Guidance Document

Special Characteristics

GD-038 Rev. 02

Contents:

Quality Management & Project Quality QM-PQ	Written on	Approved on
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0. Change Description

Updated Roles to new organizational structure. Added info about storage location in Project Office in chapter 4.5.

1. Objective

Huf products must be safe and reliable, were

- Safety is the condition of being protected from danger, risk, or injury in the field, assembly, and production.
- Reliability is the ability of a system or component to perform its required functions under stated conditions for a specified period of time.

In some cases, this may not be as robust as intended, that's why the characteristics in a function must be determined and maintained systematically in all new development projects. These characteristics are Special Characteristics.

As many as necessary, as little as possible.

2. Area of Applicability

Huf Group (if not limited in the "Corporate Documents Reference-Matrix" (s. CP-002)).

3. Definitions and Explanations

Characteristics

A Characteristic is a dimension or a physical, chemical, electrical, mechanical, or visual property. A Characteristic must be measurable, either directly or indirectly, either variable or attributive.

Variable Characteristics are quantitative data which can be measured, and the result is expressed in an absolute measurement reading e. g. Millimetres, Inches, Newton, etc.

Attributive Characteristics are qualitative data that are measured or counted resulting in conformance or non-conformance, pass or fail.

General:

- All dimensions, specifications, and tolerances displayed on drawings are important and function related. According to ISO 8015, the limits of the functionality of a part are to be entered in the Technical Product Specification (e. g. drawing) as tolerance limits. Within the tolerance limits, the part functions at 100%.
- All part dimensions and specifications must meet requirements and be produced within tolerance.

Special Characteristics

Special Characteristics are characteristics that require special care and attention. The extra workload which may be involved with the heightened care and attention is justified by the possible consequences of a failure of the function.

Special Characteristics may be influenced by the manufacturing process (Huf and/or suppliers) and require appropriate controls to maintain the required process capability and achievement of requirements.

NOTE: Special Characteristics can include product characteristics or manufacturing process parameters. (In order to have a clear connection to the function, the product characteristic should be selected as the special characteristic that is directly linked to the chosen manufacturing process parameters; the process parameters corresponding to the selected product characteristic will be documented in the Control Plan.)

There are two different types of Special Characteristics at Huf:

Critical Characteristics (CC)

are characteristics that may affect the:

- Safe vehicle and/or product function
- Compliance with legal and regulatory requirements
- Environmental requirements

These Characteristics can originate from different sources e.g., Design FMEA, Technical Safety Concept etc., having a causal relationship to the effect of Potential failure modes rated 9-10 for severity.

Please note: As long as a characteristic is not ultimately confirmed as a Critical Characteristic “CC”, it can be referred to as Potential Critical Characteristic “YC”
(YC = **Y**es - could be **C**ritical).

Significant Characteristics (SC)

are characteristics that may affect:

- Fit, form or function of the product
- Reliability (performance) of the product
- Production process

These Characteristics can originate from different sources e.g., Design FMEA, Technical Safety Concept etc., having a causal relationship to the effect of Potential failure modes rated 8 for severity, or were agreed by the team (e. g. Lessons Learnt), having severity rated less than 8.

Please note: As long as a characteristic is not ultimately confirmed as a Significant Characteristic “SC”, it can be referred to as Potential Significant Characteristic “YS” (**YS** = **Y**es - could be **S**ignificant).

Special Characteristics must be assigned in the "Special Characteristics List” (FMEA tool respectively CForm-0108), Specifications, Drawings, FMEAs, Control Plan, customer documents.

Standard Characteristics
All Characteristics except CC and SC

Robustness,
is the ability of a part or a system to resist changes of its variables or environment.
is the insensitive reaction against specified and abuse handling functions.

Process Capabilities (Cm (Pm), Cmk (Pmk); Pp, Ppk; Cp, Cpk)

See ISO 22514-1 ff.

