Danfoss has a strong commitment to economic, environmental and socially sustainable development. As a result of this commitment, Danfoss has signed up to the principles of the United Nations’ Global Compact (www.unglobalcompact.org), and established a Code of Conduct for Suppliers, which includes respect for universally recognized standards for the environment, human rights, labor and anti-corruption.

Signatures

The Supplier shall sign the Code of Conduct, CoC Acknowledgement Letter, and conduct self-assessment, at the Supplier’s expense.

Audits

Suppliers with direct production are within the scope of audit, the focus will be on tier-1 supplier’s manufacturing site, and Suppliers are responsible for their suppliers (all its sub-tier suppliers). Upon
Request from Danfoss, sample checking of tier-2 suppliers and/or other sub-tier suppliers will be conducted.

Danfoss reserves the right to appoint a third-party audit company (chosen/selected by Danfoss) to carry out full Code of Conduct audit, at the Supplier’s expense. The Supplier is required to comply with such requests from Danfoss.

12 Negative List
The Supplier is required, at all times, to comply with the latest Danfoss’ Negative List, and shall document the type and amount of any hazardous substances present in the Products, or used in production processes.

It is the responsibility of Suppliers to subscribe to the Danfoss Negative List link on all changes and revisions.

It is important to note that the Supplier shall not supply to Danfoss, or Danfoss customers any Products, containing substances, as included in Danfoss’ Negative List for substances and materials. Failure to comply with the Negative List can lead to very serious consequences, and Supplier shall bear all associated responsibility and liability.

Danfoss CoC link: http://www.danfoss.com/AboutUs/Corporate+Citizenship/NegativeList.htm

13 Risk Management
The Supplier shall identify and prioritize risks affecting delivery of Products or Services to Danfoss as agreed upon. The Supplier shall produce proper contingency plans for highest ranking risks to assure meeting Danfoss Product demands, with due consideration of risk exposure to Danfoss, and Danfoss’ customers.

It is important to note that the Supplier shall provide Danfoss, and Danfoss’ customers with their contingency plans upon request from Danfoss.

14 Definitions and Abbreviations

8D
A problem solving process developed by Ford Motor Company. The name 8D originates from the fact there are eight disciplines associated with this problem solving format. Danfoss has adopted the 8D format to be used for both internal and external problem solving activities.

Capability
The maximum amount of variation inherent in a manufacturing process. Improving process
capability involves taking steps to limit the amount of variation to defined acceptable limits and thus bring the process into control.

**Capability Index**
The comparison of available tolerance to the portion of the tolerance consumed by a process in a state of statistical control.

**Cpk**
The capability index, which accounts for process capability centering, and is defined as the minimum of CP Upper or CP Lower. It relates the scaled distance between the process mean and the closest specification limit to half the process spread.

**Corrective Action Report (CAR)**
A formal request by Danfoss to take action to eliminate the cause(s) of an existing nonconformity or other undesirable situation in order to prevent recurrence.

**Control Plan (CP)**
Reflect a strategy for controlling Products and Product processes to ensure all process outputs remain in a state of control. The plan is used and maintained throughout the Product life cycle and is responsive to changing process conditions via written descriptions of the actions that are required at each phase of the process from receiving through shipping.

**Control Shipping Levels (CSL 1 & 2)**
Control Shipping Level 1 (CSL1), a demand to Supplier, in order to have them put in place a redundant inspection process (at their site) to sort for specific, agreed and specified non-conformances. The purpose to isolate customer (Danfoss) from receiving nonconforming Products. This inspection is in addition to normal controls, is enacted by Supplier’s employees, and must be in addition to normal production process controls, through which Supplier’s internal defective/defect rate will be monitored by Danfoss. The purpose is to measure the effectiveness of secondary inspection process, and the corrective actions taken to eliminate the initial non-conformances.

Control Shipping Level 2 (CSL2), a further demand to Supplier, in order to put in place a 3rd party inspection process (at Supplier’s expense) to sort for specific non-conformance; in addition to maintaining CSL1, while continue implementing corrective actions specified on CSL1.

**Early Production Containment (EPC)**
A demand to Supplier, in order to have them put in place a redundant inspection process (at their site) to sort for specific, agreed and specified non-conformances. The purpose to isolate customer (Danfoss) from receiving nonconforming Products, during the early production stage. This inspection is in addition to normal controls, is enacted by Supplier’s employees, and must be in addition to normal production process controls, through which Supplier’s internal defective/defect rate will be monitored by Danfoss. The purpose is to measure effectiveness of secondary
inspection process, and the corrective actions taken to eliminate the initial non-conformances. EPC shall make use of the reinforced control plan.

**Failure Mode and Effects Analysis (FMEA)**
A preventive analytical technique to methodically study the cause and effects of potential failures in a Product or a Product process. The Product or process is examined for all the ways in which a failure can occur. For each potential failure, an assessment is made of its effect on the system and its seriousness, and a review is made of the action being taken (or planned) to minimize the probability of failure or to minimize the effects of the failure.

**Gage Repeatability and Reproducibility (Gage R&R or R&R)**
The evaluation of a gauging instrument's accuracy by determining whether the measurements taken with it are repeatable and reproducible.

**Non-conformance**
Any non-compliance resulting in a Product being Non-conforming.

**Non-conforming Product**
A Product that does not meet one or more of the following requirements: (i) is designed and manufactured based on Supplier’s best knowledge on product design, product materials and product technology; (ii) is fit for any normal or agreed purpose; (iii) is free from defects in design, materials and workmanship; and (iv) complies with agreed specifications and requirements.

