



Key Characteristic Designation System Process

1 Introduction

Note: Nothing in this standard supercedes applicable laws and regulations.

Note: In the event of conflict between the English and domestic language, the English language shall take precedence.

1.1 Purpose. This standard defines how General Motors uses the Key Characteristic Designation System (KCDS) to standardize its approach for the identification, documentation and communication of characteristics that require additional care to ensure consistency and compliance to customer requirements and government regulations within GM and its supplier community.

1.1.1 Policy. This standard is intended to ensure a method of application that is clear, uniform and consistent with other standards used at General Motors and its supplier community.

This standard also supports the understanding that:

- All dimensions, specifications, and tolerances displayed on product drawings or Master Process Documents (MPD) are important.
- All part dimensions and specifications must meet requirements and be produced within tolerance.

1.2 Applicability. This standard applies to all General Motors planning, product and process designs, manufacturing and assembly processes.

This standard applies to all Suppliers (internal and external) of products and processes to General Motors that are used in the design, manufacture, assembly, and distribution of GM products.

1.3 Remarks. Variation is inherent in any manufacturing and/or assembly process. Knowledge of the magnitude and consequences of this variation helps Engineers design appropriate products and processes within appropriate parameters that meet or exceed customer requirements. The Key Characteristic Designation System (KCDS) helps the Product Engineer communicate additional product and process requirements to the manufacturing/assembly community.

The Key Characteristic Designation System aids in the economical manufacture of quality products by supporting the control and reduction of variation in the manufacturing/assembly process and by supporting the development of robust designs (e.g., Design for Six Sigma).

2 References

Note: Only the latest approved standards are applicable unless otherwise specified.

2.1 External Standards/Specifications.

None

2.2 GM Standards/Specifications.

GMW3059 GMW15862

2.3 Additional References.

2.3.1 For GM Internal Users of this Standard.

KCDS Web Page. Use this URL to locate KCDS Templates, GM KCDS RASICs, Global KCDS Designation Reference spreadsheets, and additional reference standards.

Non-Fastener KCDS Template: <https://gmweb.gm.com/sites/KCDS/Pages/Home.aspx>

Fastener KCDS Template: <https://gmweb.gm.com/sites/fastening1/Pages/Home.aspx>

For GM Powertrain users, reference the Global Quality Requirements GQR-120.16 and EtQ-114 Global Powertrain KCDS Procedure and Design Standard

2.3.2 Additional Information.

- Automotive Industry Action Group (AIAG) Advanced Product Quality Planning and Control Plan, APQP-2
- AIAG Potential Failure Mode and Effects Analysis
- AIAG Statistical Process Control, SPC-3
- CG4338 Supplier Quality Statement of Requirements 1927-3
- DaimlerChrysler, Ford Motor Company, and General Motors Supplier Quality Requirements Automotive Industry Action Group/American Society for Quality (AIAG/ASQ) reference material obtained through the GM Quality Network or the AIAG at www.aiag.org
- *The Deming Route* by William W. Scherkenbach

3 Requirements

3.1 Planning Stage. During the Planning Stage, parts and/or systems that need to go through the KCDS process are selected based on new unique design or technology, past history and current items listed on KCDS templates.

3.1.1 Multidisciplinary Team. Implementing KCDS within any product program timing requires a multidisciplinary (cross-functional) team approach, including departments and regions.

Appropriate and affected functional areas should be involved in the selection of all parts, part features and/or assemblies requiring Additional Care and their related process control plans for a given part, subsystem, system, of a vehicle or program.

3.1.2 Team Identification. The KCDS Cross-Functional Team includes the full range of activities from Engineering to manufacturing including but not limited to design, supplier development, Quality/Reliability, and supplier communities (internal and external).

Identifying variable characteristics (Key Product Characteristics (KPC) and Product Quality Characteristics (PQC)) and attribute quality characteristics (such as Product Traceability and Confirmation), which require additional care, involves judgment and experience and is best done through a Cross-Functional Team and a broad range of experience.

3.1.3 Team Member Selection. The list of team members is intended to be functional in nature and actual membership or titles of the people could vary widely from group to group. Some members of the team are required on an "as needed basis". As a minimum, the team must include representation from Product Engineering, Quality/Reliability and Manufacturing Engineering/Supplier Quality Engineering.

For example:

- Bill of Material Family Owner (BFO)
- Design Release Engineer/Designing Engineer
- KCDS Engineer/Facilitator
- Supplier Quality Engineer
- Manufacturing Engineer
- Manufacturing/Assembly Representative
- Quality/Reliability Engineer
- Dimensional Management Engineer
- Service Engineer
- Product Safety Representative
- Fastening Engineer
- Software Engineer

3.2 Stage 1 - Additional Care Selection. It is important in this Stage for the team, led by the Design Release Engineer/Designing Engineer, to review Standard Care practices and procedures (Glossary, 5.1.1) and discuss standard care expectations of the assembly/manufacturing facility prior to selecting the items which need additional care.

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Documents

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These specific standard care expectations/instructions/process capability data documentation can fall into the following four (4) categories and are to be documented on the MPD, on the part drawing (with an attribute quality characteristic (AQC) or documentation required (DR) symbol), in the Statement of Requirements (SOR) as defined by CG4338, and control plan:

- Functional Check
- Special Component Handling
- Engineering Standard Work Expectations
- Documentation Required (DR)

Following the review of the standard care expectations, the team reviews the parts and/or systems identified in the planning stage and determine which parts, part features and/or assembly characteristics require additional care in manufacturing/assembly. See Figure B1.

Data and Engineering judgment are required to arrive at the best list with which to begin. Both discussion and trials help establish confidence in choices. Product Engineering may request documentation of process capability data on specified standard product characteristics with a DR symbol.

