Advanced Product Quality Planning

APQP

Third Edition

AIAG

ADVANCING MOBILITY

ADVANCED PRODUCT QUALITY PLANNING (APQP)

Reference Manual

Third Edition

Issued June 1994, Second Printing February 1995 (new cover only), Second Edition, July 2008

Third Edition March 2024
Ford Motor Company, General Motors Company, and Stellantis
ISBN: 978 1 60534 482 6

FOREWORD

Third Edition

Effective March 1, 2024, APQP Third Edition and Control Plan Reference Manual replace APQP and Control Plan Second Edition unless otherwise specified by your customer.

The APQP and Control Plan Second Edition were split into separate manuals. Decoupling of the two will facilitate more timely updates as systems evolve.

Factors driving the need for this update:

- Changes to other references necessitate updates for APQP to remain relevant. For example, new terminology and concepts consistent with IATF 16949, AIAG & VDA FMEA Handbook and other Ford, General Motors, and Stellantis core tool manuals.
- The due diligence for APQP is being strengthened to avoid pitfalls from known risk factors.
- Incorporation of lessons learned from past projects and problems.
- Applications of APQP are changing to meet demands imposed by higher automation and ultimately autonomous driving, electrification and expanding definition of mobility.
- Addition of a "Safe Launch" requirement to the Production Control Plan, to be applied in initial launch of Mass Production.
- Appropriate references to customer specifics provided without the full text.
- Supplier input was actively solicited and incorporated when appropriate.

This manual continues to provide general guidelines for ensuring that Advanced Product Quality Planning is implemented in accordance with the requirements of the customer. There are no specific instructions on how to arrive at each APQP entry, this is a task best left to each organization.

The intent of APQP is to proactively assess and mitigate risk factors impacting product launch.

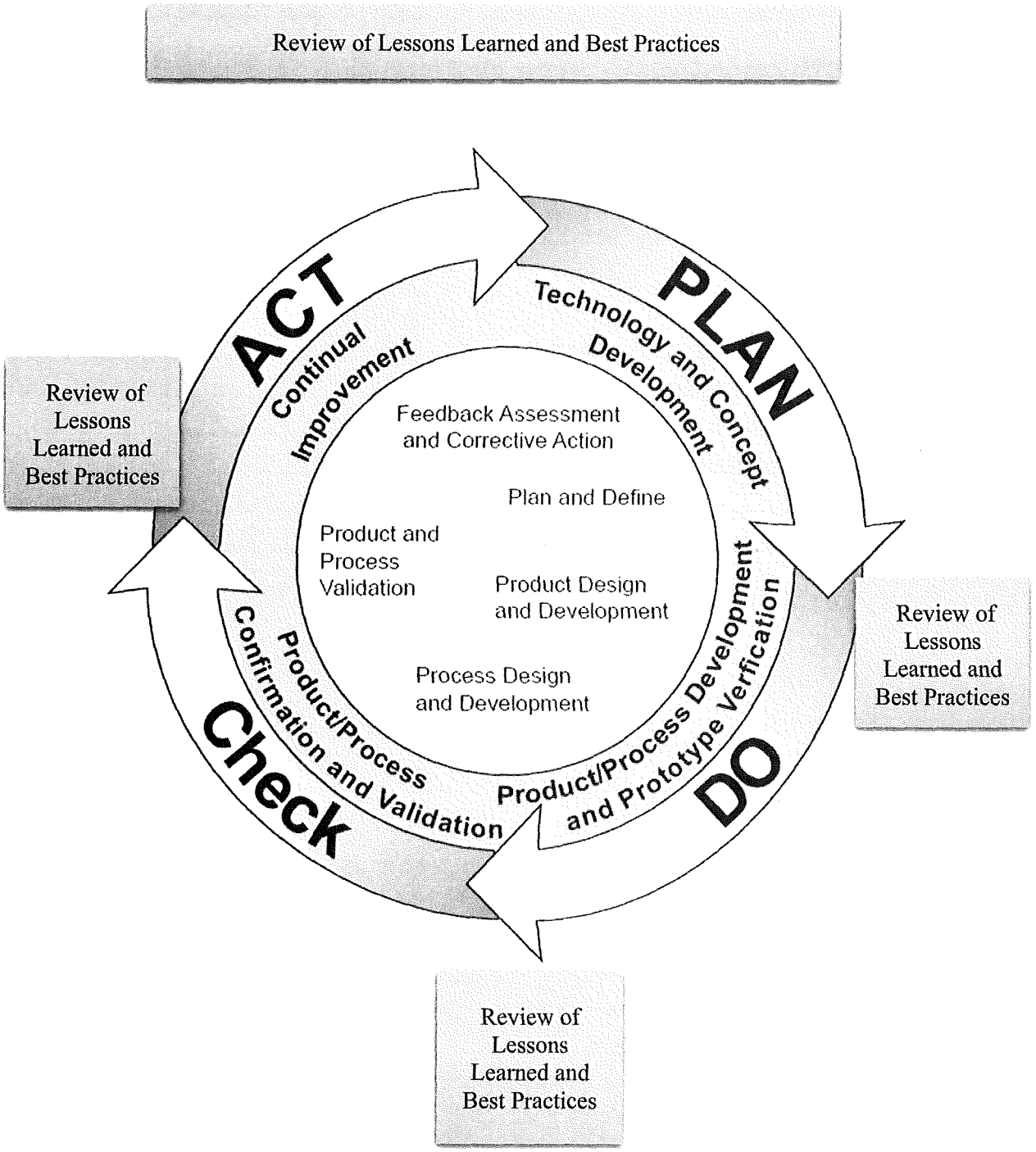
While these guidelines are intended to cover most situations normally occurring either in the early planning, design phase, or process analysis, there will be questions that arise. Please direct any questions to your authorized customer representative.

The following individuals and their respective companies participated in the revision process.

Keith Peterfeso, Ford Motor Company
Lida Kuehne, General Motors Company
Scott Trantham, General Motors Company
Bryan Book, Stellantis
Giovanni DeSantis, Stellantis
William Jones, Stellantis

TABLE OF CONTENTS

PRODUCT QUALITY PLANNING CYCLE



SIPOC Diagram illustrating the "Organization"

Supplier	Input	Processes	Output	Customer
Your Suppliers External or Internal		You are here You are the "Organization" You are the "APQP Process Owner"		Your Customers External or Internal

Supply Chain Depiction

Tier of the Organization	Supplier	Organization	Customer
0	Tier 1	OEM	Consumer
1	Tier 2	Tier 1	OEM
2	Tier 3	Tier 2	Tier 1
N	Tier N+1	Tier N	Tier N-1

Note: This is a reference manual. The visual above describes your organization within the planning process. It is important to understand your suppliers and customers, and inputs and outputs of each.

Introduction

Fundamentals of Advanced Product Quality Planning (APQP)

Advanced Product Quality Planning (APQP) is a structured method of defining and establishing the steps necessary to ensure that a product satisfies the customer and meets all performance and quality requirements. The goal of product quality planning is to facilitate communication with everyone involved to ensure that all required steps are completed on time. Effective product quality planning depends on a company's leadership commitment to the effort required in achieving customer satisfaction.

Some of the benefits of product quality planning are:

- To direct resources to satisfy the customer.
- To promote early identification of required changes.
- To increase First Time Quality in new parts.
- To provide a quality product on time at the lowest cost.

Work practices, tools, and analytical techniques described in this manual are listed in a logical sequence to make it easy to follow. Each Advanced Product Quality Plan is unique. Actual timing and sequence of execution is dependent on customer needs and expectations and/or other practical matters. The earlier a work practice, tool, and/or analytical technique can be implemented in the Product Quality Planning Cycle, the better.

Purpose of this Manual

The purpose of this manual is to communicate to organizations (internal and external) and suppliers, standardized best practices for Advanced Product Quality Planning developed jointly by Ford, General Motors, and Stellantis. This manual provides guidelines designed to produce a product quality plan, which will support the development of a product or service that will satisfy the customer (see Section 1.6).

The following terms used in this edition are used to describe the supply chain. The term "organization" refers to the unit to which these guidelines apply. For example, the unit could be a company, specific facility, or even a specific process. See the SIPOC diagram on page ix for more detail.

Benefits in using these guidelines include:

- Reduction in the complexity of product quality planning for the customers and organizations.

- Establishing a common language and comprehensive process as a means for organizations to easily communicate with all parties involved.

This reference manual contains guidelines that support requirements as described in IATF 16949 and applicable customer specific requirements. Nothing in this manual is intended to supersede or conflict with the requirements of IATF 16949, or any customer specific requirements.

All checklists and forms must be considered by the APQP team.

The Product Quality Planning Cycle shown on page viii is a graphic depiction of a typical program. Various phases are sequenced to represent planned timing to execute the functions described. The purpose of the Product Quality Planning Cycle is to emphasize:

- Up-front planning – the first three quarters of the cycle are devoted to up-front product quality planning through product/process validation.
- The act of implementation – the fourth quarter is where the importance of evaluating the output serves two functions: to determine if customers are satisfied, and to support the pursuit of continual improvement.

Depicting product quality planning as a cycle illustrates the never-ending pursuit of continual improvement that can only be achieved by taking the experience in one program and applying that acquired knowledge to the next program.

Product Quality Planning Responsibility

Product Quality Planning Functions will differ for two types of organizations:

- Design Responsible – All APQP chapters apply.
- Not Design Responsible – Manufacturing only or service organizations (heat treat, warehousing, transportation, software uploading etc.). Some of the content of chapters 1 and 2 may not apply, however the organization should discuss with their customer the relevant outputs and documentation to ensure customer requirements are fully understood and met.

If a business model falls outside these two defined types, APQP responsibilities should be clarified with the customer.

Getting Started

0.1 Organize the Team

The organization's first step in product quality planning is to assign a process owner for the APQP project. In addition, a cross-functional team should be established to ensure effective product quality planning. The team should include leadership representatives from multiple functions such as engineering, manufacturing, software support, material control, purchasing, quality, human resources, sales, field service, suppliers, and customers, as appropriate.

The organization must have a methodology to identify high risk that considers at a minimum the elements in Appendix A-0.

Establish an APQP kick-off meeting with leadership representatives for the team including selected suppliers.

0.2 Define the Scope

It is important for the organization's product quality planning team in the earliest stage of the product program to identify customer needs, expectations, and requirements. Leadership should appoint a project/program team manager responsible for overseeing the planning process. (In some cases, it may be advantageous to rotate the team manager during the planning cycle.)

At a minimum, the team should meet to:

- Define the roles and responsibilities of each area represented.
- Identify the customers – internal and external.
- Define customer requirements. Request detailed requirements for each customer. Seek to fully understand all requirements, clarify any ambiguous needs directly with the customer. Reference Appendix C for tools.
- Select the disciplines, individuals, and/or suppliers that should be added to the team, and those not required.
- Understand all customer program expectations and develop customer specific statement of requirement.
- Assess the feasibility of the proposed design, performance requirements and manufacturing process.
- Identify costs, timing, and constraints to be considered.
- Determine assistance required from the customer.
- Identify documentation required and a process for maintaining or updating the documents.

0.3 Team-to-Team

The organization's product quality planning team must establish lines of communication with applicable customer, organization and supplier teams. This may include regular meetings with other teams. The extent of team-to-team contact is dependent upon the number of issues requiring resolution.

0.4 Training

The success of APQP is dependent upon an effective training program that communicates all the requirements and development skills to fulfill customer needs and expectations. The customer may have additional specific APQP training requirements. Training needs can be assessed by using the Core Tools Self-Assessment available through the AIAG website.

0.5 Sourcing

Development and fulfillment of products that conforms to all customer requirements begins with a reliable and capable supply chain. Close collaboration between purchasing and the rest of the APQP planning team is crucial to the selection and confirmation of all sources of parts, materials, equipment, and services necessary to complete the program.

Existing and especially new suppliers require thorough vetting to ensure viability of the design and capability to consistently manufacture and deliver the specified product on time and in full. A sourcing checklist (such as the A-9 Sourcing Checklist in this document, or an equivalent) should be completed to confirm supplier suitability, and/or an action plan is in place to mitigate risk identified.

The scope for sourcing ends with an acceptable result of the vetting process, including completion of any planned actions on the sourcing checklist. All other activities of APQP are to be cascaded to the supplier and confirmed by the organization per this manual.

0.5.1 High Risk Supplier Evaluation

The organization must have a method to identify "high risk" suppliers (see section 0.1 "Organize the Team"). Criteria used to define "high risk" include, but are not limited to, the following:

- A new supplier to the organization.
- A new location or site ("Greenfield" or "Brownfield").
- History of poor quality.
- Historical issues that resulted in quality spills at the customer.

- Responsible for one or more incidences of historical field actions.
- Supplied components have safety or regulatory requirements.
- Failure of components with FMEA rated severity of 8+ (refer to the AIAG & VDA FMEA Handbook).
- Historical poor launch performance.
- New technology.
- No certification to ISO 9001 or IATF 16949.

Organizations should give preferential consideration to suppliers that are NOT considered "high risk". However, when necessity requires using a "high risk" supplier (e.g., due to customer direction, lack of alternatives) the organization must:

- Hold an APQP kick-off meeting.
- Implement regular APQP meetings.
- Implement Risk Mitigation plans with the suppliers.
- Report on status of "high risk" suppliers and Risk Mitigation plans during the organization's own APQP meetings with the customer.

0.6 Customer and Organization Involvement

The primary customer may initiate the quality planning process with an organization. However, the organization has an obligation to establish a cross-functional team to manage the product quality planning process. Organizations must expect the supplier to use an equivalent methodology.

In cases where the customer directs the organization to source from a specified supplier, it is still the responsibility of the organization to work with the supplier to complete all supplier-related APQP activity. In situations where the directed supply is from a competitor or where confidentiality is a concern, the organization and the customer should discuss how to obtain the required information and the agreement must be documented in the applicable commercial agreement.

0.7 Simultaneous Engineering

Simultaneous engineering is a process where cross-functional teams strive for a common goal. It replaces the sequential series of phases where results are transmitted to the next area for execution. The purpose is to expedite the introduction of quality products sooner. The organization's product quality planning team ensures that other areas/teams plan and execute activities that support the common goal.

0.8 Control Plans

Control plans provide a written summary description for the systems used in minimizing process and product variation. Separate control plans cover three distinct phases:

- Prototype – A description of the dimensional measurements, material and functional tests that will occur during prototype build typically led by design or engineering functions.
- Pre-launch – A description of the dimensional measurements, material and functional tests that will occur after prototype and before initial production launch. Customers may request a Safe Launch or Enhanced Containment period during pre-launch.
- Production – A comprehensive documentation of product/process characteristics, process controls, tests, and measurement systems that will occur during mass production. Start of production must include a Safe Launch or Enhanced Containment period to ensure containment of potential nonconformities.

0.9 Concern Resolution

During the planning process, the team will encounter product design and/or processing concerns. These concerns should be documented on a matrix with assigned responsibility and timing. Disciplined problem solving methods are recommended in difficult situations. Analytical techniques described in Appendix C should be used as appropriate.

0.10 Product Quality Timing Plan

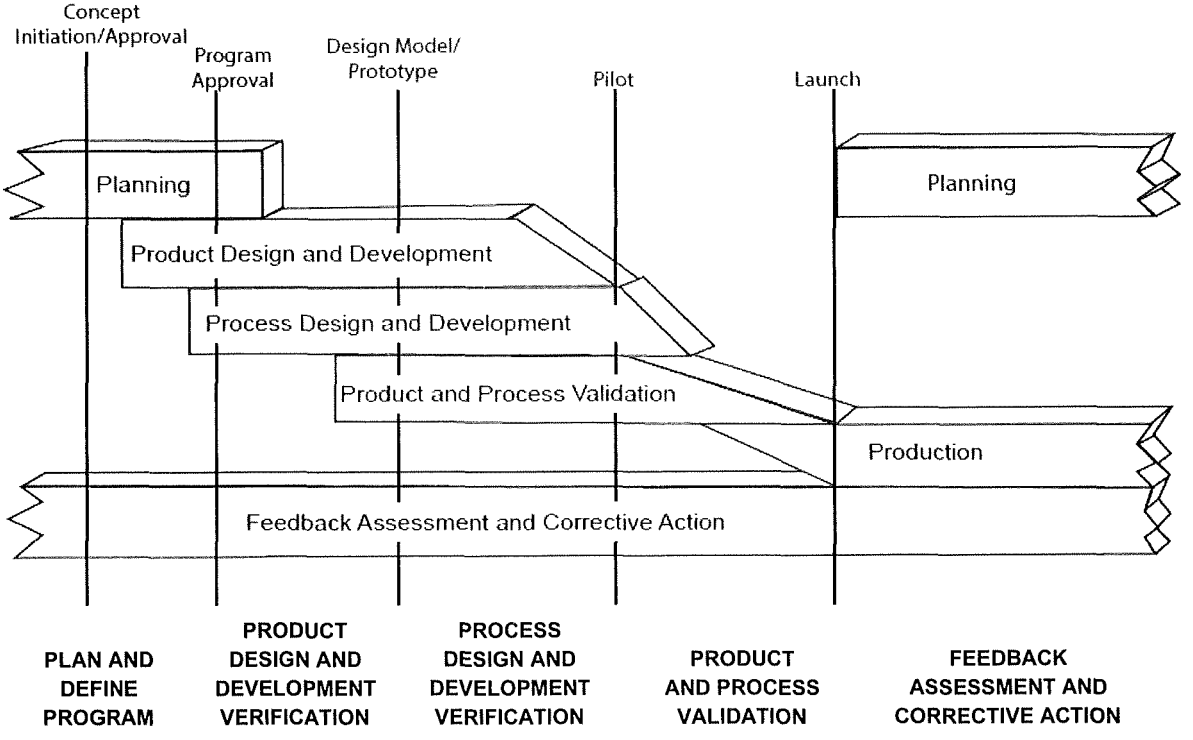
The organization's product quality planning team's first order of business following organizational activities, should be the development of a Timing Plan. Type of product, complexity and customer expectations should be considered in selecting the timing elements that should be planned and charted. All team members should agree with each event, action, and timing. A well-organized timing chart should list

customer and internal milestones, tasks, assignments, and phase gate reviews plus other events where required. (The Critical Path Method may be appropriate, reference Appendix C.) Also, the chart provides the planning team with a consistent format for tracking progress and setting meeting agendas. To facilitate status reporting, each event should have a "start" and a "completion" date with the actual point of progress recorded. Effective status reporting supports program monitoring with a focus on identifying items that require special attention.

0.11 Plans Relative to the Timing Chart

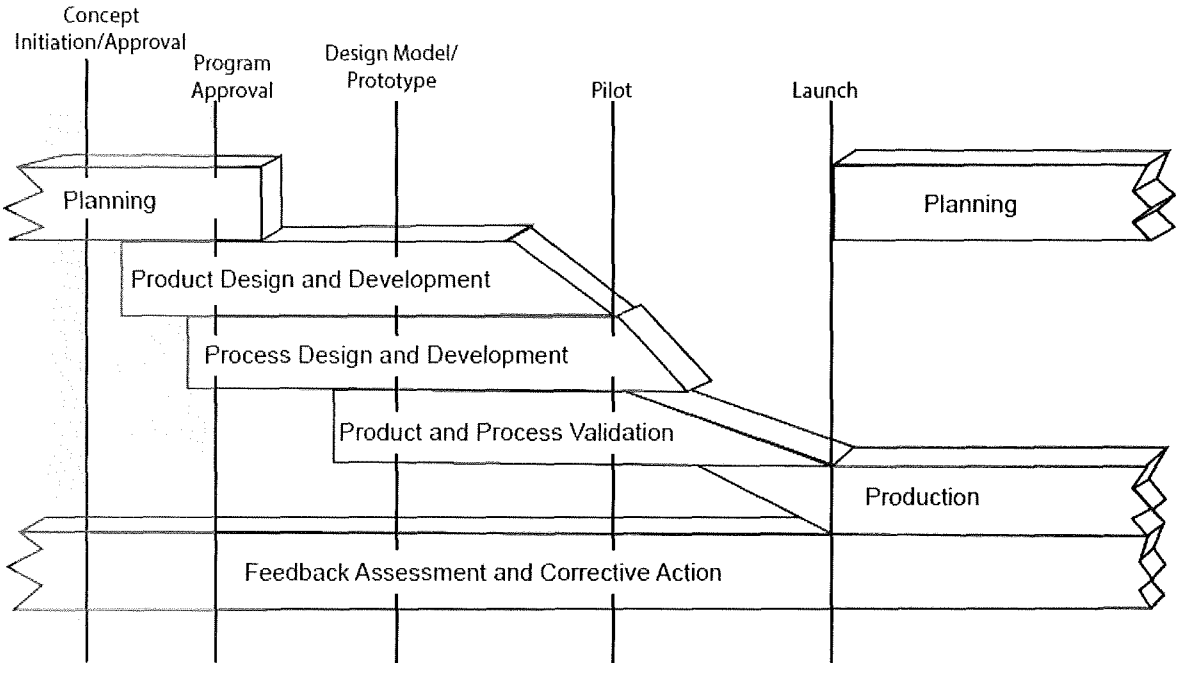
The success of any program depends on meeting customer needs and expectations in a timely manner at a cost that represents value. The Product Quality Planning Timing Chart (below) and the Product Quality Planning Cycle (described previously) require a planning team to concentrate its efforts on problem prevention. Problem prevention is driven by simultaneous engineering performed by product and manufacturing engineering activities working concurrently. Project teams must evaluate the feasibility of any change in project scope and obtain customer agreement on any changes (with respect to time, cost, quality etc.) to ensure project change is approved and well managed. The organization's product quality planning team is responsible for assuring that timing meets or exceeds the customer timing plan.

PRODUCT QUALITY PLANNING TIMING CHART



Chapter 1
Plan and Define Program

PRODUCT QUALITY PLANNING TIMING CHART



OUTPUTS (Become inputs for Chapter 2):

- **Design Goals**
- **Reliability and Quality Goals**
- **Preliminary Bill of Material**
- **Preliminary Process Flow Chart**
- **Preliminary Identification of Special Product and Process Characteristics**
- **Product Assurance Plan**
- **Capacity Planning**
- **Leadership Support**
- **Change Management Implementation**
- **APQP Program Metrics**
- **Risk Assessment Mitigation Plan**

Introduction

Chapter 1 describes how customer needs and expectations are linked to planning and defining a quality program. The goal of any product program is meeting customer needs while providing competitive value. The initial step of the product quality planning process is to ensure that customer needs and expectations are clearly understood.

