



**WORLDWIDE
ENGINEERING
STANDARDS**

General Specification

GMW15745

GM Dimensional Engineering Supplier Minimum Requirements

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. GM requires its production/design suppliers to adopt GM's commitment to quality and expects the suppliers to conform to GM processes, policies and procedures. This portion of the Statement of Requirements (SOR) describes the minimum dimensional requirements/tasks that the awarded supplier is expected to perform.

1.2 Applicability. GM requires its production suppliers to adopt GM's philosophy of total commitment to quality and expects the supplier to meet or exceed the standard of 100% conformance to GM processes, policies, and procedures.

1.3 Remarks. Support for dimensional engineering deliverables. The GM Dimensional Engineering team member assigned to this SOR is listed on the GM Buyer's Contact list. The GM Dimensional Engineering team member will:

1.3.1 Assist supplier(s) in understanding and implementing GM's Dimensional Engineering processes, policies, and procedures.

1.3.2 Review dimensional engineering deliverables as required and defined in Section 4.

1.3.3 Review the GM Dimensional Engineering Plan incorporated in the Geometric Dimensioning and Tolerancing drawings (GD&T).

1.3.4 Attend/participate in technical reviews conducted by Advance Purchasing to obligate the potential suppliers to the GMW15745 requirement.

1.3.5 Manufacturing responsible supplier must review and optimize component level GM Dimensional Engineering deliverables compared to supplier's manufacturing processes and provide feedback to the design responsible supplier and dimensional engineer in support of meeting purchased assembly requirements.

1.3.6 For cases when GM has design responsibility for the system, subsystem, or component parts within the supplier integrator's commodity, the supplier integrator, with vehicle level integration, shall perform the role of the GM Dimensional Engineering team member by completing all dimensional tasks identified in this SOR for any GM designed parts within the supplier integrator's commodity. This includes all dimensional activities throughout the course of the vehicle program.

1.3.7 In the event of conflicting requirements between the main SOR and GMW15745, Appendix B of the SOR takes precedence.

2 References

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

2.1 External Standards/Specifications.

ASME Y14.5M

2.2 GM Standards/Specifications.

GMW3059

GMW16812

2.3 Additional References.

- Continuous Improvement Procedure (GM GP-8) (GM1747).
- Critical Parts List.
- Dimensional Technical Specification.
- Dimensional Technical Specification (DTS) Inventory Workbook.
- E² Work Order.
- Early Production Containment (GM GP-12).
- Global Design infoBOOK.
- Global Dimensional Information System (GDIS) Supplier Data Submission Requirements and Referencing the slides titled "Feature Label", found in GM SupplyPower.
- Global Dimensional Information System (GDIS) Supplier Data Submission Requirements and Locating slide titled "General File Naming Conventions", found in GM SupplyPower.
- Global GD&T Drawing Format Requirements.
- Global Part Submission Procedure for Matching (GM10067).
- Global Supplier Quality Manual (GM1927).
- GM 5-Phase process.
- GM Buyer's Contact List.
- GM Competitive Best of Best (CBoB) DTS targets.
- GM Dimensional Engineering Plan
- GM Procedure for Suppliers of Material for Pre-Prototype and Prototype: GM GP-11 (GM1820).
- GM SupplyPower PowerPoint Presentation: "How to Request Access to Covisint SupplyPower Dimensional Planning and Validation (DPV) Portal.pptx".
- GM SupplyPower PowerPoint Presentation: "How to Upload Supplier Data to GDIS-DPV Using Covisint.pptx".
- Statement of Requirements (SOR), Appendix B and Appendix F7.
- Subsystem Technical Specifications (SSTS).
- Supplier Quality Processes and Management (GM GP-5).
- Vehicle Technical Specifications (VTS).

