ASME STS-1–2021

(Revision of ASME STS-1–2016)

Steel Stacks

AN AMERICAN NATIONAL STANDARD

The American Society of Mechanical Engineers

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Two Park Avenue • New York, NY • 10016 USA

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ASME issues written replies to inquiries concerning interpretations of technical aspects of this Standard. Interpretations are published on the Committee web page and under http://go.asme.org/InterpsDatabase. Periodically certain actions of the ASME STS Committee may be published as Cases. Cases are published on the ASME website under the STS Committee Page at http://go.asme.org/STScommittee as they are issued.

Errata to codes and standards may be posted on the ASME website under the Committee Pages to provide corrections to incorrectly published items, or to correct typographical or grammatical errors in codes and standards. Such errata shall be used on the date posted.

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The American Society of Mechanical Engineers
Two Park Avenue, New York, NY 10016-5990

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FOREWORD

In early 1978, the American Society of Mechanical Engineers was approached by a group interested in formulating a standard for the design, fabrication, and erection of steel stacks and their appurtenances. They felt there was a need for such a Standard to establish a better level of standardization in the industry and for safeguarding the community. Because of the particular nature of stacks and their susceptibility to failures due to wind and seismic-induced vibrations, along with corrosion and erosion, the design process is a complex one. Additionally, recent regulations by the Environmental Protection Agency concerning emissions have placed a strong emphasis on the mechanical design of stacks. In the last several decades, much research has been done and many papers written on the subject. While investigation and research continued, it was the feeling of these persons that some formal guidelines needed to be established. Therefore, in April of 1979, a group composed of stack users, researchers, designers, fabricators, and erectors convened at the United Engineering Center in New York City under the auspices of the American Society of Mechanical Engineers to formulate such a code.

With the above in mind, the group subdivided and began gathering information to formulate guidelines for mechanical design, material selection, the use of linings and coatings, structural design, vibration considerations, access and safety, electrical requirements, and fabrication and construction. When these were established, a section on maintenance and inspection was added. The following is a result of their work and investigation. The initial document was approved as an American National Standard in August 1986 and published as ASME/ANSI STS-1-1986 in May 1988.

During the next 3 yr, the committee received comments from the public at large and from its own membership regarding the Standard's content. Several formulas needed correction, and some of the symbols needed clarification. Section 6.3.3 regarding Earthquake Response was also reviewed and revised to allow for static rather than dynamic analysis in certain cases and to correlate it with ASCE STD-7-88 (formerly ANSI A58-1). These changes were then submitted to the general membership and approved.

In 1994, the committee was reorganized to further review and update this steel stack Standard. Emphasis was given to the Structural Design and Vibrations chapters. Chapter 4, "Structural Design," was rewritten to be more compatible with the nomenclature, formulae, and symbols used in the Manual of Steel Construction — Allowable Stress Design (ASD), 9th Edition and Load and Resistance Factor Design (LRFD), 1st Edition. Chapter 5, "Vibrations," was revised to be more "user friendly." These and other chapters were updated to include the latest recognized applicable codes and standards.

The 2006 edition included changes and improvements to the Environmental Protection Agency regulation concerning emissions that have created a strong emphasis on the mechanical design of steel stacks, made necessary changes found through practical experience with the previous edition, expanded formulas as necessary, and provided both revised and new sections for steel stack design, fabrication, and erection. It revised sections on appurtenances to meet today's requirements for these items. A new section provided the fundamental concepts for guyed stacks. Revisions to the section on the physical properties of steel at elevated temperatures were made to match information available through a comprehensive review of current technical literature. Sections on vibration included minor changes but yielded a more workable standard. Also, a detailed example was included to provide a method for determining the magnitude of across wind loads. One method was included to address fatigue due to vibration. Fatigue can be a significant issue in steel stack design and needs to be considered in the design. Methods to determine across wind load and seismic loads were provided in the nonmandatory appendices. If fatigue requires close examination, the engineer is cautioned to review this issue with other design standards if necessary. There are several standards among them that can be helpful: AISC, CICIND, or ASME.

This Standard is available for public review on a continuing basis. This provides an opportunity for additional public review input from industry, academia, regulatory agencies, and the public-at-large.

ASME STS-1–2011 was approved as an American National Standard on March 11, 2011. ASME STS-1–2016 was approved as an American National Standard on September 23, 2016. ASME STS-1–2021 was approved by ANSI as an American National Standard on October 19, 2021.

ASME STS COMMITTEE
Steel Stacks

(The following is the roster of the Committee at the time of approval of this Standard.)

