U.S. Department of Transportation
Federal Aviation Administration

Policy Statement

Subject: Use of Metallic Materials Properties Development and Standardization (MMPDS) Handbook

Date: mm/dd/yy

Initiated By: AIR-622

Policy No: PS-AIR-600-20-05

1 SUMMARY

1.1 This policy statement provides information on the use of the Metallic Materials Properties Development and Standardization (MMPDS) Handbook as an acceptable method for showing compliance with the requirements of title 14, Code of Federal Regulations (14 CFR) 23.613, 25.613, 27.613, and 29.613. This policy statement supersedes Policy Statement PS-AIR100-2006-MMPDS. Like that 2006 policy, this policy version provides information on the use of the MMPDS Handbook as a source for statistically based material allowables and strength properties data for conventional aerospace metallic materials in standard product forms (e.g., plates, sheets, extrusions) and joining technologies. It defines the term "latest version of the MMDPS Handbook," and clarifies that material design values based on earlier versions of the MMPDS Handbook or MIL-HDBK-5 can be used in type design changes and continued airworthiness activities (e.g., repairs) if there is no known safety issue associated with them.

1.2 This policy statement expands the list of regulations for which the MMPDS Handbook can be used for showing compliance to include §§ 23.2260, 31.33, and 35.17.

1.3 This policy statement also establishes the MMPDS Handbook as a source for statistically-based material allowables and strength properties data for nonconventional materials and joining technologies (e.g., additively manufactured parts). However, for such nonconventional materials, applicants would need to provide test data or other evidence to demonstrate material equivalency and applicability of the material allowables from MMPDS Volume II.

2 CANCELLATION

This policy statement cancels Policy Statement PS-AIR100-2006-MMPDS, "Metallic Materials Properties Development and Standardization (MMPDS) Handbook," dated July 25, 2006.

3 CURRENT REGULATORY AND ADVISORY MATERIAL

The following information is relevant to the use of the MMPDS Handbook as an accepted method of compliance.

3.1 Title 14, Code of Federal Regulations (14 CFR)

The following 14 CFR regulations are related to material strength properties. You can download the full text of these regulations from the Federal Register website at Electronic Code of Federal Regulations (eCFR).

- Section 23.613, "Material strength properties and design values."
- Section 23.2260, "Materials and processes."
- Section 25.613, "Material strength properties and material design values."
- Section 27.613, "Material strength properties and design values."
- Section 29.613, "Material strength properties and design values."
- Section 31.33, "Materials."
- Section 33.15, "Materials."
- Section 35.17, "Materials and manufacturing methods."

3.2 FAA Advisory Circular

AC 25.613-1, "Material Strength Properties and Material Design Values," is related to the guidance in this policy statement. The latest version of this document is available on the Dynamic Regulatory System.

3.3 FAA Order

FAA Order IR 8100.16, "Aircraft Certification Service Policy Statement, Policy Memorandum, and Deviation Memorandum Systems," is related to the guidance in this policy statement. The latest version of this document is available on the Dynamic Regulatory System.

3.4 Battelle Memorial Institute

The MMPDS Handbook, published by Battelle, is related to the guidance provided in this policy statement and AC 25.613-1. As an FAA accepted method of compliance for the cited regulations, applicants should use the latest version of the handbook for type certification projects and continued airworthiness activities. The handbook is available for purchase at MMPDS.org and other sources.

3.5 Definition of Key Terms

The following definitions are provided for the purpose of this policy statement:

- Design Value. A material or structural property established to represent the finished part property. These numbers are typically based on material allowables and adjusted, using building block tests as necessary to account for the range of part

geometric features (e.g., holes, notches, surface finish) and in-service environmental conditions (e.g., temperature, moisture, and fluid). Design values are used in analysis to compute structural design margins.

- Latest version of MMPDS Handbook. Any edition of the MMPDS Handbook published on or after the application date for a new or amended type certificate or supplemental type certificate or part manufacturing approval (PMA), or the most current published edition on the date of approval of engineering data supporting a continued airworthiness activity.
- Material Allowable. A bulk material property derived from the statistical reduction of data from a stable process. The amount of data required to derive these values is governed by the statistical significance (or basis) and methods employed in analyzing the collected data. The application of material allowables may require additional considerations for use in design.
- Key Process Variable. Aspect of the manufacturing process that may impact the capability to meet the specified requirements. These include physical, chemical, metallurgical, mechanical property, or dimensional requirements.