3 Requirements

3.1 System/Subsystem/Component/Part Definition. Not applicable.

3.2 Product Characteristics.

3.2.1 Performance Requirements.

3.2.1.1 GM Dimensional Engineering Plan. The supplier shall develop a Dimensional Engineering Plan approved by the GM Dimensional Engineering team member that describes how they will meet the technical specification requirements. The Dimensional Engineering Plan provides an overview of how the engineering tasks are going to be accomplished answering the questions of who, what, when, where, and how. The Dimensional Engineering Plan shall consist of the following minimum requirements:

- Task Timing Schedule, (chart) which identifies all tasks to be accomplished and shall show the start and completion time for each task with respect to the program(s) timing milestones.
- Frequency for conducting engineering technical reviews.
- Describe the tools and processes recommended or necessary to meet the requirements of this SOR.
- Will define which build strategies will require formal documentation.
- Will identify the measurement system strategy specifying the measurement equipment required to collect variable and/or attribute data.

- Data submission requirements.

3.2.1.2 Definition of all open issues such as unbalanced Technical Specifications (TS), build strategies without consensus, etc., with an identified required completion date and responsible individuals (this is sometimes referred to as an action plan). Action plans are required to be reported out to program management on an as needed basis. Suppliers shall initiate and conduct problem identification and resolution through the GM 5-Phase process following the steps of identify, analyze, plan, implement, and evaluate.

3.2.1.3 The supplier shall review the Dimensional Engineering Plan with the GM Dimensional and Supplier Quality Engineering team member within the first 2 months of being awarded the contract.

3.2.1.4 The assembly responsible supplier is responsible for the assembly process, which includes any features they control within their process. These suppliers are required to provide data on those features and required to provide supporting documentation at the Advance Purchasing technical reviews.

3.2.1.5 The GM Dimensional Engineering team member shall buyoff on the frequency, and Global Vehicle Development Process (GVDP) and milestones, for conducting GM Dimensional Engineering Plan reviews. This includes reviewing all analysis and/or single parts/part of assembly build strategies, technical specifications, product drawing(s) and measurement point information, when required by the GM Dimensional Engineering team member and documented in the GM Dimensional Engineering Plan. Any problems discovered during the review shall be resolved prior to the next review. If problems are not resolved, Problem Reporting and Resolution (PRR) documents may be created to facilitate communication to GM (see GP-5 Procedure).

3.2.1.6 Problems discovered in achieving requirements of this SOR will be documented using the Problem Resolution Tracking System Plus (PRTS+).

3.2.2 Technical Specification.

3.2.2.1 The GM Dimensional Engineering team member shall provide the vehicle level supplier integrator or design responsible supplier with copies of the initial Dimensional Technical Specification (DTS) list and the current GM Competitive Best of Best (CBoB) DTS targets. The GM Dimensional Engineering team member or the vehicle level supplier integrator's dimensional engineer shall provide the supplier with copies of the initial technical specification list. The technical specification commonly referred to as DTS, Vehicle Technical Specifications (VTS), and Subsystem Technical Specifications (SSTS), describes in engineering metrics, the agreed upon nominal and the allowable build variation tolerance limits required for a vehicle to meet or exceed GM requirements for fit and/or function. The supplier is responsible to identify technical specification for all other fit and/or functional conditions.

3.2.2.2 The design responsible supplier shall facilitate program buy-in to technical specification values, balancing these requirements with support of alternate build strategies referencing 3.2.3 and 3.2.4.

3.2.2.3 Suppliers with vehicle level integration responsibilities shall:

3.2.2.3.1 Perform the GM Dimensional Engineering team member role.

3.2.2.3.2 Work with the design studio to optimize clays and develop leading strategies to meet or exceed world class specifications where required, based on commodity.

3.2.2.3.3 Maintain/develop DTS using GM CBoB DTS targets.

3.2.2.3.4 Work with all suppliers within the supplier integrator's commodity and interfacing commodity's suppliers to balance technical specification requirements.

3.2.2.3.5 Place technical specification nominal onto Criteria Sections (CS)/Design Execution Sections (DES) typical sections as required.

3.2.2.3.6 Maintain the technical specifications inventory list and CS/DES typical sections, when changes to the technical specifications occur.

3.2.2.3.7 Develop and maintain a DTS inventory list for a condensed DTS for the portion of the vehicle, which the supplier integrator is responsible. The DTS pictorial shows the technical specification requirement (superceding the earlier CS/DES typical sections).

3.2.2.3.8 Develop and maintain predicted variation status to DTS in pictorial format or any format as directed by the GM Dimensional Engineering team member.

