ASME PTC 19.3 TW-2016
(Revision of ASME PTC 19.3 TW-2010)

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Thermowells

Performance Test Codes

AN AMERICAN NATIONAL STANDARD

The American Society of
Mechanical Engineers

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The American Society of Mechanical Engineers
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FOREWORD

In 1957, the ASME Performance Test Codes Committee 19.3 determined that the 1930 edition of the *Supplement on Temperature Measurement* dealing with thermowells was unsatisfactory. Since the design of thermowells requires both thermal and stress considerations, the ASME Boiler and Pressure Vessel Committee was approached for assistance. However, the special needs for the design of intrusive pipe fittings were deemed beyond the scope of what could be properly included in the vessel codes.

The PTC 19.3 Committee is charged with temperature measurement and thermowell design. The purpose of the thermowell is to facilitate temperature measurement while resisting fluid forces of the process. This committee undertook the task of providing guidance in this area, on the basis of a paper authored by J. W. Murdock[1], ultimately leading to the publication of PTC 19.3-1974, *Supplement on Instruments and Apparatus, Part 3, Temperature Measurement.* Prior to the acceptance of PTC 19.3-1974, the incidence of thermowell failures during the start-up testing of high-pressure steam turbines was unacceptable; its subsequent use in steam services has been highly successful at preventing catastrophic thermowell failure.

Since its publication, PTC 19.3 has received widespread acceptance and use in both steam and nonsteam applications outside the scope of the performance test codes. In 1971 an ASME ad hoc committee, PB51, under the jurisdiction of the PTC Board, was formed to assess the thermowell standard. This committee, designated PTC 19.3.1, produced a draft thermowell standard. In 1999, PTC 19.3 undertook the task of completing this draft. In the course of this effort, it was discovered that a number of thermowells designed to PTC 19.3-1974 but placed in nonsteam services suffered catastrophic failure. Review of the literature revealed that the PTC 19.3.1 draft did not incorporate recent, significant advances in our knowledge of thermowell behavior, and in 1998 the committee decided to thoroughly rewrite the standard. The goals of the new Standard were to provide a thermowell rating method that could be used in a myriad array of services, including processes involving corrosive fluids; offer advice where fatigue endurance is critical; and establish criteria for insuring sensor reliability. These factors resulted in a more reliable basis for thermowell design than the PTC 19.3-1974 Supplement. By 2004, it was decided that users would be better served if the new thermowell strength calculation Standard was separated from the rest of PTC 19.3.

The publication of the 2010 edition was well received by industry and adoption of the Code generated significant feedback. In addition to several Technical Inquiries, a Code Case was approved by the PTC Standards Committee in 2012 to add additional guidance for passing through the in-line resonance condition and adjust the manufacturing tolerances in the tables. Citing the continued industry feedback, the PTC Committee decided to revise the document again to incorporate the Code Case and add clarifications to elbow and angled installations. It is intended that this Edition of the Standard not be retroactive.

This Edition of PTC 19.3 TW was approved as an American National Standard by the ANSI Board of Standards Review on January 5, 2016.

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Performance Test Codes

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Secretary, PTC Standards Committee
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http://go.asme.org/Inquiry

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The Committee welcomes proposals for revisions to this Code. Such proposals should be as specific as possible, citing the paragraph number(s), the proposed wording, and a detailed description of the reasons for the proposal, including any pertinent documentation.

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Requests for Cases shall provide a Statement of Need and Background Information. The request should identify the Code and the paragraph, figure, or table number(s), and be written as a Question and Reply in the same format as existing Cases. Requests for Cases should also indicate the applicable edition(s) of the Code to which the proposed Case applies.

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The request for an interpretation should be clear and unambiguous. It is further recommended that the inquirer submit his/her request in the following format:

Subject:	Cite the applicable paragraph number(s) and the topic of the inquiry.
Edition:	Cite the applicable edition of the Code for which the interpretation is being requested.
Question:	Phrase the question as a request for an interpretation of a specific requirement suitable for general understanding and use, not as a request for an approval of a proprietary design or situation. The inquirer may also include any plans or drawings that are necessary to explain the question; however, they should not contain proprietary names or information.

Requests that are not in this format may be rewritten in the appropriate format by the Committee prior to being answered, which may inadvertently change the intent of the original request.

ASME procedures provide for reconsideration of any interpretation when or if additional information that might affect an interpretation is available. Further, persons aggrieved by an interpretation may appeal to the cognizant ASME Committee or Subcommittee. ASME does not "approve," "certify," "rate," or "endorse" any item, construction, proprietary device, or activity.

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THERMOWELLS

Section 1
Object and Scope

1-1 OBJECT

The object of this Standard is to establish a mechanical design standard for reliable service of tapered, straight, and stepped-shank thermowells in a broad range of applications. This includes an evaluation of the forces caused by external pressure, and the combination of static and dynamic forces resulting from fluid impingement.

1-2 SCOPE

This Standard applies to thermowells machined from bar stock and includes those welded to or threaded into a flange as well as those welded into a process vessel or pipe with or without a weld adaptor. Thermowells manufactured from pipe are outside the scope of this Standard.

Thermowells with specially designed surface structures (e.g., a knurled surface or a surface with spiral ridges) are beyond the scope of this Standard, due to the difficulty of providing design rules with broad applicability for these types of thermowells.

Thermowell attachment methods, standard dimensions, parasitic vibration of a sensor mounted inside the thermowell, and thermal equilibrium of the sensor relative to the process stream are beyond the scope of this Standard. In addition, thermowells fabricated by welding, including flame spray or weld overlays, at any place along the length of the shank or at the tip are outside the scope of this Standard.

The application of the overlay to a bar-stock thermowell may affect any number of critical attributes such as natural frequency, damping, material properties, or surface finish. These changes are difficult to account for in the calculations, therefore, there is risk that an inappropriately designed thermowell could be installed.