ASME TDP-1–2023
(Revision of ASME TDP-1–2013)

Prevention of Water Damage to Steam Turbines Used for Electric Power Generation: Fossil-Fueled Plants

AN AMERICAN NATIONAL STANDARD

The American Society of Mechanical Engineers

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FOREWORD

In the late 1960s, the two major U.S. steam turbine manufacturers issued design recommendations to stem the increasing occurrence of water-induced damage to steam turbines. Consequently, utilities and designers began formulating their own design criteria because of the economic need to keep the generating units in service. Realizing the need for a uniform set of design criteria, the American Society of Mechanical Engineers (ASME) formed the Standards Committee on Turbine Water Damage Prevention (TWDP) to develop recommended practices for the electric-power-generating industry. The TWDP Committee, comprising representatives of utilities, equipment manufacturers, and design consultants, produced TDP-1, which was approved as an ASME standard by the ASME Standardization Committee and the ASME Policy Board, Codes and Standards, on July 26, 1972.

In 1979, the TDWP Committee proposed revising the Standard to include information on condenser steam and water dumps, direct-contact feedwater heaters, and steam generators. The revised Standard was approved by the ASME Standardization Committee on April 25, 1980. Another edition, ANSI/ASME TDP-1–1985, was approved as an American National Standard on September 13, 1985.

In 1994, the ASME Board on Standardization disbanded the TDWP Committee and withdrew ANSI/ASME TDP-1 due to a perceived lack of interest and use by the industry. However, subsequent interest in ANSI/ASME TDP-1 from previous and potential users convinced ASME to reconstitute the TDWP Committee under the Board on Pressure Technology Codes and Standards in June 1997. The re-formed committee revised ANSI/ASME TDP-1–1985, producing ASME TDP-1–1998, which was approved as an American National Standard on June 17, 1998.

Advances in power plant technology, most notably combined-cycle, multiple-steam generators; cycling; cogeneration technology; and modern plant instrumentation and control systems, convinced the TWDP Committee to again revise the Standard. The result was ASME TDP-1–2006, which was approved as an American National Standard on November 6, 2006.

Prompted by the broad acceptance of ASME TDP-1–2006, ASME reissued the Standard in 2013 with mandatory requirements rather than the recommended practices of the previous editions. ASME TDP-1–2013 was approved as an American National Standard on February 5, 2013.

ASME TDP-1–2023 clarifies the safety systems of the integrated control systems shown in the figures, clarifies and adds design guidance on plants with multiple steam drum systems, and adds guidance on selected level measurement devices. This edition also revises the design specifications of warm-up lines per current industry practice, clarifies the use of separate controllers for drain valves, addresses indirect level measurements, and adds definitions and device identification abbreviations. ASME TDP-1–2023 was approved as an American National Standard on November 20, 2023.

ASME TWDP COMMITTEE
Turbine Water Damage Prevention

(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 e-mail 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 numbers, 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 numbers

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

(d) A case is effective for use when the public review process has been completed and it is approved by the cognizant supervisory board. Approved cases are posted on the committee web page.

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 Interpretation Submittal Form at https://go.asme.org/InterpretationRequest. Upon submitting the form, the inquirer will receive an automatic e-mail confirming receipt.

ASME does not act as a consultant for specific engineering problems or for the general application or understanding of the Standard requirements. If, based on the information submitted, it is the opinion of the committee that the inquirer should seek assistance, the request will be returned with the recommendation that such assistance be obtained. Inquirers can track the status of their requests at https://go.asme.org/Interpretations.

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Interpretations are published in the ASME Interpretations Database at https://go.asme.org/Interpretations as they are issued.

Committee Meetings. The TWDP 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/TWDPcommittee.

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PREVENTION OF WATER DAMAGE TO STEAM TURBINES USED FOR ELECTRIC POWER GENERATION: FOSSIL-FUELED PLANTS

1 SCOPE

This Standard includes required and recommended practices concerned primarily with the prevention of water damage to steam turbines used for fossil-fuel-fired electric power generation. The practices address damage due to water, wet steam, and steam backflow into a steam turbine. The practices are applicable to conventional steam cycle, combined-cycle, and cogeneration plants. The practices cover design, operation, inspection, testing, and maintenance of those aspects of the following power plant systems and equipment concerned with preventing the induction of water into steam turbines:

(a) motive steam systems
(b) steam attemperation systems
(c) turbine extraction/admission systems
(d) feedwater heaters
(e) turbine drain system
(f) turbine steam seal system
(g) start-up systems
(h) condenser steam and water dumps
(i) steam generator sources

Any connection to the turbine is a potential source of water either by induction from external equipment or by accumulation of condensed steam. The sources treated herein specifically are those found to be most frequently involved in causing damage to turbines. Although water induction into the high- and intermediate-pressure turbines has historically been recognized as the most damaging, experience has shown that water induction in low-pressure turbines can cause significant damage and should also be taken seriously.

This Standard is not intended to impose new requirements retroactively for existing facilities.

2 CRITERIA

2.1 Basis

2.1.1 The normal practice to prevent turbine water induction is to

(a) identify systems that have a potential to allow water to enter the turbine

(b) design, control, maintain, test, and operate these systems in a manner that prevents accumulation of water

2.1.2 However, since malfunctions do occur, implement one or more of the following steps to prevent turbine damage due to water induction:

(a) detect the presence of water either in the turbine or, preferably, external to the turbine before the water has caused damage

(b) isolate the water by manual or, preferably, automatic means after it has been detected

(c) dispose of the water by either manual or, preferably, automatic means after it has been detected

2.1.3 No single failure of equipment, device, or signal, or loss of electrical power, shall result in water or cold steam entering the turbine.

2.1.4 Steam lines connecting to the steam turbine directly or indirectly shall be designed to ensure that any saturated steam or condensate that may have collected while the line or portion of the line was out of service is drained and warmed adequately prior to being returned to service.

2.1.5 Any automatic control system used to control steam line drain valves identified in these guidelines shall be designed so that the system has a means of initiating automatic valve actuation and a separate means of verifying the appropriateness of the automatic action. For example, if a drain valve is closed automatically based on a timer, something other than the timer, such as a level switch that would alarm if water were still present in the steam line, shall be used to verify that the timer initiation was appropriate. If an inappropriate action is taken, an alarm shall be provided.

2.1.6 An integrated control system (ICS) such as a distributed control system can, by its inherent design, provide additional control and monitoring capability for power plant systems and equipment. Use of an ICS has been considered as an option for control and monitoring potential sources that might allow water to enter the turbine. If an ICS is available, the additional redundancy and availability of that system shall be used as indicated in this Standard. However, if no ICS is provided, following the non-ICS specific requirements is intended to still represent a conservative design for protection from water induction.