

Danfoss Supplier Quality Manual



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REVISION HISTORY			
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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, which is embedded in our 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 to meet Danfoss expectations and these are also applied when Danfoss screens new potential Suppliers.

3 General Requirements

All Products and Services shall comply with Danfoss specifications and requirements.

Danfoss has an expectation of ZERO DEFECTS on all Products and Services delivered from the Supplier.

In line with our ZERO DEFECTS goal, the Supplier (including its sub-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 drawings, specifications and requirements.
2. Explicitly review and understand all requirements provided to the Supplier concerning Danfoss Products and Services. 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, acquires written approval from Danfoss prior to implementing any change that may impact form, fit, function, quality, reliability, safety, delivery, service or its compliance with regulatory and statutory requirements. This shall include, but is not limited to, manufacturing processes and materials, quality standards for acceptance, and inspection and testing requirements.
4. Danfoss is working in accordance with ISO/TS 16949 requirements. The suppliers should have a QMS continuous improvement program developing the system toward the requirements of ISO/TS 16949.
5. Measure own performance on all given KPI's from Danfoss.

6. Possess expertise and resources to perform effective risk assessment from product development to serial production. Possess expertise and resources to perform effective root cause analysis, and to take corrective and preventive actions.
7. 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 within 1 working day.
8. Comply with all its obligations towards Danfoss including, but not limited to:
 - Danfoss Code of Conduct (CoC)
 - Danfoss Negative List
 - Non-Disclosure obligations
 - Danfoss Customer Specific Requirements (CSR)
9. It is expected that the Supplier sign up for the Supplier Quality Manual (SQM) Alert function <http://www.danfoss.com/about/procurement/supplier-expectations/> in order to receive future updates of the Danfoss Supplier Quality Manual. Minor changes in the Supplier Quality Manual are expected to be implemented in a few weeks and major within a few months.

Danfoss recognizes that Suppliers providing items such as traded goods, catalogue parts and services may not be able to meet all of the requirements of this Supplier Quality Manual. 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 an addendum where the exceptions are documented and approved by Danfoss.

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

3.1 Quality Targets

Zero defects are the common expectation for all suppliers.

It is expected that Zero defects are achieved by manufactured quality and not only delivered quality. However, in order to monitor the Supplier's efforts to reach Zero defects, Danfoss may define other targets to meet Danfoss expectations.

3.2 Quality Improvement Plan (QIP)

At Danfoss' request, the Supplier shall (within reasonable time) present a QIP to Danfoss that meets the targets and requirements stated in Danfoss' request.

Supplier's QIP should be based on a post-mortem analysis of previous year's failures in order to identify technical, managerial and systemic issues. QIP should cover quality, reliability, logistic, service issues, as well as any specific Danfoss requests.

When the QIP has been accepted by Danfoss, the Supplier is responsible for implementing the QIP. The effectiveness of the implemented activities shall on regular basis be evaluated by both the Supplier and Danfoss. The Parties' evaluation may result in amendments of the QIP.

3.3 Communication

All formal communications must be in English, unless otherwise agreed with Danfoss, and this rule shall apply to all documents sent by the Supplier.

Supplier shall pro-actively, directly and effectively involve the 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 and Services fulfilling all Danfoss specifications and requirements, and be capable of reducing cost over time.

4.1 Quality Management System (QMS)

The Supplier must maintain an 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 and Services 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

Other internationally recognized standard(s) may be accepted, but require written approval from Danfoss.

If the Supplier doesn't hold a 3rd party certification, Danfoss will audit the supplier's QMS, as necessary, to verify conformance to Danfoss expectations until one is in place.

Note: The Supplier must notify Danfoss if their registration expires and shall send a copy of the certificates each time it is renewed within 2 weeks after having received it. The certificate shall be sent to the following Danfoss mailbox: qcertificate@danfoss.com

Danfoss reserves the right to access all certification/ registration details of the Supplier.

In addition, Danfoss reserves the right to:

- Conduct Danfoss supplier quality assessments in addition to third party verification;
- Invite customers to participate in relevant audits;
- Disqualify, demote, adjust Supplier segmentation status, requiring full requalification prior to resuming business and/ or shipment with Danfoss;
- Notify third party certification/registration body used by the Supplier in case of the breach/ misuse of its Quality Management System.

