GM WORLDWIDE ENGINEERING STANDARDS	General Specification	GMW15758

ADV Process Development and Validation Terminology

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. The General Motors Analysis Development Validation (ADV) Process is the process of planning and executing the standard work required to develop, validate and certify that a component, subsystem, system and/or vehicle meets its technical requirements (Component Technical Specifications (CTS), Subsystem Technical Specifications (SSTS), Vehicle Technical Specifications (VTS)).

This specification documents the ADV Process development and validation terminology.

1.2 Applicability. This terminology applies to all component, subsystem, system and vehicle (CTS, SSTS, VTS) development and validation conducted by General Motors and/or its Suppliers worldwide.

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 GMW15760

2.3 Additional References.

- Component Technical Specifications (CTS)
- Current versions of Automotive Industry Action Group (AIAG) documents can be obtained by calling 01 (248) 358-3003. If documents cannot be obtained via the above telephone number, contact the Buyer or the Buyer's Lead Engineer.
- GM3660 Final Validation Sign-off (available at www.gmsupplypower.com)
- Subsystem Technical Specifications (SSTS)
- Vehicle Technical Specifications (VTS)

3 Requirements. Global ADV Process Definitions.

3.1 General Development and Validation Terminology.

3.1.1 Development and Validation – Formal Definitions. The two fundamental terms used in the Analysis Development and Validation (ADV) Process are development and validation.

- **Development:** The structured process of comparing, modifying, selecting, and optimizing, through analyses, demonstrations, inspections, and/or physical tests, to meet a requirement.
- **Validation:** The formal process of confirming, through analyses, demonstrations, inspections, and/or physical tests, that a requirement is met.

3.1.1.1 These two definitions are function-based rather than organization-based. Both focus on the same product technical requirement. Both use the same methods: analyses, demonstrations, inspections, and tests.

© Copyright 2017 General Motors Company All Rights Reserved

Documents Document Sharing Hub

Copyright General Motors Company
Provided by IHS Markit under license with General Motors Company
Reproduction, distribution or publication of these standards is expressly prohib
Licensee=/, User=,
Not for Resale,
Full document details: GMW GMW15758 2017

3.1.1.2 Validation is a formal process, whereas development is less formal. During development, the intent is to understand the limits of the design and to evolve the design. Development anticipates that technical requirements will not be met and continues until it is believed that technical requirements are met. Validation is a confirmation process. Validation anticipates that technical requirements have been met. A technical requirement is validated when the requirement is met. Neither definition identifies what is being developed or validated.

- **Feature Validation**: Feature Validation is defined as the comprehensive set of activities which confirm that the vehicle program meets the feature based requirements as defined by the Feature Technical Specification (FTS). Feature Validation focuses on functional behavior and performance from a customer perspective.
- **System Validation**: System Validation is defined as the comprehensive set of activities which confirm that all requirements as defined in the System Technical Specification (STS) are met. System Validation allows for the validation of individual systems without having all of the systems complete, functional, and integrated.
- **Subsystem Validation**: Subsystem Validation is defined as the comprehensive set of activities which confirm that all requirements as defined in the Subsystem Technical Specification (SSTS) are met. Subsystem validation focuses on interfaces between groups of integrated components.
- **Component Validation**: Component Validation is defined as the comprehensive set of activities which confirm that all requirements as defined in the Component Technical Specification (CTS) are met.

The validation process only confirms that the functional and performance requirements within the technical specification are met (e.g., Noise and Vibration, Safety, Reliability/Durability, Corrosion, Functional Operation, etc.) It does not confirm the technical specification in its entirety.

3.1.2 Development and Validation Methods.

3.1.2.1 Formal Method Definitions.

- **Analysis:**
  1. A calculation of the product or manufacturing system/process performance under specified conditions using mathematical representations (e.g., mathematical models, simulations, algorithms, equations), in accordance with a procedure, and documenting the results.
  2. The generation of conclusions through the examination of data.
- **Demonstration:** Exercising the product or manufacturing process under specified conditions, in accordance with a procedure, and documenting the results.
- **Inspection:** Examination of the product or manufacturing process under specified conditions, in accordance with a procedure, and documenting the specified physical characteristics.
- **Test:** Exercising the product or manufacturing process, under specified conditions, in accordance with a procedure, collecting quantitative data via instrumentation, and documenting the results.

3.1.2.2 General Discussion.

3.1.2.2.1 Development and validation methods are applied individually or in combination. For example, analysis can complement testing and increase confidence that a design, which meets its drawing specification, will always meet its technical requirements.

3.1.2.2.2 The term "test" commonly refers to both demonstrations and tests. However, the difference is significant. During a test, the part, component, subsystem, or vehicle is instrumented and data is collected, whereas, a demonstration involves no instrumentation. Most Durability Road Schedules are demonstrations rather than tests.

