

Availability:
Unrestricted

Master Document: **Production Part Approval Process (PPAP)**

Standard No.: **GS-0008** Revision level: **D** Release date: 2010-06-12

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Local Edition:

Language:

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Most recent change history:

Revision	Description of Change
C to D	Designated access to this standard as Unrestricted. Removed embedded templates. Replaced 'critical' characteristics with 'safety' characteristics to reflect changes to GS-0004. Added note to section 2.2 to specify additional SD responsibility at sub-supplier level on custom assemblies where supplier has design control.

Changes in relation to previous issue are written with red, alternatively for figures and tables with a red frame around.

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1 GENERAL

The Production Part Approval Process will be used for:

1. a new part or product.
2. correction of a discrepancy on a previously submitted part.
3. product modified by an engineering change to design records, specifications, or materials.
4. any situations required by Section 3.

NOTE: If there is any question concerning the need for production part approval, contact the customer PPAP coordinator.

2 PPAP PROCESS REQUIREMENTS

2.1 Significant Production Run

For production parts, product for **PPAP** shall be taken from a significant run. This production run shall total a minimum of **30 consecutive parts (unless specifically agreed otherwise with the customer)** and be manufactured at the production site, **at the production rate**, using the production tooling, gaging, process, materials, and operators. Parts from each unique production process stream shall be measured and representative parts tested.

2.2 PPAP Requirements

Sauer-Danfoss and its suppliers shall meet all specified requirements, e.g. design record, specifications. For product or process changes, the PPAP Worksheet Template ([available on Navigator under Quality ▶ Templates](#)) provides a guideline on which PPAP components need to be updated based on the type of change made. Any results that are outside specification are cause for Sauer-Danfoss and its suppliers not to ship components. Every effort shall be made to correct the process so that all design record requirements are met. If Sauer-Danfoss and its suppliers are unable to meet any of these requirements, the customer(s), where we have an agreement to do so, shall be contacted for determination of appropriate corrective action.

Sauer-Danfoss and its suppliers shall have the applicable items and records listed below, for each part, or family of parts, and be readily available.

Sauer-Danfoss and its suppliers shall obtain approval from the customer for exceptions or deviations to PPAP requirements.

NOTE: In general for supplied parts, Sauer-Danfoss will expect its suppliers to review and approve PPAP submittals from their sub-suppliers. In the specific case where the Sauer-Danfoss supplier is providing a custom assembly for which the supplier has design control, Sauer-Danfoss shall also review the PPAPs of the components that make up the assembly. This is to ensure the appropriate oversight of key or safety characteristics on custom applications.

NOTE: All items or records (Section 2.2.1 – 2.2.16) may not necessarily apply to every part number. For example, some parts do not have appearance requirements, and others do not have color requirements. In order to determine with certainty which items must be included, consult the design record, e.g. part print, the relevant Engineering documents or specifications, and the customer.

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NOTE: In comparing the SD list of required PPAP components with the AIAG list, the SD list does not include Qualified Laboratory Documentation nor Checking Aids. With regard to the lab qualification, the supplying organization is responsible for the integrity of any measurements included in the PPAP. With regard to checking aids, these can be discussed between supplier and customer as needed.

2.2.1 Design Record

Sauer-Danfoss and its suppliers shall have the design record for the saleable product. In all cases, the official design record is the top-level customer drawing relating to the part / component under consideration along with any other drawings, specifications, or electronic files referenced therein. If the customer does not have a top-level drawing for the part under consideration, the customer must have approved the drawing to be used. Where the design record is in electronic format, a hard copy (e.g. pictorial, geometric dimensioning & tolerancing [GD&T] sheets, drawing) should be included to identify measurements taken.

2.2.2 Any authorized Engineering Change documents

Sauer-Danfoss and its suppliers shall have any authorized engineering change documents, not yet recorded in the design record but incorporated in the product, part or tooling, in an engineering change management system.