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General. ASME Standards are developed and maintained with the intent to represent the consensus of concerned interests. As such, users of this Standard may interact with the Committee by requesting interpretations, proposing revisions or a case, and attending Committee meetings. Correspondence should be addressed to:

Secretary, STS Standards Committee
The American Society of Mechanical Engineers
Two Park Avenue
New York, NY 10016-5990
http://go.asme.org/Inquiry

Proposing Revisions. Revisions are made periodically to the Standard 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 periodically.

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(s), the proposed wording, and a detailed description of the reasons for the proposal, including any pertinent documentation.

Proposing a Case. Cases may be issued to provide alternative rules when justified, to permit early implementation of an approved revision when the need is urgent, or to provide rules not covered by existing provisions. Cases are effective immediately upon ASME approval and shall be posted on the ASME Committee web page.

Requests for Cases shall provide a Statement of Need and Background Information. The request should identify the Standard 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 Standard to which the proposed Case applies.

Interpretations. Upon request, the STS Standards Committee will render an interpretation of any requirement of the Standard. Interpretations can only be rendered in response to a written request sent to the Secretary of the STS Standards Committee.

Requests for interpretation should preferably be submitted through the online Interpretation Submittal Form. The form is accessible at http://go.asme.org/InterpretationRequest. Upon submittal of the form, the Inquirer will receive an automatic e-mail confirming receipt.

If the Inquirer is unable to use the online form, he/she may mail the request to the Secretary of the STS Standards Committee at the above address. 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 in one or two words.
Edition:	Cite the applicable edition of the Standard 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. Please provide a condensed and precise question, composed in such a way that a "yes" or "no" reply is acceptable.
Proposed Reply(ies):	Provide a proposed reply(ies) in the form of "Yes" or "No," with explanation as needed. If entering replies to more than one question, please number the questions and replies.
Background Information:	Provide the Committee with any background information that will assist the Committee in understanding the inquiry. 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 the format described above may be rewritten in the appropriate format by the Committee prior to being answered, which may inadvertently change the intent of the original request.

Moreover, 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 inquiry information submitted, it is the opinion of the Committee that the Inquirer should seek assistance, the inquiry will be returned with the recommendation that such assistance be obtained.

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.

Attending Committee Meetings. The STS Standards Committee regularly holds meetings and/or telephone conferences that are open to the public. Persons wishing to attend any meeting and/or telephone conference should contact the Secretary of the STS Standards Committee. Future Committee meeting dates and locations can be found on the Committee Page at http://go.asme.org/STScommittee.

INTRODUCTION

The following Standard applies to steel stacks; i.e., those stacks where the primary supporting shell is made of steel. It applies to both single- and multiple-walled steel stacks, either of which can be lined or unlined. It also applies to steel stacks that are guyed or to certain aspects of tower stacks. The stack may be supported on a foundation or from another structure.

This Standard covers many facets of the design of steel stacks. It outlines the consideration that must be made for both the mechanical and structural design. It emphasizes what consideration must be taken for wind- and seismic-induced vibrations. It gives guidelines for the selection of material, linings, and coatings. It gives the requirements for lighting and lightning protection based upon existing building and federal codes. It gives the requirements for climbing and access based upon current Occupational Safety and Health Administration (OSHA) standards. It emphasizes the important areas regarding fabrication and construction. It outlines areas requiring maintenance and inspection following initial operation.

Although many of the topics within these guidelines may be used for all stacks, this Standard is intended to provide design guidelines for stacks containing nonflammable gases, such as combustion exhaust gases at low internal pressures. For stacks containing combustible gases under pressure, such as flare stacks and flammable vents, additional design considerations must be addressed, including design for internal pressure, design for internal deflagration pressure, and compatibility with adjoining piping design that is in accordance with piping and/or vessel design codes, such as ASME B31.3 and Section VIII of the ASME Boiler and Pressure Vessel Code (BPVC). In addition, the materials of construction referenced in this Standard may not be allowed for use with flammable gases under pressure per ASME B31.3 and Section VIII of the ASME BPVC; materials suitable for pressure containment of flammable gases are listed in these codes. No attempt is made within this Standard to define the need or the methods to be used to consider these additional design considerations.

The information presented has been prepared in accordance with established engineering principles utilizing state-of-the-art information. It is intended for general information. While every effort has been made to ensure its accuracy, the information should not be relied upon for any specific application without the consultation of a competent, licensed professional engineer to determine its suitability. It is therefore recommended that Engineering/Design drawings of the stack bear the Professional Engineer Seal, signature, and date.

Nothing in the Standard shall be construed to alter or subvert the requirements of any existing code or authority having jurisdiction over the facility. Furthermore, alternate methods and materials to those herein indicated may be used, provided that the engineer can demonstrate their suitability to all affected agencies and authorities.