4.2 Danfoss Supplier Quality Assessments

1. QMS Assessment

Danfoss is, at all times, entitled to audit the Supplier's QMS. During this QMS audit, Danfoss shall have access to all Supplier facilities and supply chain, staff and Danfoss documents relevant for the audit. Any exceptions to be agreed up front with the lead auditor.

2. Danfoss CoC Assessment

When required, CoC assessments will be conducted as part of Supplier qualification by Danfoss or a third party at the Supplier's expense.

3. Technology, Process or Product Assessment

There may be times where assessments or audits of the manufacturing process, product or technology will be needed due to onboarding requirements, projects or non-conformances. In these cases, Technology, Process or Product assessments will be conducted of the Supplier's facilities and supply chain.

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 that the Supplier will produce Products of consistent and required quality expected by Danfoss.

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

Unless otherwise agreed with Danfoss in written, suppliers shall not manufacture or ship any products, until Full or Interim Approval is received from Danfoss, through a signed Part Submission Warrant (PSW). In a case where full approval is not granted, Danfoss will advise the 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 about the PPAP, it shall be addressed to Danfoss Purchasing Organization and subject to the final decision of Danfoss.

Due to Danfoss customer requirements, all PPAP documentations and records related to the Product or production shall be kept for a minimum of 15 years and/or for the duration specified by any 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.

Regardless if a PPAP document needs to be submitted or not to Danfoss, all PPAP documents shall be created and retained by the Supplier, unless otherwise specified by Danfoss. A PPAP shall be provided for each part/ family in the approval process.

A table of PPAP elements is shown in Section 13 (Definitions and Abbreviations)

5.1 Sample Parts and Master Sample Parts

The 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 PPAP records;
4. Identify the master sample parts as such and with a label or marking of the Danfoss approval date on the sample.
5. For PPAPs done specifically for items such as labels and packaging, the PPAP Order may take into consideration the need to reduce some of the requirements listed above. However, all needed requirements will be listed on the PPAP Order.

For detailed requirements, the Supplier shall take reference to latest revision of PPAP Reference Manual by AIAG, and shall consult with Danfoss for any questions or clarifications.

5.2 Dimensional Analysis

The Supplier shall submit all data electronically, unless otherwise 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 and shall include appropriate references to the equipment used and to the procedures used for the measurement, if applicable.

5.3 Material, Performance and Reliability Test Results

The Supplier (or a qualified independent third party) shall provide specific material, performance and/or reliability test results. Actual results must be compared against agreed upon 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)

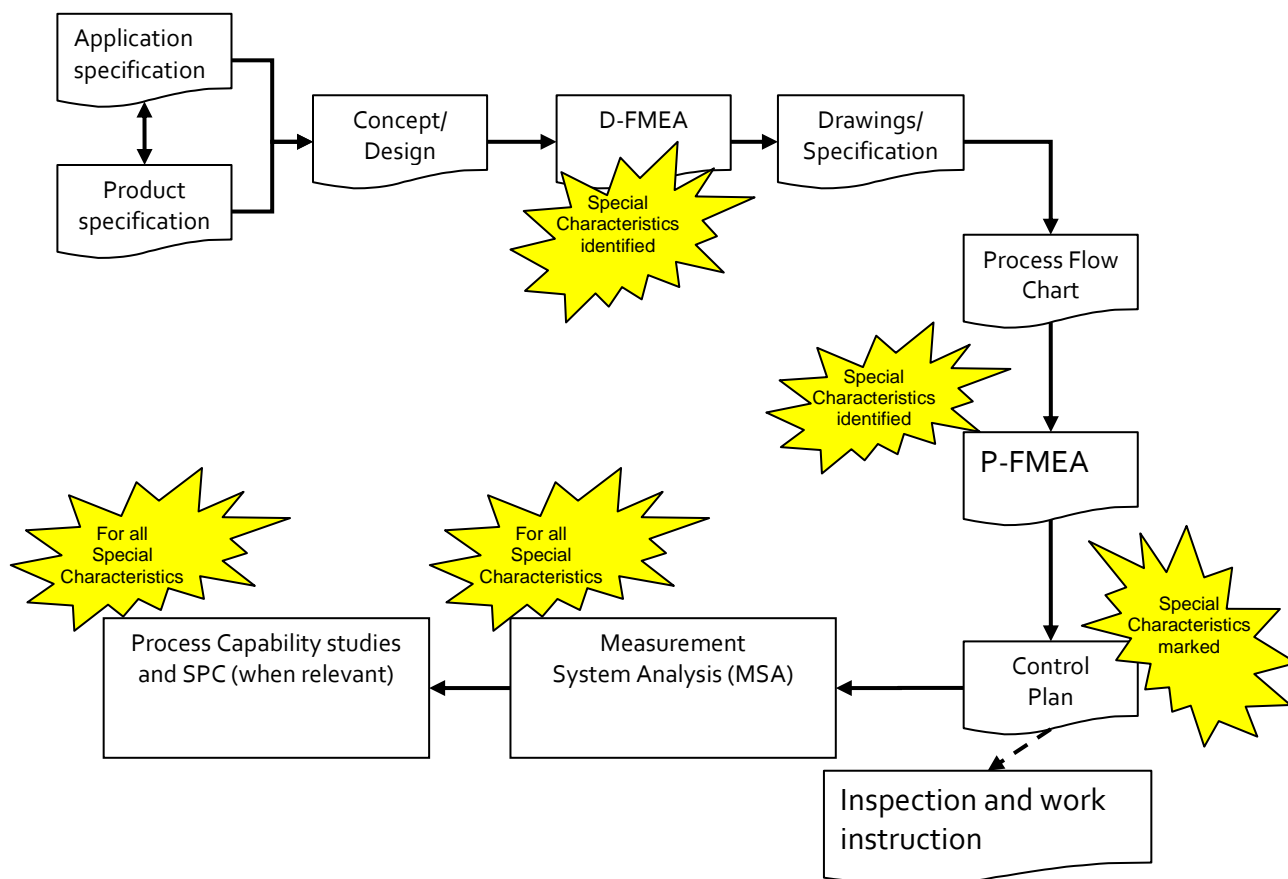
Danfoss may require an Appearance Approval Report (AAR) along with representative sample part(s) to be submitted, wherever applicable. An AAR is typically requested for an item, which is exposed to view on the exterior of a finished unit. If an AAR is specified on the PPAP Checklist, the Supplier shall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