2.2.3 Engineering Approval, when required

When required by customer agreement, Sauer-Danfoss and its suppliers shall have evidence of customer engineering approval.

2.2.4 Design Failure Mode and Effects Analysis (Design FMEA) – Ref: GS-0002

Sauer-Danfoss and its suppliers shall have a Design FMEA for parts or materials for which they are design-responsible. In most cases, the Design FMEA will be considered proprietary and will therefore not be submitted as part of the PPAP package. Whether submitted or retained, it must be prepared prior to PPAP submittal and made available to the customer for review. For general guidelines on submission / retention of PPAP components, see Section 4 of this document.

2.2.5 Process Flow Diagrams or Descriptions - Ref: GS-0063

Sauer-Danfoss and its suppliers shall have a process flow diagram or description that clearly describes the production process steps and sequence.

NOTE: Process flow diagrams or descriptions for ‘families’ of similar parts are acceptable if the new parts have been reviewed for commonality.

2.2.6 Process Failure Mode and Effects Analysis (Process FMEA) – Ref: GS-0006

Sauer-Danfoss and its suppliers shall have a Process FMEA. A single Design or Process FMEA may be applied to a process manufacturing for a family of similar parts or materials.

2.2.7 Control Plan – Ref: GS-0012

Sauer-Danfoss and its suppliers shall have a Control Plan that defines all controls used for process control.

The Control Plans are to be completed using GS-0012.

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2.2.8 Measurement System Analysis Studies – Ref GS-0010

Gage Repeatability and Reproducibility (Gage R&R) studies are to be completed using GS-0010.

Variable (vs. Attribute) gaging is to be used for all **Key** Characteristics (Features) unless prior approval has been obtained. In cases where the measurement systems are determined to be incapable according to GS-0010 at the time of PPAP submittal, this should be clearly noted on both the GR&R form and on the PSW form (Part Submission Warrant) form **available on Navigator under Quality ▶ Templates**. It will then be the decision of the customer whether to reject the PPAP and require resubmittal with satisfactory results prior to production shipment or to grant conditional approval while the corrective action plan for the discrepant condition is performed.

2.2.9 Dimensional Results (ISIR) – Ref: GS-0015

Sauer-Danfoss and its suppliers shall provide evidence that dimensional verifications required by the design record (Engineering Print requirements as specified in the customer's top-level drawing) have been completed and results indicate compliance with specified requirements. In cases where dimensional results do not meet the specifications, this should be clearly noted both in the ISIR form and in the PSW. It will then be the decision of the customer whether to reject the PPAP and require resubmittal with satisfactory results prior to production shipment or to grant conditional approval while the corrective action plan for the discrepant condition is performed.

2.2.10 Records of Material / Performance Test Results

Sauer-Danfoss and its suppliers shall have records of material and/or performance test results for tests specified on the design record or Control Plan.

2.2.10.1 Material Test Results

Sauer-Danfoss and its suppliers shall perform tests for all part(s) and product material(s), when chemical, physical, or metallurgical requirements are specified by the design record or control plan.

All tests required by the design record and related specifications should be listed in a convenient format along with the quantity tested and the actual results of each test. Also indicate any authorized engineering change documents that have not yet been incorporated in the design record.

A material test report shall indicate the:

- Design record revision level of the parts tested, and the number, date, and revision level of the specifications to which the part was tested;
- Date on which the testing took place;
- Material subcontractor's name and, when required by the customer, their Sauer-Danfoss or supplier code number for the material from the customer approved subcontractor list.

NOTE : For products with customer-developed material specifications and a customer-approved subcontractor list, Sauer-Danfoss and its suppliers shall procure materials and/or services (e.g. painting, plating, heat-treating) from subcontractors on that list.

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2.2.10.2 Performance Test Results –Ref: GS-0017

Sauer-Danfoss and its suppliers shall perform tests for all parts or product materials when performance or functional requirements are specified by the design record or Control Plan.