Inputs and outputs applicable to the planning process may vary according to the product development process, as well as customer needs and expectations.

Recommendations discussed in this chapter are:

INPUTS (not all encompassing)

- Voice of the Customer.
  - Market Research (including OEM Vehicle Build Timing and OEM Volume Expectations).
  - Historical Warranty and Quality Information.
  - Team Experience.
- Business Plan and Marketing Strategy.
- Product/Process Benchmark Data.
- Product/Process Assumptions.
- Product Reliability Studies.
- Customer Inputs.
  - Quality and Reliability Targets.
  - Cost Targets.
  - Other expected KPI targets.
- Initial Quality, JD Powers, Consumers Report.

1.1 Voice of the Customer

The "Voice of the Customer" encompasses complaints, recommendations, data and information obtained from internal and/or external customers. Methods for gathering this information appear in the following paragraphs.

1.1.1 Market Research

The organization's product quality planning team may need to obtain market research data and information reflecting the Voice of the Customer. The following sources can assist in identifying customer concerns and wants, and translate them into product and process characteristics:

- Customer interviews.
- Customer questionnaires and surveys.
- Market test and positioning reports.
- New product quality and reliability studies.
- Competitive product quality studies.
- Best Practices.
- Lessons Learned.
- 3rd Party data (such as JD Powers).

1.1.2 Historical Warranty and Quality Information

A list of historical concerns (internal and external) and wants must be prepared to assess the potential for recurrence during the design, manufacture, installation and use of the product (examples include customer returns, internal scrape/rejects). These must be considered as an extension of the other design requirements and included in the analysis of customer needs.

The following items can assist the team in identifying customer concerns and wants, and prioritizing the appropriate resolutions.

The organization must communicate applicable information to lower tiers:

- Best Practices.
- Lessons Learned.
- Warranty reports of previous model, or similar products.
- Capability indicators.
- Problem resolution reports.
- Customer plant returns and rejections.
- Key DFMEA/PFMEA failure modes.
- Other.

The organization should communicate applicable information to lower tiers:

- Organization plant internal quality reports.
- Field return product analysis.
- Social media sources.

1.1.3 Team Experience

The team may use any source of information as appropriate, including the following:

- Input from higher system level or past Quality Function Deployment (QFD) projects.
- Media commentary and analysis such as magazine and newspaper reports.
- Customer letters and suggestions.
- Best Practices.
- Benchmarking.
- Lessons Learned.
- Dealer comments.
- Fleet Operator comments.
- Field service reports.
- Internal evaluations using surrogate customers.
- Track test/Test drives, Ride and Drives.
- Leadership comments or direction.
- Problems and issues reported from internal customers.
- Government requirements and regulations.
- Contract review.
- Design Review.

1.2 Business Plan and Marketing Strategy

The customer business plan and marketing strategy will set the framework for the product quality plan. The business plan may place constraints (e.g., timing, cost, investment, product positioning, research and development [R&D] resources) on the team that affect the direction taken. The marketing strategy will define the target customer, the key sales points, and key competitors.

1.3 Product/Process Benchmark Data

The use of benchmarking (referenced in Appendix C) will provide input to establishing product/process performance targets. Research and development may also provide benchmarks and concept ideas.

One method to successful benchmarking is:

- Identify the appropriate benchmarks.
- Understand the reason for the gap between your current status and the benchmark.
- Develop a plan to close the gap, match the benchmark, or exceed the benchmark.

1.4 Product/Process Assumptions

There will be assumptions that the product has certain features, design, or process concepts. These include technical innovations, advanced materials, reliability assessments, and new technology. All should be utilized as inputs.

1.5 Product Reliability Studies

This type of data considers frequency of repair or replacement of components within designated periods of time and the results of long-term reliability/durability tests.

1.6 Customer Inputs

The next users of the product can provide valuable information relating to their needs and expectations. In addition, the next product users may have already conducted some or all the aforementioned reviews and studies. These inputs should be used by the customer and/or organization to develop agreed upon measures of customer satisfaction.

1.7 Design Goals

Design goals are a translation of the Voice of the Customer into measurable design objectives. The proper selection of design goals ensures that the Voice of the Customer is not lost in subsequent design activity. The Voice of the Customer also includes regulatory requirements such as materials composition reporting and polymeric part marking.

1.8 Reliability and Quality Goals

Reliability goals are established based on customer wants and expectations, program objectives, and reliability benchmarks. An example of customer wants and expectations could include no safety failures. Some reliability benchmarks could be competitor product reliability, warranty data, or frequency of repair over a set period. Quality goals should be based on metrics such as parts per million, conditions per thousand, customer disruptions, problem levels, or scrap reduction.

1.9 Preliminary Bill of Material

The team should establish a preliminary bill of material based on product/process assumptions and include a potential supplier list. To identify the preliminary special product/process characteristics it is necessary to have selected the appropriate design and manufacturing process.

1.10 Preliminary Process Flow Chart

The anticipated manufacturing process should be described using a process flow chart developed from the preliminary bill of material and product/process assumptions.

1.11 Preliminary Identification of Special Product and Process Characteristics

Special product and process characteristics are identified by the customer in addition to those selected by the organization through knowledge of the product and process.

Examples of input to identification of special characteristics include:

- Product assumptions based on the analysis of customer needs and expectations.
- Identification of reliability goals and requirements.
- Identification of special process characteristics from the anticipated manufacturing process.
- Similar part FMEAs.

1.12 Product Assurance Plan

The Product Assurance Plan translates design goals into design requirements and is based on customer needs and expectations. This manual does not require a specific method for preparing a Product Assurance Plan. The Product Assurance Plan can be developed in any format understood by the organization and should include:

- Outlining of program requirements.
- Identification of reliability, durability, and apportionment/allocation goals and/or requirements.
- Assessment of new technology, complexity, materials, application, environment, packaging, service, and manufacturing requirements, or any other factor that may place the program at risk.
- Use of Failure Mode and Effects Analysis (FMEA).
- Development of preliminary engineering requirements.

1.13 Capacity Planning

- Review of surrogate/ historical Overall Equipment Effectiveness (OEE).
- Program volumes/timing (consider all other customers if shared equipment) including service or aftermarket volumes.
- Prototype builds considered in equipment and facilities loading.
- Bottle Neck operations considered and mitigated.
- Production support plan (ramp up) developed.
- Organization capacity planning must include downtime related to completing required tooling, equipment, and facility maintenance.
- Organization must demonstrate their ability to meet customer contractual requirements throughout the life of the program through system capacity analysis and actual Run at Rate production to verify accuracy of the analysis.
- Organization must confirm in writing that all tiers supplying parts or services meet all quality and contractual requirements for the manufacturing of the contracted components to the customer, including capacity planning as specified in this manual.

1.14 Leadership Support

One key to the success of Advanced Product Quality Planning is the interest, commitment and support of leadership. Participation by leadership in product quality planning meetings is vital to ensuring the success of the program. Leadership should sign-off (gate review) at the conclusion of

every product quality planning phase to reinforce their commitment and support. Updates and/or requests for assistance can occur more frequently, as required. A primary goal of Advanced Product Quality Planning is to maintain leadership support by demonstrating that all planning requirements have been met and/or concerns documented and scheduled for resolution, including program timing, and planning for resources and staffing to support required capacity.

1.15 Change Management Implementation

Section 1.15 is focused on changes during the phases of APQP up through PPAP approval. These changes are focused on improving the design and processes under real conditions including production issues, and system optimization. The institutional knowledge (i.e., best practices, lesson learned) gained must be preserved, shared, and used to benefit existing and future products. Every APQP output document must have a change log including at a minimum, the reason for the change, requestor, approved by, and date.

Note: Many changes are iterative and focused on optimizing performance and cost. Only if these iterative changes fall under guiding principles 2 or 3, would change notification be warranted.

Change Definition:

Any modification, after final customer agreement on an APQP output, which could impact form, fit, and function (F3) of the part or material.

- Form is defined as the shape, size, dimensions, mass, composition and/or other physical attributes which uniquely characterize a part(s). Weight, balance, and center of mass are considerations in 'form'.
- Fit is defined as the ability of an item to physically interface or interconnect with or become an integral part of another item or assembly. This defines the relationship between the part(s), the assembly, packaging, and manufacturability (including fixtures, gages, and containers).
- Function of a part is defined as its expected performance to requirements both intended and/or documented. Function is the reason for the part's existence, which also includes appearance items (color, gloss, grain) and secondary functions (i.e., not identified as primary function of the part). Example: providing physical support for other parts in an assembly.

Note: Organization must determine any additional characteristics required for form, fit and function beyond those specified as special characteristics on the part drawing or math model. Applies especially to customer-used features and customer interface features.

Guiding Principles:

1. APQP outputs form the basis for PPAP approval as such they form the baseline and default standard for the dimensional, material, process controls, and performance characteristics that fulfill the form, fit, and function requirements for the product.
2. In general, any change to an APQP output being used for planning, verification, or validation by the customer, organization, or direct supplier must be communicated to all affected stakeholders in a timely manner. Approvals must be documented.
3. "Change to an APQP output" is any change that occurs after the output was reviewed and approved by the customer. The organization must communicate, as soon as possible, the change and follow the customer's process for reapproval of the APQP output.

Supplementary requirements:

- Designated special key (also known as critical, significant, special, safety) characteristics once defined and agreed-upon between the customer and organization may not be changed or eliminated by the organization without approval from the customer.
- Error-proofing in design and processes must be documented, or traceable in the case of electronic records, in the appropriate APQP and PPAP records.
- Once PPAP approval is achieved, follow the requirements in PPAP Section 3 – Customer notification and submission requirements.

Refer to the Change Management Checklist in Appendix A-8.

1.16 APQP Program Metrics

APQP program metrics is an overview document that is managed and completed by the project team manager.

The metrics incorporates all the critical elements of the quality program and quantifies the readiness of each element with respect to the stage of the program. The intention of the metrics is to summarize the state of the program for presentation to leadership at a gate review.

The metrics should always reflect the honest state of the program. For example, the traffic light system (red, yellow, and green) to show leadership the status for approval. Red meaning not started or missed target, yellow meaning in process or plan created and approved, and green meaning completed. (See example in Appendix C)

It is important that all elements of the program are contained in the metrics, including any special or unique characteristics of the program.

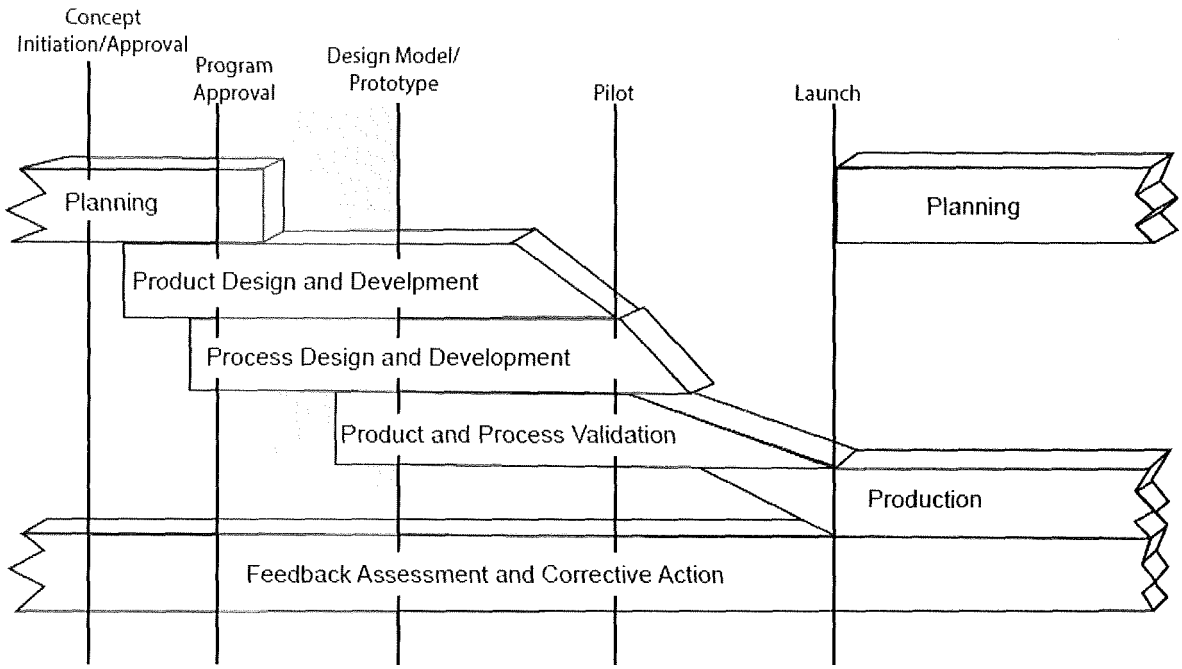
1.17 Risk Assessment Mitigation Plan

The goal of a Risk Assessment Mitigation Plan is to reduce or eliminate the impact of risk on a program.

Risk Evaluation and Mitigation Strategies (REMS) are deemed necessary when a question exists as to whether the benefits of an activity or a component outweigh its risks. REMS constitutes a mitigation plan including but not limited to prioritization, a communication plan, elements to ensure safe use and implementation to help guide the users. REMS can include avoidance, reduction or control, transference, acceptance and watch and monitor. The project team manager is responsible for overseeing this activity. REMS represents an 'upgrade' from previously required risk minimization action plans.

Chapter 2
Product Design and Development

PRODUCT QUALITY PLANNING TIMING CHART



OUTPUTS (Become inputs for Chapter 3):

- **Design Failure Mode and Effects Analysis (DFMEA)**
- **Design For Manufacturability, Assembly, and Service**
- **Design Verification**
- **Design Reviews**
- **Prototype Build Control Plan**
- **Engineering Drawings (Including Math Data)**
- **Engineering Specifications**
- **Material Specifications**
- **Drawing and Specification Changes**
- **New Equipment, Tooling and Facilities Requirements**
- **Special Product and Process Characteristics**
- **Gages/Testing Equipment Requirements**
- **Team Feasibility Commitment and Leadership Support**

Introduction

This chapter discusses the elements of the planning process during which design features and characteristics are developed into a near final form. All design factors are considered by the organization in the Advanced Product Quality Planning process even if the design is owned by the customer or shared. The steps include prototype build to verify that the product or service meets the objectives of the Voice of the Customer. A feasible design permits meeting production volumes and schedules, and is consistent with the ability to meet engineering requirements, along with quality, reliability, investment cost, weight, unit cost and timing objectives. Although feasibility studies and control plans are primarily based on engineering drawings and specification requirements, valuable information can be derived from the analytical tools described in this chapter to further define and prioritize the characteristics that may need special product and process controls.

In this chapter, the product quality planning process is designed to ensure a comprehensive and critical review of engineering requirements and other related technical information. At this stage of the process, a preliminary feasibility analysis will be made to assess the potential problems that could occur during manufacturing.

The inputs applicable to this chapter are as follows:

INPUTS (Derived from the outputs of Chapter 1)

- Design Goals.
- Reliability and Quality Goals.
- Preliminary Bill of Material.
- Preliminary Process Flow Chart.
- Preliminary Identification of Special Product and Process Characteristics.
- Product Assurance Plan.
- Capacity Planning.
- Leadership Support.
- Change Management Implementation.
- APQP Program Metrics.
- Risk Assessment Mitigation Plan.

2.1 Design Failure Mode and Effects Analysis (DFMEA)

The DFMEA is a disciplined analytical technique that assesses the probability of failure as well as the effect of such failure. A DFMEA is a living document continually updated as customer needs and expectations require. The DFMEA is an important input to the APQP process that may include previously selected product and process characteristics. The AIAG & VDA FMEA Handbook provides guidance for the preparation of a DFMEA. The Design FMEA Checklist in Appendix A-1 should also be reviewed to ensure that the appropriate design characteristics have been considered.

2.2 Design for Manufacturability, Assembly, and Service

Design for Manufacturability, Assembly, and Service is a simultaneous engineering process designed to optimize the relationship between design function, manufacturability, ease of assembly and serviceability. The scope of customer needs and expectations defined in Chapter 1 will determine the extent of the organization's product quality planning team involvement in this activity. This manual does not include or refer to a formal method of preparing a Design for Manufacturability, Assembly and Serviceability Plan.

At a minimum, the items listed here should be considered by the organization's product quality planning team:

- Design, concept, function, and sensitivity to manufacturing variation.
- Manufacturing and/or assembly process.
- Dimensional tolerances and material specifications.
- Performance requirements.
- Number of components.
- Process adjustments.
- Material handling.
- Serviceability (maintenance, repair or replacement in the field).
- Part traceability.

The above list may be augmented based on the organization's product quality planning team's knowledge, experience, the product/process, government regulations, and service requirements.

2.3 Design Verification

Design verification verifies that the product design meets the customer requirements derived from the activities described in Chapter 1.

2.4 Design Reviews

Design reviews are regularly scheduled meetings led by the organization's design engineering activity and must include other affected areas. The design review is an effective method to prevent problems and misunderstandings; it also provides a mechanism to monitor progress, report to leadership, and obtain customer approval as required.

Design reviews are a series of verification activities that are more than an engineering inspection. At a minimum, design reviews should include evaluation of:

- Design/Functional requirement(s) considerations.
- Formal reliability and confidence goals.
- Component/subsystem/system duty cycles.
- Virtual simulation and bench test results.
- DFMEA(s).
- Review of the Design for Manufacturability, Assembly, and Service effort.
- Design of Experiments (DOE) and assembly build variation results (Refer to Appendix C).
- Test to failure (special characteristics).
- Design verification progress.

A major function of design reviews is tracking design verification progress. The organization should track design verification progress through the use of a plan and report format, referred to as Design Verification Plan and Report (DVP&R) by some customers. The plan and report is a formal method to ensure:

- Design verification.
- Product and process validation of components and assemblies through the application of a comprehensive test plan and report.

The organization's product quality planning team is not limited to the items listed. The team should consider and use, as appropriate, the analytical techniques listed in Appendix C.

2.5 Prototype Build Control Plan

Prototype control plans are a description of the dimensional measurements and material and functional tests that will occur during prototype build. The organization's product quality planning team should ensure that a prototype control plan is prepared. See the AIAG Control Plan manual for details.

The manufacture of prototype parts provides an excellent opportunity for the team and the customer to evaluate how well the product or service meets the Voice of the Customer objectives.

It is the organization's product quality planning team's responsibility to review prototypes for the following:

- Ensure that the product or service meets specification and report data as required.
- Ensure that particular attention has been given to special product and process characteristics.
- Use data and experience to establish preliminary process parameters and packaging requirements.
- Communicate any concerns, deviations, and/or cost impact to the customer.

2.6 Engineering Drawings (Including Math Data)

Customer designs do not preclude the organization's product quality planning team's responsibility to review engineering drawings in the following manner. Engineering drawings may include special (governmental regulatory and safety) characteristics that must be shown on the control plan. When customer engineering drawings are nonexistent, the controlling drawings should be reviewed by the team to determine which characteristics affect fit, function, durability and/or governmental regulatory safety requirements.

Drawings should be reviewed to determine if there is sufficient information for a dimensional layout of the individual parts. Control or datum surfaces/locators must be clearly identified so that appropriate functional gages and equipment can be designed for ongoing controls. Dimensions must be evaluated to ensure feasibility and compatibility with industry manufacturing and measuring standards. If appropriate, the team should ensure that math data is compatible with the customer's system for effective two-way communications.

2.7 Engineering Specifications

A detailed review and understanding of the controlling specifications will help the organization's product quality planning team to identify the functional, durability and appearance requirements of the subject component or assembly. Sample size, frequency, and acceptance criteria of these parameters are generally defined in the in-process test section of the engineering specification. Otherwise, the sample size and frequency are to be determined by the organization and listed in the control plan. In either case, the organization should determine which characteristics affect meeting functional, durability, and appearance requirements.

2.8 Material Specifications

In addition to drawings and performance specifications, material specifications should be reviewed for special characteristics relating to physical properties, performance, environmental, handling, and storage requirements. These characteristics should also be included in the control plan. Material specification should be documented in the design record.

2.9 Drawing and Specification Changes

Where drawing and specification changes are required, the team must ensure that the changes are formally documented and promptly communicated to all affected areas within your organization, your suppliers and customers.

2.10 New Equipment, Tooling and Facilities Requirements

The DFMEA, Product Assurance Plan and/or design reviews may identify new equipment and facilities including meeting capacity requirements. The organization's product quality planning team should address these requirements by adding the items to the Timing Chart. The team should ensure that there is a process to determine that new equipment and tooling are capable and delivered on time. Facilities progress should be monitored to ensure completion prior to planned production tryout. Refer to the New Equipment, Tooling and Test Equipment Checklist in Appendix A-3.

2.11 Special Product and Process Characteristics

In the Plan and Define Program stage (Chapter 1), the team identified preliminary special product and process characteristics. The organization's product quality planning team should build on this listing and reach consensus through the evaluation of the technical information. The organization should refer to the appropriate customer specific requirements for additional details on the use of special product and process characteristics. If the special characteristic is identified by the customer, the organization must use the appropriate classification as required by the customer. The use of organization designated classifications is allowed if the customer agrees and there is documentation such as a correlation matrix to link to customer designation. The consensus is to be documented on the appropriate control plan. The Control Plan Special Characteristics worksheet referenced in Appendix C, is a recommended method to document and update special characteristics. The organization can use any form that meets the documentation requirements. Refer to customer specific requirements for unique approval requirements.