5.5 Special Characteristics

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.

The consequence of being marked as a special characteristic in the Control Plan can only be 100% control or SPC (ref AAIG manual) when initial capability has been demonstrated.

Note: Special Characteristics shall also include all relevant regulatory and statutory requirements, but are not limited to such.



Danfoss will select or identify the Special Characteristics, which the Supplier needs to control. Special Characteristics will be communicated through various methods, including:

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

It is the responsibility of the Supplier to include all Special Characteristics and special process characteristics in their PFMEA and Control Plan.

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

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 a capability study analysis, a minimum value of Cpk (short term) 1.67 and Ppk (long term) 1.33 is required unless otherwise specified by Danfoss. 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 by Danfoss.

For those drawing requirements that are not identified as Special Characteristics, the Supplier should strive for a Cpk of minimum 1.0.

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 the Supplier. This shall be 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, as agreed upon 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, the 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 consecutively produced and randomly sampled in the production run for approval parts. The process capability study shall contain a minimum of thirty (30) consecutive 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 a preliminary process capability is defined in the table below. 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) consecutive pieces to be used for the preliminary process capability.

No. of Process Flows or Cavities	Random Sample Size (n)
= 1	n ≥ 30 pieces or pieces specified on PPAP Order*
≥2 ≤3	n ≥ 25 pieces per cavity
≥4 ≤50	n ≥ 50 pieces (cavity x cycles => 50) but minimum 5 cycles
> 50	n = minimum 5 cycles

* The quantity of pieces can be reduced in such cases, but not limited to, high cost to manufacture Product or annual volume is less than suggested sample size requirements. Instruction will be given on the PPAP Order.

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.

Number of Distinct Categories (NDC) is optional and depends on Danfoss and/or Danfoss customer's demands.

Acceptance Criteria for MSA Study		
Number of Distinct Categories (ndc)	Gage R&R	Status
ndc ≥ 5	GR&R ≤ 10 %	The measurement system can be approved.
2 ≤ ndc < 5	10 % < GR&R ≤ 30 %	The measurement system can be approved if Danfoss accepts the measurement uncertainty. Corrective actions may be required by Danfoss.
ndc < 2	GR&R > 30 %	The measurement system cannot be approved.

Attribute gages that are used to monitor Special Characteristics must also undergo applicable gage studies. The method used shall be formally agreed upon in advance between Danfoss and the 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 to be 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 sequences beginning at material receipt through packaging and shipping, where process steps shall include operations performed by outside sources (such as sub-suppliers for 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 Order, 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 a 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, if approved in advance by Danfoss.