The test report shall indicate:

- Design record revision level of the parts tested, and the number, date, and revision level of the specifications to which the part was tested;
- Any authorized engineering change documents that have not yet been incorporated in the design record;
- Date on which the testing took place.

NOTE: Results for all tests required by the design record or related specifications should be documented in the Product Verification Plan and Report (PVPR) structure (see GS-0017).

2.2.11 Initial Process Studies – Ref: GS-0007

2.2.11.1 General

The level of initial process capability (P_p , P_{pk} =Short Term Capability) shall be determined to be acceptable prior to submission for all **Key** Characteristics (Features), see GS-0004, designated by the customer or supplier.

NOTE: In the case of characteristics which are not deemed **safety** or key but are important enough to the customer that additional supporting data is requested, the required initial process capability for these characteristics must be > 1.00 (as per GS-0007). These characteristics will be agreed upon between the customer and the supplier prior to PPAP submittal and the necessary documentation supplied with the PPAP.

2.2.11.2 Capability Indices

Capability Studies are to be completed using the Global Standard for Capability Study, GS-0007, or a process equivalent.

2.2.11.3 Strategy When Acceptance Criteria Are Not Satisfied

The supplier shall contact the customer if the process cannot be improved.

If acceptance criteria cannot be attained by the **PPAP** submission promise date, the supplier shall submit to the customer for approval a corrective action plan and a modified Control Plan normally providing for 100% inspection. Continued variation reduction efforts must be maintained until the acceptance criteria requirements are met.

2.2.12 Appearance Approval Report (AAR)

A separate Appearance Approval Report (AAR) shall be completed for each part or series of parts for which a submission is required if the product/part has appearance requirements on the design record.

Upon satisfactory completion of all required criteria, Sauer-Danfoss and its suppliers shall record the required information on the AAR. The completed AAR and representative production products/parts shall be submitted to the location specified by the customer to receive disposition. AARs (complete with part disposition and customer signature) shall then accompany the PSW at the time of final submission based upon the submission level requested. Additional requirements may be recorded in customer-specific requirements.

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NOTE 1: AAR typically applies only for parts with color, grain, or surface appearance requirements. AAR's are extremely rare for either parts supplied to Sauer-Danfoss or products supplied by Sauer-Danfoss to its customers. In general, AAR's will only be performed when specifically requested by a customer.

NOTE 2: Certain customers may not require entries in all AAR fields.

2.2.13 Sample Production Parts

Sauer-Danfoss and its suppliers shall provide sample product as requested by the customer and as defined by the submission request.

2.2.14 Master Sample

Sauer-Danfoss and its suppliers shall retain a master sample for the same period as the production part approval records, or a) until a new master sample is produced for the same customer part number for customer approval, or b) where a master sample is required by the design record, Control Plan or inspection criteria, as a reference or standard to be used. The master sample shall be identified as such, and shall show the customer approval date on the sample. Sauer-Danfoss and its suppliers shall retain a master sample for each position of a multiple cavity die, mould, tool or pattern, or production process unless otherwise specified by the customer. The purpose of the master sample is to provide a reference point to the initial product / process status. This can be especially valuable where something changes some time after product introduction and the characteristics involved are not easily measurable.

NOTE: Due to the difficulty of retaining master samples for multiple process streams, multiple product configurations, and multiple customers, the retention of master samples when Sauer-Danfoss is the supplier will be considered optional. When specifically requested by the customer, arrangements may be made to retain a master sample(s). Similarly, when Sauer-Danfoss is the customer, the retention of master samples by the supplier shall be performed on request.

2.2.15 Customer-Specific Requirements

Sauer-Danfoss and its suppliers shall have records of compliance to all applicable customer specific requirements. For bulk materials, any customer-specific requirements shall be documented.