2.12 Gages/Testing Equipment Requirements

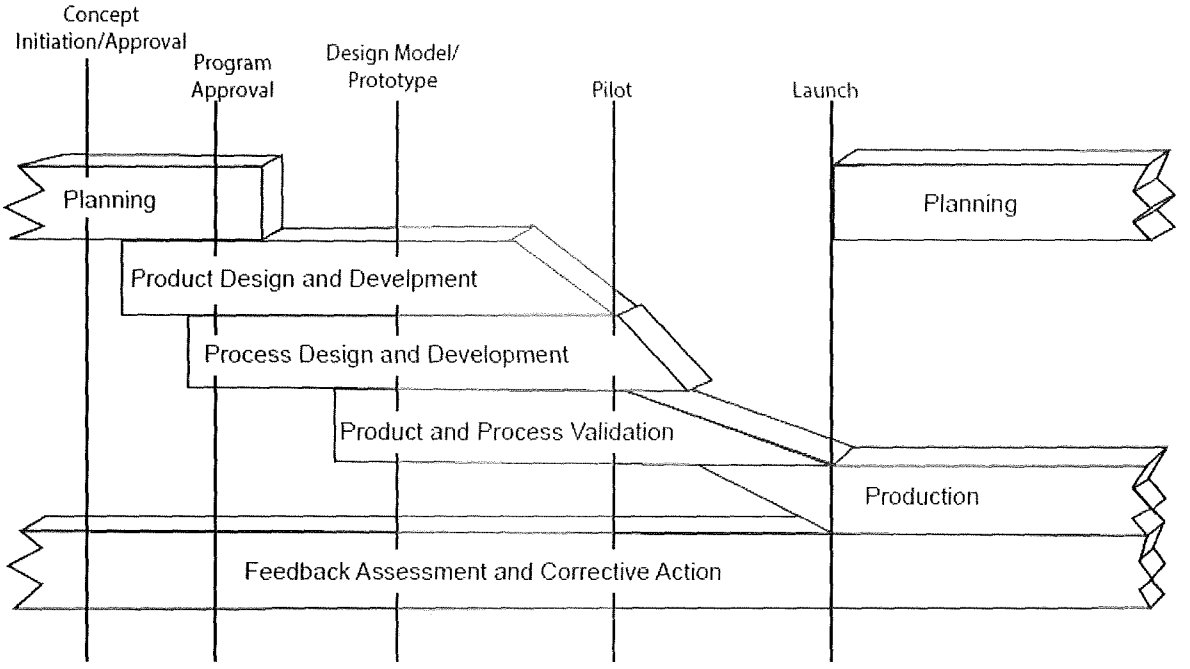
Gages/testing equipment requirements may also be identified at this time. The organization's product quality planning team should add these requirements to the Timing Chart. Progress should be monitored to ensure that required timing is met.

2.13 Team Feasibility Commitment and Leadership Support

The organization's product quality planning team must assess the feasibility of the proposed design at this time. Customer design ownership does not preclude the organization's obligation to assess design feasibility. The team must be satisfied that the proposed design can be manufactured, assembled, tested, packaged, and delivered in sufficient quantity on schedule at an acceptable cost to the customer. This review must include consideration for all design for Manufacturability, Assembly, and Service requirements including appearance. The Design Information Checklist in Appendix A-2 allows the team to review its efforts in this section and make an evaluation of effectiveness. This checklist will also serve as a basis for the open issues discussed in the Team Feasibility Commitment, Appendix D. The team consensus that the proposed design is feasible must be documented along with all open issues that require resolution and presented to leadership for their support. The Team Feasibility Commitment form shown in Appendix D is an example of the type of written record recommended.

Chapter 3
Process Design and Development

PRODUCT QUALITY PLANNING TIMING CHART



OUTPUTS (Become inputs for Chapter 4):

- **Packaging Standards and Specifications**
- **Product/Process Quality System Review**
- **Process Flow Chart**
- **Floor Plan Layout**
- **Process Failure Mode and Effects Analysis (PFMEA)**
- **Pre-Launch Control Plan**
- **Process Instructions**
- **Measurement Systems Analysis Plan**
- **Preliminary Process Capability Study Plan**
- **Leadership Support**

Introduction

This chapter discusses the major features of developing a manufacturing system and its related control plans to achieve quality products. The tasks to be accomplished at this step of the product quality planning process depend upon the successful completion of the prior stages contained in the first two chapters. This next step is designed to ensure the comprehensive development of an effective manufacturing system. The manufacturing system ensures that customer requirements, needs and expectations are met.

Inputs applicable to the process step in this chapter are as follows:

INPUTS (Derived from the outputs of Chapter 2)

- Design Failure Mode and Effects Analysis (DFMEA).
- Design for Manufacturability, Assembly, and Service.
- Design Verification.
- Design Reviews.
- Prototype Build Control Plan.
- Engineering Drawings (including Math Data).
- Engineering Specifications.
- Material Specifications.
- Drawing and Specification Changes.
- New Equipment, Tooling and Facilities Requirements.
- Special Product and Process Characteristics.
- Gages/Testing Equipment Requirements.
- Team Feasibility Commitment and Leadership Support.

3.1 Packaging Standards and Specifications

The customer will usually have packaging requirements that should be incorporated into any packaging specifications for the product, including packaging for service. If none are provided, the packaging design should ensure product integrity at point of use. The organization's product quality planning team should ensure that individual product packaging (including interior partitions) is designed and developed for production and service. Customer packaging standards or generic packaging requirements should be used when appropriate. In all cases the packaging design should ensure that the product performance and characteristics will remain unchanged during packing, transit, and unpacking. The packaging should be compatible with all identified material handling equipment including robots.

3.2 Product/Process Quality System Review

The organization's product quality planning team must review the manufacturing site(s) Quality Management System. Any additional controls and/or procedural changes required to produce the product must be updated, documented and included in the process flow chart, PFMEA, process control plan, and work instructions (not all inclusive). This is an opportunity for the organization's product quality planning team to improve the existing quality system based on customer input, team expertise, and previous experience. The Product/Process Quality Checklist provided in Appendix A-4, or equivalent should be used by the organization's product quality planning team to verify completeness.

3.3 Process Flow Chart

The process flow chart is a schematic representation of the current or proposed process flow. It is used to analyze sources of variations of machines, materials, methods, and manpower from the beginning to end of a manufacturing or assembly process and to emphasize the impact of sources of variation on the process. The flow chart helps to analyze the total process rather than individual steps in the process. The flow chart assists the organization's product quality planning team to focus on the process when conducting the PFMEA and designing the control plan. The Process Flow Chart Checklist in Appendix A-6, or equivalent should be used by the organization's product quality planning team to verify completeness.

3.4 Floor Plan Layout

The floor plan should be developed and reviewed to determine the acceptability of important control items, such as special process characteristic, inspection and re-entry points, control chart location, applicability of visual aids, interim repair stations, and storage areas to contain nonconforming material. All material flow should be aligned to the process flow chart and control plan. The Floor Plan Checklist in Appendix A-5 should be used by the organization's product quality planning team to verify completeness. The floor plan layout should be developed in such a manner to optimize the material travel, handling and value-added use of floor space and should facilitate the synchronous flow of materials through the process.

3.5 Process Failure Mode and Effects Analysis (PFMEA)

A PFMEA must be conducted during product quality planning and before beginning production. It is a disciplined review and analysis of a new or revised process and is conducted to anticipate, resolve, or monitor potential process problems for a new or revised product. For further information on the creation and maintenance of PFMEAs refer to the AIAG & VDA FMEA Handbook and customer specific requirements. The Process FMEA Checklist in Appendix A-7 should be used by the organization's product quality planning team to verify completeness.

3.6 Pre-Launch Control Plan

Pre-Launch control plans are a description of the dimensional measurements, materials and functional tests that will occur after prototype and before initial production launch. The pre-launch control plan must include additional product/process controls to be implemented until the production process is validated. The purpose of the pre-launch control plan is to contain potential nonconformities during or prior to initial production runs.

Examples of enhancements in the pre-launch control plan are:

- More frequent inspection.
- More in-process and final check points.
- Robust statistical evaluations.
- Enhanced audits and inspections.
- Identification of error-proofing devices.

The customer may require a Safe Launch plan during Pre-Launch (See section 4.7).

For further information on the creation and maintenance of control plans refer to the AIAG Control Plan Manual. The Control Plan Checklist in Appendix A-10 should be used by the organization's product quality planning team to verify completeness.

3.7 Process Instructions

The organization's product quality planning team must ensure that process instructions provide sufficient understanding and detail for all personnel who have direct responsibility for the operation of the processes. These instructions should be developed from the following sources:

- FMEAs.
- Control plan(s).
- Engineering drawings, performance specifications, material specifications, visual standards and industry standards.
- Process flow chart.
- Floor plan layout.
- Packaging standards and specifications.
- Process parameters.
- Organization expertise and knowledge of the processes and products.
- Handling requirements.
- Operators of the process.

The process instructions for standard operating procedures should be visible and should include set-up parameters such as machine speeds, feeds, cycle times, and tooling, and should be accessible to the operators and supervisors. Additional information for process instruction preparation may be found in appropriate customer specific requirements.

3.8 Measurement Systems Analysis Plan

The organization's product quality planning team must ensure that a plan to accomplish the required measurement systems analysis is developed, including checking aids. This plan should include, at a minimum, a laboratory scope appropriate for the required measurements and tests, the responsibility to ensure gage linearity, accuracy, repeatability, reproducibility, and correlation for duplicate gages. Refer to the AIAG Measurement Systems Analysis (MSA) reference manual and customer specific requirements.

3.9 Preliminary Process Capability Study Plan

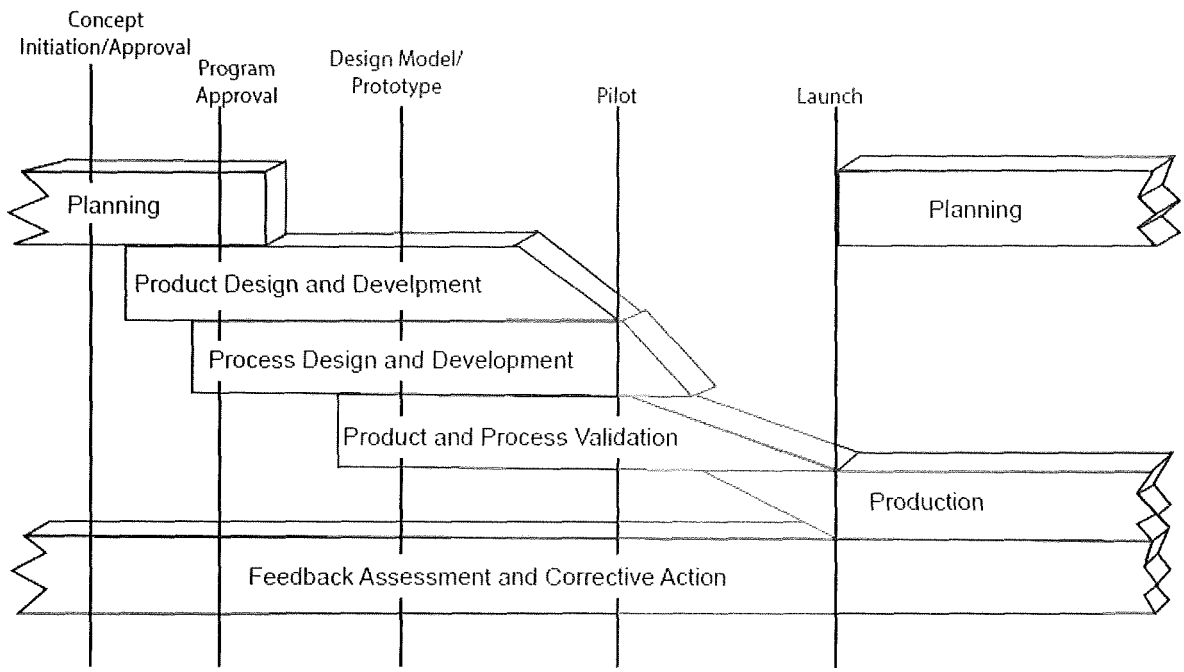
The organization's product quality planning team must ensure the development of a preliminary process capability study plan. The characteristics identified in the control plan will serve as the basis for the preliminary process capability study plan (e.g., dimensional, weldments, fastener performance). Reference the AIAG Production Part Approval Process (PPAP) manual, Statistical Process Control (SPC) reference manual, and customer specific requirements for further definition.

3.10 Leadership Support

The organization's product quality planning team should schedule a formal review designed to reinforce leadership commitment at the conclusion of the process design and development phase. This review is critical to keeping leadership informed as well as gaining support to assist in resolution of any open issues. Leadership support includes the confirmation of the planning and providing the resources and staffing to meet the required capacity.

Chapter 4
Product and Process Validation

PRODUCT QUALITY PLANNING TIMING CHART



OUTPUTS (Become inputs for Chapter 5):

- **Significant Production Run**
- **Measurement Systems Analysis**
- **Preliminary Process Capability Study**
- **Production Part Approval**
- **Production Validation Testing**
- **Packaging Evaluation**
- **Production Control Plan**
- **Quality Planning Sign-Off and Leadership Support**

Introduction

This chapter discusses the major features of validating the manufacturing process through an evaluation of a significant production run. During a significant production run, the organization's product quality planning team validates that the control plan and process flow chart are being followed as they would in production and the product meets customer requirements. Additional concerns relative to the pre-launch control plan should be identified for investigation and resolution prior to regular production runs.

The inputs applicable to the process steps in this chapter are as follows:

INPUTS (Derived from the outputs of Chapter 3)

- Packaging Standards and Specifications.
- Product/Process Quality System Review.
- Process Flow Chart.
- Floor Plan Layout.
- Process Failure Mode and Effects Analysis (PFMEA).
- Pre-Launch Control Plan.
- Process Instructions.
- Measurement Systems Analysis Plan.
- Preliminary Process Capability Study Plan.
- Leadership Support.

4.1 Significant Production Run

The significant production run must be conducted using production tooling, production equipment, production environment (including production operators), production facility, production gages and production rate. The validation of the effectiveness of the manufacturing process begins with the significant production run (refer to the AIAG Production Part Approval Process (PPAP) manual or the appropriate customer specific requirements for additional details). All control plan checks must be performed at least once during a run of the significant production run's length. The minimum quantity for a significant production run is usually set by the customer but can be exceeded by the organization's product quality planning team.

Output of the significant production run (product) is used for:

- Preliminary process capability study.
- Measurement systems analysis.
- Production rate demonstrated.
- Process review.

- Production validation testing.
- Production part approval.
- Packaging evaluation.
- First time capability (FTC).
- Quality planning sign-off.
- Sample production parts.
- First time quality (FTQ).
- Master samples, including appearance approval samples, if applicable.

4.2 Measurement Systems Analysis

All monitoring and measuring devices should be subjected to a measurement system analysis prior to the significant production run. Those monitoring and measuring devices should be used to check all identified characteristics per the production control plan during the significant production run. Refer to the AIAG Measurement Systems Analysis (MSA) reference manual for more details.

4.3 Preliminary Process Capability Study

The preliminary process capability study should be performed on all special characteristics and/or per customer specific requirements identified in the control plan using randomly selected parts (if appropriate). The study provides an assessment of the readiness of the process for production. Refer to the AIAG Production Part Approval Process (PPAP) manual and AIAG Statistical Process Control (SPC) reference manual for details concerning the preliminary process capability study. Refer to customer specific requirements for unique requirements.

4.4 Production Part Approval

PPAP's purpose is to provide the evidence that all customer engineering design record and specification requirements are properly understood and met by the organization and that the manufacturing process will consistently produce product meeting these requirements during an actual production run at the quoted production rate. Refer to the AIAG Production Part Approval Process (PPAP) manual.

4.5 Production Validation Testing

Production validation testing refers to engineering tests that confirm products made from production tools and processes meet customer engineering standards (including appearance requirements and customer specific requirements).

4.6 Packaging Evaluation

All test shipments (when required) and test methods must assess the protection of the product from normal transportation damage and adverse environmental factors. Customer-specified packaging does not preclude the organization's product quality planning team involvement in evaluating the effectiveness of the packaging. This also includes verifying the effectiveness of backup packaging, when required.

4.7 Production Control Plan

The production control plan is a written description of the systems for controlling production parts and processes. The production control plan is a living document and should be updated to reflect the addition or deletion of controls based on experience gained by producing parts. (Approval by the authorized customer representative may be required.) The start of production will include a "Safe Launch" or "Enhanced Containment" period to ensure containment of potential nonconformities. The Safe Launch period typically incorporates added inspection items or increased frequency of checks and monitoring and may include tighter control or specification limits. Consult your customer for specific requirements related to Safe Launch. Mass production provides the organization with the opportunity to evaluate output, review the control plan and make appropriate changes. See the AIAG Control Plan Manual.

4.8 Quality Planning Sign-Off and Leadership Support

The organization's product quality planning team should perform a review at the manufacturing location(s) and coordinate a formal sign-off. The product quality sign-off indicates to leadership that the appropriate APQP activities have been completed. The sign-off occurs prior to first product shipment and includes a review of the following:

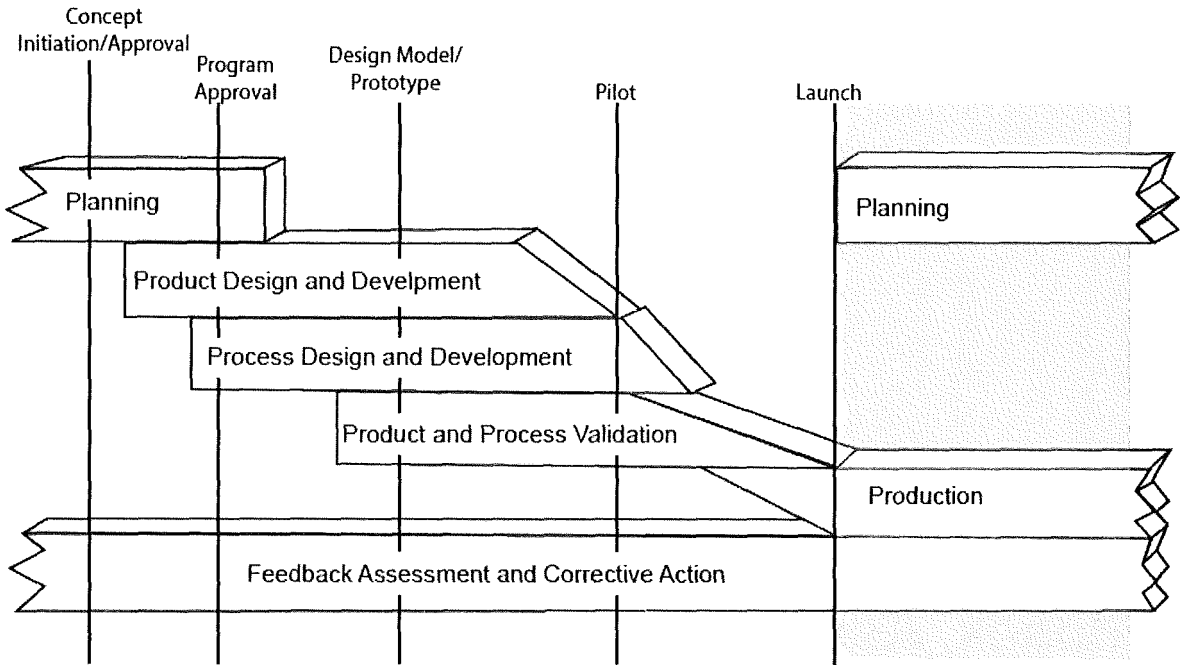
- Process Flow Charts. Verify that process flow charts exist and are being followed.
- Control Plans. Verify that control plans exist, are available and are followed at all times for all affected operations.

- Process Instructions. Verify that these documents contain all the special characteristics specified in the control plan and that all PFMEA recommendations have been addressed. Compare the process instructions, PFMEA and process flow chart to the control plan.
- Monitoring and Measuring Devices. Where special gages, fixtures, test equipment or devices are required per the control plan, verify gage repeatability and reproducibility (GR&R) and proper usage. Refer to the AIAG Measurement Systems Analysis (MSA) reference manual for more information.
- Demonstration of Required Capacity. Using production processes, equipment, and personnel, verify that the process is able to meet the quoted production capacity and meet customer requirements. This may require a customer sign-off and multiple runs. Review individual customer specific requirements.

Upon completion of the sign-off, a review with leadership should be scheduled to inform them of the program status and gain their support with any open issues. The Product Quality Planning Summary and Approval report shown in Appendix E is an example of the documentation required to support an effective quality planning sign-off.

Chapter 5
Feedback, Assessment and Corrective Action

PRODUCT QUALITY PLANNING TIMING CHART



OUTPUTS:

- **Reduced Variation**
- **Improved Customer Satisfaction**
- **Improved Customer Service and Delivery**
- **Effective Use of Lessons Learned / Best Practices**

Introduction

Quality planning does not end with installation and process validation. It is the component manufacturing stage where output can be evaluated when all special and common causes of variation are present. This is also the time to evaluate the effectiveness of the product quality planning effort. The production control plan is the basis for evaluating a product or service at this stage. Variable and attribute data are both evaluated. Appropriate actions are described in the AIAG Statistical Process Control (SPC) reference manual and any applicable customer specific requirements. Organizations that fully implement an effective APQP process will be in a better position to meet customer requirements including any special characteristics specified by the customer.

Quality planning also should be implemented whenever a product or process change is implemented following launch and process validation, up to and including PPAP for the implemented change. Reference the AIAG Production Part Approval Process (PPAP) manual; in addition, customers may have specific requirements for notification of changes, APQP, and PPAP.

The inputs applicable to the process step in this chapter are as follows:

INPUTS (Derived from the outputs of Chapter 4)

- Significant Production Run.
- Measurement Systems Analysis
- Preliminary Process Capability Study.
- Production Part Approval.
- Production Validation Testing.
- Packaging Evaluation.
- Production Control Plan.
- Quality Planning Sign-off and Leadership Support.

5.1 Reduced Variation

Control charts and other statistical techniques should be used as tools to identify process variation. Analysis and corrective actions should be used to reduce variation. Continual improvement requires attention not only to the special causes of variation but understanding common causes and seeking ways to reduce these sources of variation. Proposals should be developed including costs, timing, and anticipated improvement for customer review.

The reduction or elimination of a common cause may provide the additional benefit of lower costs. Organizations should be using tools such as value analysis and reduction of variation to improve quality and reduce cost. Refer to the AIAG Statistical Process Control (SPC) reference manual and any applicable customer specific requirements for details on long-term capability, special and common causes of variation.