The FMEA is a living document and shall be revised as changes are made to the Product, process and when quality issues are found (FMEAs shall be reviewed and updated, as necessary, as part of the Non-conforming Products process defined in Section 6 of this Supplier Quality Manual).

PFMEA will include a 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. This CP shall detail the control and inspection activities that have been implemented to ensure conformity to Danfoss drawings and specifications. Special Characteristics will be marked with their respective reference number(s).

The Control Plan is to be 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 and when quality issues are found (Control Plans shall be reviewed and updated, as necessary, as part of the Non-conforming Products process defined in Section 6 of this Supplier Quality Manual).

5.11 Process Audit

Danfoss may require a process 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 the Supplier's sub-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

Danfoss may pass on regulatory or statutory requirements to the Supplier. These requirements may require the Supplier to provide such items as (but not limited to) compliance letters, test results, cleanliness results, or part certifications.

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 any of these regulatory or statutory requirements (c.f. Section 8 Change Management).

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.

5.14 Early Production Containment (EPC)

Danfoss may require EPC at a Supplier's site, in order to put in place a redundant inspection process to prevent potential non-conformances during the start-up of production after PPAP approval.

6 Non-conforming Products

This section outlines the Supplier requirements and responsibilities as a result of non-conforming product due to Supplier's fault.

6.1 Reimbursement

In order to cover Danfoss' costs related to nonconforming products, the Supplier is entitled to reimburse the product, claim handling, administration in accordance with Framework Agreement (FWA) requirements.

6.2 Immediate Containment Actions due to Non-conformances Identified after Shipment

If non-conforming products are identified after shipment from the Supplier, one or more of the following immediate containment actions 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 place (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 high quality products to Danfoss, which is in line with Danfoss' goal of Zero Defects.

6.3 Immediate Containment Actions due to 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 these products shall be initiated. Non-conforming products shall not be shipped to Danfoss, unless a waiver is granted by an authorized Danfoss representative.

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. Danfoss will review the non-conformance and work with the Supplier on an appropriate disposition:

- If the non-conformance affects form, fit, function, quality, reliability, safety, delivery, service of the product, or its compliance with regulatory or statutory requirements, and/or is a cosmetic defect;
- If there is likelihood that the non-conforming product has inadvertently shipped from the Supplier's factory to Danfoss;
- If the non-conforming product is likely to cause late delivery to Danfoss;
- In all cases where there is a report of a non-conformance from another customer, regulatory agency or internally at the Supplier that could possibly affect the form, fit, function, quality,

reliability, safety, delivery, service of the product, or its compliance with regulatory or statutory requirements, and/or is a cosmetic defect.

All products approved by a waiver that are shipped to Danfoss must be accompanied by a copy of the approved waiver requisition.

6.4 Corrective and Preventive Actions

When non-conforming products are discovered, the Supplier shall submit a formal written corrective and preventive action report, to address the specific defects identified.

- The general format of the corrective and preventive action will be a Corrective Action Report form (8D), unless otherwise agreed upon in advance by an authorized Danfoss representative. The Supplier shall submit the 8D form 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 1 working day (starting from Supplier's receipt of the 8D form).
- If Danfoss disagrees with the Supplier's containment action, the Supplier must respond (with a revised containment action) within 1 working day (starting from Supplier's receipt of Danfoss' notice).

Failure analysis leading to the root cause determination shall be done within 5 working days or at an alternative time-frame agreed upon in advance with Danfoss.

- The Supplier shall use appropriate tools such as, but not limited to, fishbone diagram, 5W+2H, FTA (Factor Tree Analysis) for occurrence and non-detection, LLC (Lessons Learnt Cards) to effectively prevent recurrence of the non-conformance.
- The 8D form will not be considered complete until all 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 responsible for the product non-conformity, including any non-conformities 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).

6.5 Controlled Shipping Level (CSL1 and CSL2)

In the event of recurring non-conformances where the corrective action plan has failed, Danfoss reserves the right to issue a Controlled Shipment Level (CSL) program at the Supplier's site for specified products, and at the Supplier's expense.

CSL1 includes, but is not limited to:

- 100% sorting/inspection on the products, which shall be carried out 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;
- 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;

In order to safeguard Danfoss' interest, if there is a failure to successfully achieve CSL1, it will automatically be escalated to CSL 2.