2.2.16 Part Submission Warrant (PSW)

Upon satisfactory completion of all required measurements and tests, as indicated in the PPAP Worksheet template, Sauer-Danfoss and its suppliers shall record the required information on the Part Submission Warrant (PSW) template.

Both forms are available on Navigator under Quality ▶ Templates.

A separate PSW shall be completed for each customer part number unless otherwise agreed to by the customer.

Sauer-Danfoss and its suppliers shall verify that all of the measurement and test results show conformance with customer requirements (or note any discrepancies and request deviations if appropriate) and that all required documentation is available. Sauer-Danfoss or its supplier's management representative shall approve the PSW and provide date, title, and telephone number.

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3 CUSTOMER NOTIFICATION AND SUBMISSION REQUIREMENTS

3.1 Customer Notification

Sauer-Danfoss shall notify its customers and / or obtain PPAP approval per the Customer Notification Policy (GS-0050) for the situations outlined in Tables 3.1 and 3.2.

Suppliers shall notify Sauer-Danfoss of any design and process changes as indicated in the table below. Upon approval of the change, PPAP submittal and approval is required prior to shipment of the modified product or product from the modified process.

Table 3.1

Requirement	Clarification or examples
1. Use of other construction or material than was used in the previously approved part or product.	For example, other construction as documented on a deviation (permit) or included as a note on the design record and not covered by an engineering change as described in Table 3.2 #3.
2. Production from new or modified tools (except perishable tools of the same grade and type), dies, moulds, patterns, etc., including additional or replacement tooling.	This requirement only applies to tools, which due to their unique form or function can be expected to influence the integrity of the final product. It is not meant to describe standard tools (new or repaired of same make and type), such as standard measuring devices, drivers (manual or power), etc.
3. Production following upgrade or rearrangement of existing tooling or equipment.	<p>Upgrade means the reconstruction and/or modification of a tool or machine or to increase the capacity, performance, or change its existing function. This is not meant to be confused with normal maintenance, repair or replacement of parts, etc., for which no change in performance is to be expected and post repair verification methods have been established.</p> <p>Rearrangement is defined as activity that changes the sequence of product/process flow from that documented in the process flow diagram (including the addition of a new process).</p> <p>Minor adjustments of production equipment may be required to meet safety requirements such as, installation of protective covers, elimination of potential ESD risks, etc. These changes can be made without customer approval unless the process flow is changed as a result of this adjustment.</p>

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Requirement	Clarification or examples
4. Production from tooling and equipment transferred to a different plant site or from an additional plant site.	Production process tooling and/or equipment transferred between buildings or facilities in one or more sites.
5. Change of subcontractor for parts, non-equivalent materials, or services (e.g.: heat-treating, plating).	Sauer-Danfoss and its suppliers are responsible for approval of subcontracted material and services.
6. Product produced after the tooling has been inactive for volume production for twelve months or more.	For product that has been produced after tooling has been inactive for twelve months or more: Notification is required when the part has had no active purchase order and the existing tooling has been inactive for volume production for twelve months or more. The only exception is when the part has low volume, e.g. service or specialty vehicles. However, a customer may specify certain PPAP requirements for service parts.
7. Product and process changes related to components of the production product manufactured internally or manufactured by subcontractors. Additionally, Sauer-Danfoss and its suppliers shall concur with any requests by a subcontractor before submission to the customer.	Any change that affects customer requirements for fit, form, function, performance, and/or durability requires notification to the customer. NOTE: The fit, form function, performance, and/or durability requirements should be part of customer specifications as agreed on during contract review.
8. Change in test/inspection method, equipment, or new technique (no effect on acceptance criteria)	Sauer-Danfoss and its suppliers should have evidence that the new method or equipment provides results equivalent to the previous method or equipment.
Additionally, for bulk materials: 9. New source of raw material from new or existing supplier Change in product appearance attributes	These changes would normally be expected to have an effect on the performance of the product.
10. Change in equipment.	Examples are new equipment, alternate or additional equipment, replacement, or change in size.
11. Tooling or equipment moved to a different location within the same plant (unless designed to be mobile).	Based on lean manufacturing initiatives, some equipment is designed for mobility, i.e. on wheels with quick disconnects. Equipment of this type generally does not require disassembly, or special preparation prior to movement, nor activities such as re-leveling or realignment, subsequent to a move.