3.2.2.3.9 Assist in the development of the risk assessment contained in the DTS Inventory Workbook report. The risk assessment report consists of the predicted variation status to GM CBoB DTS targets, program DTS,

and benchmarking status to identified competitor DTS capability. The risk assessment report will be in a pictorial or other format.

3.2.2.3.10 Validate vehicle level technical specification requirements in production vehicles.

3.2.2.3.11 Assist in the development of the status to competitive vehicles report contained in the DTS Inventory Workbook. This report consists of the program targets compared to the CBoB targets, identifying the program targets at risk and any action plans required to meet the CBoB targets.

3.2.3 Build Strategy.

3.2.3.1 Build strategies describe product and process enablers that guide how vehicle, major subsystems, assemblies, subassemblies, and/or parts will be designed and assembled. In essence, the build strategy defines how to design and assemble the vehicle to absorb, control, and hide, dimensional variation to ensure the product meets the technical specifications (along with other product and manufacturing requirements), and the parts and assemblies load into the vehicle.

3.2.3.2 When the Global Bill of Process (GBOP) is followed, the Common Datum Locating Strategy (CDLS) or build strategy, shall be used. The CDLS will define the datum configurations for locating parts and assemblies. The datum locating configurations may include: Hole/Hole, Hole/Slot, Hole/Surface, Slot/Surface, Surface/Surface, etc.

3.2.3.3 If the GBOP is not used, multiple build strategies should be explored and analyzed to assist in choosing the most effective build strategy to meet technical specification requirements.

3.2.3.4 The design responsible supplier shall:

3.2.3.4.1 Develop build strategy(s), and review them at the GM Dimensional Engineering Plan reviews. The GM Dimensional Engineering Plan will define which build strategies will require formal documentation, and which do not require documentation (other than the execution of the design). Build strategies do not have to be in a GM format.

3.2.3.4.2 Ensure the mating systems will not conflict meeting the technical specifications.

3.2.3.4.3 Ensure that purchased assemblies load into the vehicle, and will not conflict with later sequenced assembly's ability to load.

3.2.3.4.4 Provide a copy of the build strategies/requirements for their part to other suppliers for their part design.

3.2.4 Dimensional Analysis. Dimensional Analysis is used to predict whether or not the technical specifications can be met by allocated tolerances for parts/assemblies and the assembly process. Dimensional Analysis must be performed using statistical tolerance techniques, i.e., one (1) dimensional Root Sum Square (RSS), or Three Dimensional Control System (3DCS) or Variation Simulation Analysis (VSA). Supplier must use Dimensional Analysis to develop product tolerance capability and balance it with given dimensional requirements.

3.2.4.1 The design responsible supplier shall:

3.2.4.1.1 Perform dimensional analysis for all technical specifications involving two (2) or more parts within their system.

3.2.4.1.2 Develop an action plan in all cases where the dimensional analysis does not support meeting the technical specifications.

3.2.4.1.3 The GM Dimensional Engineering team member and/or the supplier integrator's dimensional engineer, reserve the option to review all dimensional analysis and/or a summary of the analysis, i.e., summary should identify part, tolerance description, tolerance, and percent (%) contribution with resultant prediction, and percent out-of-specification. GM reserves the right to use developed models.

3.2.4.2 For programs with vehicle level integration, the supplier integrator shall:

3.2.4.2.1 Collect the part and process variation information and perform design/technical specification related analysis when analysis in question spans multiple design responsible suppliers. The owning integrator for a specific DTS is responsible for the compilation for the overall analysis.

3.2.4.2.2 Perform the role of the GM Dimensional Engineering team member by completing the GM Dimensional Engineering tasks that are identified in 3.2.1.1 through 3.4.2 for GM designed parts within the supplier integrator's commodity.

3.2.4.2.3 Support assessing the risk assessment for meeting DTS requirements.

3.2.5 GD&T data sets/drawings and measurement point information.

3.2.5.1 GD&T data sets/drawings shall meet ASME Y14.5M and GM GD&T addendum (GMW16812).

3.2.5.2 The design responsible supplier shall:

3.2.5.2.1 Coordinate and create GD&T to the build strategy. Parts must be gauged to functionally represent the vehicle assembly build process.