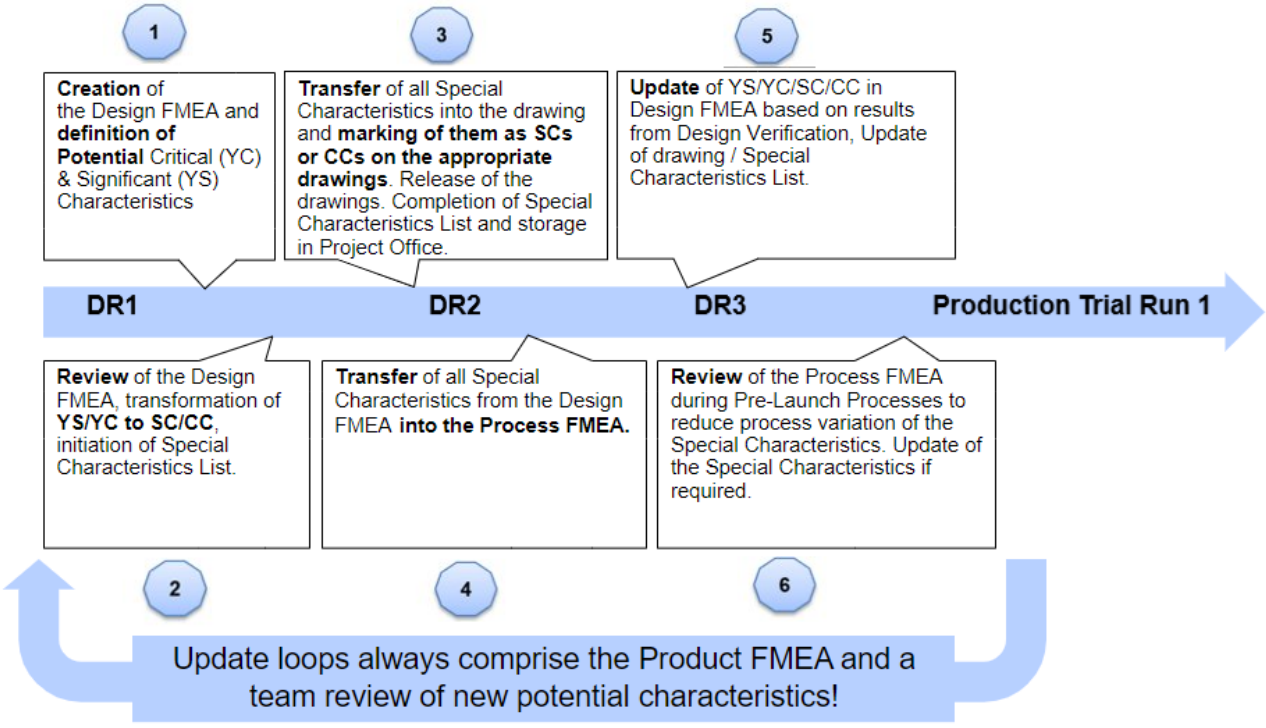
Cm*, Cmk*	machine capability indices
Pp, Ppk,	process performance indices
Cp, Cpk,	process capability indices
* Pm, Pmk (new according to ISO 22514-1)	machine performance indices

"Pass Through" Characteristics

"Pass Through" Characteristics are those Characteristics (Special or Standard) that are produced or manufactured by a Tier 2, which are not controlled, or functionally tested between Tier 2 and OEM and supplied directly to the OEM's or End user (path through).

4. Proceedings and Procedures

4.1 General Steps



4.2 Responsibilities

Product Development

Technical Project Lead is responsible to:

- lead the process and the team to identify the Special Characteristics during the product development process and to incorporate these characteristics into the Design Failure Mode and Effects Analysis (Design FMEA), drawings and Special Characteristics List
- request the project-specific nomination of team members and moderate team meetings

The Developer is responsible to:

- develop robust designs to eliminate the need for Special Characteristics
- define actions to verify Potential Special Characteristics during the design process to eliminate the need for Special Characteristics

The above responsibilities end when the DR3 is rated as green. The “Technical Project Lead” is team member in the project until the end of the project.