4 BACKGROUND

4.1 The MMPDS Handbook is a comprehensive resource for statistically based metallic material allowables and strength properties data used in aerospace applications. Its acceptance by the FAA supports consistent compliance with structural design requirements. It is important to note that the MMPDS Handbook is not the only acceptable source of such data for compliance showing. Using MMPDS material allowables can significantly reduce the need for extensive FAA reviews of strength properties data during certification, streamlining the process. This standardization helps avoid redundancy, lowers industry costs, and ensures consistent safety in structural approvals across FAA offices. Industry has used these material allowables and strength properties data to establish design values to use in analysis to compute structural design margins. Depending on the application, it may be necessary to apply influence factors to MMPDS material allowables to establish application-specific design values.

4.2 Prior to 2024, the MMPDS Handbook primarily addressed material allowables for commonly used conventional aerospace metallic materials in standard product forms and joining technologies (e.g., mechanically fastened joints). Industry and government regulatory agencies recognized that it was necessary to develop another volume of the handbook to address nonconventional materials and joining technologies such as additive manufacturing and friction stir welding. The 2024 edition of the MMPDS Handbook (MMPDS-2024) introduces a two-volume structure to address both conventional and nonconventional metallic materials and joining technologies. While Volume I continues to focus on conventional materials and joining technologies, the added Volume II addresses nonconventional materials and joining technologies.

4.3 The FAA has been providing oversight of the MMPDS Handbook since issuing the 2006 predecessor to this policy statement, which formally accepted it as a method of compliance, ensuring its alignment with regulatory standards and industry needs. The Handbook's data enables efficient certification processes, avoiding the high costs and delays associated with independent material validation.

4.4 This policy statement supersedes PS-AIR100-2006-MMPDS, and provides guidance to applicants for using the MMPDS Handbook in type certification projects and continued airworthiness activities. Applicants should differentiate their compliance approach depending on whether they use Volume I of the handbook for conventional metallic materials and joining technologies or Volume II for nonconventional metallic materials and joining technologies, such as additive manufacturing.

5 RELEVANT PAST PRACTICE

5.1 The MMPDS Handbook has been a key resource for the FAA and the aerospace industry for decades, providing statistically-based material allowables and strength properties data to support compliance with structural design requirements. It replaced the "Department of Defense Handbook: Metallic Materials and Elements for Aerospace Vehicle Structures," designated as MIL-HDBK-5.[1]

5.2 Since its acceptance by the FAA via Policy Statement PS-AIR100-2006-MMPDS in 2006, the MMPDS Handbook has been used to demonstrate compliance with §§ 23.613, 25.613, 27.613, and 29.613 for type certification projects and continued airworthiness activities. Under this practice, MMPDS material allowables can be used without additional showing of compliance, streamlining the certification process for conventional materials and joining technologies. As a member of the Government Steering Group[2], the FAA intends to continue to oversee the development and coordination process of the handbook.

5.3 MMPDS material allowables are unadjusted. The applicant should account for factors such as part geometry, in-service environmental conditions, or other factors that can influence mechanical properties. In some cases, they should be adjusted through building block tests to establish appropriate application-specific design values.

5.4 The 2024 edition of MMPDS Volume II does not contain any material allowables or strength properties data, but the FAA expects them to be published in later revisions. Unlike the A- and B-Basis allowables from MMPDS Volume I, the C- and D-Basis

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[1] As discussed in the 2006 policy statement, MIL-HDBK-5 was relied upon for decades by industry and federal agencies as an accepted source of material allowables and strength properties data, and remains cited in certain FAA airworthiness standards, though it is no longer published.

[2] The MMPDS Government Steering Group is a body of FAA and other government agency representatives that provides strategic oversight, direction, and funding support for the MMPDS Handbook. It ensures the handbook is relevant to meets airworthiness and regulatory standards for metallic materials and fasteners.

allowables from MMPDS Volume II need further showing to validate their applicability to a specific certification criterion or application.

