

**Global Statement of Requirements**

**Appendix G4:**

CAE Tasks & Deliverables

**For**

**Cam Shaft Assembly Housing**

**4/12/2024**

**Version: 1.0**

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Contents

[1 Introduction 2](#_Toc163813435)

[2 CAE Kick Off, Analysis Plan and Meetings 2](#_Toc163813436)

[3 Deliverables 2](#_Toc163813437)

[3.1 CAD Data and Physical Property 3](#_Toc163813438)

[3.1.1 Delivery Method 3](#_Toc163813439)

[3.2 Analysis 4](#_Toc163813440)

[4 CAE Sign Off 4](#_Toc163813441)

[5 Data Archive 4](#_Toc163813442)

[6 Acronyms 4](#_Toc163813443)

[7 Revision Log 5](#_Toc163813444)

# Introduction

This document establishes the Computer Aided Engineering (CAE) requirements for supplier, on the Cam Shaft Assembly Housing. It details CAE portion of the Analysis/Development/Validation (ADV) Process Tasks and Deliverables. Refer to Appendix G for ADV process and additional requirements.

# *CAE Kick Off, Analysis Plan and Meetings*

Supplier shall also present its CAE capability and capacity in a technical review, prior to supplier selection, to demonstrate sufficient simulation support capacity.

CAE kick-off meeting is expected to take place within 2 weeks after supplier selection, to be coordinated with the part DRE. Supplier CAE should contact GM propulsion program CAE single point contact (SPC) named on the cover page, DE/DRE who initiated the eSOR and Validation engineer to set up a kick-off meeting. DE/DRE and Validation engineer attendance are mandatory for this meeting.

Supplier initial CAE plan shall cover all CAE deliverables in section 3, and supplier shall present it in the kick-off meeting. Other kick-off meeting agenda items may include, but not limited to:

Supplier historical data on analysis correlation with test

* GM criteria for supplier modeling capability assessment
* GM relevant modeling guidelines and quality checklist
* GM update on required physical data defined in section 3.1.1

Supplier shall name a person who is responsible for all simulation activities (Supplier CAE SPC). After discussing with GM CAE and making required plan revisions, supplier CAE shall present the final plan to GM CAE, within 4 weeks after supplier selection.

Supplier shall participate in virtual reviews, when requested by the GM CAE SPC. Supplier shall also participate in status reviews and technical reviews requested by the GM CAE SPC.

# *Deliverables*

Supplier shall provide GM CAE single point contact all required models, inputs, and CAD Data specified in Section 3 to support program timing and PPDR events. Timing of PPDR’s are detailed in Appendix B. These data are required to support GM propulsion or system level modeling and analysis activities. Figure 1 shows the required delivery timing to support the PPDR process. CAE deliverables timing of tier 2 directed buy suppliers, shall support tier 1 supplier timing. Deviations to the required submission dates must be approved by the GM CAE single point contact.

Figure 1: Supplier Analysis Timing & Input Requirements

PPDR

CTR

CAD Data Due

CAE Input/ Material Data Due

Supplier CAE

Kick-off

Supplier

Analysis Due

1 week

6 weeks

8 weeks

10 weeks

Upon request, supplier shall also provide Subsystem Level CAE models, which are used for supplier in-house analysis, and the analysis results.

Also, up to date CAD Data, Physical properties and CAE models may be requested when a design change requires additional CAE work up to SORP.Supplier shall be able to fulfil GM requests within five working days of the inquiry.

The Supplier is responsible to conduct all CAE tasks & deliverables on-time and with quality, or they will be subject to an escalation process that could result in the issuance of a Supplier Practical Problem Solving (SPPS) to ensure irreversible corrective action.

## CAD Data and Physical Property

Supplier shall submit the Cam Shaft Assembly Housing NX math data as an assembly file identified by the 8-digit GM production part number. Detailed modeling of attachments is not required, just location and type. Each part shall be identified in the assembly file by unique part or alphanumeric file numbers. Supplier shall notify the GM CAE SPC of any changes of the parts that may influence the behavior of the analysis.