3.1.2.2.3 The second analysis method (reference paragraph 3.1.2.1) "the generation of conclusions through the examination of data" commonly means "engineering judgment". The use of engineering judgment for validation must be based upon sound engineering principles. This involves the review of existing data and information. Re-use of an existing engineering solution is a situation where engineering judgment may be the appropriate method for validation.

3.2 Validation Type Definitions. Two distinct types of validation are defined.

- Design Validation (DV)
- Product Validation (PV)

© Copyright 2017 General Motors Company All Rights Reserved

Documents
Document Sharing Hub

Copyright General Motors Company
Provided by IHS Markit under license with General Motors Company
Reproduction, distribution or publication of these standards is expressly prohib
Licensee=/, User=,
Not for Resale,
Full document details: GMW GMW15758 2017

3.2.1 Design Validation (DV). The purpose of Design Validation it is to confirm that the design meets its technical requirements as designed. This can be done using either prototype or production tools.

3.2.1.1 Formal Definition. Design Validation is the process of confirming through analyses, demonstrations, inspections and/or physical tests that the product design meets its technical requirements (as specified in CTS, SSTS, VTS) **without** including the effects of manufacturing variation.

3.2.1.2 Discussion. Historically, Design Validation has been a confirmation that the "nominal design" meets its technical requirements. However, the true intent is to confirm that design, including the variation inherent in the product design (design tolerances, material variation within the material specification, etc.,) meets its technical requirements. This shall be the goal whenever the analytical capability exists and/or it is feasible to build a set of test properties that capture the relevant variation.

3.2.1.2.1 Design Validation is required for every performance, functional and regulatory requirement (including reliability and durability).

3.2.1.2.2 Whenever possible, analysis should be used as the method for Design Validation. Analysis enables the assessment of variation on the ability of a product design to meet its technical requirements. This includes material variation (with specification), tolerances and tolerance stack-ups, interface variation, input variation, etc.

3.2.1.2.3 When "test" properties are used for Design Validation, the properties that conform to the design record must be used. Dimensions and materials must be within specification and the part must conform to all of the other "built to" specifications. When parts do not meet the design record, they must be approved for testing with a clear understanding of the performance impact.

3.2.1.2.4 Whenever feasible, multiple samples should be used for Design Validation executed using test, demonstration, or inspection methods.

3.2.1.2.5 If a product design is modified after Design Validation is complete and/or the ambient environment changes, then the design shall be re-validated to the impacted technical requirements. A Design Review Based on Failure Modes (DRBFM) should be completed to understand the impact of the change.

3.2.2 Product Validation (PV). The purpose of Product Validation is to ensure that the product as produced by the serial production manufacturing/assembly processes will meet its technical requirements. That is, the further addition of manufacturing/assembly variation at line rate on the home-line does not generate performance/durability issues.

3.2.2.1 Formal Definition. Product Validation is the process of confirming through analyses, demonstrations, inspections and/or physical tests that the product meets its technical requirements (as specified in CTS, SSTS) when **including** the effects of manufacturing variation; that is the manufacturing variation resulting from the actual process capability. The parts used for physical testing shall be produced off the production tools in the home-line location(s) where home-line is defined as final location(s) for the production tools to support serial production. Product Validation should be done on each Data Universal Numbering System (DUNS) code contracted to make the component/subsystem.

For hardware produced from production tools at the home-line location(s) and equipment is used, then GMW15760 "Multi-Variable Sample Selection Procedure" must be used to select the samples. **Note:** GM Powertrain may employ other sampling strategies as alternatives to GMW15760.

3.2.2.2 Discussion. Product Validation is applicable to validation of component and subsystem technical requirements, but not vehicle technical requirements.

3.2.2.2.1 A change in design, manufacturing/assembly process or supplier always requires a thorough assessment of the amount of PV. The scope of PV Testing is driven by the level of change to design or process. A list of thought starters, to assist in determining if PV is required, is included in Appendix A.

3.2.2.2.2 Product Validation and Process Capability. The process capability of a manufacturing/assembly system is its ability to consistently produce a product (e.g., part, component) that meets the "build to" specifications. The goal of Product Validation is not to assess and confirm process capability; however, it is highly coupled with uncertainty about the manufacturing/assembly process capability.

3.2.2.2.3 Details.

3.2.2.2.3.1 Whenever possible, analysis should be used as the method for Product Validation. For example, it should be used whenever the manufacturing capability is known, and the influence of manufacturing variation on performance to a technical requirement can be modeled.

© Copyright 2017 General Motors Company All Rights Reserved

Documents
Document Sharing Hub

Copyright General Motors Company
Provided by IHS Markit under license with General Motors Company
Reproduction, distribution or publication of these standards is expressly prohib
Licensee=/, User=,
Not for Resale,
Full document details: GMW GMW15758 2017