The goal is to arrive at the critical few, rather than the non-critical many. Select characteristics that promote prevention rather than detection. Communicate the importance of the critical characteristic in a clear and unambiguous fashion.

To ensure a robust design, the work in Stage 1 should be reiterated periodically throughout the entire process to reduce the need for long term/continuous additional care. See Appendix A for information on how to identify special characteristics.

3.2.1 Variable Characteristic Criteria. A KPC or PQC or DR is traceable back to the design/performance requirements.

Other selection criteria are:

- Part tolerance around a target dimension and/or other variables that affect final build quality (e.g., tolerance on hole size, form, orientation, location (Regardless of Feature Size (RFS)), part length tolerance).
- Measurable and controllable.
- Released in global product description system (GPDS) and/or on the part drawing.

If a final build characteristic, (e.g., clearance, compression ratio, transmission smoothness, leak rate, product performance specification), is selected, focus must be placed on the individual parts and their contribution to the overall variation. Templates (for Vehicle) and Bill of Design (BOD) – (for Powertrain) are available/linked from the GM Global KCDS web site. (KCDS Web Page, 2.3.1)

Note: A variable characteristic should not be designated a Key Product Characteristic or Product Quality Characteristic (PQC) just because it is important that the specification be met, since all specifications must be met.

3.2.1.1 Key Product Characteristic Criteria. Selection should be based on or indicated by a loss function or other method to identify a customer based target.

3.2.1.2 Product Quality Characteristic Criteria. Selection should be based on or indicated by a loss function or other method to identify a customer based tolerance.

3.2.2 Attribute Quality Characteristic Criteria. Attribute characteristics that are listed on KCDS templates apply to all parts of the same functional name, unless otherwise specified on the template. New designs and their new parts/assemblies not listed should be reviewed for error proofing of the critical attributes.

When designating an attribute that requires additional care, an attribute control method (which insures 100% compliance) shall be used. This method should only be used where the costs are offset by reductions in the risks and costs of product problems, including costs of detection and remedy. Data, which may be obtained from design failure mode and effects analysis (DFMEA), design review based on failure mode (DRBFM), process failure mode and effects analysis (PFMEA), customer returns or warranty claims, should be available to support this request.

Attribute characteristics are selected by the type of attribute, and may fall into the following categories as defined above and are released into global product description system (GPDS), MPD and/or on the part drawing (with a KCDS symbol):

- Confirmation

- a. Verification
- b. Secondary Assembly Function
- c. Compliance
- Product Traceability

3.3 Stage 2 - Controls and Process Selection. In this stage, the Team, led by the Manufacturing Engineer, determines the controls and/or process requirements for all parts/part features and/or assemblies requiring additional care. They also own the development of the process control plans used to document the control or reduction of KPC/PQC variation with a key control characteristics (KCC). See Figure B2.

3.3.1 Key Control Characteristic Criteria. Many factors can affect the relationship between a KPC and/or a PQC and its KCC. Examples are changes in material, equipment, and the methods and systems that are used to make a product.

Ongoing control of the KPC/PQC is required and documented on a Process Control Plan. Once KCCs are defined and process control is in place, product checks for the KPC/PQC should be reduced to a product or process verification/validation level.

A method for adjusting the KCC to set the KPC/PQC to its nominal value is required.

3.3.2 Key Control Characteristic Identification Guidelines.

3.3.2.1 It is directly traceable to a KPC/PQC.

3.3.2.2 There is a strong causal relationship to the KPC/PQC.

3.3.2.3 It is particularly significant in ensuring a KPC/PQC achieves its target value.

3.3.2.4 It is not (usually) specified on product drawings or product documentation.

3.3.2.5 Is documented on a Process Control Plan.

The tests apply to characteristics that are measured by either variable or attribute data.

3.3.3 Key Control Characteristic Methodology. Identify the operations that impact each KPC/PQC with a flowchart of the process.

- Identify any process parameters in each operation that impact each KPC/PQC. A Fishbone (Cause and Effect) Diagram is a useful tool for this.
- Determine the causal relationship to the characteristics.
- Process characteristics with the strongest causal relationship become control characteristics.
- Record the information on a process control plan.

3.3.4 Attribute Characteristic Methodology. Controls for attribute characteristics, which have been identified as needing additional care, require 100% conformance to requirements and therefore error proofing is the best method.

3.4 Stage 3 - Required Actions. In this stage, controls of the parts requiring additional care are implemented into the manufacturing/assembly process to ensure product conformance. Controls on the KCC are implemented to ensure that variation is controlled or reduced.

3.4.1 Key Product Characteristic. The manufacturing/assembly plant must control the target nominal for each KPC. Controls shall include: statistical process control (SPC), process control plans, quality procedures or 100% variable inspection. Continuous improvement is required up to Cpk 2.0 (6 sigma).

3.4.2 Product Quality Characteristic. The manufacturing/assembly plant must maintain the tolerance for each PQC through appropriate process control plans and quality procedures.

3.4.3 Documentation Required. The manufacturing/assembly plant must maintain the tolerance for each DR through appropriate process control plans and quality procedures.

3.4.4 Attribute Quality Characteristic. The following two designations fall under AQC.

3.4.4.1 Confirmation. The manufacturing/assembly plant must ensure that all attribute characteristics designated with a Confirmation minimally have 100% check for conformance to requirements, and other specific additional tasks as described by Product Engineering and shown designation on the MPD or part drawings. This could include 100% secondary check. Three types of Confirmation are: Verification, Secondary Assembly Function, and Compliance.

3.4.4.2 Product Traceability. The manufacturing/assembly plant must ensure that all parts designated for traceability must be documented/tracked to the supplier's lot number, date of manufacture, and Vehicle

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