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3.2 Submission to Customer

Sauer-Danfoss shall successfully perform **PPAP** prior to the first production shipment in the following situations (See Table 3.2). Sauer-Danfoss shall review and update, as necessary, all applicable items in the **PPAP** file to reflect the production process, regardless of whether or not the customer requests a formal submission. The submittal or retention of PPAP documentation is then dictated by the SD Customer Notification Policy (GS-0050).

Suppliers shall submit for **PPAP** approval prior to the first production shipment in the following situations (See Table 3.2). Suppliers shall review and update, as necessary, all applicable items in the **PPAP** file to reflect the production process.

Table 3.2

Requirement	Clarification or examples
1. A new part or product (i.e. a specific part, material, or color not previously supplied to the customer)	Submission is required for initial release of a new product (part). A new part/product or material added to a family may use appropriate PPAP documentation from a previously fully approved part within the same product family.
2. Correction of a discrepancy on a previously submitted part.	Submission is required to correct any discrepancies on previously submitted part. A “discrepancy” can be related to: <ul style="list-style-type: none"> • The product performance against the customer requirement • Dimensional, capability or GR&R issues • Subcontractor issues • Full approval of a part replacing an interim approval • Testing, including material, performance, engineering validation issues
3. Engineering change to design records, specifications, or materials for production product/part number(s).	Submission is required on any engineering change to production product/part design records, specifications or materials.
Additionally, for bulk materials:	
4. Process technology new to the organization, not previously used for this product.	

4 SUBMISSION / RETENTION OF PPAP COMPONENTS

The standard PPAP submission level for Sauer-Danfoss as both supplier and customer is Level 4 as per AIAG PPAP Fourth Edition. This means that a PPAP submittal consists of a minimum of a PSW plus the additional components specified by SD and agreed to by the customer. The table below specifies which components should be submitted as part of a standard PPAP package and which should be retained but available to the customer to

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review. The general guideline driving submittal vs. retention is that if the information in a PPAP document is deemed by the division to be proprietary it will be retained by the SD location. In these cases the customer may still review the documents upon request.

Item	PPAP Document	Retained or Submitted
1	Design Record	S
2	Engineering Change Documents	S*
3	Customer Engineering Approval	S*
4	Design FMEA	R**
5	Process Flow Diagrams	S**
6	Process FMEA	S**
7	Control Plan	S**
8	Measurement Systems Analysis Studies	S
9	Dimensional Results (ISIR)	S
10	Material, Performance Test Results	S
11	Initial Process Studies (Capability)	S
12	Appearance Approval Report	S*
13	Sample Product	S
14	Master Sample	R*
15	Records of Compliance with Customer Specific Requirements	S*
16	PSW	S

* - If this component is relevant

** - These components may be submitted or retained at the discretion of the business unit. At a minimum they must be available for customer review.

CHANGE HISTORY:

Date	Old/New Rev.	Description(s) of Change(s)
2006-08-15	A / B	Changes to: Reflect Fourth Edition of AIAG PPAP Standard Reference SD Customer Notification Policy (GS-0050) Reference the new PSW form and revised worksheet Reflect the removal of GS-0014 (PSW Standard)
2007-01-24	B / C	PSW form revised to include specification of production rate, and standard revised to clarify that production run must be performed at production rate.
2010-03-24	C / D	Designated access to this standard as 'Unrestricted' Removed embedded templates Replaced 'critical' characteristics with 'safety' characteristics to reflect changes to GS-0004. Added note to section 2.2 to specify additional SD responsibility at sub-supplier level on custom assemblies where supplier has design control.