3.2.5.2.2 Provide input to the Master Datum Model (MDM) as required (datum coordination and location strategy).

3.2.5.2.3 Identify Key Characteristic Designation System (KCDS) and document them on the GD&T release.

3.2.5.2.4 Document assembly level GD&T for assemblies as shipped to GM.

3.2.5.2.5 Complete GD&T for detail parts to support all parts shipped to early build events as stated in the GVDP. The GM Dimensional Engineering team member and/or the supplier integrator's dimensional engineer reserve the option to review all GD&T measurement point information, prior to release into the GM system.

3.2.5.2.6 The supplier integrator shall facilitate buy-in for defining which single parts/part of assembly components requires GD&T releases.

3.2.5.2.7 The manufacturing responsible supplier shall coordinate datums (including single parts/part of assembly components), tolerances, and measurement points in the assembly and part tools, develop process plans showing clamping and welding sequence, and are required to provide supporting documentation at the GM Dimensional Engineering Plan reviews.

3.2.5.2.8 Programs with vehicle level supplier integration, the supplier integrator shall perform the role of GM Dimensional Engineering. The supplier integrator's dimensional engineer shall release and maintain the GD&T and releases in accordance to all GM standards.

3.2.6 Measurement Point Deliverables. The Measurement Point information identifies all Product Quality Characteristics (PQC), Key Product Characteristics (KPC), and other measurement points to be measured for purchased parts/assemblies in order to meet vehicle level fit and/or functional requirements.

For critical parts, the GM engineer is responsible to provide the measurement point file that represents the minimum number of features required to define part quality. Measurement points and naming conventions are included in the initial file. Suppliers will then be responsible to document and maintain changes to the initial Measurement Points. Revisions to the initial Measurement Points must conform to GM Feature Label Global Naming convention, and be communicated back to the GM engineer.

3.2.6.1 The GM Dimensional Engineering team member (or integrator), shall obtain from the GM Dimensional Engineering representative, the program specific:

3.2.6.1.1 Finished Vehicle Measurement Location (FVML) file (spreadsheet and graphic showing interfaces) available at Verified Data Release (VDR).

3.2.6.1.2 KCDS critical parts list available at Design Sign Off (DSO) plus six (6) weeks.

3.2.6.1.3 Inputs/results from quality tools (i.e., Design Failure Mode and Effects Analysis/Design for Manufacturing (DFMEA/DFM), etc.)

3.2.6.1.4 Work with the GM Dimensional Engineering team member to coordinate measurement points within and between commodities.

3.2.6.1.5 Coordinate and communicate measurement point locations with the manufacturing responsible supplier of interfacing commodities to ensure that all critical points are identified.