Process Development

The Project Quality Engineer is responsible to:

- incorporate the Special Characteristics into the Process Failure Mode and Effects Analysis (Process FMEA) and ensure that they are included in the Control Plan
- develop appropriate controls for Special Characteristics

The Industrial Engineer Assembly is responsible to:

- develop stable and capable processes

Organize the Cross-Functional Team

Identification of Special Characteristics which require additional care involves judgement and experience and shall be done by a Cross-Functional Team and a broad range of experience.
The team members may vary from project to project, but the following team members shall always be involved, they have to be invited according to the topics (as needed basis).

Team members:

- Technical Project Lead,
- Developer,
- Industrial Engineer Assembly,
- Project Quality Engineer.

If needed, additional experts from Purchasing, Supplier Management, Operations, or others have to be involved.

The definition, update and approval of the Special Characteristics takes place within meetings of the Cross-Functional Team.

The initial determinations have to be handled by the team prior to the project milestones.

4.3 Determination of Special Characteristics

Creation of Design FMEA and definition of Potential Critical (YC) & Potential Significant (YS) Characteristics 1

Predetermined (fixed) Special Characteristics:

Special characteristics which are defined by the customer shall be directly marked in the Design FMEA as SC/CC. It has to be defined how the characteristics have to be handled, respectively test or control methods have to be defined.

Definition of Potential Critical (YC) & Potential Significant (YS) Characteristics

The team needs to determine inside of the Design FMEA what is and is not a Potential Critical- and Potential Significant Characteristic, under consideration of the defined criteria.

Following criteria have to be considered, but not limited to Product Safety:

- Customer Requirements
- Homologation and regulation requirements
- Risk (Lessons Learnt, Warranty/Field/0km, Tests, Cost impact)
- **F**it, **F**orm, **F**unction and per**F**ormance (4**F**)

- Feasibility Requirements
- Process capabilities, Subsequence processes
- Operator safety

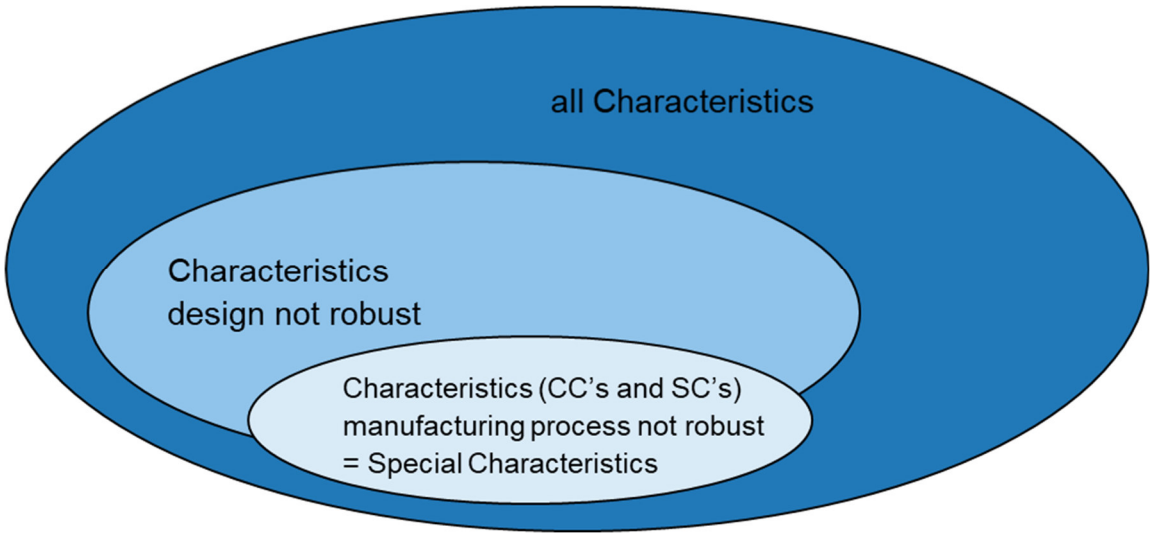
It is important in this stage for the team, to review the Specification and discuss expectations of the assembly/manufacturing facility prior to selecting the items which need additional care.

The chosen Potential Critical and Potential Significant Characteristics have to be marked as YC or YS in Design FMEA-Tool.

Potential Special Characteristics are targets for elimination through robust design practices.