5.5 Several FAA regulations require design values to be chosen to minimize the probability of structural failures due to material variability. Sections 23.613, 23.2260, 25.613, 27.613, 29.613, and 31.33 specify that material strength properties must be based on enough tests of material meeting specifications to establish design values on a statistical basis. Section 35.17 specifies that the suitability and durability of materials used in the propeller must be established on the basis of experience, tests, or both. Moreover, §§ 23.613, 25.613, 27.613, and 29.613 define the statistical basis required in those design values. For single-load path structure, where the failure of one member would lead to overall structural failure, the regulations require selecting design values that assure a 99% probability of exceeding the material strength with 95% confidence (i.e., a T99 value). MMPDS A- and C-Basis allowables are designed to conservatively meet this requirement at the bulk material property level. For redundant structure, where multiple load paths exist and the failure of one member would not necessarily lead to overall structural failure, the regulations require selecting design values that assure a 90% probability of exceeding the material strength with 95% confidence (i.e., a T90 value). MMPDS B- and D-Basis allowables are designed to meet this requirement at the bulk material level. The precise definitions of MMPDS A-, B-, C-, and D-Basis are provided in the handbook. Therefore, MMPDS material allowables can be used to comply with the corresponding regulatory requirements. This is true also for § 23.2260 if § 23.613 is accepted by the FAA as a means of compliance with that regulation. Although 31.33, and 35.17 do not specify the required statistical basis for different types of structural applications, MMPDS material allowables can be used for showing compliance with acceptance from the cognizant FAA certification office.

5.6 Conventional materials are controlled by well-defined industrial or governmental standards and specifications such that the process output is generally consistent and the material strength properties can be statistically determined. This approach, taken in MMPDS Volume I for A- and B-Basis allowables, is largely predicated on the widely held consensus that the material specifications, production processes, testing and data collection practices, material characteristics, and statistical methods for conventional materials are sufficiently understood and/or controlled to allow standardization and subsequent approval by regulatory authorities without a need for further showing of compliance.

5.7 The strength properties of nonconventional materials are highly dependent on manufacturing processes, which can vary significantly between manufacturers, facilities, and machines, including two or more machines of the same model. As a result, applicants choosing to use C- or D-Basis allowables published in MMPDS Volume II generally need to demonstrate equivalency of their materials with the corresponding industrial or government standards and specifications cited in the handbook. This establishes the applicability of the C- or D-Basis allowables used in a specific certification criterion or application.

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6.1 MMPDS material allowables and strength properties data can be used to make a compliance showing with §§ 23.613(b), 25.613(b), 27.613(b), and 29.613(b), as applicable. This is also true for § 23.2260(c) and (d) if § 23.613(b) is accepted by the FAA as a means of compliance with those regulations. In addition, MMPDS material allowables can be used for showing compliance with §§ 31.33(b) and 35.17(c) with acceptance from the cognizant FAA certification branch.

6.2 The A- and B-Basis allowables from MMPDS Volume I for conventional materials and joining technologies are accepted without additional showing of compliance. However, the C- and D-Basis allowables from MMPDS Volume II for nonconventional materials and joining technologies need further showing of compliance.

6.3 In the context of this policy statement and C- or D-Basis allowables from MMPDS Volume II, “further showing” means applicants should describe their methodology for generating data to demonstrate equivalency between the strength properties of materials used in their type certification projects or continued airworthiness activities and data such as that found in MMPDS Volume II. Applicants should complete the appropriate qualifications for their manufacturing processes and provide test data or other evidence to show that the C- or D-Basis allowables proposed to be used are applicable to their applications.

6.4 Applicants choosing to use C- or D-Basis allowables from MMPDS Volume II may conduct a limited test plan to validate the equivalency of materials, production processes and the associated material and process controls being used on their projects to those used to derive the MMPDS allowables. For a particular material form, applicants should perform enough tests to show that their machines, processes, and procedures produce material strength properties that are equivalent to those published in MMPDS Volume II. The purpose of this additional data is to provide evidence that validates the applicability of the C- or D-Basis allowables to a specific certification criterion or application. Another objective of further showing is for applicants to demonstrate that the manufacturing processes for their nonconventional materials are stable and conform to the material and process specifications called out in the type design data. If any of the key process variables are subsequently changed, then additional testing may be required.