5.2 Improved Customer Satisfaction

Detailed planning activities and demonstrated process capability of a product or service are important components to customer satisfaction. However, the product or service still has to perform in the customer environment. This product usage stage requires organizational participation. In this stage much can be learned by the organization and customer. The effectiveness of the product quality planning efforts can also be evaluated at this stage.

The organization and customer become partners in making the changes necessary to correct any deficiencies and to improve customer satisfaction. Reference AIAG PPAP Manual Section 3.1 Customer Notification and any applicable customer specific requirements.

5.3 Improved Customer Service and Delivery

The customer service and delivery stage of quality planning continues the organization and customer partnership in solving problems and continuous improvement. When problems occur in the customer's environment, effective problem containment and timely delivery of replacement parts is vital. Similarly, if field problems (problems related to the end-user customer) occur, the customer relies on the organization to support problem correction and timely availability of replacement parts to the customer's field service organization.

The experience gained in this stage provides the customer and organization with the necessary knowledge to reduce process variation, inventory, and quality costs and to provide the right component or system for the next product.

5.4 Effective Use of Lessons Learned/Best Practices

A lessons learned or best practices portfolio is beneficial for capturing, retaining and applying knowledge and should be reviewed after each stage of the APQP process. Input to lessons learned and best practices can be obtained through a variety of methods including:

- Review of Things Gone Right/Things Gone Wrong (TGR/TGW).
- Data from warranty and other performance metrics.
- Corrective action plans.
- "Read across" with similar products and processes.
- DFMEA and PFMEA studies.
- Preservation of institutional knowledge through the permanent documentation of error-proofing solutions.

It is recommended that lessons learned and best practices be incorporated into foundation or family DFMEAs and PFMEAs as applicable. Refer to the AIAG & VDA FMEA Manual section 1.3.6 Foundation and Family FMEAs for additional detail.

APPENDIX A
PRODUCT QUALITY PLANNING CHECKLISTS

Purpose of the Checklists

The checklists included in this manual are provided as a guide to assist the organization in verifying the APQP process to ensure completeness and accuracy. The checklists are not intended to fully define or represent all the elements of the APQP process. Using checklists should be one of the activities to confirm full application of the APQP process. The checklists are designed to allow users to "check-the-box" when completing. In reviewing the questions in the checklist, where "No" is identified as the appropriate response, the column "Comment/Action Required" is used to identify the action required to close the gap, including the impact on the APQP process. The follow-up action should include the identification of an individual responsible and schedule. Use the "Person Responsible" and "Due Date" columns. All follow-up actions should always be completed as quickly as possible. Where change management is affected, this needs to be noted. When checklists are used effectively and clearly, they can be used to direct suppliers as well as in-house teams.

A-0 APQP Risk Factors Checklist

Customer or Internal Part No _____ Revision Level _____

	General Risk Criteria	Yes	No	Comment / Action Required	Person Responsible	Due Date
	A. Commitment					
1	Customer product requirements understood					
2	Additional customer requirements understood and complied with					
3	Management oversight confirmed					
	B. Part Criticality					
4	Safety item					
5	Historical problems					
6	Pass through potential					
	C. Workload					
7	Simultaneous launches					
8	Adequate resources					
9	Bottlenecks and constraints					
	D. Management					
10	Significant management changes					
11	Engaged					
12	Adequate resources					
13	Appropriate priority set					
14	KPI's set and monitored					
15	Contingency plans are adequate					
	E. Leadership					
16	Knowledgeable					
17	Engaged					
18	Checklists being used and reviewed					
	F. Process Owners					
19	All functions represented					
20	Knowledgeable					
21	If applicable, the organization is familiar with the requirements of special process audits (AIAG CQI's) and auditors qualifications for CQI audits					
	G. Knowledge					
22	Retention and storage method adequate					
23	Transfer method adequate					
24	"Read across" adequate					
	H. Performance					
25	Past launch issues/lessons learned					
26	Containment actions					
	I. Certification					
27	IATF certification current					
28	Certified APQP experts on staff					
	J. Sub-tier Management					
29	Evidence APQP used					
30	If applicable, the supplier is familiar with the requirements of special process audits (AIAG CQI's) and auditors qualifications for CQI audits					

A-0 APQP Risk Factors Checklist

	General Risk Criteria	Yes	No	Comment / Action Required	Person Responsible	Due Date
Risk criteria by phase						
	Plan and Define					
	Checklist completed					
	Actions reviewed					
	Actions completed					
	Product Design and Development					
	Checklist completed					
	Actions reviewed					
	Actions completed					
	Process Design and Development					
	Checklist completed					
	Actions reviewed					
	Actions completed					
	Product and Process Validation					
	Checklist completed					
	Actions reviewed					
	Actions completed					
	Feedback, Assessment and Corrective Action					
	Checklist completed					
	Actions reviewed					
	Actions completed					

* Every "No" item must have approved action plan

Revision Date: _____

Prepared By: _____

A-1 Design FMEA Checklist

Customer or Internal Part No _____ Revision Level _____

	Question	Yes	No	Comment / Action Required	Person Responsible	Due Date
1	Was the DFMEA prepared using the current requirements from your customer?					
2	Have historical campaign and warranty data been reviewed?					
3	Have best practices and lessons learned from similar part DFMEAs been considered?					
4	Have corporate databases been used in the best practice, lessons learned reviews and read across all applicable locations?					
5	Does the DFMEA identify all special and critical characteristics including failure modes?					
6	Have pass-through characteristics (glossary) been identified and reviewed with affected suppliers for FMEA alignment and appropriate controls in the supply base?					
7	Have special characteristics designated by the customer or organization been reviewed with affected suppliers to assure FMEA alignment?					
8	Have design characteristics that affect high risk priority failure modes been identified?					
9	Have appropriate corrective actions been assigned to high risk priority numbers?					
10	Have appropriate corrective actions been assigned to high severity numbers?					
11	Have appropriate corrective actions been reviewed with cross-functional teams?					
12	Have risk priorities been revised when corrective actions have been completed and verified?					
13	Have FMEAs been reviewed and approved, if required by customer engineering?					

* Every "No" item must have approved action plan

Revision Date: _____

Prepared By: _____

A-2 Design Information Checklist

Customer or Internal Part No _____ Revision Level _____

	Question	Yes	No	Comment / Action Required	Person Responsible	Due Date
	A. General					
1	Does the design require:					
a	New materials?					
b	Special tooling?					
c	New technology?					
d	New manufacturing process?					
2	Has assembly build variation analysis been considered?					
3	Has Design of Experiments been considered? (Consider DOE as a resource for testing and validation)					
4	Is there a plan for prototypes in place?					
5	Has a DFMEA been completed?					
a	If yes, was it completed by a cross-functional team?					
6	Has a DFMA&S (Design For Manufacturability, Assembly, and Service) been completed?					
7	Have service and maintenance issues been considered?					
8	Has the Design Verification Plan been considered?					
a	If yes, was it completed by a cross-functional team?					
9	Are all specified tests, methods, equipment and acceptance criteria clearly defined and understood?					
10	Have special characteristics been selected?					
11	Is there a plan to verify customer portals and security?					
12	Is Bill Of Material (BOM) complete?					
13	Are special characteristics properly documented?					
	B. Engineering Drawings					
14	Are reference dimensions identified to minimize inspection layout time?					
15	Are sufficient control points and datum surfaces identified to design functional gages?					
16	Are tolerances compatible with accepted manufacturing standards?					
17	Can existing and available inspection technology measure all design requirements?					
18	Is the customer designated engineering change management process used to manage engineering changes?					
	C. Engineering Performance Specifications					
19	Have special characteristics been identified?					
20	Are test parameters sufficient to address required use conditions, e.g., production validation and end use?					
21	Have parts manufactured at minimum and maximum specifications been tested as required?					
22	Will all product testing be done in-house?					
a	If not, is it done by an approved supplier? (Accredited or per Customer Specific Requirements)					

A-2 Design Information Checklist

Customer or Internal Part No _____ Revision Level _____

	Question	Yes	No	Comment / Action Required	Person Responsible	Due Date
23	Is the specified in-process performance test sampling size and/or frequency consistent with manufacturing volumes?					
24	Is the method of checks/tooling/and testing equipment equivalent to the final processing location?					
25	Can manufacturing processes, including required pass-through, secondary checks, and daily error-proofing verifications, achieve and sustain specified tolerances on an ongoing basis?					
26	Has customer approval been obtained, e.g., for testing and documentation, as required?					
	D. Material Specification					
27	Are special material characteristics identified?					
28	Where the organization is design responsible, are specified materials, heat treat and surface treatments compatible with the durability requirements in the identified environment?					
29	Where required, are the material suppliers on the customer approved list?					
30	Has the organization developed and implemented a process to control incoming material quality?					
31	Have material characteristics requiring inspection been identified? If so,					
a	Will characteristics be checked in-house?					
b	If checked in-house, is test equipment available?					
c	If checked in-house, is test equipment adequate for the task?					
d	If checked in-house, are competent people available to assure accurate testing?					
32	For pass-through material characteristics, has the control that is required been agreed upon with your customer?					
33	Will outside laboratories be used?					
a	Does the organization have a process in place to ensure laboratory competency such as accreditation? NOTE: Competency needs to be assured, regardless of the organization's relationship with the laboratory.					
34	Have the following material requirements been considered:					
a	Handling, including environmental aspects?					
b	Storage, including environmental aspects?					
c	Have the materials/substance composition been reported in accordance with customer requirements e.g., IMDS?					
d	Have polymeric parts been identified/marked per customer requirements?					
e	Labeling requirements for shipping, containers, and components?					

* Every "No" item must have approved action plan

Revision Date: _____

Prepared By: _____

A-3 New Equipment, Tooling, and Test Equipment Checklist

Customer or Internal Part No _____ Revision Level _____

	Question	Yes	No	Comment / Action Required	Person Responsible	Due Date
1	**Does the design require:**					
a	New materials?					
b	Quick change?					
c	Volume fluctuations?					
d	Mistake-proofing?					
2	**Have lists been prepared identifying: (Include all sub-tiers)**					
a	New equipment?					
b	New tooling?					
c	New test equipment (including checking aids and masters for checking aids)?					
d	Is consideration given for andon detection for equipment and work station status?					
3	**Have acceptance criteria been agreed upon and documented per customer requirements for: (Include all sub-tiers)**					
a	New equipment?					
b	New tooling?					
c	New test equipment (including checking aids)?					
4	Will a preliminary capability study be conducted at the tooling and/or equipment manufacturer?					
5	Has test equipment feasibility and accuracy been established?					
6	Has consideration been given for verification of communications between automated systems (e.g., customer portals, data collection, functions captured, traceability, software capability) during equipment buy-off?					
7	Is a preventive maintenance plan complete for equipment and tooling?					
a	Critical tooling and machine parts need a min/max inventory level - long lead time parts					
8	Is there a contingency plan in place for long lead time items that can not be kept in inventory?					
9	Are setup instructions for new equipment and tooling complete, understandable, and in work instruction format?					

A-3 New Equipment, Tooling, and Test Equipment Checklist

	Question	Yes	No	Comment / Action Required	Person Responsible	Due Date
10	Will capable gages be available to run preliminary process capability studies at the equipment supplier's facility?					
a	Are sufficient resources allocated to support data collection?					
b	Is there a plan for all error-proofing devices that have not been validated to be 100% check until validation is complete?					
11	Has an error-proofing list been created for each piece of equipment (will need to complete other processes in APQP)?					
12	Will preliminary process capability studies be run at the processing plant?					
13	Have process characteristics that affect special product characteristics been identified?					
14	Were special product characteristics used in determining acceptance criteria?					
15	Does the manufacturing equipment have sufficient capacity to handle forecasted production and service volumes?					
16	Is testing capacity sufficient to provide adequate testing?					
17	Has the measurement equipment been verified and documented showing qualification for the required scope of measurement and testing?					
18	Has the PFMEA been comprehended and incorporated into tooling and equipment design?					
19	Have changes been reported per customer requirements?					

* Every "No" item must have approved action plan

Revision Date: _____

Prepared By: _____

A-4 Product/Process Quality Checklist

Customer or Internal Part No _____ Revision Level _____

	Question	Yes	No	Comment / Action Required	Person Responsible	Due Date
1	Is customer assistance or approval required for the development of the control plan?					
2	Has the organization identified who will be the quality liaison with the customer?					
3	Has the organization identified a qualified and trained employee who will be the quality liaison with its suppliers?					
4	Has the quality management system been reviewed and approved per current customer specific requirements (CSR)?					
5	Are there sufficient personnel identified to cover:					
a	Control plan requirements?					
b	Layout inspection?					
c	Engineering performance testing?					
d	Problem reaction and resolution analysis?					
e	Programming (system updates)?					
f	Work instructions maintenance/updates (timely updates)?					
6	Is there a documented training program that:					
a	Includes all employees?					
b	Lists who has been trained? - Current and posted in area (e.g., Current Training Schedule, Harvey Ball 4 quadrant chart)					
c	Provides a training schedule?					
7	Has training been completed for:					
a	Statistical process control?					
b	Capability studies?					
c	Problem solving?					
d	Mistake-proofing? (e.g., error-proofing/red rabbits)					
e	Reaction plans?					
f	Material handling? (handling of defective material)					
g	Other topics as identified?					
8	Is each operation provided with process instructions that are linked to the control plan?					
9	Are standard operator instructions accessible at each work station?					
10	Do operator instructions include pictures, diagrams, and are in understandable language?					
11	Are all special characteristics identified?					
a	If yes, are they posted at work stations?					
12	Are passthrough features included in the standard operator instructions?					
13	Were operators/team leaders involved in developing standard operator instructions?					
14	Do inspection instructions include:					
a	Easily understood engineering performance specifications?					
b	Test frequencies which have been based upon industry standards, statistical process control methods?					
c	If sampling frequency is not 100%, is the frequency based upon volume produced to support effective containment? (see AIAG Control Plan Manual, Control Plan form, field 23 for additional detail)					
d	Sample sizes?					
e	Reaction plans?					
f	Documentation requirements?					

A-4 Product/Process Quality Checklist

	Question	Yes	No	Comment / Action Required	Person Responsible	Due Date
15	Are visual aids:					
a	Appropriate, easily understood and comprehensive?					
b	Available?					
c	Accessible?					
d	Approved?					
e	Dated and current?					
16	Is there a procedure to implement, maintain, and establish reaction plans, for issues such as out of control conditions based on statistical process control?					
17	Is there an identified problem solving process that includes root cause analysis?					
18	Are the latest drawings and specifications available for the operator, at the points of the inspection?					
a	Have engineering tests (dimensional, material, appearance, and performance) been completed and documented as required in accordance with customer requirements?					
19	Are the current forms/logs available for appropriate personnel to record inspection results?					
20	Are the following available and placed at the appropriate points of the operation?					
a	Monitoring and measurement devices?					
b	Gage instructions?					
c	Reference samples?					
d	Inspection logs?					
21	Have provisions been made to certify and calibrate gages and test equipment at a defined frequency that is appropriate?					
22	Have required measurement system capability studies been:					
a	Completed and documented?					
b	Accepted?					
23	Have initial process capability studies been conducted per customer requirements?					
24	In case of inadequate process capability, is there a documented containment plan until process capability has been achieved?					
25	Are layout inspection equipment and facilities adequate to provide initial and ongoing layout of all details and components in accordance with customer requirements?					
26	Is there a documented procedure for controlling incoming material that may include, for example, the following items:					
a	Characteristics to be inspected? (e.g., drawings, critical features, pass-through)					
b	Frequency of inspection? (e.g., PFMEA/Control Plan)					
c	Sample size?					
d	Designated location for approved product?					
e	Disposition of nonconforming products?					

A-4 Product/Process Quality Checklist

	Question	Yes	No	Comment / Action Required	Person Responsible	Due Date
27	Have sample production parts been provided per customer requirements?					
28	Is there a procedure to identify, segregate, and control nonconforming products to prevent shipment?					
29	Are there locked bins?					
30	Are rework/repair procedures available to ensure conforming product?					
31	Is there a procedure to requalify repaired/reworked material? (included Independent Repair Confirmation [IRC], reintroduction into main line)					
32	Has a master or qualified sample, if required, been retained at work station/center as part of the first piece approval/in-process inspection (i.e., boundary sample, master good)?					
33	Is there an appropriate lot traceability procedure from incoming through shipping? (to minimize exposure to your customer)					
34	Are periodic audits of outgoing products planned and implemented?					
35	Are periodic assessments of the quality system planned and implemented?					
36	Has the customer approved the packaging and the packaging specification, including backup packaging?					
a	If any updates to the packaging - has containerization been provided the new information immediately?					

* Every "No" item must have approved action plan

Revision Date: _____

Prepared By: _____

A-5 Floor Plan Checklist

Customer or Internal Part No _____ Revision Level _____

	Question	Yes	No	Comment / Action Required	Person Responsible	Due Date
1	Have lean concepts been applied in considering material flow?					
2	Does the floor plan identify all required process and inspection points?					
3	Are all special characteristic stations identified on Plant Layout - for example all trace stations, (including teardown)?					
4	Is andon equipment identified at each station?					
5	Have clearly marked areas for all material, tools, and equipment at each operation been considered?					
6	Has sufficient space been allocated for all equipment?					
7	Are process and inspection areas:					
a	Of adequate size?					
b	Properly lighted?					
c	Current work instructions?					
d	Current gages/measuring tools?					
8	Do inspection areas contain necessary equipment and record storage?					
9	Are there adequate:					
a	Staging areas?					
b	Impound areas?					
c	Room for dunnage racks/material?					
10	Are inspection points located to prevent the shipment of nonconforming products?					
11	Are there controls for each process to eliminate contamination or inappropriate mixing of product?					
12	Is material protected from overhead or air handling systems contamination?					
13	Have facilities been provided for final product audit?					
14	Are facilities adequate to control movement of nonconforming incoming material?					
15	Is there a containment area for damaged containers?					
16	Have changes been reported per customer requirements?					

* Every "No" item must have approved action plan

Revision Date: _____

Prepared By: _____

A-6 Process Flow Chart Checklist

Customer or Internal Part No _____ Revision Level _____

	Question	Yes	No	Comment / Action Required	Person Responsible	Due Date
1	Does the flow chart illustrate the entire process from receiving through shipping, including outside processes and services?					
a	Have all customer portals been verified for all updates?					
b	Are all label requirements for each customer reviewed and understood?					
2	In the development of the process flow chart, was the DFMEA used, if available, to identify specific characteristics that may be critical?					
3	Is the flow chart linked to product and process checks in the control plan and PFMEA?					
4	Have special characteristics stations been identified?					
5	Does the flow chart describe how the product will move, e.g., roller conveyor, slide containers?					
6	Has the pull system/optimization been considered for this process?					
7	Have provisions been made to identify and inspect reworked product before being used?					
8	Are re-entry points identified in the flow chart?					
9	Are material controls for movement and staging of product, including appropriate identification, properly defined and implemented? The controls should address incoming supplier product as well as subcontracted processes.					

* Every "No" item must have approved action plan

Revision Date: _____

Prepared By: _____

A-7 Process FMEA Checklist

Customer or Internal Part No _____ Revision Level _____

	Question	Yes	No	Comment / Action Required	Person Responsible	Due Date
1	Is the DFMEA and Process Flow Diagram (PFD) used to develop the PFMEA?					
2	Does the PFMEA contain failure mode read across from DFMEA?					
3	Was the process FMEA prepared by a cross-functional team?					
4	If yes, has the team taken into account all customer specific requirements, including FMEA methodologies as shown in the current edition of FMEA?					
5	Have all operations including subcontracted, or outsourced processes and services been considered?					
6	Have all operations affecting customer requirements including fit, function, durability, governmental regulations and safety been identified and listed *sequentially*?					
7	Were similar part/process FMEA's considered?					
8	Have historical campaign and warranty data been reviewed and used in the analysis?					
9	Are the product and process requirements used to determine the failure modes aligned with process functions and PFD?					
10	Do the effects consider the customer in terms of the subsequent operation, assembly, and product?					
11	Is the severity for each failure mode calculated based on the highest effect and match customer requirements?					
12	Have the causes been described in terms of something that can be corrected or controlled?					
13	Is historical data (warranty data, customer records, manufacturing data, etc.) used to identify the occurrence number for each cause?					
14	Is occurrence number defined according to customer requirements?					
15	Are preventive controls focusing on cause/failure mode control before going to the next operation?					
16	Has severity and/or occurrence risk been taken into account when selecting detection controls?					
17	Was supplier and/or customer risk priority method used to prioritize PFMEA risk?					
18	Are detection numbers according to customer requirements?					
19	Does PFMEA consider recommended actions based on supplier and/or customer risk prioritization method?					
20	Have the appropriate controls to address all of the identified failure modes been applied?					
21	Were detection and occurrence revised when corrective action was completed?					
22	Do the effects consider the customer in terms of the subsequent operation, assembly, and product?					
23	Were customer plant problems used as an aid in developing the PFMEA?					

* Every "No" item must have approved action plan

Revision Date: _____

Prepared By: _____

A-8 Change Management Checklist

Customer or Internal Part No _____ Revision Level _____

	Question	Yes	No	Comment / Action Required	Person Responsible	Due Date
1	Do you have a change management process?					
2	Do you have a written procedure for your change management process and does it include your sub-tiers?					
3	Do you have resources to manage the change management process?					
4	Do you have evidence that you received the required customer approval before implementing changes?					
5	Has the change been communicated and approved by all affected departments?					
6	Has the affected supplier been notified of changes?					
7	Have bank builds been considered?					
8	Have the quality documents been updated? (e.g., DFMEA, PFMEA, Control Plan, and Standardized Work).					
9	Is a reasonable sample size used for Production Trial Run (PTR), based on risk?					
10	Has consideration been given for the change in other areas (read-across)?					
11	Do you post quality alerts if applicable to the change?					
12	Do you have evidence of a part trial performed?					
13	Is your change management process the same for internal and external request?					
14	Are the parts contained/stored, and clearly identified prior to and after the PTR build?					
15	Are there change management meetings before and after the change?					

