Change History

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1 PURPOSE

The purpose of this procedure is to outline the steps necessary to design and develop electrical and mechanical hardware for new products or major changes to existing products. The Engineering and Management teams may determine that some of the phases do not apply to a given project or that some of the deliverables can be pulled up into an earlier phase. In such cases, the reasoning behind the decisions will be documented and stored in the SharePoint Project Folder (SPF) or design history file. In addition, the Project Plan will be modified to eliminate the unnecessary phases and to update the deliverable milestones.

If scope changes are requested, they are negotiated, approved and documented using the Project Scope Change Form or some other appropriate means. Records of the project scope change are kept in the SPF in compliance with the Records Retention Matrix.

2 INFORMATIVE REFERENCES

- ISO9001:2000 5.2 Customer focus
- ISO9001:2000 7.3 Design and development

3 FLOW CHART

![Flow Chart Image]

4 HARDWARE ENGINEERING PROCESSES


The Technical Reference Documents (TRD) and Functional Specification Package expand the requirements presented in the Product Requirements document with the appropriate level of detail so that electrical circuit designs, 3D models, etc can be designed and built.
The deliverables include, but are not limited to:

Approved Technical Reference Documents and Functional Specification Package

4.1.1 Elements

Elements of the Functional Specification Package that are related to Hardware are underlined below are the following as applicable, but are not limited to:

1. Technical Reference Documents
   - System throughput, maintenance and power requirements
   - Security
   - Ballot format
   - Ballot marking parameters
   - User interface
   - Configurable settings
   - Required outputs (i.e. Reports)
   - Communication interfaces
   - Error Handling
   - Operational Diagnostics

2. Memory requirements
3. Mechanical requirements
4. Subsystems requirements
5. Environmental requirements
6. Agency requirements
7. Test reports

Once the Functional Specification Package is completed, it is submitted for review and approval.

4.1.2 Review and Approval

The Functional Specification Package are distributed to Engineering and Program Management for their review and approval. Approved changes are incorporated into the Functional Specifications. Records of the review and approval are maintained in the SharePoint Project Folder in compliance with the Records Retention Matrix.

4.1.3 Design Control

The approved Functional Specifications are released to Document Control following the Engineering Change Order procedure.
4.2 Preliminary Designs

The deliverables may include, but are not limited to:

Project Plan, which may include:
- Schedule
- Budget
- Resources (including external to Hardware team)
- Capital
- Risk Matrix (Risk items with initial Mitigation Plans)

Product Allocation Plan (units for Sales, Marketing, ITA, Agency, testing, etc.)
- Build quantities at each phase
- Block Diagrams
- Preliminary ITA involvement and planning

4.2.1 Electrical Design & Development

Electrical design consists of refining the block diagram and drawing the schematics based on the Functional Specifications. A peer design review may be held prior to submitting the design for cross-functional review.

4.2.2 Mechanical Design & Development

Mechanical Design consists of drawing industrial design sketches, creating the 3D Model and the corresponding 2D drawings. A peer design review may be held prior to submitting the design for cross-functional review.

4.2.3 Cross-Functional Design Review

After the preliminary design has been completed, a meeting is held with representatives from Electrical Engineering, Mechanical Engineering and Program Management to review the design and propose any necessary changes. Approved changes are incorporated into the electrical and mechanical designs.

Records of the Preliminary Design Cross-Functional Design Review are kept in the SharePoint Project Folder in compliance with the Records Retention Matrix.

4.3 Prototype Phase

The prototype process consists of taking a preliminary design concept and creating a small number of prototypes and/or subassemblies to begin the test and inspection process. Early design concepts are explored. SLAs and machined parts are allowed as appropriate.

The deliverables may include, but are not limited to:
- Updated Project Plan
- Preliminary schematics
- Preliminary models
Acceptable risk level
Functional prototype subsystems or product
Update to ITA

4.3.1 Circuit Board Assembly and Testing

The board and electrical components are built internally or by a supplier. The completed PCBA is subjected to various tests, based on test plans specified in the Functional Specifications, which may require proving the design concept is feasible and that the PCBA samples are functional.

Results of the evaluation and verification of the electrical prototype sample(s) are maintained in the SharePoint Project Folder in compliance with the Records Retention Matrix.

4.3.2 Mechanical Prototypes

Mechanical prototypes such as models, SLA, machined parts, etc. are created internally or externally as applicable for concept visualization. Samples may be submitted to the Contract Manufacturer to evaluate Design For Test (DFT) and Design For Manufacturability (DFM).

Results of the evaluation and verification of the mechanical prototype sample are maintained in the SharePoint Project Folder in compliance with the Records Retention Matrix.

4.3.3 Cross-Functional Review

Upon completion of the tests and inspection reports, a meeting is held between the Engineering groups and Program Management, to review information and identify issues. Every item on the Functional Specification document may be reviewed as necessary. Approved changes are incorporated into the electrical and mechanical designs.

Records of the Prototype Phase Cross-Functional Design Review are kept in the SharePoint Project Folder in compliance with the Records Retention Matrix.

4.4 Development Phase

The Development phase consists of taking the prototype design and creating a small number of units to begin the system integration test and inspection process.

The deliverables may include, but are not limited to:
- Updated Project Plan
- Acceptable risk level
- Mature schematics, PCB layout, BOM, models
- Form Factor defined
Functional prototypes
Update to ITA
Verification Test Plan

4.4.1 Circuit Boards Assembly and Testing

The board and electrical components are built internally or by a supplier. The completed PCBA is subjected to various tests, based on test plans specified in the Functional Specifications, which may require verification that all items are present, that the electrical components fit in the housing and that the circuit boards samples are functional.

Results of the evaluation and verification of the electrical prototype sample are maintained in the SharePoint Project Folder in compliance with the Records Retention Matrix.

4.4.2 Mechanical Prototypes

Mechanical prototypes such as models, SLA, machined parts, etc. are created internally or externally as applicable for concept verification. Samples may be submitted to the Contract Manufacturer to evaluate DFM and DFT.

Results of the evaluation and verification of the mechanical prototype sample(s) are maintained in SharePoint Project Folder in compliance with the Records Retention Matrix.

4.4.3 Cross-Functional Review

Upon completion of the tests and inspection report a meeting is held between the Engineering groups and Program Management, to review information and identify issues. Every item on the Functional Specifications document may be reviewed as necessary. Approved changes are incorporated into the electrical and mechanical designs accordingly.

Records of the Prototype Phase Cross-Functional Design Review are kept in the SharePoint Project Folder in compliance with the Records Retention Matrix.

4.4.4 Design Control

The approved Functional Specifications document is released through the Document Control procedure.