3.2.6.2 The manufacturing responsible supplier and/or gage supplier shall:

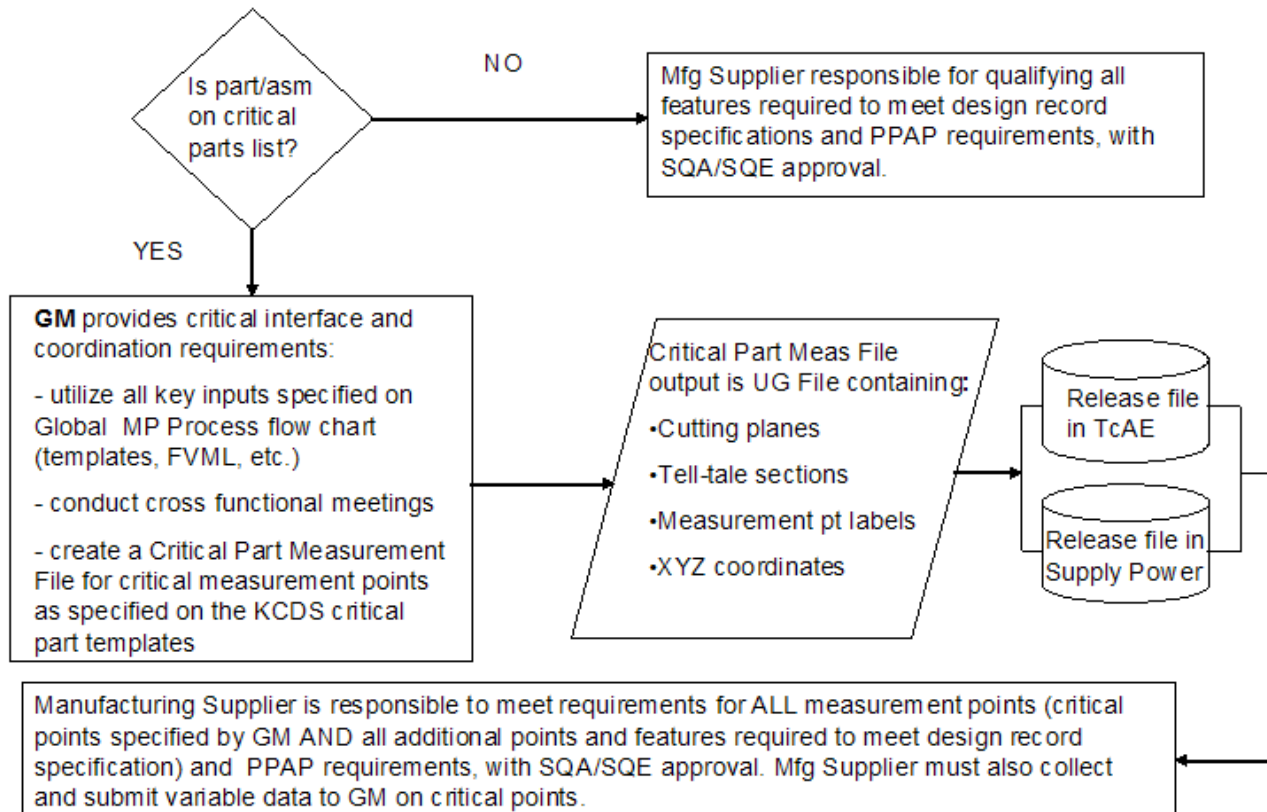
3.2.6.2.1 Reference SOR Appendix F7 for any program specific GD&T and measurement information.

3.2.6.2.2 Contact the GM Dimensional Engineering team member or integrator dimensional engineer to ensure that all required measurement points are defined.

3.2.6.2.3 Coordinate measurement points within shipped assemblies.

3.2.6.2.4 Follow the global measurement point development process for purchased parts/assembly as identified in Figure 1.

Figure 1: Global Measurement Point Development Process for Purchased Parts/Assemblies



Note: Asm = Assembly, FVML = Finished Vehicle Measurement Location, KCDS = Key Characteristic Designation System, Meas = Measurement, Mfg = Manufacturing, MP = Measurement Point, PPAP = Production Part Approval Process, PT = Point, SQA = Supplier Quality Assurance, SQE = Supplier Quality Engineer, TcAE = Teamcenter Automotive Edition, UG = Unigraphics.

3.2.6.2.5 Maintain points to latest released part level.

3.2.6.2.6 Utilize the "GM Gap and Flush Modeling Rules" (as defined in the Global Design infoBook) to develop the x, y, z point coordinates and i, j, k vector coordinates for all measurement points to be included in their control plans.

3.2.6.2.7 Create a measurement plan for parts and assemblies on the Critical Parts List that:

3.2.6.2.7.1 Ensures critical part measurement file requirements (cutting planes with tell-tale sections) (vectors attributed with x, y, z and i, j, k coordinates and measurement point label) provided via GM's FVML document and incorporated in their overall measurement plan. This plan includes critical points and all other points and features required to meet design record specifications.

3.2.6.2.7.2 Parts and assemblies designated by GM as "critical" may require electronic data flow. Reference Section 4 and all of Appendix A in this document for requirements of the supplier to submit the data electronically to GM.

3.2.6.2.7.3 Create a measurement plan for parts and assemblies not on the Critical Parts List that includes all points and features required to meet design record specifications. The measurement point set will include points identified by the integrator and any other points deemed necessary by the manufacturing supplier and/or GM engineering to validate the part. Electronic measurement data representing the applicable release level per build event compatible with GM data systems must be available upon request.

3.2.7 Physical Characteristics. Not applicable.

3.2.8 Dependability. Not applicable.

3.2.9 Serviceability. Not applicable.