* Every "No" item must have approved action plan

Revision Date: _____

Prepared By: _____

A-9 Sourcing Checklist

Customer or Internal Part No _____ Revision Level _____

	Question	Yes	No	Comment / Action Required	Person Responsible	Due Date
1	Does the supplier facility capacity plan meet organization quality and delivery requirements, including service parts?					
2	Have your supply chain lead times been considered within the capacity plan?					
3	Has the supplier reviewed lessons learned from previous or similar projects?					
4	Has the supplier reviewed the DFMEA and PFMEA, if appliable?					
5	Is the supplier aligned with severities, special and pass-through characteristics listed in PFMEAs?					
6	Does the supplier have an acceptable recovery plan?					
7	Does the supplier have a process and resource plan for evaluation and management of tiered suppliers?					
8	Does the supplier have evidence of prior product experience or technical expertise relevant to new product?					
9	Can the supplier meet manpower resource commitments to ensure successful completion of program; proper skills and training to perform the necessary tasks?					
10	Can the supplier verify any special assembly techniques, test methods or containment procedures used?					
11	Has the supplier met all sourcing requirements and provides all documentation required by customer?					
	ENGINEERING FUNCTION					
12	Does the supplier currently supply to the automotive industry?					
13	Are customer and organization specification subscriptions up to date?					
14	Does the supplier have experience with this commodity? If so, list how long in Comments.					
15	Is the supplier experienced with the material grade/type as defined on drawing? (e.g., plastic, steel, rubber)					
16	Does the supplier have acceptable design capability for the specific component(s)?					
17	Are the supplier's drawing and engineering software systems compatible with customer requirements?					
18	Is the supplier capable of exchanging engineering data electronically?					
19	Does the supplier have an effective change management process with all appropriate functions represented?					
20	If timing is compressed does the supplier have the resources to manage?					
21	Are there any open concerns from the technical review, e.g., feasibility, timing?					
22	Does the supplier have a system and resources to manage all regulatory requirements, such as safety, IMDS, REACH?					
23	Does the supplier use error-proofing for special characteristics as described in section 2.11 APQP?					
24	Does the supplier have any exceptions to the requirements?					

A-9 Sourcing Checklist

	Question	Yes	No	Comment / Action Required	Person Responsible	Due Date
	MANUFACTURING SYSTEMS					
25	Does the supplier site have experience manufacturing this commodity or similar product?					
26	Is the supplier's manufacturing site in the same region/country as ours?					
27	Will the supplier use existing production equipment for the program?					
28	Are specialized tooling or fixtures required for this program?					
29	Does the supplier have in-house tooling/pattern-making capability?					
30	Does the part require special handling or shipping care?					
31	Are there specified labeling requirements?					
a	Does the supplier have a traceability process capability?					
32	Does the supplier have a well-defined and implemented process for preventive maintenance?					
33	Does the supplier have a process for predictive maintenance?					
34	Is usage of statistical process controls evident on the shop floor, using both variable and attribute data as applicable?					
35	Does the supplier have experience with pass-through characteristics?					
36	Does the supplier understand the pass-through characteristics from the supplier to the end customer?					
37	Does the supplier use mistake-proofing for special characteristics?					
38	Does the supplier validate detection systems (e.g., rabbit, reject master)?					
39	Does the supplier have experience in high volume production?					
40	Does the supplier have experience with the required tolerance ranges?					
41	Are the inspection areas well lit and are visual aids present?					
42	Do all work stations have work instructions and reaction plans clearly documented and accessible?					
43	Are all major concerns found during the manufacturing process review/audit resolved?					
44	Is the manufacturing facility clean and well organized?					
45	Does the manufacturing facility fulfill requirements for water services, air, floor space, storage, power outages, etc.?					
46	Does the supplier evaluate equipment efficiencies and through-put as a performance indicator, such as OEE?					
47	Are any risks due to new building construction or expansion at the site mitigated?					
48	As applicable, does the supplier meet minimum CTPAT criteria? This includes applicable foreign regulatory requirements, e.g., product certification.					
	QUALITY SYSTEM					
49	Is the supplier third-party certified? If so, list any major nonconformances in their most recent third-party surveillance audit in Comments.					
50	Does the supplier's recent Parts Per Million (PPM) performance meet the organization's PPM requirement? If available, note the previous year's average in Comments.					
51	Does the supplier track internal PPM? If so, list the average for the past year.					
52	Does the supplier's recent Parts Per Billion (PPB) performance meet the organization's PPB requirement, if applicable? If available, note the previous year's average in Comments.					
53	Does the supplier track internal PPB? If so, list the average for the past year.					
54	Does the supplier have an effective and documented corrective action process?					
55	Does the supplier have an effective and documented product and process continuous improvement process?					

A-9 Sourcing Checklist

	Question	Yes	No	Comment / Action Required	Person Responsible	Due Date
	MANUFACTURING SYSTEMS					
56	Does the supplier have an effective and documented system for managing its sub-suppliers?					
57	Are predictive tools used for preventive maintenance?					
58	Does the supplier have an effective and documented gage calibration capability?					
59	Does the supplier have a documented layered process audit (LPA) process? (Reference AIAG CQI-8 Layered Process Audit Guideline)					
60	Does the supplier conduct effective layered process audits (LPA)?					
61	Does the supplier have regular management review meetings?					
62	Does the supplier have clearly defined and appropriate metrics for monitoring quality performance?					
63	Does the supplier have an effective and documented lessons learned process?					
64	Does lessons learned include launch issues?					
65	Does lessons learned include read-across?					
66	Does the supplier have an effective and documented process for managing pass-through characteristics (PTCs)?					
	COMMERCIAL					
67	Does the supplier have a well-defined program management process in place?					
68	Does the supplier have adequate management resources (e.g., engineers, qualified staff)?					
69	Does the supplier have an inventory control system that ensures adequate supply and FIFO of current product?					
70	Is the supplier's financial rating acceptable?					
71	Did or will the supplier accept the organization's quality requirements?					
72	Did or will the supplier accept the organization's P.O. terms and conditions?					
73	Did the supplier request any exceptions during team feasibility assessment?					
74	Did the supplier provide a capacity and investment plan?					
	TECHNOLOGY					
75	Does the supplier have all the necessary machinery, tooling and equipment for *product realization*?					
76	Does the supplier have experience manufacturing similar product with existing product and process technology?					
77	List any potential risk due to implementation of new product or process technology in Comments.					
78	Does the supplier have customer and/or organization portal capability and cyber security system?					

* Every "No" item must have approved action plan

Revision Date: _____

Prepared By: _____

A-10 Control Plan Checklist

Applicable Control Plan Stage: Prototype ☐
Pre-Launch ☐
Safe Launch ☐ (If Safe Launch is included in Pre-Launch or Production Control Plan, check both)
Production ☐

Customer or Internal Part No _____ Revision Level _____

	Question	Yes	No	N/A	Comment / Action Required	Person Responsible	Due Date
1	Was the control plan developed according to the methodology described in the AIAG Control Plan Manual?						
2	Were DFMEA, PFMEA and Process Flow Chart used to prepare the control plan?						
3	Have all the controls identified in the PFMEA been included in the control plan?						
4	Are all DMFEA items with severity rank of 9-10 that flow to PFMEA for control designated as special characteristics?						
5	Are all special product/process characteristics included in the control plan?						
6	Are material specifications requiring inspection identified?						
7	Does the control plan address incoming (material/components) through processing/assembly including packaging?						
8	Are all pass-through characteristics with last point of control at the organization that may impact the customer on this control plan?						
9	Are all interdependent processes included on this control plan, or linked to this control plan?						
10	If there are repair or rework processes, are they included on this control plan or on a separate control plan linked to this control plan?						
11	Have repair and rework processes been approved by customer?						
12	Are engineering performance testing and dimensional requirements identified?						
13	Are all error-proofing devices listed on the control plan, with method and frequency to confirm effectiveness or proper functioning?						
14	Does the frequency to confirm effectiveness or proper functioning of error-proofing devices enable effective containment of product produced since the last good verification check?						
15	Are sample sizes based upon industry standards, statistical sampling plan tables, or other statistical process control methods or techniques?						
16	If sampling frequency is not 100%, is the frequency based upon volume produced to support effective containment?						
17	Are gages and test equipment available as required by the control plan?						
18	Are the gage methodology and compatibility appropriate to meet customer requirements?						
19	Have measurement systems analysis been completed in accordance with customer requirements?						
20	If required, has the customer approved the control plan?						
21	Have lessons learned and "Read Across" actions been implemented?						

Revision Date _____

Prepared By: _____

APPENDIX B
GATED MANAGEMENT

Introduction

APQP Section 1.14 Leadership Support states:

"One of the keys to the success of Advanced Product Quality Planning is the interest, commitment, and support of leadership. Participation by leadership in product quality planning meetings is vital to ensuring the success of the program. Leadership should sign-off (gate review) at the conclusion of every product quality planning phase to reinforce their commitment and support."

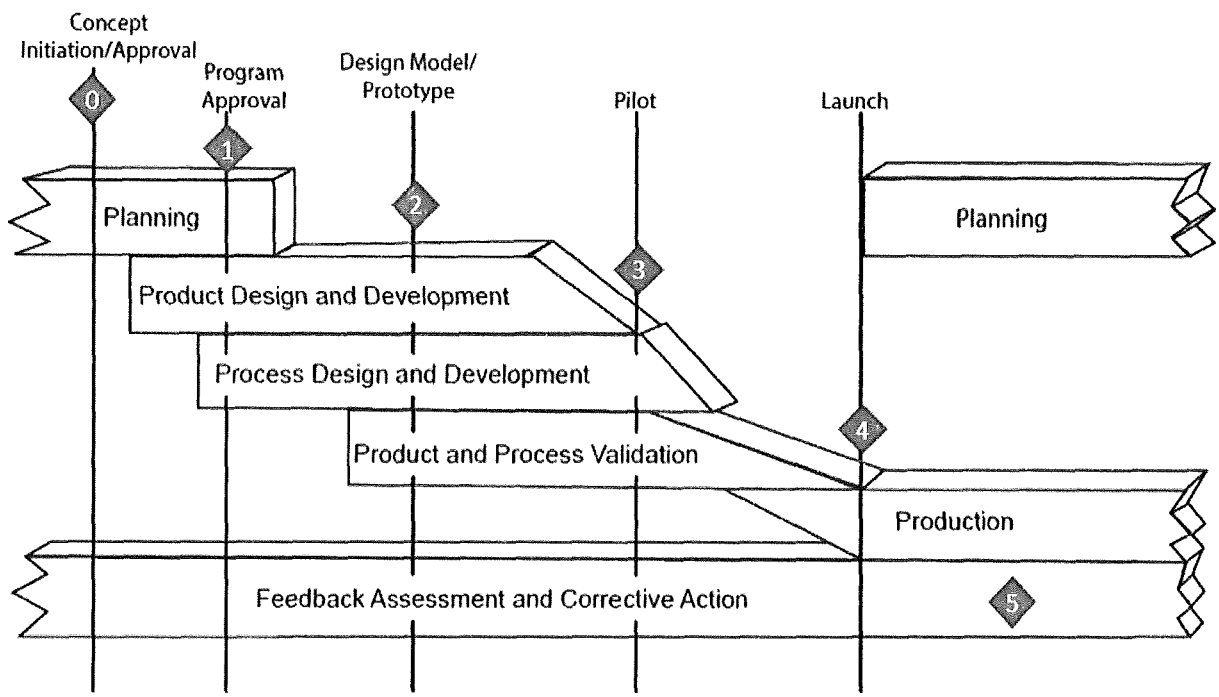
The APQP manual content provides two clear examples of documenting Leadership Support:

- 2.13 Team Feasibility Commitment and Leadership Support (Appendix D).
- 4.8 Quality Planning Sign-Off and Leadership Support (Appendix E).

However, those two examples are only applied to the Product Design and Development phase and the Product and Process Validation phase, respectively.

The Gated Management framework in this appendix provides an example of a more holistic approach that meets the expectation of Leadership sign-off (gate review) at the conclusion of ***every product quality planning phase***.

The figure below shows the Product Quality Planning Timing Chart, with 6 "gates" identified, corresponding to program milestones.



The table below summarizes the framework of a management review at each gate.

The *Results Documentation* shown for each gate is patterned after the Product Quality Planning Summary and Approval. Each gate has a unique Product Quality Planning Summary and Approval form, indicating the information confirmed and decisions made at the gate. The *Results Documentation* descriptions in the table below ("Information to be confirmed" column) may be a summary of individual items; see the Product Quality Planning Summary and Approval for each gate for examples of detailed items to be reviewed.

Appendix D Team Feasibility Commitment and Leadership Support is also included as *Results Documentation* for Gate 2.

Gate	**Decision(s) to be Made**; *Results Documentation*	Information to be confirmed (at minimum) - Numbers reference APQP section
0	**Concept Initiation/Approval** *E-0 Product Quality Planning Summary & Approval*	0.1 APQP Risk Assessment Team Responsibilities (RASIC, etc.) Capacity Assessment Leadership Support Assessment Technology Requirements Assessment Facility and Infrastructure Readiness Assessment Resources Readiness Assessment Sourcing Assessment Styling/Appearance Assessment 0.10 Product Quality Timing Plan APQP Program Metrics development Lessons Learned Implementation
1	**Program Approval** *E-1 Product Quality Planning Summary & Approval*	1.12 Product Assurance Plan 1.13 Capacity Planning 1.14 Leadership Support Plan 1.15 Change Management 1.16 APQP Program Metrics 1.17 Risk Assessment Mitigation Plan Facility and Infrastructure Readiness Plan Resources Readiness Plan Supplier Sourcing & Readiness Plan Program Timing Plan Lessons Learned Implementation
2	**Design Feasibility Approval** *E-2 Product Quality Planning Summary & Approval* *D Team Feasibility Commitment*	Design can be produced as defined Process Capability outlook OK (based on history) Adequate Capacity Design allows efficient material handling, assembly & serviceability Within normal cost parameters Tiered Supplier Design Review Lessons Learned Implementation
3	**Process Feasibility Approval** *E-3 Product Quality Planning Summary & Approval*	Packaging standards can be met Site QMS assess/plan (including personnel/training) Process Documentation (Process Flow-->PFMEA-->CP-->WI) MSA and SPC studies Tiered Supplier Process Capability Lessons Learned Implementation
4	**Launch Readiness/Approval** *E-4 Product Quality Planning Summary & Approval*	Significant Production Run PPAP, including PV testing MSA and SPC studies Packaging Evaluation Process Documentation (Process Flow-->PFMEA-->CP-->WI) Tiered Supplier Launch Readiness Lessons Learned Implementation
5	**Feedback, Assessment & Corrective Action** *E-5 Product Quality Planning Summary & Approval*	Process Capability Results Approval to End Safe Launch, Implement Production Control Plan Lessons Learned Incorporation

The Product Quality Planning Summary and Approval forms are provided in the following pages, along with instructions on how to fill out the forms and actions needed based on the results of the gate review.

The Product Quality Planning Summary and Approval forms indicate that items with incomplete or unacceptable results require development of an action plan. It is recommended that the organization develop a clear escalation process, both internally and with the customer, in cases where gate reviews conclude incomplete or with unacceptable results.

In some cases, changes will occur after a "gate" has been approved. Gate 1 approval includes confirmation of the change management log, which is to be confirmed at all subsequent gate reviews as confirmation that all changes have been managed appropriately, including reapprovals of past deliverables if applicable. See APQP 1.15 Change Management Implementation and Checklist A-8 for additional detail.

PRODUCT QUALITY PLANNING SUMMARY AND APPROVALS

GATE 0 PROGRAM CONCEPT

DATE: _____

PRODUCT NAME: _____ PART NUMBER / REV: _____

CUSTOMER: _____ MANUFACTURING PLANT: _____

1. PROGRAM ASSESSMENTS: (results of feasibility assessments related to):

	RESULT/STATUS*	
	ACCEPTABLE (Y/N)	PENDING
0.1 APQP RISK ASSESSMENT		
1.13 CAPACITY ASSESSMENT		
1.14 LEADERSHIP SUPPORT ASSESSMENT		
TECHNOLOGY REQUIREMENTS ASSESSMENT		
FACILITY AND INFRASTRUCTURE READINESS ASSESSMENT		
RESOURCES READINESS ASSESSMENT		
SOURCING ASSESSMENT		
STYLING/ APPEARANCE ASSESSMENT		
TIMING PLAN ASSESSMENT		

* RESULT:
If "ACCEPTABLE" is NO, must have an action plan detailing how to address
If "Pending", enter planned date of completion

2. PROGRAM MANAGEMENT

	RESULT/STATUS*	
	ACCEPTABLE (Y/N)	PENDING
TEAM RESPONSIBILITIES		
APQP METRICS DEVELOPMENT		

3. LESSONS LEARNED IMPLEMENTATION

	COMPLETE	PENDING*
FROM PAST PROGRAM ASSESSMENTS		

* If Pending, must have an action plan

4. Approvals (signed by all relevant members)

_____ TEAM MEMBER/TITLE/DATE

_____ TEAM MEMBER/TITLE/DATE

_____ TEAM MEMBER/TITLE/DATE

_____ TEAM MEMBER/TITLE/DATE

_____ TEAM MEMBER/TITLE/DATE

_____ TEAM MEMBER/TITLE/DATE

Product Quality Planning Summary and Approval – Gate 0 (Program Concept) Section Instructions

1. Program Assessments:
    - Using various assessment tools/methods, indicate result or status of the assessment. Items numbered refer to assessments described in the APQP manual. Consult customer for any required assessment tools and criteria for acceptability.
    - If assessment is complete, indicate if ACCEPTBLE using Yes or No. If ACCEPTABLE is No, the organization must have an action plan detailing how to address.
    - If assessment is PENDING, indicate date planned to complete.
    - Refer to APQP Risk Factors Checklist in Appendix A-0, and Sourcing Checklist in Appendix A-9.

2. Program Management:
    - For Team Responsibilities and APQP Metrics Development indicate result or status of development.
    - If development is completed, indicate if acceptable using Yes or No. If ACCEPTABLE is No, the organization must have an action plan detailing how to address.
    - If development is PENDING, indicate date planned to complete.

3. Lessons Learned Implementation:
    - Based on Program Assessments from past programs, indicate result or status of implementation of lessons learned.
    - Enter completed quantity of lessons learned in COMPLETE box.
    - Enter quantity of lessons learned required but not completed in PENDING box. Each item listed as PENDING must have an action plan for implementation.
    - If there are no applicable lessons learned, indicate N/A in the COMPLETE box.

4. Approvals:
    - Relevant team members should sign the form and indicate title and date of signature.

PRODUCT QUALITY PLANNING SUMMARY AND APPROVALS

GATE 1 PROGRAM APPROVAL

DATE: _____

PRODUCT NAME: _____ PART NUMBER / REV: _____

CUSTOMER: _____ MANUFACTURING PLANT: _____

1. PROGRAM PLANNING

	RESULT/STATUS*	
	ACCEPTABLE (Y/N)	PENDING
1.12 PRODUCT ASSURANCE PLAN		
1.13 CAPACITY PLANNING		
1.14 LEADERSHIP SUPPORT PLAN		
1.15 CHANGE MANAGEMENT(LOG)		
1.16 APQP PROGRAM METRICS		
1.17 RISK ASSESSMENT MITIGATION PLAN		
FACILITY AND INFRASTRUCTURE READINESS PLAN		
RESOURCES READINESS PLAN		
SUPPLIER SOURCING & READINESS PLAN		
PROGRAM TIMING PLAN		

* RESULT:
If "ACCEPTABLE" is NO, must have an action plan detailing how to address
If "Pending", must have an action plan

2. LESSONS LEARNED IMPLEMENTATION

	COMPLETE	PENDING*
FROM PAST PROGRAM PLANNING		

* If Pending, must have an action plan

3. Approvals

_____ TEAM MEMBER/TITLE/DATE

_____ TEAM MEMBER/TITLE/DATE

_____ TEAM MEMBER/TITLE/DATE

_____ TEAM MEMBER/TITLE/DATE

_____ TEAM MEMBER/TITLE/DATE

_____ TEAM MEMBER/TITLE/DATE

Product Quality Planning Summary and Approval – Gate 1 (Program Approval) Section Instructions

1. Program Planning:
    - Indicate result or status of the planning for each item assessed in Gate 0, and overall Program Timing Plan. Items numbered are described in the APQP manual. Consult customer for any required plans and criteria for acceptability.
    - If the plan is complete, indicate if ACCEPTBLE using Yes or No. If ACCEPTABLE is No, the organization must have an action plan detailing how to address.
    - If the plan is PENDING, indicate the date planned to complete.
    - Refer to Change Management Checklist in Appendix A-8.

2. Lessons Learned Implementation:
    - Based on Program Planning from past programs and preceding stages of current program, indicate result or status of implementation of lessons learned.
    - Enter completed quantity of lessons learned in COMPLETE box.
    - Enter quantity of lessons learned required but not completed in PENDING box. Each item listed as PENDING must have an action plan for implementation.
    - If there are no applicable lessons learned, indicate N/A in the COMPLETE box.

