ASME TDP-1–2013
(Revision of ASME TDP-1–2006)

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, a substantial increase in the number of reported occurrences of steam turbine damage by water induction precipitated design recommendations from the two major U.S. steam turbine manufacturers in an attempt to reduce such incidents. Consequently, utilities and designers began formulating their own design criteria because of the economic need to keep the generating units in service. Realizing the common need for a uniform set of design criteria to alleviate this problem, an American Society of Mechanical Engineers (ASME) Standards Committee was formed, consisting of representatives of utilities, equipment manufacturers, and design consultants to develop recommended practices for use in the electric generating industry.

This Standard, resulting from the work and deliberation of the Turbine Water Damage Prevention Committee, was approved as a Standard of The American Society of Mechanical Engineers by the ASME Standardization Committee and the ASME Policy Board, Codes and Standards, on July 26, 1972.

In 1979, the Committee proposed a revision to this Standard to include information on condenser steam and water dumps, direct contact feedwater heaters, and steam generators. This proposed revision was approved by the ASME Standardization Committee on April 25, 1980.

The 1985 revision was approved as an American National Standard on September 13, 1985. In 1994, the ASME Board on Standardization approved the disbandment of the Committee on Turbine Water Damage Prevention along with the withdrawal of the standard TDP-1. This was due to perceived lack of interest and use by the industry.

Subsequent interest from users and potential users for TDP-1 convinced ASME to reconstitute the Committee under the Board on Pressure Technology Codes and Standards in June 1997. As a result of this committee's work, TDP-1–1985 was revised and 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 Committee to again revise the Standard. The result was TDP-1–2006. This revision was approved as an American National Standard on November 6, 2006.

The current Standard is a revision of TDP-1–2006. The broad acceptance that this Standard has received caused ASME to decide to reissue it in mandatory language rather than a recommended practice. In addition to the change to mandatory language, this revision also includes minor modifications and clarifications to the previous revision. This revision was approved as an American National Standard on February 5, 2013.

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

1 SCOPE

This Standard includes 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 (DCS) 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.