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Parts, Materials & Processes (PMP)

What is PMP and why do you need it?

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Overview: Systems designed and manufactured for military, space and launch vehicle applications must exhibit first-time quality and meet the highest reliability standards for a long and useful life span. There are many factors involved in meeting these goals, including part selection, material selection and compatibility, controlled design guidelines and standardized fabrication procedures. Controlling these factors are the primary objectives of an organization's Parts, Materials and Processes (PMP) program.

PMP Program: A detailed PMP program ensures the selection, application and procurement of standardized electrical and mechanical parts, materials and processes that are controlled to meet contractual requirements, improve system quality and reliability, and reduce program costs. The key to a successful PMP program is documentation. Program requirements must be understood, parts and materials selection criteria must be specified, and manufacturing processes must be documented and approved. A typical PMP program focuses on the following areas:

- Program Specific Design Guidelines
- Electrical and Mechanical Approved Parts Lists
- Material Identification/Usage List
- Specialized Electrical and Mechanical Fabrication Processes

Each of these areas have numerous lower-tiered functions which must be controlled and documented. Because of the complexity and importance of these efforts, many organizations have a PMP group separate from the engineering or quality core groups. These PMP groups are typically staffed by electrical component engineers, mechanical engineers, chemical engineers and process engineers. The Air Force Space Command, Space and Missile Systems Center standard SMC-S-009, "Parts, Materials, and Processes Control Program for Space Vehicles" offers guidelines for implementing and maintaining a PMP program.
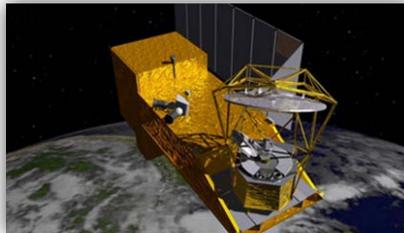
Design Guidelines: A PMP program should contain system specific design guidelines and requirements pertaining to part qualification ratings, part and sub-system parameter derating requirements, system interface requirements, etc. Procedures for controlling and implementing material and part waivers and deviations should also be specified in the PMP program. In addition, a PMP program should document the procedures for reviewing and approving engineering drawings and engineering change orders (ECO's) for applicable parts, materials, or manufacturing impacts.

Parts Lists: One of the key PMP program functions involves establishing requirements for the development and maintenance of an approved electrical parts list and an approved mechanical parts list. These approved parts lists (along with the material identification/usage list discussed below) are the basis of a successful PMP program. The requirements set forth for the selection, qualification and approval of electrical and mechanical parts for inclusion in the approved parts lists directly affect the success of the end system to meet all contractual requirements. This typically involves selecting industry standard component specifications for electrical and mechanical parts (i.e. military specifications) or creating unique specification control drawings (SCD's) for each part type used in the final system. Control documentation must also be created to provide guidelines for performing the required qualification and lot acceptance tests necessary for each part type. Requested deviations from these approved lists must be thoroughly researched, documented and approved to ensure that all component and system level specification requirements are met. These deviations are typically requested and approved using a controlled Non-Standard Parts Approval Request (NSPAR) or a waiver process.

Material Identification/Usage List: Like the approved parts lists just discussed, the Material Identification/Usage List is a list of materials qualified and approved for specific applications. Typically, this list will also document approved material finishes for specific environments and applications, as well as address any compatibility issues with other materials or finishes in the final system. The PMP program must also implement standards and controls to test, qualify and document specific material properties such as corrosion susceptibility, flammability, toxicity, and environmental contamination, depending on the program requirements. Like the approved parts lists, guidelines must be established to provide for the research, documentation and approval of requested material/finish deviations.

Fabrication Processes: Finally, the PMP program must provide for the documentation, control and approval of any unique or specialized electrical and mechanical fabrication processes used to manufacture all circuits, components and subsystems in the end system. This typically involves identifying the accepted industry standards or military specifications which cover processes such as machining and metal-work, circuit board fabrication, component soldering operations, electrical wiring, etc., and certifying that all work performed meets these standards and specifications. If no suitable process specifications are available, the PMP staff must develop and document the appropriate manufacturing procedures to ensure that final system requirements are met. The PMP program should also allow for the review and disposition of discrepant parts and materials during fabrication. This process allows the PMP staff to determine if any procedure improvements are required.

Summary: Implementation of a comprehensive Parts, Materials and Processes program with fully documented approved parts and materials lists and consistent fabrication procedures will improve overall system quality and long-term reliability, while controlling program costs.