3. Approvals:
    - Relevant team members should sign the form and indicate title and date of signature.

PRODUCT QUALITY PLANNING SUMMARY AND APPROVALS

GATE 2: DESIGN FEASIBILITY

DATE: _____

PRODUCT NAME: _____ PART NUMBER / REV: _____

CUSTOMER: _____ MANUFACTURING PLANT: _____

1. DFMEA — APPROVED: YES☐ NO*☐ — DATE APPROVED _____
2. DFMA&S — APPROVED: YES☐ NO*☐ — DATE APPROVED _____
3. DESIGN VERIFICATION — MEETS CUSTOMER REQUIREMEI YES☐ NO*☐
4. PROTOTYPE BUILD — APPROVED: YES☐ NO*☐ — DATE APPROVED _____

CONTROL PLAN APPROVAL — CUSTOMER APPROVED: YES☐ NO☐ NOT REQUIRED☐ — DATE APPROVED _____

5. SPECIFICATIONS REVIEW

	QUANTITY IDENTIFIED		
	REQUIRED	ACCEPTABLE	PENDING*
ENGINEERING DRAWINGS			
ENGINEERING SPECIFICATIONS			
MATERIAL SPECIFICATIONS			
DRAWING AND SPECIFICATION CHANGES			

6. NEW EQUIPMENT, TOOLING & FACILITIES REQUIREMENTS — APPROVED: YES☐ NO*☐ — DATE APPROVED _____

7. SPECIAL PRODUCT & PROCESS CHARACTERISTICS

	QUANTITY IDENTIFIED	
	CUSTOMER	ORGANIZATION
PROCESS		
PRODUCT		

8. GAGE AND TEST EQUIPMENT REQUIREMENTS — APPROVED: YES☐ NO*☐ — DATE APPROVED _____

9. TIERED SUPPLIER DESIGN REVIEW

	QUANTITY IDENTIFIED		
	REQUIRED	ACCEPTABLE	PENDING*
DFMEA			
PROTOTYPE BUILD CONTROL PLAN			
NEW EQUIPMENT, TOOLING & FACILITIES			
SPECIAL PRODUCT/PROCESS CHARACTERISTICS			
GAGE AND TEST EQUIPMENT REQUIREMENTS			

10. LESSONS LEARNED IMPLEMENTATION

	COMPLETE	PENDING*
FROM PAST PROGRAMS & PRECEDING STAGES		

* If Pending, must have an action plan

11. Approvals

_____ TEAM MEMBER/TITLE/DATE

_____ TEAM MEMBER/TITLE/DATE

_____ TEAM MEMBER/TITLE/DATE

_____ TEAM MEMBER/TITLE/DATE

_____ TEAM MEMBER/TITLE/DATE

_____ TEAM MEMBER/TITLE/DATE

* REQUIRES PREPARATION OF AN ACTION PLAN TO TRACK PROGRESS.

Product Quality Planning Summary and Approval – Gate 2 (Design Feasibility) Section Instructions

> Note: Unless otherwise indicated, "Approval" means approval by relevant authority within the organization. Confirm with the customer if they require customer approval of any items and include customer approval on this form.

1. DFMEA:
   - Indicate internal approval of DFMEA (Yes or No).
   - If approval is No, the organization must have an action plan detailing how to address.
   - Refer to Design FMEA Checklist in Appendix A-1.

2. Design for Manufacturability, Assembly, and Service:
   - Indicate internal approval of DFMEA (Yes or No).
   - If approval is No, the organization must have an action plan detailing how to address.

3. Design Verification:
   - Indicate if design is verified to meet customer requirements derived from APQP activities described in Chapter 1, including customer input.
   - If design verification is No, the organization must have an action plan detailing how to address, or customer approval of the design as proposed.

4. Prototype Build Control Plan:
   - Indicate internal approval of Prototype Build Control Plan (Yes or No).
   - If approval is No, the organization must have an action plan detailing how to address.
   - Indicate customer approval of Prototype Build Control Plan (Yes, No or Not Required).
   - If approval is No, the organization must have an action plan detailing how to address.
   - Refer to Control Plan Checklist in Appendix A-10.

5. Specifications Review:
   - For each specification type listed, indicate the total quantity REQUIRED, the quantity that are ACCEPTABLE, and the quantity that are PENDING.
   - All items listed as PENDING require preparation of an action plan to address and track progress.
   - See Chapter 2 for description of the specifications to be reviewed; refer to Design Information Checklist in Appendix A-2.

6. New Equipment, Tooling & Facilities Requirements:
   - Indicate internal approval of New Equipment, Tooling & Facilities Requirements (Yes or No). Approval indicates not only identification of the requirements and inclusion in the Timing Chart, but also that there is a process to determine new equipment is capable and delivered on time.
   - If approval is No, the organization must have an action plan detailing how to address.
   - Refer to New Equipment, Tooling and Test Equipment Checklist in Appendix A-3.

7. Special Product and Process Characteristics:
    - Indicate the quantity of Special Product and Process Characteristics identified by the CUSTOMER.
    - Indicate the quantity of additional Special Product and Process Characteristics identified by organization.
    - Refer to Special Characteristics Worksheet in the AIAG Control Plan manual.

8. Gage and Test Equipment Requirements:
    - Indicate internal approval of Gage and Test Equipment Requirements (Yes or No). Approval indicates identification of the requirements and inclusion in the Timing Chart.
    - If approval is No, the organization must have an action plan detailing how to address.

9. Tiered Supplier Design Review:
    - The items listed are the minimum APQP activities related to Design Development verified for the supply chain.
    - For each item listed, indicate the total quantity REQUIRED, the quantity that is ACCEPTABLE, and the quantity that is PENDING.
    - All items listed as PENDING require preparation of an action plan to address and track progress.

10. Lesson Learned Implementation:
    - Based on items from past programs and preceding stages of current program, indicate result or status of implementation of lessons learned.
    - Enter completed quantity of lessons learned in COMPLETE box.
    - Enter quantity of lessons learned required but not completed in PENDING box. Each item listed as PENDING must have an action plan for implementation.
    - If there are no applicable lessons learned, indicate N/A in the COMPLETE box.

11. Approvals:
    - Relevant team members should sign the form and indicate title and date of signature.

PRODUCT QUALITY PLANNING SUMMARY AND APPROVALS

GATE 3: PROCESS FEASIBILITY

DATE: _____

PRODUCT NAME: _____ PART NUMBER / REV: _____

CUSTOMER: _____ MANUFACTURING PLANT: _____

1. PRODUCT/PROCESS QUALITY SYSTEM REVIEW ACCEPTABLE ☐
   IMPROVEMENT NEEDED ☐
   PLANNED COMPLETION DATE OF IMPROVEMENTS _____
2. PROCESS FLOW CHART APPROVED: YES ☐ NO* ☐ DATE APPROVED _____
3. FLOOR PLAN LAYOUT APPROVED: YES ☐ NO* ☐ DATE APPROVED _____
4. PFMEA APPROVED: YES ☐ NO* ☐ DATE APPROVED _____
5. PRE-LAUNCH CONTROL PLAN APPROVAL APPROVED: YES ☐ NO* ☐ DATE APPROVED _____
   CUSTOMER APPROVED: YES ☐ NO* ☐ NOT REQUIRED ☐ DATE APPROVED _____
6. PROCESS INSTRUCTIONS APPROVED: YES ☐ NO* ☐ DATE APPROVED _____
7. GAGE AND TEST EQUIPMENT
   MEASUREMENT SYSTEM ANALYSIS PLAN APPROVED: YES ☐ NO* ☐ DATE APPROVED _____
8. PRELIMINARY PROCESS CAPABILITY STUDY PLAN APPROVED: YES ☐ NO* ☐ DATE APPROVED _____
9. TIERED SUPPLIER PROCESS REVIEW

	QUANTITY		
	REQUIRED	ACCEPTABLE	PENDING*
PFMEA			
PRE-LAUNCH CONTROL PLAN			
MSA PLAN			
Ppk - SPECIAL CHARACTERISTICS PLAN			

10. LESSONS LEARNED IMPLEMENTATION

COMPLETE	PENDING*

FROM PAST PROGRAMS & PRECEDING STAGES

* If Pending, must have an action plan

11. Approvals

_____ TEAM MEMBER/TITLE/DATE

_____ TEAM MEMBER/TITLE/DATE

_____ TEAM MEMBER/TITLE/DATE

_____ TEAM MEMBER/TITLE/DATE

_____ TEAM MEMBER/TITLE/DATE

_____ TEAM MEMBER/TITLE/DATE

* REQUIRES PREPARATION OF AN ACTION PLAN TO TRACK PROGRESS.

Product Quality Planning Summary and Approval – Gate 3 (Process Feasibility) Section Instructions

Note: Unless otherwise indicated, "Approval" means approval by relevant authority within the organization. Confirm with the customer if they require customer approval of any items and include customer approval on this form.

1. Product/Process Quality System Review:
   - Indicate if ACCEPTABLE or IMPROVEMENT NEEDED.
   - If IMPROVEMENT NEEDED, indicate planned completion date of improvements.
   - Refer to Product/Process Quality Checklist in Appendix A-4.

2. Process Flow Chart:
   - Indicate internal approval of Process Flow Chart (Yes or No).
   - If approval is No, the organization must have an action plan detailing how to address.
   - Refer to Process Flow Chart Checklist in Appendix A-6, or equivalent.

3. Floor Plan Layout:
   - Indicate internal approval of Floor Plan Layout (Yes or No).
   - If approval is No, the organization must have an action plan detailing how to address.
   - Refer to Floor Plan Checklist in Appendix A-5.

4. PFMEA:
   - Indicate internal approval of PFMEA (Yes or No)
   - If approval is No, the organization must have an action plan detailing how to address.
   - Refer to Process FMEA Checklist in Appendix A-7.

5. Pre-Launch Control Plan: (may also include Safe Launch elements)
   - Indicate internal approval of Pre-Launch Control Plan (Yes or No).
   - If approval is No, the organization must have an action plan detailing how to address.
   - Indicate customer approval of Pre-Launch Control Plan (Yes, No or Not Required).
   - If approval is No, the organization must have an action plan detailing how to address.
   - Refer to Control Plan Checklist in Appendix A-10.

6. Process Instructions:
   - Indicate internal approval of Process Instructions (Yes or No). Approval indicates not only documentation, but accessibility of Process Instructions to responsible personnel.
   - If approval is No, the organization must have an action plan detailing how to address.
   - Refer to Chapter 3, section 3.8 for description of the Process Instructions to be reviewed.

7. Gage and Test Equipment Measurement System Analysis (MSA) Plan:
   - Indicate internal approval of Gage and Test Equipment MSA Plan (Yes or No).
   - If approval is No, the organization must have an action plan detailing how to address.
   - Refer to the AIAG MSA reference manual, and customer specific requirements.

8. Preliminary Process Capability Study Plan
   - Indicate internal approval of the Preliminary Process Capability Study Plan (Yes or No).
   - If approval is No, the organization must have an action plan detailing how to address.
   - Refer to Chapter 3, section 3.9 for details.

9. Tiered Supplier Process Review:
    - The items listed are the minimum APQP activities related to Process Development verified for the supply chain.
    - For each item listed, indicate the total quantity REQUIRED, the quantity that are ACCEPTABLE, and the quantity that are PENDING.
    - All items listed as PENDING require preparation of an action plan to address and track progress.

10. Lesson Learned Implementation:
    - Based on past programs and preceding stages of current program, indicate result or status of implementation of lessons learned.
    - Enter completed quantity of lessons learned in COMPLETE box.
    - Enter quantity of lessons learned required but not completed in PENDING box. Each item listed as PENDING must have an action plan for implementation.
    - If there are no applicable lessons learned, indicate N/A in the COMPLETE box.

11. Approvals:
    - Relevant team members should sign the form and indicate title and date of signature.

PRODUCT QUALITY PLANNING SUMMARY AND APPROVALS

GATE 4: LAUNCH READINESS

DATE: _____

PRODUCT NAME: _____ PART NUMBER / REV: _____

CUSTOMER: _____ MANUFACTURING PLANT: _____

1. PRELIMINARY PROCESS CAPABILITY STUDY

	QUANTITY		
	REQUIRED	ACCEPTABLE	PENDING*
Ppk - SPECIAL CHARACTERISTICS			
Ppk - OTHER CHARACTERISTICS			

2. PRODUCTION CONTROL PLAN APPROVAL APPROVED: YES☐ NO*☐ DATE APPROVED _____
CUSTOMER APPROVED: YES☐ NO*☐ NOT REQUIRED☐ DATE APPROVED _____

3. INITIAL PRODUCTION SAMPLES
CHARACTERISTIC CATEGORY

	QUANTITY			
	SAMPLES	CHARACTERISTICS PER SAMPLE	ACCEPTABLE	PENDING*
DIMENSIONAL				
VISUAL				
LABORATORY				
PERFORMANCE				

4. GAGE AND TEST EQUIPMENT
MEASUREMENT SYSTEM ANALYSIS (MSA)

	QUANTITY		
	REQUIRED	ACCEPTABLE	PENDING*
SPECIAL CHARACTERISTICS			
OTHER CHARACTERISTICS			

5. PROCESS MONITORING

	QUANTITY		
	REQUIRED	ACCEPTABLE	PENDING*
PROCESS MONITORING INSTRUCTIONS			
PROCESS SHEETS			
VISUAL AIDS			

6. PACKAGING/SHIPPING

	QUANTITY		
	REQUIRED	ACCEPTABLE	PENDING*
PACKAGING APPROVAL			
SHIPPING TRIALS			

7. SIGNIFICANT PRODUCTION RUN MEETS CUSTOMER AND INTERNAL PRODUCTION PLANNING: YES☐ NO*☐

8. TIERED SUPPLIER READINESS

	QUANTITY		
	REQUIRED	ACCEPTABLE	PENDING*
Ppk - SPECIAL CHARACTERISTICS			
CONTROL PLAN			
MSA			
SIGNIFICANT PRODUCTION RUN			

PRODUCT QUALITY PLANNING SUMMARY AND APPROVALS
GATE 4: LAUNCH READINESS (continued)

9. PRODUCTION PART APPROVAL (PPAP) (CUSTOMER APPROVAL STATUS)

APPROVED	☐
INTERIM APPROVAL*	☐
REJECTED*	☐
NOT REQUIRED	☐

10. LESSONS LEARNED IMPLEMENTATION

FROM PAST PROGRAMS & PRECEDING STAGES

COMPLETE	PENDING*

* If Pending, must have an action plan

11. Approvals

TEAM MEMBER/TITLE/DATE	TEAM MEMBER/TITLE/DATE
TEAM MEMBER/TITLE/DATE	TEAM MEMBER/TITLE/DATE
TEAM MEMBER/TITLE/DATE	TEAM MEMBER/TITLE/DATE

* REQUIRES PREPARATION OF AN ACTION PLAN TO TRACK PROGRESS.

Product Quality Planning Summary and Approval – Gate 4 (Launch Readiness) Section Instructions

> Note: Unless otherwise indicated, "Approval" means approval by relevant authority within the organization. Confirm with the customer if they require customer approval of any items and include customer approval on this form.

1. Preliminary Process Capability Study:
   - Under REQUIRED, indicate the total quantity REQUIRED. At a minimum, this must include all Special Characteristics. Additional characteristics may be included using OTHER CHARACTERISTICS.
   - Under ACCEPTABLE, indicate the quantity accepted per customer requirements.
   - Under PENDING, indicate the quantity not accepted. All items listed as PENDING require preparation of an action plan to address and track progress until an acceptable result is achieved.

2. Production Control Plan Approval: (may also include Safe Launch elements)
   - Indicate internal approval of Production Control Plan (Yes or No).
   - If approval is No, the organization must have an action plan detailing how to address.
   - Indicate customer approval of Production Control Plan (Yes, No or Not Required).
   - If approval is No, the organization must have an action plan detailing how to address.
   - Refer to Control Plan Checklist in Appendix A-10.

3. Initial Production Samples:
   - Under SAMPLES, indicate the quantity of samples inspected for each item.
   - Under CHARACTERISTICS PER SAMPLE, for each item indicate the number of characteristics inspected on each sample for each category.
   - Under ACCEPTABLE, for each item indicate the quantity of characteristics acceptable on all samples.
   - Under PENDING, for each item indicate the quantity of characteristics not accepted. All items listed as pending require preparation of an action plan to address and track progress until acceptable result is achieved.

4. Gage and Test Equipment Measurement System Analysis (MSA):
   - Under REQUIRED, indicate the total quantity required. At a minimum, this must include all Special Characteristics. Additional characteristics may be included using OTHER CHARACTERISTICS.
   - Under ACCEPTABLE, indicate the quantity accepted per AIAG Measurement System Analysis manual and/or customer requirements.
   - Under PENDING, indicate the quantity not accepted. All items listed as pending require preparation of an action plan to address and track progress until acceptable result is achieved.

5. Process Monitoring:
   - Under REQUIRED, for each item indicate the total quantity required.
   - Under ACCEPTABLE, for each item indicate the quantity accepted.
   - Under PENDING, for each item indicate the quantity not accepted. All items listed as pending require preparation of an action plan to address and track progress until acceptable result is achieved.

6. Packaging/Shipping:
    - Under REQUIRED, for each item indicate the total quantity required.
    - Under ACCEPTABLE, for each item indicate the quantity accepted.
    - Under PENDING, for each item indicate the quantity not accepted. All items listed as pending require preparation of an action plan to address and track progress until an acceptable result is achieved.

7. Significant Production Run
    - Indicate if results of Significant Production Run verify customer and internal production planning requirements.
    - Refer to Chapter 4, section 4.1 for details.

8. Tiered Supplier Readiness:
    - The items listed are the minimum APQP activities related to Launch Readiness verified for the supply chain.
    - Under REQUIRED, for each item indicate the total quantity required.
    - Under ACCEPTABLE, for each item indicate the quantity accepted.
    - Under PENDING, for each item indicate the quantity not accepted. All items listed as PENDING require preparation of an action plan to address and track progress until an acceptable result is achieved.

9. Production Part Approval (PPAP):
    - Indicate customer approval status using appropriate check box.
    - Approval status of INTERIM APPROVAL or REJECTED requires preparation of an action plan to address and track progress until customer approval is achieved.
    - Refer to AIAG Production Part Approval (PPAP) manual, and customer specific requirements.

10. Lesson Learned Implementation:
    - Based on past programs and preceding stages of current program, indicate result or status of implementation of lessons learned.
    - Enter completed quantity of lessons learned in COMPLETE box.
    - Enter quantity of lessons learned required but not completed in PENDING box. Each item listed as PENDING must have an action plan for implementation.
    - If there are no applicable lessons learned, indicate N/A in the COMPLETE box.

11. Approvals:
    - Relevant team members should sign the form and indicate title and date of signature.

PRODUCT QUALITY PLANNING SUMMARY AND APPROVALS

GATE 5: FEEDBACK, ASSESSMENT & CORRECTIVE ACTION

DATE: _____

PRODUCT NAME: _____ PART NUMBER / REV: _____

CUSTOMER: _____ MANUFACTURING PLANT: _____

1. PROCESS CAPABILITY STUDY

	QUANTITY		
	REQUIRED	ACCEPTABLE	PENDING*
Cpk - SPECIAL CHARACTERISTICS			
Cpk - OTHER CHARACTERISTICS			

2. PRODUCTION CONTROL PLAN APPROVAL (APPROVAL TO END SAFE LAUNCH)

APPROVED: YES☐ NO*☐ DATE APPROVED _____

CUSTOMER APPROVED: YES☐ NO*☐ NOT REQUIRED☐ DATE APPROVED _____

3. LESSONS LEARNED INCORPORATION

	COMPLETE	PENDING*
:URRENT PART (FMEA/CP/WORK INSTRUCTIONS)		
FAMILY/FOUNDATION FMEAs/CPs		
"READ ACROSS" SYSTEM UPDATED		

4. Approvals

_____ TEAM MEMBER/TITLE/DATE

_____ TEAM MEMBER/TITLE/DATE

_____ TEAM MEMBER/TITLE/DATE

_____ TEAM MEMBER/TITLE/DATE

_____ TEAM MEMBER/TITLE/DATE

_____ TEAM MEMBER/TITLE/DATE

* REQUIRES PREPARATION OF AN ACTION PLAN TO TRACK PROGRESS.

Product Quality Planning Summary and Approval – Gate 5 (Feedback, Assessment and Corrective Action) Section Instructions

Note: Unless otherwise indicated, "Approval" means approval by relevant authority within the organization. Confirm with the customer if they require customer approval of any items and include customer approval on this form.

1. Process Capability Study:
   - Under REQUIRED, indicate the total quantity REQUIRED. At a minimum, this must include all Special Characteristics. Additional characteristics may be included using OTHER CHARACTERISTICS.
   - Under ACCEPTABLE, indicate the quantity accepted per customer requirements.
   - Under PENDING, indicate the quantity not accepted. All items listed as PENDING require preparation of an action plan to address and track progress until an acceptable result is achieved.

2. Production Control Plan Approval (Approval to End Safe Launch):
   - Indicate internal approval to end Safe Launch and implement Production Control Plan (Yes or No).
   - If approval is No, the organization must have an action plan detailing how to address.
   - Indicate customer approval to end Safe Launch and implement Production Control Plan (Yes, No or Not Required).
   - If approval is No, the organization must have an action plan detailing how to address
   - Refer to Control Plan Checklist in Appendix A-10, and customer's Safe Launch program requirements and exit criteria.

3. Lesson Learned Incorporation:
   - Based on accumulated lessons learned of current program, indicate result or status of implementation of lessons learned related to the current part, Family/Foundation FMEAs and Control Plans (if applicable), and the organization's system to ensure application of lessons learned across the entire organization.
   - For each item, enter completed quantity of lessons learned in COMPLETE box.
   - For each item, enter quantity of lessons learned required but not completed in PENDING box. Each item listed as PENDING must have an action plan for implementation.
   - If there are no applicable lessons learned, indicate N/A in the COMPLETE box.

4. Approvals:
   - Relevant team members should sign the form and indicate title and date of signature.

APPENDIX C
ANALYTICAL TECHNIQUES

Introduction

This Chapter describes several common analytical techniques used during the APQP process. It is not intended to be all inclusive.

APQP Program Metrics

The APQP program metrics is an overview document managed and completed by the project team manager.

The metrics incorporates all the critical elements of the quality program and quantifies the readiness of each element with respect to the stage of the program. The intention of the metrics is to summarize the state of the program for presentation to leadership at a gate review.

The metrics should always reflect the honest state of the program. An example may be the traffic light system (red, yellow, and green) to show leadership the status for approval. Red meaning not started or missed target, yellow meaning in process or plan created and approved, and green meaning completed.

It is important that all elements of the program are contained in the metrics, including any special or unique characteristics of the program.

	Project Leadership					Project Management Team									Last Review Date	6/22/xxxx
Responsible / Deliverables	Executive	Purchasing	Finance	Role #4	Role #5	Project Manager	IT Manager	Production Manager	Quality Manager	HR/ Recruitment	Design/Styling Manager	Engineering Manager	Material Manager	Maintenance Manager	Status	
Initiate Planning	X															
Evaluate Risks			X												Number of tasks	xx
Get Approved Resources		X													Number completed	xx
Obtain Equipment Approval			X												%	
Determine Program Requirements						X			X							
Create Program Schedule (Timing)						X										Completed
Determine Lead Time for Parts								X								In process
Determine Equipment Timing & Inspection														X		Not started or missed target
Testing & Verification							X							X		
Training for all Department										X						
Tasks / Target Date	1/15/xx	2/8/xx	2/15/xx	3/5/xx	3/20/xx	4/5/xx	4/20/xx	4/5/xx	4/20/xx	5/5/xx	5/20/xx	6/5/xx	6/20/xx	6/5/xx	Responsible Owner	Action Plan
Assess Security Risks - Software		x													J. Smith	
Submit Request for New Org Template				x											D. Jones	
Review CSR & SOR for Compliance	x														T. Samual	
Submit PO for xxx Tester			x												S. Test	
Create Orientation Packet for New Hires				x											A. Zeal	

Assembly Build Variation Analysis

An assembly build variation analysis is an analysis that simulates the buildup of an assembly and examines tolerance accumulation, statistical parameters, sensitivity, and "what if" investigation.