Review of Design FMEA, transformation of YS/YC to SC/CC 2

During this phase, the team focus is on determining whether the design and production process is evaluated as robust.
Selection of SC/CC is based on possible failures and must be refracted down to characteristics.



A YS/YC shall be transformed to an SC/CC if:

- The design is estimated as not fully robust.
- The manufacturing tolerances can be maintained only with considerable effort.
- They are extremely sensitive to manufacturing conditions and/or the slightest changes in material characteristics.

SC/CC have to be documented in the Design FMEA.

The YC- and YS-markings will keep as YC and YS in the Design FMEA, if characteristics were not confirmed as Special Characteristics.

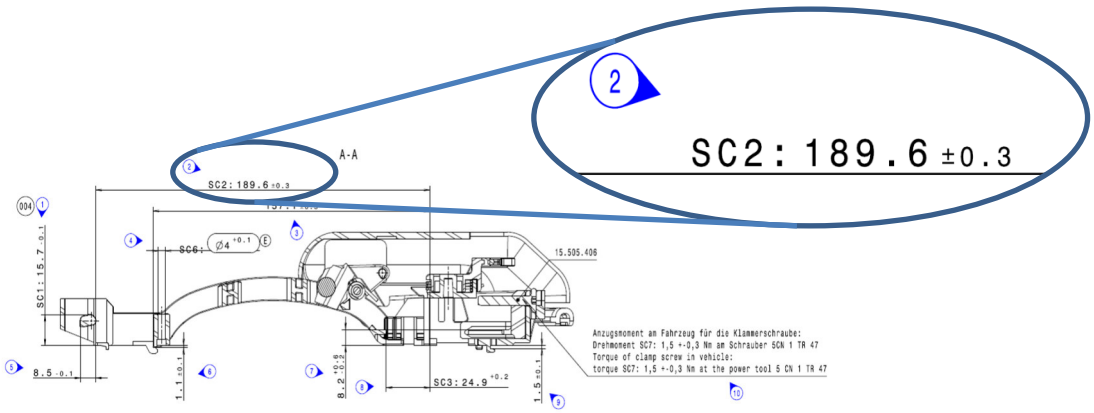
NOTE: The pure requirement to manufacture a characteristic within the specification is not reason enough to define it as a special characteristic.

Transfer of all predetermined and confirmed Special Characteristics into the drawing and marking of them as CC's or SCs on the appropriate drawings. Release of the drawings. Complete Special Characteristics List.

3

NOTE (for functional safety context): If a Technical Safety Concept (TSC) with Special Characteristics exists, the Special Characteristics from the TSC have to be transferred into the Special Characteristics List, to ensure the continuity and the traceability.

Example marked drawing with e. g. SCs (CCs accordingly):



Transfer of all predetermined and confirmed Special Characteristics from the Design FMEA into the Process FMEA, via Special Characteristics List. 4

Milestone 1-4:
Shall be finished before Design Review 2 is conducted.

Update of YS/YC/SC/CC in Design FMEA based on results from Design Verification, Update of drawing. 5

Milestone 5:
Shall be finished before Design Review 3 is conducted

Review of the Process FMEA during Pre-launch processes to reduce process variation of Special Characteristics. 6

The team reviews the Process FMEA and will identify actions that reduce or eliminate risk through robust process practices and characteristics controls.

- **Identification of Process Parameters related to Special Characteristics arising specifically from process operations on the Process FMEA.**

  - Identification of any process parameters in each operation that impact each SC/CC.
  - Determination of the causal relationship to the SC/CC.
  - Process parameter with the strongest causal relationship become control characteristics.

- **Definition of Controls for Special Characteristics and incorporation of them in the Control Plan**

Control of the process parameter around some target value will ensure that variation of the Special Characteristic is maintained or minimized around its nominal target value. Control of a process parameter is generally the most cost effective method of controlling a (Special)

Characteristic. When a process parameter cannot be identified for the Special Characteristic select appropriate controls.
Controls can include Poka Yoke, SPC, sampling with a containment plan (first part approval; first /last part) or 100% inspection (A 100 % inspection shall always be an exception, it usually causes additional process time and costs. It shall be used as a control for not stable/capable processes).