6.5 The MMPDS Handbook provides limited background and considerations on the concept of further showing; it does not define a specific methodology or guidelines. Therefore, applicants choosing to use the handbook to show compliance should describe their methodology and criteria for showing that the C- or D-Basis allowables from MMPDS Volume II are applicable to their type certification projects or continued airworthiness activities.

6.6 Applicants choosing to use the MMPDS Handbook for their type certification projects or continued airworthiness activities should seek to use the latest version. The FAA

provides the following guidance for the use of the MMPDS Handbook as a method of compliance with the regulations:

6.6.1 **Type Design Changes and Continued Airworthiness Activities**: Applicants for a type design change approval or approval of engineering data supporting a continued airworthiness activity on an existing certificated product should use material allowables and strength properties data from the latest version of the MMPDS Handbook or other source acceptable to the FAA in showing compliance with the regulations. However, where practicable, design values used in the original certification of the products can be used if there is no known safety issue associated with them. This includes design values based on material allowables and strength properties data from earlier versions of the MMPDS Handbook or MIL-HDBK-5.

6.6.2 **New Type Designs and Part Manufacturing Approvals:** Applicants for a type design approval for a new product or PMA should use material allowables and strength properties data from the latest version of the MMPDS Handbook or other FAA-accepted sources to show compliance with the regulations.

6.6.3 **Alternative Design Values**: Under §§ 23.2260(g), 25.613(f), 27.613(d), and 29.613(d), applicants can use other material design values if approved by the Administrator. AC 25.613-1 provides guidance for establishing such design values under § 25.613(f). This guidance can also be used for establishing design values under §§ 23.2260(g), 27.613(d), and 29.613(d).

6.6.4 **Available Practices**: Although the use of the MMPDS Handbook is accepted for showing compliance, applicants are not limited to this resource. Other methods and data sources that meet the regulatory requirements can be considered, provided they are acceptable to the FAA. When determining which material allowables and strength properties data to use, applicants are encouraged to consider the specific conditions of their project and evaluate the latest MMPDS Handbook version or equivalent data to ensure compliance.

7 EFFECT OF POLICY

7.1 This is a guidance document. Its content is not legally binding in its own right and will not be relied upon by the Department as a separate basis for affirmative enforcement action or other administrative penalty. Conformity with this guidance document is voluntary only, and nonconformity will not affect rights and obligations under existing statutes and regulations.

7.2 The contents of this policy statement do not have the force and effect of law and are not meant to bind the public in any way. This policy statement is intended only to provide clarity to the public regarding existing requirements under the law or agency policies.

7.3 This policy statement does not constitute a new regulation. Agency employees and their designees and delegations should not depart from this policy statement without the

concurrence of the policy issuing office. The authority for FAA employees and designees to deviate from this policy is delegated to the Director of the Policy and Standards Division.

7.4 If a proposed method of compliance appears to differ from the guidance expressed in this policy statement, the reviewing office should coordinate any proposed approval or compliance finding with the policy-issuing office. Conversely, if a proposed method of compliance that appears to follow this policy statement should not be approved, in the opinion of the reviewing office, then the reviewing office should coordinate any proposed denial with the policy issuing office.

7.5 Additional information on the effect of FAA policy statements can be found in FAA Order IR 8100.16, "Aircraft Certification Service Policy Statement, Policy Memorandum, and Deviation Memorandum Systems."

8 IMPLEMENTATION

This policy statement discusses compliance methods that may be applied to type certificate, amended type certificate, supplemental type certificate, and amended supplemental type certification programs. This policy statement also discusses compliance methods that may be applied to PMA and approval of engineering data supporting a continued airworthiness activity. The compliance methods apply to those programs with an application date that is on or after the effective date of the final policy. If the date of application precedes the effective date of the final policy, and the methods of compliance have already been coordinated with and approved by the FAA or its designee, the applicant can choose to either follow the previously acceptable methods of compliance or follow the guidance contained in this policy statement.

9 CONCLUSION

The MMPDS Handbook continues to be an acceptable source of statistically based material allowables and strength properties data for conventional and nonconventional metallic materials and joining technologies. Therefore, applicants seeking a type design approval, PMA, or approval of engineering data supporting a continued airworthiness activity can use the MMPDS Handbook as a method of showing compliance with §§ 23.613(b), 23.2260(c) and(d), 25.613(b), 27.613(b), 29.613(b), 31.33(b), and 35.17(c), as applicable.