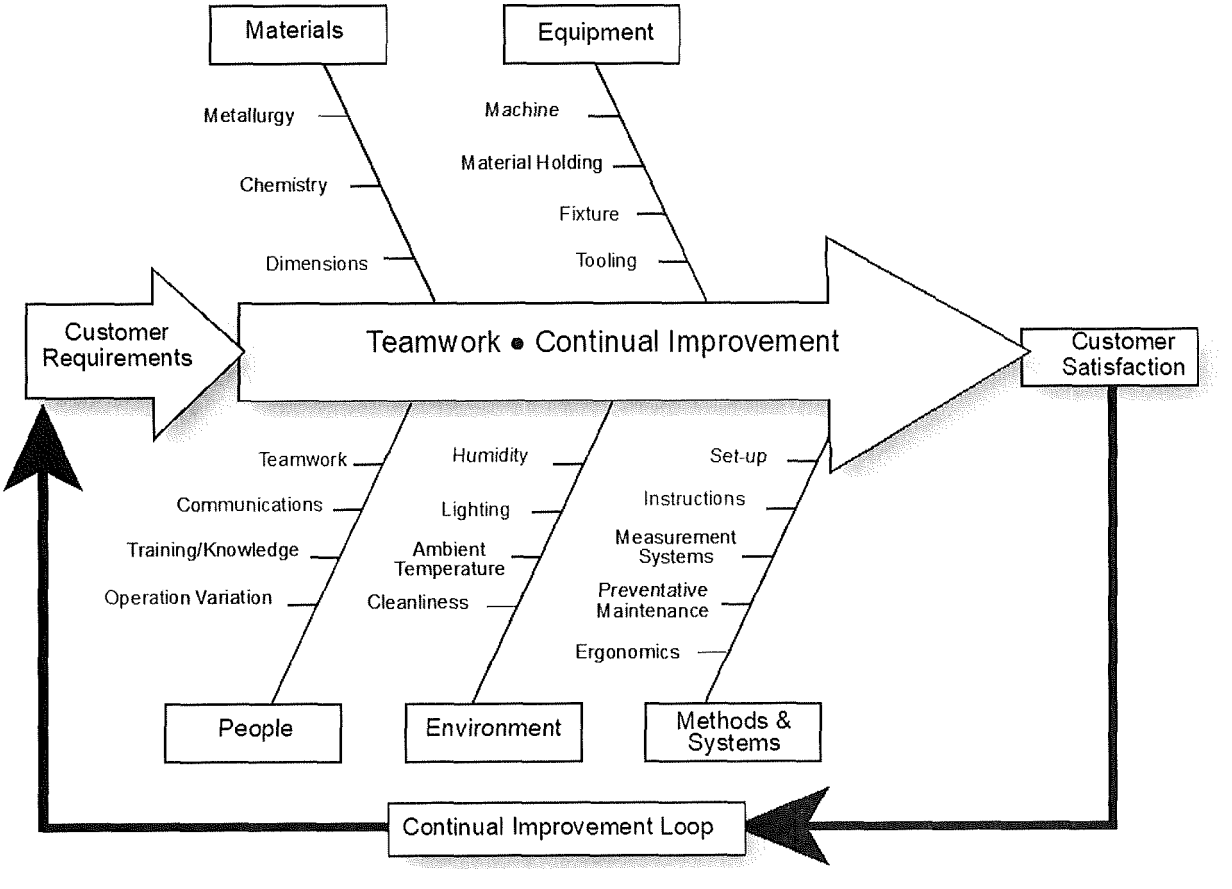
Benchmarking

Benchmarking is a systematic approach to identifying standards for comparison. It provides input to the establishment of measurable performance targets, as well as ideas for product design and process design. It can also provide ideas for improving business processes and work procedures.

Product and process benchmarking should include the identification of world class or best-in-class based on customer and internal objective performance measures and research into how this performance was achieved. Benchmarking should provide a stepping stone for developing new designs and processes that exceed the capabilities of benchmark companies.

Cause and Effect Diagram

The "cause and effect" diagram is an analytical tool to indicate the relationship between an "effect" and all possible "causes" influencing it. This is sometimes referred to as fishbone diagram, Ishikawa diagram, or feather diagram.



Cause and Effect Diagram

The Cause and Effect Diagram organizes the types of process inputs into a cause-and-effect model, where the primary groupings are People, Materials, Equipment, Methods and Systems, Environment and Customer Requirements.

The key to successful development of cost-effective processes is identification of the sources of variation and appropriate control methods.

Control Plan Special Characteristics

The Control Plan Special Characteristics worksheet is a recommended method to document and update special characteristics. See Section 2.11.

CONTROL PLAN SPECIAL CHARACTERISTICS

☐ Prototype ☐ Pre-Launch ☐ Production ☐ Safe Launch

Control Plan Number		Key Contact/Phone			Date (Orig.)	Date (Rev.)
Part Number/Latest Change Level		Core Team			Customer Engineering Approval/Date (If Req'd.)	
Part Name/Description		Supplier/Plant Approval/Date			Customer Quality Approval/Date (If Req'd.)	
Supplier/Plant	Supplier Code	Other Approval/Date (If Req'd.)			Other Approval/Date (If Req'd.)	
No.	Description/Rationale	Specification/Tolerance	Class	Process/Product	Illustration/Pictorial	

Critical Path Method

The critical path method can be a Pert or Gantt Chart that shows the chronological sequence of tasks that require the greatest expected time to accomplish. It can provide valuable information as to:

- Interrelationships.
- Early forecast of problems.
- Identification of responsibility.
- Resource identification, allocation and leveling.

Design of Experiments (DOE)

A design experiment is a test or sequence of tests where potential influential process variables are systematically changed according to a prescribed design matrix. The response of interest is evaluated under the various conditions to:

- Identify the influential variables among the ones tested.
- Quantify the effects across the range represented by the levels of the variables.
- Gain a better understanding of the nature of the causal system at work in the process.
- Compare the effects and interactions.

Application early in the product/process development cycle can result in:

- Improved process yields.
- Reduced variability around a nominal or target value.
- Reduced development time.
- Reduced overall costs.

Design for Manufacturability and Assembly

Design for Manufacturability and Assembly is a simultaneous engineering process designed to optimize the relationship between design function, manufacturability, and ease of assembly. The enhancement of designs for assembly and manufacturing is an important step. Plant representatives should be consulted early in the design process to review components or systems and provide input on specific assembly and manufacturing requirements. Specific dimensional tolerances should be determined based on the like process. This will assist in identifying the equipment required and any process changes necessary.

Design for Serviceability

Design for Serviceability is a simultaneous engineering process designed to optimize the relationship between design function, ease of assembly, and ease of repair. The enhancement of designs for serviceability is an important step. Service engineering representatives should be consulted as early as a design's concept to review components, assemblies, and sub-systems to provide input on specific service strategies, design criteria, requirements, and best practices. This early input will assist in ensuring an improved accuracy of diagnostics, avoidance of special service tools, improved ease of maintenance tasks, reduced service part costs, avoidance of special handling requirements, lower labor time of repair, and lower cost of repairs.

Design Verification Plan and Report (DVP&R)

The Design Verification Plan and Report (DVP&R) is a method to plan and document testing activity through each phase of product/process development from inception to ongoing refinement. An effective DVP&R provides a concise working document that aids engineering personnel in the following areas:

- Facilitates the development of a logical testing sequence by requiring the responsible areas to thoroughly plan the tests needed to ensure that the component or system meets all engineering requirements.
- Ensures product reliability meets customer-driven objectives.
- Highlights situations where customer timing requires an accelerated test plan.
- Serves as a working tool for responsible area(s) by:
  - Summarizing functional, durability, and reliability testing requirements and results in one document for ease of reference.
  - Providing the ability to easily prepare test status and progress reports for design reviews.

Detailed instructions can be obtained from the appropriate Ford, GM, and Stellantis engineering areas.

Failure Mode and Effects Analysis (FMEA)

A systematic approach to the execution of engineering disciplines to deliver customer expectations while avoiding product and process failure modes and effects through maximizing robustness and reducing or eliminating mistakes.

- It is better to prevent failure modes rather than to detect them.
- Countermeasures to potential failures are taken in the development phase.

Mistake-Proofing/Error-Proofing

Mistake-proofing is a technique to identify errors after they occur. Mistake-proofing should be used as a technique to control repetitive tasks or actions and prevent nonconformances from being passed on to the subsequent operation and ultimately the customer. Error-proofing is a technique used to identify potential process errors and either design them out of the product or process, or eliminate the possibility that the error could produce a nonconformance.

- Error-proofing describes designs, devices, and/or methodologies to prevent defective parts from being produced (occurrence controls on DFMEA or PFMEA), or to detect defective parts and ensures they are contained within the process or prevented from shipping to customers (detection controls on DFMEA or PFMEA).
- Mistake-proofing is a sub-set of error-proofing that tends to focus on detecting the presence of a defect, and either stopping further production or ensuring all defective and suspect parts are contained.
- The continuum diagram below is one way of looking at the thinking behind categorizing the controls as error-proofing or mistake-proofing. In some cases, design or device controls may not be feasible, so reliance on methodologies and standardized work practices may be chosen. However, it is desirable to choose the approach that results in the highest level of assurance possible.
- Regardless of the categorization (error-proofing or mistake-proofing), verification of effectiveness of the controls is required:
  - If devices are used that provide the necessary controls, those devices must be listed on the control plan, and a method to periodically verify effectiveness of the device in prevention or detection of the failure mode or cause must be included in the control plan. Frequency of the verification should be based on ability to enable effective containment of product produced since the last good verification result.
  - If methodologies and standardized work practices are used to provide the necessary controls, effectiveness of those methodologies and practices should be verified periodically through use of Layered Process Audits, SPC data analysis, or other methods agreed upon between the customer and organization.

Error-Proofing

- Product design
  - Remove the possibility of error by designing out the potential cause during product development
- Process design
  - Remove the possibility of error by designing out the potential cause during process development
- Prevention
  - Designing the part or process so only the correct result can be performed
    - Unique connectors, guide pins, etc.

Mistake-Proofing

- Control
  - Designing the workspace to "Do It Right The First Time" (DIRTFT)
    - Lighting
    - Visual controls
    - Checklists and data entry verification
    - Hand-off protocol
    - Goals, KPI's, shift stand-up meetings, etc.
    - Layered Process Audits (LPA)
- Detection
  - Notification of a nonconformance for immediate corrective action
    - Automated checking devices
    - Alarms and line stoppage
  - Outgoing QA checks
- Correction
  - Incoming QA checks at the next operation
  - Off line rework

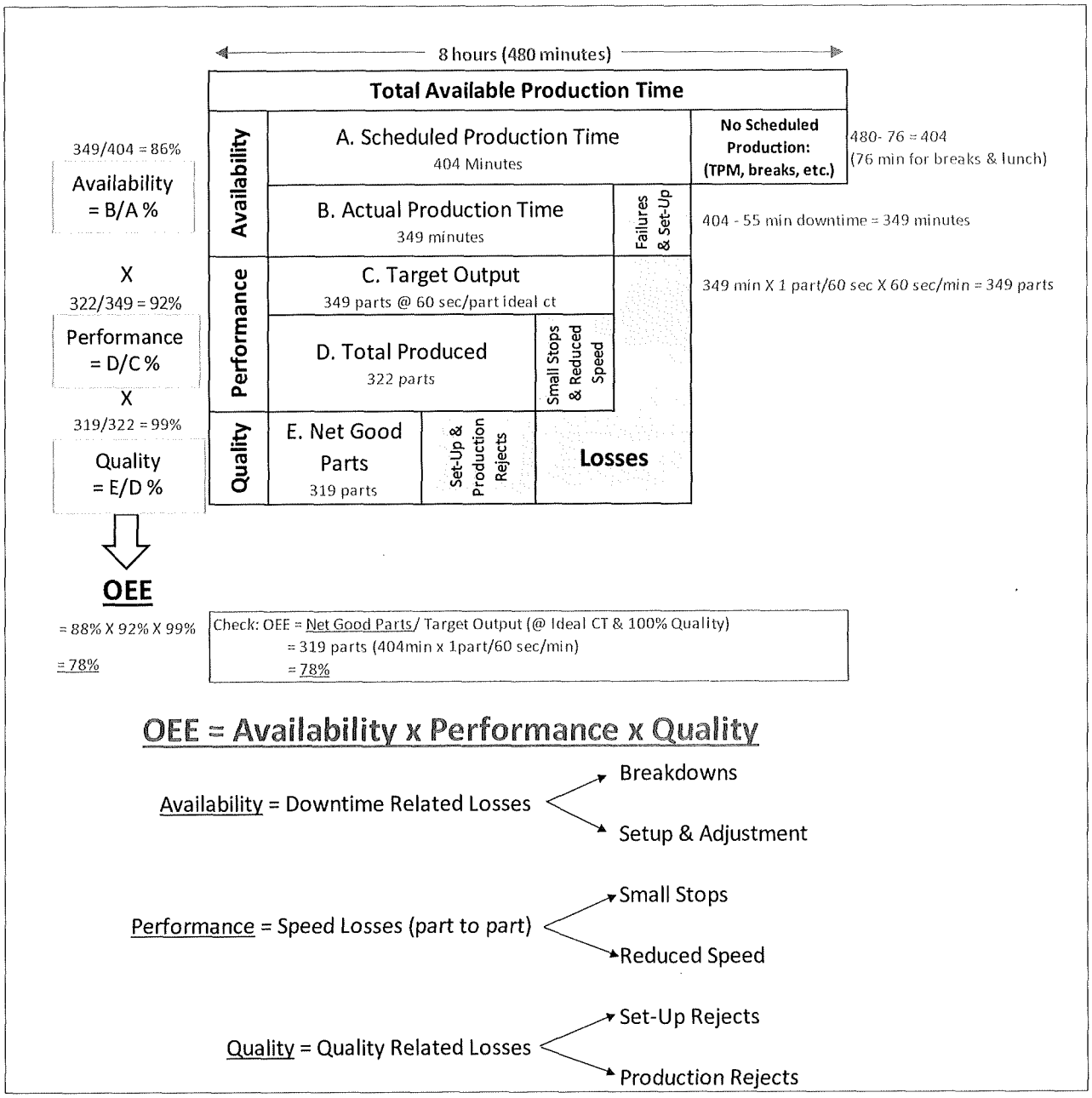
OEE (Overall Equipment Effectiveness)

OEE (Overall Equipment Effectiveness) is a measure of how well a manufacturing operation is utilized (facilities, time, and material) compared to its full potential, during the periods when it is scheduled to run. It identifies the percentage of manufacturing time that is truly productive. An OEE of 100% means that only good parts are produced (100% quality), at the maximum speed (100% performance), and without interruption (100% availability).

The benefits of OEE Measurement:

- Improve effectiveness of equipment.
- Shop floor employee involvement/empowerment.
- Reduction in equipment downtime and maintenance costs.
- Improved management of maintenance cycle.
- Increased productivity by identifying bottlenecks.
- Increased rate of quality, reduced scrap.

Without the historical data of OEE it would be difficult to accurately determine the true capacity of a manufacturing process and its ability to support customer demand.

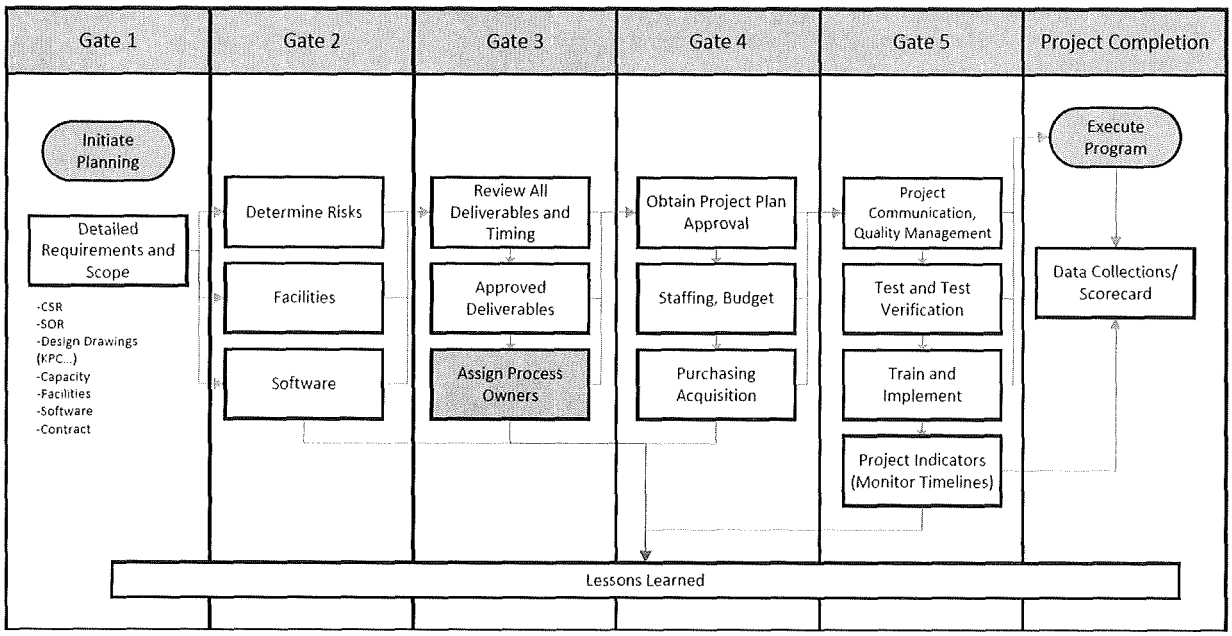


OEE Calculation Example

Process Flow Charting

Process flow charting is a visual approach to describing and developing sequential or related work activities. It provides both a means of communication and analysis for planning, development activities, and manufacturing processes.

Since one goal of quality assurance is to eliminate nonconformities and improve the efficiency of manufacturing and assembly processes, advanced product quality plans should include illustrations of the controls and resources involved. These process flow charts should be used to identify improvements and to locate significant or critical product and process characteristics that will be addressed in control plans to be developed later.



Process Flow Chart Example

Risk Assessment Mitigation Plan

HAZARD	RISK	RISK RATING	RISK CONTROL/ PLAN	IMPLIMENT/ MONITOR	RESPONSIBILITY	RISK RATING AFTER CONTROL	RATING GUIDE
Supplier not ready	High	8	Develop supplier	Weekly review meetings	Purchasing	4	HIGH 7 TO 10
Design behind schedule	Medium	5	Add design resource	Daily review status with design	Program management	2	MEDIUM 4 TO 7
Plant equipment late	High	9	Daily status meetings with equipment supplier	Daily reports to senior management	Plant management	5	LOW 1 TO 4

The items shown above are examples only. When creating a mitigation plan do not use these as items in your plan.

Traceability

The text below uses the term "part", but similar concepts may be applied to components, materials, modules, etc.

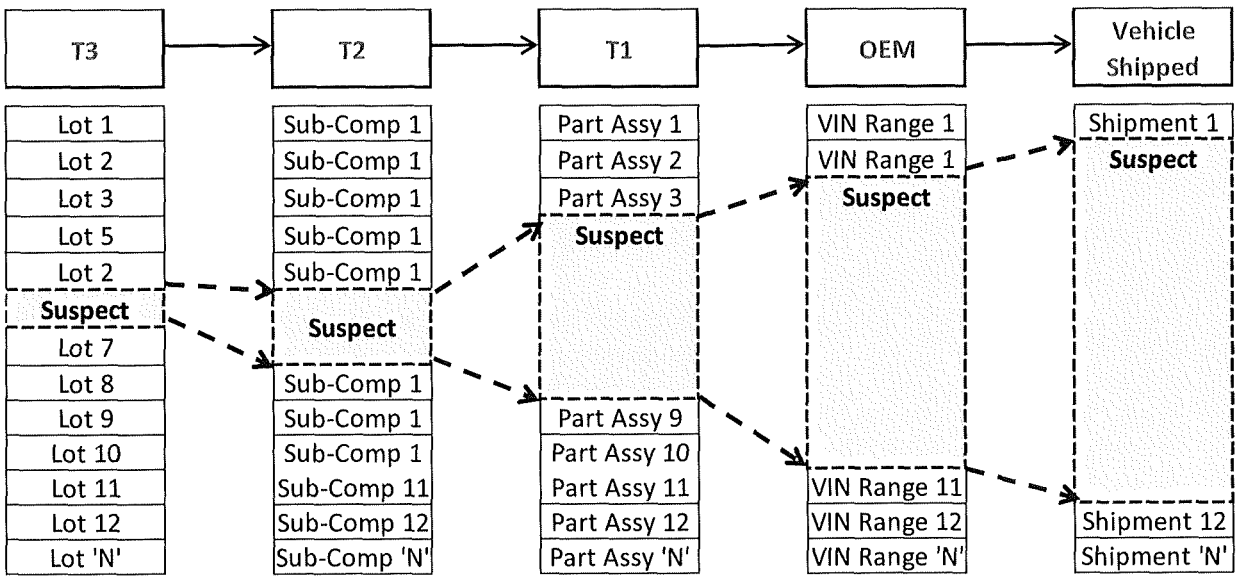
Traceability provides quick and accurate part genealogy data to limit the scope of potential problems, typically by either enabling containment of suspect nonconforming product or accurate identification of suspect product that has escaped containment.

In an ideal situation, parts will have one to one "part identifier to Vehicle Identification Number (VIN)" traceability; however, this is not always feasible so alternate methods such as lot traceability to a VIN range may be used.