Target values for Performance/Capability indices for CC, SC, and Standard Characteristics*:

	Machine Capability (Machine Performance)		Process Performance		Process Capability	
	Cm (Pm)	**Cmk (Pmk)**	**Pp**	**Ppk**	**Cp**	**Cpk**
CC	≥ 2,00	≥ 1,67	≥ 2,00	≥ 1,67	≥ 1,33	≥ 1,33
SC	≥ 2,00	≥ 1,67	≥ 2,00	≥ 1,67	≥ 1,33	≥ 1,33
Standard	≥ 1,67	≥ 1,67	≥ 1,67	≥ 1,67	≥ 1,33	≥ 1,33

* Customer specific agreements and requirements have to be considered if agreed by Huf.

In case of that the process is not normal distributed, a Six Sigma limit (3,4 ppm) can be used as alternative acceptance criteria, these have to be agreed and determined by cooperation of the team.

In case of a **not adjustable process,** relevant acceptance criteria have to be agreed and determined by cooperation of the team.

In the case of more than one **tool-related dimension** on a part, the verification can be done by selection of one representative dimension (e.g., dimension with the smallest tolerance). The process capability proof has to be done, representative for all other tool-related dimensions on this part, with this selected dimension.

If no dimensions on the drawing are suitable for the capability proof, a measurable dimension can be extracted from the CAD model data to use this dimension for capability proof. The smallest tolerance specified on the drawing, related to the tool direction, shall use as the tolerance for the extracted dimension.

Additional Special Characteristics may be found during the pre-launch process. These characteristics must be identified by the team.
The Steps 1 to 4 have to go through again.

The process to determine Special Characteristics is finally completed if all design/process alternatives are exhausted and necessary associated controls are identified in the Process FMEA and documented in the Control Plan.

Milestone 6:
Shall be finished before Industrial Engineering Process Step "'Accept the Equipment; Production Trial Run 1", to status "All taken actions (Action Priority High and Medium) are finished and closed".

4.4 Supplier Involvement

The Project Buyer is responsible for the introduction and the implementation of the attachment: "Special Characteristics (Guideline for supplier)" if suppliers are involved.
The Project Buyer has to communicate confirmed Special Characteristics by Huf, to the suppliers, to ensure that they are properly addressed, considered, and controlled. The suppliers have to ensure that this information is addressed to their suppliers.

"Pass Through" Characteristics
The Project Quality Engineer identifies the pass-through characteristics. In the communication with the supplier the Project Buyer takes special care of these characteristics, to ensure that they are properly addressed, considered, and controlled, too.

4.5 Documentation

Special Characteristics must be defined and documented in CForm-0108 Special Characteristics List, including a "Customer Conversion Table" to assure compliance to latest customer-specified definitions and symbols. Customer specific agreements and requirements have to be considered if agreed by Huf.

The completed CForm-0108 is stored in Project Office and fundamental part of the Project Handover acc. CForm-0228.

All Special Characteristics must be identified or marked (where presentable) in the relevant documents e.g.:

- FMEAs
- Drawings
- Control Plan
- Inspection Plan
- Work Instructions

Any recordings of CC/SC relevant data or information generated during project phase or in serial production must be archived for a minimum period of 30 years after its creation.

Customer Conversion Table (example)

Customer Symbols				
Company	Symbol	Description	CC	SC
Ford	SC	Significant Characteristic		X
Ford	CC ▽	Critical Characteristic CC is equivalent to the inverted Delta	X	
Ford	HI	High Impact Characteristic		X
Ford	OS	Operator Safety Characteristic		X

Changes of Special Characteristics (Change Management Process)

Changes of Special Characteristics shall be treated with request for change process.
(RfC GD-044).
If Special Characteristics are affected by modifications, a review of the FMEAs, Control Plan, Inspection Plan and Work Instruction has to be done.

5. List of Supporting Documents

(all references that do not refer to other Business Standards and Guidelines (see CP-002))

- CForm-0108 - Special Characteristics List

6. Attachments

- GD-038 Special Characteristics (Guideline for supplier)