**On Time Delivery**
The number of purchase order line items delivered on time to the required date and quantity divided by the number of total purchase order line items required.

**Products**
Any products, parts, components, materials and/or services manufactured for delivery or delivered to Danfoss.

**Ppk**
The performance index, which accounts for process performance centering, and is defined as the minimum of PP Upper or PP Lower.

**Production Part Approval Check Sheet (PPAP Checklist)**
A document intended to clearly identify requirements and eliminate ambiguity between Danfoss and Supplier, prior to production. It identifies Supplier, part information, Special Characteristics, and qualification requirements, Danfoss authorization and Supplier sign off.

**Parts Per Million (PPM)**
A measurement of the defect rate in a product, calculated as: PPM = (Total number of defective parts) x 1,000,000 / (Total number of parts received by Danfoss).
Product Submission Warrant (PSW)
The Product Submission Warrant contains Supplier, Product information, required documentation, the Supplier application warrant and Danfoss disposition. The submission approval by Danfoss authorizes Supplier to start production.

Process Capability
The range over which the natural variation of a process occurs as determined by the system of common causes.

Process Certification
Process Certification is Danfoss’ methodology to achieve and sustain statistically controlled and capable processes for manufacturing, business, support, maintenance, assembly, and test.

Production Material and Services
Includes parts, components or raw material that are directly used in the manufacture of Danfoss products; supplier designed Products that are incorporated into a Danfoss assembly/product; and finished goods branded by Danfoss.

Special Characteristics
Special characteristics are describing product characteristics and process parameters which have a significant influence on the product performance due to customer specific requirements and product specification(s). Not fulfilling the special characteristics definition could cause extreme and serious failures that affects the safe and proper use of Danfoss product or could violate statutory and regulatory requirements.

15 Reference Materials
It is the responsibility of Supplier to ensure that it is working to the latest version of specifications, and/or publications referenced in this Supplier Quality Manual, as well as purchase order requirements.

The following publications are available from the Automotive Industry Action Group (AIAG). These may be ordered on-line at: http://www.aiag.org.

AIAG/reference manual APQP “Advanced Product Quality Planning and Control Plan”
AIAG/reference manual MSA “Measurement Systems Analysis”
AIAG/reference manual SPC “Statistical Process Control”
AIAG/reference manual FMEA “Potential Failure Mode and Effects Analysis”
AIAG/reference manual PPAP “Production Part Approval Process”
16 Appendices

Appendix 1 – Process Certification

Process Certification is Danfoss’ methodology to achieve and sustain statistically controlled and capable processes for manufacturing, business, support, maintenance, assembly, and test. Process Certification Milestones define the steps and the tools used to implement process certification.

Appendix 2- Process Capability Calculation

\[ P_p = \frac{USL - LSL}{6s_p} \quad P_{pk} = \min\{P_{pu}; P_{pl}\} \quad P_{pu} = \frac{USL - \bar{X}}{3s_p} \quad P_{pl} = \frac{\bar{X} - LSL}{3s_p} \]

\[ s_p = \sqrt{\frac{\sum_{i=1}^{n}(\bar{X} - X_i)^2}{n-1}} \]

\[ P_p \text{ and } P_{pk} \text{ are based on the overall spread of the measurements.} \]

\[ C_p = \frac{USL - LSL}{6s_c} \quad C_{pk} = \min\{C_{pu}; C_{pl}\} \quad C_{pu} = \frac{USL - \bar{X}}{3s_c} \quad C_{pl} = \frac{\bar{X} - LSL}{3s_c} \]

\[ C_p \text{ and } C_{pk} \text{ values can be calculated, if the data are taken from a } \bar{X} \text{ control chart.} \]

\[ C_p \text{ and } C_{pk} \text{ are calculated if your spread calculation is based on within sub-group variation from a } \bar{X} \text{ control chart. } s_c = \frac{R}{d_2} \text{ for } \bar{X} \text{ R control charts and } s_c = \frac{s}{c_4} \text{ for } \bar{X} \text{ s control charts. The factors } d_2 \text{ and } c_4 \text{ are associated with the use of control charts. Reference: AIAG SPC Manual.} \]

\[ cpm = \sqrt{\frac{\sum_{i=1}^{n} (T - X_i)^2}{n-1}} \]

\[ cpm \text{ value can be specified if the responsible engineer regards this parameter is useful.} \]

\[ cpm \text{ is based on a special spread calculated with respect to the target. } s_{cpm} = \sqrt{\frac{\sum_{i=1}^{n} (T - X_i)^2}{n-1}} \]

\[ cpm = \frac{USL - LSL}{6s_{cpm}} \quad \text{Assuming bilateral tolerance: } (USL-T)=(T-LSL) \]

Process capability study shall be documented by the supplier for Special Characteristics in Production Part Approval Process, and the supplier shall be able to present current/ latest verification records within five working days.

17 Templates

The following are the forms referenced in this manual. To obtain blank forms, or for assistance in completing forms, suppliers should access the link www.Danfoss.com.
1. Parts Warrant (PSW)
2. Production Part Approval - Dimensional Test Results*
3. Production Part Approval – Material Test Results*
4. Production Part Approval – Performance Test Results*
5. Appearance Approval Report (AAR)*
6. Control Plan*
7. PPAP Checklist*
8. SCR Form

* If approved in writing by Danfoss using plant, the Supplier may use its own internal documents/forms, as long as they contain all required information.