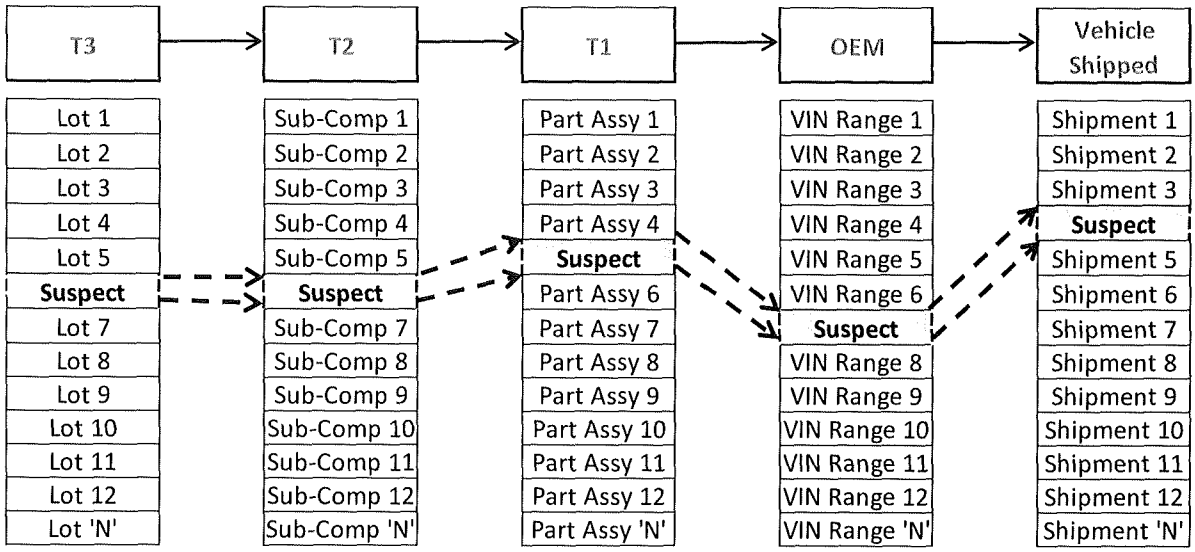
While the organization may develop traceability systems and methods based on their own risk assessment, the customer may have specific requirements for specific parts. These requirements may be part of technical data such as drawings or may be communicated in other methods.

The images below illustrate the impact of weak and strong traceability systems.

Refer to the AIAG CQI-28 Traceability Guideline for additional background and details of industry practices.



Example of Weak Traceability



Example of Strong Traceability

Some key points to consider and address when establishing traceability for specific parts include:

- Obtain agreement with your customer on what parts require traceability, and if "Part to VIN" or "Lot to VIN Range" traceability is required. Confirming choices made will conform to any regulatory requirements.
- Obtain agreement with your customer on the methods to identify individual parts (e.g., serial number) or groups of parts/materials (e.g., lot number), and how the identifier will be associated (e.g., direct part marking, lot coding on bins of parts, RFID tags) with the part(s).
- Obtain agreement with your customer on how the identifier for the individual part or group of parts will be read, associated with their product, and stored for future use (e.g., scan QR code at assembly point and assign to VIN number which is stored in VIN history files).
- Include traceability considerations in both product and process FMEA. The type of traceability identification, and the assurance of a capable process to identify parts and read/store/use part traceability data should be considered.
- When selecting part or lot identifying methods, consider durability of the identifier through the entire supply chain and into the field. It must remain "readable" for the life of the product.
- Ensure systems for FIFO and "mixed part prevention" are robust and checked for effectiveness using internal audits. These systems are critical to enabling accurate and timely containment or field treatment.

APPENDIX D
TEAM FEASIBILITY COMMITMENT

TEAM FEASIBILITY COMMITMENT

Customer: _____ Date: _____

Part Number: _____ Part Name: _____

Revision Level _____

Feasibility Considerations

Our product quality planning team has considered the following questions.
The drawings and/or specifications provided have been used as a basis for analyzing the organizations ability to meet all specified requirements. All "no" answers are supported with attached comments identifying our concerns and/or proposed changes to enable the organization to meet the specified requirements.

Yes	No	CONSIDERATION
		Is product adequately defined (application requirements, etc.) to enable feasibility evaluation?
		Can Engineering Performance Specifications be met as written?
		Can appearance requirements be met as designed?
		Can product be manufactured to tolerances specified on drawing?
		Can product be manufactured with process capability that meet requirements?
		Is there adequate capacity to produce product?
		Does the design allow the use of efficient material handling techniques?
		Can the product be manufactured within normal cost parameters? Abnormal cost considerations may include:
		- Costs for capital equipment?
		- Costs for tooling?
		- Alternative manufacturing methods?
		Is statistical process control required on the product?
		Is statistical process control presently used on similar products?
		Where statistical process control is used on similar products:
		- Are the processes in control and stable?
		- Does process capability meet customer requirements?

Conclusion

☐	Feasible	Product can be produced as specified with no revisions.
☐	Feasible	Changes recommended (see attached).
☐	Not Feasible	Design revision required to produce product within the specified requirements.

Approval

_____ Team Member/Title/Date

_____ Team Member/Title/Date

_____ Team Member/Title/Date

_____ Team Member/Title/Date

_____ Team Member/Title/Date

_____ Team Member/Title/Date

APPENDIX E
QUALITY PLANNING SUMMARY AND APPROVAL

PRODUCT QUALITY PLANNING SUMMARY AND APPROVAL

DATE: _____

PRODUCT NAME: _____ PART NUMBER / REV: _____

CUSTOMER: _____ MANUFACTURING PLANT: _____

1. PRELIMINARY PROCESS CAPABILITY STUDY

	QUANTITY		
	REQUIRED	ACCEPTABLE	PENDING*
Ppk - SPECIAL CHARACTERISTICS			
Ppk - OTHER CHARACTERISTICS			

2. PRODUCTION CONTROL PLAN APPROVAL APPROVED: YES ☐ NO* ☐ DATE APPROVED _____

CUSTOMER APPROVED: YES ☐ NO* ☐ NOT REQUIRED ☐ DATE APPROVED _____

3. INITIAL PRODUCTION SAMPLES
CHARACTERISTIC CATEGORY

	QUANTITY			
	SAMPLES	CHARACTERISTICS PER SAMPLE	ACCEPTABLE	PENDING*
DIMENSIONAL				
VISUAL				
LABORATORY				
PERFORMANCE				

4. GAGE AND TEST EQUIPMENT
MEASUREMENT SYSTEM ANALYSIS (MSA)

	QUANTITY		
	REQUIRED	ACCEPTABLE	PENDING*
SPECIAL CHARACTERISTICs			
OTHER CHARACTERISTICs			

5. PROCESS MONITORING

	QUANTITY		
	REQUIRED	ACCEPTABLE	PENDING*
PROCESS MONITORING INSTRUCTIONS			
PROCESS SHEETS			
VISUAL AIDS			

6. PACKAGING/SHIPPING

	QUANTITY		
	REQUIRED	ACCEPTABLE	PENDING*
PACKAGING APPROVAL			
SHIPPING TRIALS			

7. SIGNIFICANT PRODUCTION RUN MEETS CUSTOMER AND INTERNAL PRODUCTION PLANNING: YES ☐ NO* ☐

8. TIERED SUPPLIER READINESS

	QUANTITY		
	REQUIRED	ACCEPTABLE	PENDING*
Ppk - SPECIAL CHARACTERISTICS			
CONTROL PLAN			
MSA			
SIGNIFICANT PRODUCTION RUN			

PRODUCT QUALITY PLANNING SUMMARY AND APPROVAL (continued)

9. PRODUCTION PART APPROVAL (PPAP) (CUSTOMER APPROVAL STATUS)

APPROVED	☐
INTERIM APPROVAL*	☐
REJECTED*	☐
NOT REQUIRED	☐

10. LESSONS LEARNED IMPLEMENTATION

FROM PAST PROGRAMS & PRECEDING STAGES

COMPLETE	PENDING*

* If Pending, must have an action plan

11. Approvals

TEAM MEMBER/TITLE/DATE	TEAM MEMBER/TITLE/DATE
TEAM MEMBER/TITLE/DATE	TEAM MEMBER/TITLE/DATE
TEAM MEMBER/TITLE/DATE	TEAM MEMBER/TITLE/DATE

* REQUIRES PREPARATION OF AN ACTION PLAN TO TRACK PROGRESS.

Product Quality Planning Summary and Approval – Instructions

Note: Unless otherwise indicated, "Approval" means approval by relevant authority within the organization. Confirm with the customer if they require customer approval of any items and include customer approval on this form.

1. Preliminary Process Capability Study:
   - Under REQUIRED, indicate the total quantity REQUIRED. At a minimum, this must include all Special Characteristics. Additional characteristics may be included using OTHER CHARACTERISTICS.
   - Under ACCEPTABLE, indicate the quantity accepted per customer requirements.
   - Under PENDING, indicate the quantity not accepted. All items listed as PENDING require preparation of an action plan to address and track progress until an acceptable result is achieved.

2. Production Control Plan Approval: (may also include Safe Launch elements)
   - Indicate internal approval of Production Control Plan (Yes or No).
   - If approval is No, the organization must have an action plan detailing how to address.
   - Indicate customer approval of Production Control Plan (Yes, No or Not Required).
   - If approval is No, the organization must have an action plan detailing how to address.
   - Refer to Control Plan Checklist in Appendix A-10.

3. Initial Production Samples:
   - Under SAMPLES, indicate the quantity of samples inspected for each item.
   - Under CHARACTERISTICS PER SAMPLE, for each item indicate the number of characteristics inspected on each sample for each category.
   - Under ACCEPTABLE, for each item indicate the quantity of characteristics acceptable on all samples.
   - Under PENDING, for each item indicate the quantity of characteristics not accepted. All items listed as pending require preparation of an action plan to address and track progress until an acceptable result is achieved.

4. Gage and Test Equipment Measurement System Analysis (MSA):
   - Under REQUIRED, indicate the total quantity required. At a minimum, this must include all Special Characteristics. Additional characteristics may be included using OTHER CHARACTERISTICS.
   - Under ACCEPTABLE, indicate the quantity accepted per the AIAG Measurement System Analysis manual and/or customer requirements.
   - Under PENDING, indicate the quantity not accepted. All items listed as pending require preparation of an action plan to address and track progress until an acceptable result is achieved.

5. Process Monitoring:
   - Under REQUIRED, for each item indicate the total quantity required.
   - Under ACCEPTABLE, for each item indicate the quantity accepted.
   - Under PENDING, for each item indicate the quantity not accepted. All items listed as pending require preparation of an action plan to address and track progress until an acceptable result is achieved.

6. Packaging/Shipping:
   - Under REQUIRED, for each item indicate the total quantity required.
   - Under ACCEPTABLE, for each item indicate the quantity accepted.
   - Under PENDING, for each item indicate the quantity not accepted. All items listed as pending require preparation of an action plan to address and track progress until acceptable result is achieved.

7. Significant Production Run
   - Indicate if results of Significant Production Run verify customer and internal production planning requirements.
   - Refer to Chapter 4, section 4.1 for details.

8. Tiered Supplier Readiness:
   - The items listed are the minimum APQP activities related to Launch Readiness verified for the supply chain.
   - Under REQUIRED, for each item indicate the total quantity required.
   - Under ACCEPTABLE, for each item indicate the quantity accepted.
   - Under PENDING, for each item indicate the quantity not accepted. All items listed as PENDING require preparation of an action plan to address and track progress until an acceptable result is achieved.

9. Production Part Approval (PPAP):
   - Indicate customer approval status using appropriate check box.
   - Approval status of INTERIM APPROVAL or REJECTED requires preparation of an action plan to address and track progress until customer approval is achieved.
   - Refer to AIAG Production Part Approval (PPAP) manual, and customer specific requirements.

10. Lesson Learned Implementation:
    - Based on past programs and preceding stages of current program, indicate result or status of implementation of lessons learned.
    - Enter completed quantity of lessons learned in COMPLETE box.
    - Enter quantity of lessons learned required but not completed in PENDING box. Each item listed as PENDING must have an action plan for implementation.
    - If there are no applicable lessons learned, indicate N/A in the COMPLETE box.

11. Approvals:
    - Relevant team members should sign the form and indicate title and date of signature.

Appendix E

Quality Planning Summary and Approvals

APPENDIX F
REFERENCE MATERIAL

The following manuals can be obtained from AIAG at www.aiag.org.

AIAG & VDA Failure Mode and Effects Analysis (FMEA) Handbook

This reference manual can be used as a guide to assist in the development of Design FMEA, Process FMEA, and Supplemental FMEA for Monitoring and System Response.

Control Plan Reference Manual

This manual provides general guidelines for ensuring that Control Plans are implemented in accordance with the requirements of the customer.

Measurement Systems Analysis (MSA) Reference Manual

This reference manual describes common methods of evaluating measurement system variation and gives general guidance in the application of techniques.

Production Part Approval Process (PPAP)

This requirements document covers generic requirements for production part approval for all production and service commodities.

Statistical Process Control (SPC) Reference Manual

This reference manual provides a unified reference for statistical process control and gives general guidance in the application of techniques.

CQI-8 Layered Process Audit Guideline

This guideline integrates LPA with management of Key Performance Indicators (KPIs) and includes recommendations for expanding ownership beyond the Quality function, for writing effective LPA check sheet questions, and explains the audit process in more detail.

CQI-14 Automotive Warranty Management: A Guideline for Industry Best Practices

CQI-14 is designed to promote advances in consumer satisfaction and continuous warranty improvement by providing a recommended, robust warranty management program that instills a consumer-centric approach to warranty management by focusing on incident rate reduction.

CQI-19 Sub-Tier Supplier Management Process Guideline

This guideline defines the minimum quality-related requirements for Sub-Tier suppliers and provides explicit guidance on effective identification and control of Pass-Through Characteristics (PTC).

CQI-28 AIAG Traceability Guideline

AIAG's Traceability Guideline is a single, consistent application guideline for traceability, highlighting best practices and showcasing applications/case studies of the latest technology solutions.

APPENDIX G
Sector Specific Guidance

Introduction

Experience has shown that variation in the interpretation of APQP, Control Plans (CP), and PPAP in non-traditional parts manufacturing sectors causes significant waste throughout the supply chain. Suppliers get different interpretations of what is expected from customers, supplier quality engineers, auditors, and internally between departments.

Goal

Improve the applicability of APQP/CP/PPAP by clarifying requirements for specific sectors or commodities with significant differences in design and manufacturing operations. Provide a means for developing, documenting, and distributing clarifications. Clarifications may include changes in terminology, alternate requirements, or change in applicability.

Rules for successful sector requirements:

- Sector clearly defined.
- Broadly applicable across the sector and possibly beyond that.
- Sector consensus on agreement to use the revised definitions.
- OEM agreement.

Method

Sector proposes clarifications indexed to the APQP/CP/PPAP requirements through the following process: All referenced forms are available at https://www.aiag.org/quality/automotive-core-tools/apqp

1. The sector identifies and justifies the need for clarification (typically initiated by a few motivated representatives).
2. The sector, to proceed with development of the guidance table, completes and submits a petition to AIAG using the on-line petition form.
3. AIAG reviews the petition and works with the author to prepare it for submission.
4. When all requirements are met, AIAG manages the review and approval process with the appropriate oversite team for the approval to start.
5. AIAG, or the appropriate sector association, conducts a call to action for volunteers and forms a team to draft the guidance table.
6. The sector team reaches consensus on the significant clauses in the APQP/CP/PPAP and develops the guidance table.
7. The sector team submits the draft guidance table to AIAG for review with the appropriate oversite team for disposition.
8. If rejected, AIAG provides feedback to the sector team.
9. If approved, return to sector team for stakeholder review and reconciliation of comments.
10. After final approval, AIAG announces and posts the guidance table as a free download.
11. Ongoing edits and periodic reviews are managed by AIAG.

APPENDIX H
GLOSSARY

Glossary

Andon: A visual management tool that indicates status of a process and signals/alerts if an abnormality occurs that requires action. The alert can be activated manually by a worker or may be activated automatically by the production equipment itself. Alert systems may incorporate audio alarms, text, or other displays.

Apportionment: Synonymous with the term Reliability Apportionment, which is the assignment of reliability goals from system to subsystem in such a way that the whole system will have the required reliability.

Benchmark Data: The results of an investigation to determine how competitors and/or best-in-class companies achieved their level of performance.

Bill of Material: Total list of all components and materials required to manufacture the product.

Customer: The entity that is receiving the output of the organization.

Critical Characteristics: Characteristics in addition to special characteristics that the organization or customer identifies for special treatment. Sometimes referred to as key characteristics.

Design Failure Mode and Effects Analysis (DFMEA): An analytical technique used by a design responsible organization as a means to ensure, to the extent possible, that potential failure modes and their associated causes/mechanisms have been considered and addressed. See the current edition of FMEA.

Design for Manufacturability and Assembly: A simultaneous engineering process designed to optimize the relationship between design function, manufacturability, and ease of assembly.

Design for Serviceability: A simultaneous engineering process designed to optimize the relationship between design function, ease of assembly, and ease of repair.

Design Information Checklist: A mistake-proofing checklist designed to ensure that all important items were considered in establishing design requirements.

Design Reviews: Milestone checkpoints to review progress of the design process, a proactive process.

(Design) Validation: Confirmation through objective evidence, that the requirements for a specific intended use or application have been fulfilled. Testing to ensure that product conforms to defined user needs and/or requirements. Design validation follows successful design verification and is normally performed on the final product under defined operating conditions. Multiple validations may be performed if there are different intended uses.

(Design) Verification (DV): Confirmation through objective evidence, which specified requirements have been fulfilled. Testing to ensure that all design outputs meet requirements may include activities such as:

- Design Review
- Performing Alternate Calculations
- Understanding Tests and Demonstrations
- Review of Design Stage Documents Before Release

Durability: The probability that an item will continue to function at customer expectation levels, at the useful life without requiring overhaul or rebuild due to wear-out.

Error-Proofing: Describes designs, devices and/or methodologies to prevent defective parts from being produced, or to detect defective parts and ensure they are contained with the process or prevented from shipping to customers.

Failure Modes Effects Analysis (FMEA): See current edition of FMEA.

First Time Quality: A measure of the ability of a given manufacturing operation or process to produce defect-free components on the first pass. It is equivalent to this equation below for a given period. First Time Quality excludes all rework and repair operations.

$$\frac{\#\ of\ acceptable\ parts\ produced}{total\ \#\ of\ parts\ attempted\ to\ be\ produced} x100\%$$

Feasibility: A determination that a process, design, procedure, or plan can be successfully accomplished in the required time frame.

Leadership (Upper): In the context of APQP, leadership has responsibility for sponsoring and assuring the completion of all aspects of the APQP process. This is accomplished by ensuring adequate resources, setting priorities, and challenging the team to meet all timing and Key Performance Indicators (KPI) goals.

Management (Project): In the context of APQP, management applies to decision makers and process owners who are accountable for the successful completion of applicable sections of APQP. Success is achieved through the manager's knowledge, commitment, engagement, and attention to detail. Common criteria for successful project completion are contained in the checklists in Appendix A.

Mistake-Proofing: A subset of error-proofing that tends to focus on detecting the presence of a defect, and either stopping further production or ensuring all defective and suspect parts are contained.

Organization: APQP process owner.

OEE (Overall Equipment Effectiveness): A measure of how well a manufacturing operation is utilized (facilities, time, and material) compared to its full potential, during the periods when it is scheduled to run. It identifies the percentage of manufacturing time that is truly productive. An OEE of 100% means that only good parts are produced (100% quality), at the maximum speed (100% performance), and without interruption (100% availability).

Packaging: A unit that provides protection and containment of items plus ease of handling by manual or mechanical means.

Parts per Million: PPM stands for "parts per million" and is a key metric in Lean Six Sigma. PPM is a measure of the number of defects in a process or product. In order to calculate PPM, you first need to identify the number of defects and then divide that by the number of units produced. Defect rate measured in parts per million.

Pass-Through Characteristics: Characteristics manufactured within the supplier process and used in the organization's process without modification or further validation.

Preliminary Bill of Material: An initial Bill of Material completed prior to design and print release.

Preliminary Process Flow Chart: An early depiction of the anticipated manufacturing process for a product.

Process Failure Mode and Effects Analysis (PFMEA): An analytical technique used by a manufacturing responsible engineer/team as a means to ensure that, to the extent possible, potential failure modes and their associated causes/mechanisms have been considered and addressed. See the current edition of FMEA.

Product Assurance Plan: A part of the product quality plan. It is a prevention-oriented management tool that addresses product design, process design, and when applicable software design.

Quality Planning Sign-off: A review and verification by the organization's product quality planning team that all planned controls and processes are being followed, and appropriate milestones are met or have action plans in place to mitigate risk.

RASIC: A tool or technique used to clarify roles and responsibilities among teams. The acronym stands for Responsible, Approve, Support, Inform, Consult. Typically at the start of a program or project, stakeholders assign roles or actions using the appropriate letter of RASIC.

Reliability: The probability that an item will continue to function at customer expectation levels at a measurement point, under specified environmental and duty cycle conditions.

Reliability Apportionment: See Apportionment.

Significant Production Run: Product made using all production tools, processes, equipment, environment, facility, and cycle time.

Simulation: The practice of imitating some or all of the behavior of one system with a different, dissimilar system.

Special Characteristics: Product and process characteristics designated by the customer, including governmental regulatory and safety, and/or selected by the organization through knowledge of the product and process. A subset of special characteristics may be classified using terms such as critical or key, as defined by individual organizations.

Subsystem: A major part of a system which itself has the characteristics of a system, usually consisting of several components, or processes.

Supplier: The entity that supplies a product or service to the organization.

System: A combination of several components, processes or pieces of equipment integrated to perform a specific function.

Team Feasibility Commitment: A commitment by the organization's product quality planning team that the design can be manufactured, assembled, tested, packaged, and shipped in sufficient quantity at an acceptable cost, and on schedule.

Timing Plan: A plan that lists tasks, assignments, events, and timing required to provide a product that meets customer needs and expectations.

Voice of the Customer: Customer feedback both positive and negative, including likes, dislikes, problems, and suggestions.

APPENDIX I
INDEX

Index