Supplier shall also assign all required material properties of the components to the solid bodies for each of the assembly components and shall verify that the Materials Specification Sheet is correctly populated.

Other engineering data that the Supplier may be asked to provide are:

* Part Material Properties, e.g., mechanical, thermal, and electrical properties.
* Part Physical Property, e.g. mass, center of gravity, moments of inertia, etc.
* Attachment or connector capacity, e.g. fastener retention force.
* Manufacturability Characteristics, e.g. formability, mold flow and deep draw characteristics.

If the supplier is responsible for selection of material standards and/or is the material supplier, the supplier shall provide material property information, supporting test data in an Excel spreadsheet for the particular grade of material per the timing specified in Figure 1. The material properties required are specified in the Appendix C.

All testing, as specified in this document, shall be performed in laboratories that are accredited to ISO/IEC 17025. Lab accreditation documentation shall be provided upon request. The test facilities and equipment shall be in good working order and shall have a valid current calibration label. Calibration in accordance to ISO 7500-1 is required.

### Delivery Method

External suppliers, which are not TeamCenter integrated, shall provide all models to GM via GM Data Exchange Interface; e.g. P2P Aspera.TeamCenter integrated suppliers should use TeamCenter TcAE to transfer data directly. Supplier shall notify CAE Contact (named on cover page) and DRE when the data is transferred.

All test data generated per requirements as listed shall be provided using Test Data Templates available at GM Supply Power website (<https://gmsupplypower.covisint.com/web/portal/home>). Supplier shall notify CAE Contact (named on cover page) and DRE when the data is transferred.

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Aspera P2P

GM Data

Management

TeamCenter

Database

**Non TeamCenter Integrated Supplier**

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**TeamCenter Integrated Supplier**

Figure 2: Supplier data delivery method

## Analysis

The supplier is required to conduct mold fill (including shot sleeve) and solidification modeling to assure the integrity of the casting. The supplier must be capable of and demonstrate the use of analytical tools (Magma, ProCast, AnyCasting, or equivalent software) to do this work.

Supplier shall provide the following data to enable GM to perform system-level analysis: SDAS (Secondary Dendritic Arm Spacing), porosity, temperature profile, and residual stress from casting simulation.

GM may require the supplier to perform additional analyses during the development of the component, if it is deemed necessary by GM to confirm the functionality and robustness of the assembly, or is needed to further improve component design.

# *CAE Sign Off*

The Supplier shall comply with the requirements listed below:

1. CAD data and physical properties listed in Section 3.1 are delivered to GM on time.
2. CAE models listed in Section 3.2 are delivered to GM on time.
3. All other CAE tasks/deliverables specified in this SOR or GM written requests are complete.

# *Data Archive*

Supplier shall store math models, which represents the final production design, for a duration specified by GM. Analysis results, correlation, reports and other documents related to the production design shall also be retained for a duration specified by GM.

# Acronyms

ADVP&R Analysis/Development/Validation Plan and Report

Directed Buy GM determines it is necessary to dictate to the Tier 1 a Tier 2 component and supplier; GM negotiates, sources and advises Tier 1 of commercial conditions, including not-to-exceed price; Tier 1 contracts with Directed Buy supplier

MRD Material Required Date

PPDR Product and Process Design Review

GVPE Global Vehicle, Propulsion and Electrification

SPC Single Point Contact

CTR Component Technical Review

PLM XML a Siemens PLM Software format for facilitating product lifecycle interoperability using XML

XML Extensible Markup Language

PDT Product Development Team

PPAP Production Part Approval Process

# Revision Log

This revision Log lists all approved changes implemented in this document

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Rev. # | Paragraph # | Description | Approving Organization | Approver | Date |
| 0 | All | Initial Template Release | VDDV |  | 5/17/2019 |
| 1 | All | Initial Cam Shaft Assembly Housing Template Release | CCDF | Melani Wright | 4/12/24 |
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