CSL2 includes, but is not limited to:

- All CSL1 measures listed above, which will be inspected by a Danfoss-designated 3rd party or by Danfoss (at the Supplier's expense);
- Blocking of new business, subject to the sole and final decision of Danfoss.

The Supplier may be notified of additional requirements, when needed by Danfoss.

Exit from CSL1 and CSL2 will be determined by Danfoss, when set criteria are met and corrective actions are implemented and validated.

7 Supplier Monitoring and Top Worst Supplier Management Program

7.1 Supplier Monitoring

Danfoss will monitor Supplier's performance based on, but not limited to, the following six areas:

- Quality Performance (PPM);
- QMS Compliance (ISO 9001, TS16949);
- Delivery Performance (On Time Delivery);
- Service Performance (8D, PPAP, response time etc.);
- Claims Performance (Number and type of claims);
- CoC compliance (letters, assessments, etc.)

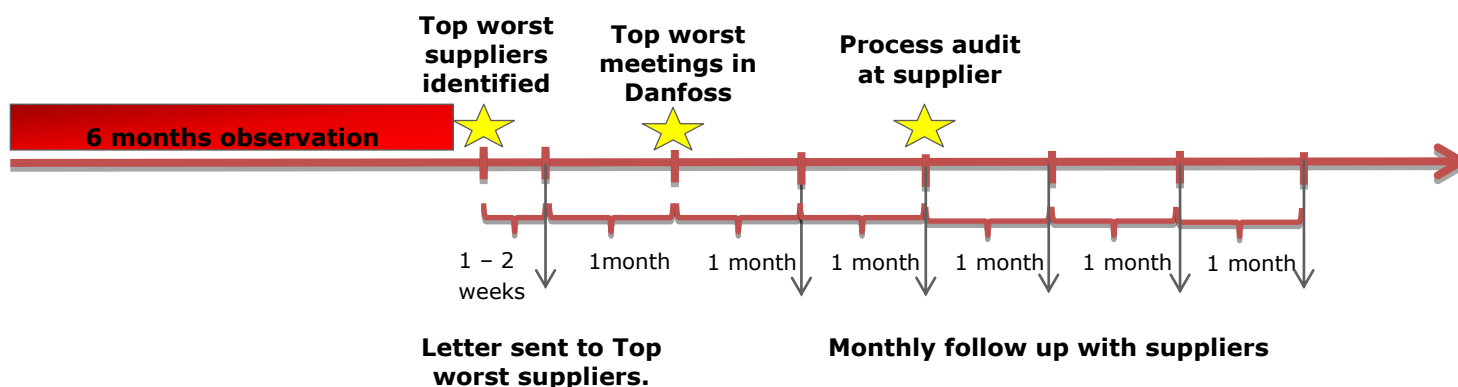
The Supplier will continually be monitored.

If supplier performance does not meet agreed upon targets, a QIP may be initiated in according with section 3.2 of this Supplier Quality Manual.

This monitoring is closely tied to promoting and demoting of the Supplier's segmentation status within Danfoss' Supplier Management System. A Supplier's failure to fulfill Danfoss' performance requirements can result in, but is not limited to, new business hold and/or phase-out.

7.2 Danfoss Top Worst Supplier Management Program

Danfoss has defined a program to manage suppliers which repeatedly fail to reach Danfoss quality targets. This program is summarized as follows with the principal picture of the process:



The criteria to identify those Suppliers into this program are as follows, but are not limited to:

- PPM level, as compared to target set by Danfoss;
- Claims performance;
- Customer claims (not detected by Danfoss);
- Recurrence of problems;
- On time delivery (OTD) as compared to target set by Danfoss;
- CoC compliance.
- Costs of Poor Quality (CoPQ) related to supplier non-conformities

For each above criteria, supplier performance is measured over the last 6 months and is compared with other Danfoss Suppliers within the same supplier segmentation. Suppliers which appear most frequently in the above-mentioned criteria may be selected for this program.

Meetings for this program between Danfoss and the Supplier will be scheduled and may require participation from senior management, if requested by Danfoss. During these meetings, the Supplier shall present its analysis regarding its poor performance and its commitment to improving its performance in the future. If Danfoss decides there is a need for a process audit, it will be carried out by Danfoss within a reasonable timeframe.

In the Top worst meeting with senior management participation the exit criteria for the Supplier to exit this program will be defined.

If the performance of the Supplier does not improve while being part of this program, Danfoss may take the decision to put new business on hold and/or phase-out the Supplier.

