ASME PHM-1–2025

# Guideline for Manufacturing Prognostics and Health Management (PHM): Determining PHM Inclusion in Factory Operations



AN AMERICAN NATIONAL STANDARD

The American Society of Mechanical Engineers

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Date of Issuance: February 18, 2025

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# CONTENTS

# FOREWORD

ASME PHM-1 began with a workshop on advanced monitoring, diagnostics, and prognostics operations held in June 2017 at the University of Southern California hosted by the American Society of Mechanical Engineers (ASME) and the National Institute of Standards and Technology (NIST). Over two days, the goal was to identify areas where ASME might be able to develop guidelines and standards that would make it more efficient, cost-effective, and profitable for manufacturers to monitor the overall health of their factories.

At this workshop, several areas were highlighted that might be ready for standardization. From this effort, the PHM Subcommittee on Monitoring, Diagnostics, and Prognostics was created. A second workshop was help from May 7 to 11, 2018, at NIST entitled "Moving From 'React and Repair' to 'Predict and Prevent'" to gather more information in this space.

From these two efforts, the ASME Board on Standardization and Testing voted to approve the formation of the PHM Subcommittee on Monitoring, Diagnostics, and Prognostics for Manufacturing Operations on July 2, 2018. The charter of the subcommittee is to develop standards and guidelines that advance the design and implementation of monitoring, diagnostic, and prognostic capabilities, along with ways of verifying and validating their performance to enhance adaptive maintenance and operational control strategies within manufacturing.

ASME PHM-1 is part of a planned series to help manufacturers continue to monitor the health of their systems. This Standard was approved by the ASME Manufacturing and Advanced Manufacturing Standards Committee on February 14, 2024. ASME PHM-1 was approved by the American National Standards Institute (ANSI) Board on Standards Review on January 29, 2025.

# ASME MAM COMMITTEE
# Manufacturing and Advanced Manufacturing

(The following is the roster of the committee at the time of approval of this standard.)

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**Revisions and Errata.** The committee processes revisions to this Standard on a periodic basis to incorporate changes that appear necessary or desirable as demonstrated by the experience gained from the application of the Standard. Approved revisions will be published in the next edition of the Standard.

In addition, the committee may post errata on the committee web page. Errata become effective on the date posted. Users can register on the committee web page to receive email notifications of posted errata.

This Standard is always open for comment, and the committee welcomes proposals for revisions. Such proposals should be as specific as possible, citing the paragraph number, the proposed wording, and a detailed description of the reasons for the proposal, including any pertinent background information and supporting documentation.

**Cases**

*(a)* The most common applications for cases are

*(1)* to permit early implementation of a revision based on an urgent need

*(2)* to provide alternative requirements

*(3)* to allow users to gain experience with alternative or potential additional requirements prior to incorporation directly into the Standard

*(4)* to permit the use of a new material or process

*(b)* Users are cautioned that not all jurisdictions or owners automatically accept cases. Cases are not to be considered as approving, recommending, certifying, or endorsing any proprietary or specific design, or as limiting in any way the freedom of manufacturers, constructors, or owners to choose any method of design or any form of construction that conforms to the Standard.

*(c)* A proposed case shall be written as a question and reply in the same format as existing cases. The proposal shall also include the following information:

*(1)* a statement of need and background information

*(2)* the urgency of the case (e.g., the case concerns a project that is underway or imminent)

*(3)* the Standard and the paragraph, figure, or table number

*(4)* the editions of the Standard to which the proposed case applies

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**Interpretations.** Upon request, the committee will issue an interpretation of any requirement of this Standard. An interpretation can be issued only in response to a request submitted through the online Inquiry Submittal Form at https://go.asme.org/InterpretationRequest. Upon submitting the form, the inquirer will receive an automatic email confirming receipt.

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**Committee Meetings.** The MAM Standards Committee regularly holds meetings that are open to the public. Persons wishing to attend any meeting should contact the secretary of the committee. Information on future committee meetings can be found on the committee web page at https://go.asme.org/MAMcommittee.

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# GUIDELINE FOR MANUFACTURING PROGNOSTICS AND HEALTH MANAGEMENT (PHM): DETERMINING PHM INCLUSION IN FACTORY OPERATIONS

## 1 INTRODUCTION

Manufacturers are constantly challenged to optimize their maintenance activities. Improvement targets typically include reducing downtime, waste, and costs while increasing profits, efficiency, and overall competitiveness. The manufacturing industry, including technology integrators and developers, is turning to advanced monitoring, diagnostic, and prognostic capabilities to enhance equipment maintenance strategies within factory operations. Collectively known as prognostics and health management (PHM), monitoring, diagnostic, and prognostic capabilities are becoming more powerful with the advancement of computing systems, networked communications, sensors, data storage, and analytics. PHM is not only applied to individual equipment, it is also applied to work cells, production lines, and potentially even an enterprise's entire manufacturing ecosystem.

Operational safety, productivity, efficiency, and asset availability have a direct impact on the competitiveness of organizations. Unscheduled or frequent downtime can create significant obstacles to the implementation of management strategies known to improve productivity and reduce production costs. With increasing functional complexity of industrial processes and systems, there is now an increasing demand for system-level health assessment, fault diagnosis, and failure prognosis. Through the proper use of PHM technologies, an organization can achieve increased manufacturing asset availability, reduced turnaround time for production, improved process consistency and part quality, and increased safety and environmental preservation.

Numerous challenges face the manufacturing community as manufacturers attempt to design, adopt, integrate, and maintain PHM technologies within their operations. One critical hurdle is not having sufficient reference documentation that can guide them in a practical and effective way to leverage PHM technologies.

ASME PHM-1 is expected to be the first in a series of guidelines developed by the ASME PHM Subcommittee on Monitoring, Diagnostics, and Prognostics for Manufacturing Operations aimed at enhancing the manufacturing community's ability to design, implement, verify, and validate PHM capabilities. Additionally, the guidelines are intended to stimulate feedback and discussion from the manufacturing community to ensure priority needs and challenges continue to be identified and addressed through this subcommittee's efforts.

## 2 GOAL AND SCOPE

The goal of ASME PHM-1 is to present an approach applicable to almost any manufacturing organization of any size to investigate the implementation and adoption of PHM technologies. More specifically, the intention is to assist manufacturers in making decisions about when and where to integrate monitoring, diagnostic, and prognostic tools and systems in their facilities to ideally optimize maintenance of their manufacturing operations and improve their production planning. These guidelines are designed to aid in answering key questions such as where implementation of PHM can improve productivity and costs, maintain process quality targets, or help solve chronic maintenance problems. This documented process should help to determine challenges the manufacturer is facing and where PHM can help.

PHM technologies are not new and have been applied within large industries including aerospace, automotive, energy, and process industries (Barajas and Srinivasa, 2008; Roemer, Nwadiogbu, and Bloor, 2001; Walker, 2010). As an example, such industries leverage PHM to assess and predict the condition of critical equipment including jet engines, gas turbines, or oil processing units. With the successes and insights gained from implementing PHM in mission-critical domains, it is logical that manufacturers in the 21st century should seek the benefits this technology can deliver. Whether in continuous processing or discrete manufacturing operations, large organizations and original equipment manufacturers (OEMs) have the opportunity to dedicate personnel and invest in identifying the benefits and paths of adopting PHM technologies. This opportunity is more challenging for small and medium-size manufacturers, who typically have limited funds for research and acquisition of new technologies and who experience greater PHM design and implementation hurdles (Helu and Weiss, 2016; Jin et al., 2016). Smaller organizations commonly rely on user-driven manual techniques due to