8 Change Management

After receiving initial Product approval from Danfoss, the Supplier shall not make any changes to the product and processes without prior written notification and agreement with Danfoss. Such notification shall be submitted to Danfoss 6 months in advance, or as otherwise as agreed with 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 or material composition changes in the Product;
3. Changes to regulatory, statutory or legal status/documentation requirements;
4. Any manufacturing process changes (including testing and inspection):
 - Moving production equipment internally within the facility;
 - Moving production equipment to other facilities/locations;
 - Change of production process;
 - Production material changes;
 - Change of process parameters outside of previously approved operating 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 Framework Agreement (FWA) or comparable between the Supplier and Danfoss. For any change, Danfoss reserves the right to requalify the Product with an appropriate PPAP. For all change requests, temporary as well as permanent, the Supplier shall use the Danfoss change request form available at: <http://www.danfoss.com/about/procurement/Supplier-expectations/>

Any change is subject to sole and final written approval 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 the Supplier through specifications and drawings. The Supplier shall retain the appropriate quality records for Product on each shipment to support any requests made by Danfoss.

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 regulatory or statutory 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 the Product shipment and shall be agreed in advance 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.

10.1 Environmental Management System (EMS)

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

Danfoss reserves the right to audit the Supplier's EMS. During this 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.

10.2 Danfoss 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 Supplier to subscribe to the Danfoss Negative List link and to review all changes and revisions. It is important to note that the Supplier shall not supply to Danfoss any Products containing substances that are included in the Danfoss Negative List. Failure to comply with the Danfoss Negative List can lead to very serious consequences and the Supplier shall bear any associated responsibility and liability, if found in non-compliance.

The link to the Danfoss Negative List is as follows:

<http://www.danfoss.com/sustainability/information-for-customers-and-suppliers/danfoss-negative-list/>

All Suppliers have the obligation to comply with the Negative List and proactively inform Danfoss about the use of any new substances on updates of the Negative List (including Candidate List substances). Use the following mailbox for this communication: Negativelist@danfoss.com.

10.3 Conflict Minerals

Dodd-Frank Wall Street Reform and Consumer Protection Act issued in August 2012 publicly traded companies in US must report to the U.S. Securities and Exchange Commission ("SEC") if their products contain Tin, Tantalum, Tungsten or Gold (together "3TG") originating from uncertified smelters in the so-called DRC countries ("Conflict Minerals"). DRC countries are Democratic Republic

of Congo, Republic of Congo, Central Africa Republic, South Sudan, Zambia, Angola, Tanzania, Burundi, Rwanda and Uganda.

<http://www.danfoss.com/sustainability/information-for-customers-and-suppliers/conflict-minerals/>

Suppliers are required to adopt policies, management systems and exercise due diligence with respect to conflict minerals throughout their entire supply chain / sub-suppliers. Suppliers are requested to upload validated data on our platform or send a populated and validated EICC-GeSI Conflict Minerals Reporting template (CMRT), which is available here: <http://www.conflictreesourcing.org/conflict-minerals-reporting-template/>

Failure to comply with the Danfoss' Conflict Minerals policy can lead to very serious consequences and the Supplier shall bear any associated responsibility and liability, if found in non-compliance.

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 CoC for Suppliers, which includes respect for universally recognized standards for the environment, human rights, labor and anti-corruption.

Signatures

The Supplier shall sign the CoC Acknowledgement Letter and conduct a self-assessment, at the Supplier's expense.

Audits

When required for suppliers with direct production, CoC assessments will be conducted as part of Supplier qualification by Danfoss or a third party at the Supplier's expense. Suppliers Danfoss also reserves the right to ask for an audit to be conducted of any the Supplier's sub-suppliers.

12 Risk Management / Contingency Planning

The Supplier shall identify and prioritize risks affecting delivery of Products or Services to Danfoss. The Supplier shall, upon request, provide Danfoss with proper contingency plans for the highest ranked risks to assure un-interruption of delivery.

13 Supplier's Liability

In addition to the Supplier's obligations under this Supplier Quality Manual, the Supplier is liable according to the terms and conditions of the supply agreement entered between Danfoss and Supplier. For the avoidance of doubt it is outlined that the agreed PPM target is solely a target regarding Supplier's general product quality level. Supplier remains liable for all cost of poor quality relating to non conformities according to the supply agreement."

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)

A strategy for controlling Products and Product processes to ensure that all process outputs remain in a state of control. A CP 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), is a demand to Supplier in order to have them put in place a redundant inspection process (at their site) to sort for potential non-conformities to prevent their shipment to Danfoss. 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.

Control Shipping Level 2 (CSL2), is a further demand above CSL1 requirements where a redundant inspection process is put into place by the Supplier using a Danfoss-designated 3rd party or Danfoss (at the Supplier's expense).

Early Production Containment (EPC)

A demand to Supplier in order to put in place a redundant inspection process to prevent potential non-conformances during the start-up of production after PPAP approval.

Failure Mode and Effects Analysis (FMEA)

A preventive analytical technique to methodically study the cause and effects of potential failures in a Product or 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 then 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)

The evaluation of gauging an instrument's accuracy by determining whether the measurements taken with it are repeatable and reproducible.

Non-conformance or Nonconformity

A Product or Service that does not meet requirements found in Danfoss contracts, drawings, specifications, policies or with any other legal, statutory, regulatory or Danfoss 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.

Ppk

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

Parts Per Million (PPM)

A measurement of the defect rate in a product, calculated as: $PPM = (\text{Total number of defective parts}) \times 1,000,000 / (\text{Total number of parts received by Danfoss})$.

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.

Products

Any finished or semi-finished goods, parts, components, materials and/or services manufactured for delivery or delivered to Danfoss.

Product Submission Warrant (PSW)

The Product Submission Warrant contains Supplier, Product information, required documentation, the Supplier application warrant, and Danfoss disposition. A submission approval by Danfoss authorizes Supplier to start production.

Production Part Approval Process (PPAP) Order

A document intended to clearly identify requirements and eliminate ambiguity between Danfoss and the Supplier, prior to production of new or changed parts. It identifies to the Supplier, part information, Special Characteristics, qualification requirements, Danfoss authorization and Supplier sign off.

PPAP Approval Documentation Requirements

Part Approval Documentation	Level 1	Level 2	Level 3 Default Level	Level 4	Level 5
Design Record	R	S	S	*	R
for Danfoss proprietary components/details	R	R	R	*	R
for all other components/details	R	S	S	*	R
Engineering Change Documents, if any	R	S	S	*	R
Engineering Approval from Danfoss (required)	R	R	S	*	R
Design & Process FMEA	R	R	S	*	R
Process Flow Diagrams/ Flowcharts	R	R	S	*	R
Control Plans	R	R	S	*	R
Measurement System Analysis (MSA)	R	R	S	*	R
Dimensional Analysis	R	S	S	*	R
Material, Performance Reliability Test Results	R	S	S	*	R
Process Capability Studies	R	R	S	*	R
Qualified Laboratory Documentation	R	S	S	*	R
Appearance Approval Report (AAR)	S	S	S	*	R
Sample Parts	R	S	S	*	R
Master Sample Parts	R	R	R	*	R
Checking Aids	R	R	R	*	R
Danfoss Negative List conformity (including ROHS and REACH requirements)	R	R	S	*	R
Specific requirements of European Community Directives, product safety approvals (i.e. UL) and other local legal requirements when applicable	R	R	S	*	R
Part Submission Warrant (PSW)	S	S	S	S	R

S = Shall be submitted to Danfoss and retain a copy of records or documentation items at appropriate location

R = Shall be retained by the Supplier, at an appropriate location, and made available to Danfoss upon request

* = Shall be retained by the Supplier, at an appropriate location, and submitted to Danfoss upon request

Note: level 5 means full documentation and review on supplier site by Danfoss representative.

Special Characteristics

A characteristic that can infringe on safety or regulatory compliance or customer satisfaction, or a characteristic that can cause rework or scrap AND at the same time is sensitive to variation that is difficult to control within the process.

TS 16949

TS 16949: is a technical specification which includes systematic tools for product development and manufacturing. TS 16949 has expanded requirements as compared to ISO 9001.

15 Reference Materials.

The following TS 16949 publications are available from the Automotive Industry Action Group (AIAG). These may be ordered on-line at: <http://www.aiag.org>. Danfoss has decided to work according to these manuals, which is also expected from supplier side (ref 19 templates)

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 Templates

The following are the forms referenced in this manual. To obtain blank forms, or for assistance in completing forms, Suppliers should access the following link:

<http://www.danfoss.com/about/procurement/Supplier-expectations/>

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 Requirements*
8. SCR Form

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