

ASME Codes and Standards

**Examples of Use for
Mechanical Engineering Students**



ASME International

Dear Mechanical Engineering Student:

The articles in this booklet explore different facets of ASME Codes and Standards. Written by eight ASME experts, they were originally published in *ASME Mechanical Advantage*, a periodical for tomorrow's engineers.

ASME Codes and Standards play an important role in ensuring the safety of the public and in the standardization of things as common as nuts and bolts. We have selected the articles to draw your attention to some important aspects of your professional life as future mechanical engineers.

For an overview of ASME Codes and Standards, see the "Codes and Standards at a Glance" section, which immediately follows the articles.

We hope that you find this collection interesting and informative, and that it provides you with a new window into the field of ASME Codes and Standards. Please let us know what you think at: cs@asme.org.

Sincerely,

Task Group on ASME Codes and Standards for Mechanical Engineering
Faculty and Students

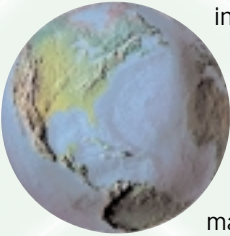
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For more information on ASME Codes and Standards, ask your faculty adviser to show you the video "Introduction to ASME Codes and Standards" and its companion booklet.

ASME's Role in the Globalization of Codes and Standards

by Don R. Frikken, P.E.

Having one global standard becomes more and more important as companies merge across international boundaries, helped by regional trade agreements such as the North American Free Trade Agreement (NAFTA) and those established by the European Union (EU), which have facilitated international mergers through the lowering of tariffs on imports.



The companies involved in these consolidations, used to selling to just one market, now find themselves selling to global markets. The standards for products in these markets are often different, which complicates manufacturing procedures. Local laws may require the use of a particular standard, yet these laws are viewed by the World Trade Organization (WTO) as technical barriers to trade, and WTO member countries are charged with reducing these and other barriers to free global trade.

What is the best way for standards-developing organizations like ASME and for users of standards to find a solution? Possible approaches are to adopt the dominant standard, or to develop an umbrella standard that references other regional and national standards, or to develop a global consensus standard from scratch. ASME is involved in helping promote whichever approach best serves a specific industry and the users of the applicable ASME standards.

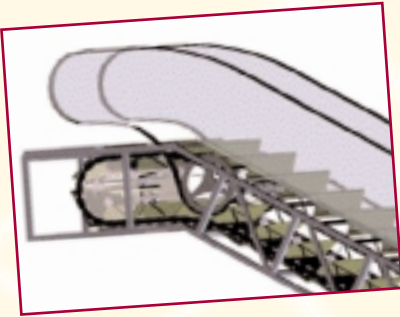
ASME standards have changed over the last few years to include new construction materials, to address new topics, and to incorporate new calculation methods. As these changes continue to be introduced, globalization brings even more change, requiring greater flexibility and adaptation from industry.

Elevators, Escalators, and Moving Walkways

by Jim Coaker

How many times in the past week have you ridden in an elevator, on an escalator, or on a moving walk? These actions are so routine in everyday life that they happen automatically and are too numerous to recall.

Behind each mechanism is a web of machinery, power sources, control systems, and redundant safeguards in both design and operation that deliver safe vertical transportation without incident. ASME International's Safety Codes for Elevators and Escalators, Inspectors' Manuals, Existing Installation Requirements, Evacuation Guide, and Electrical Requirements are one of the largest areas covered by the Society's 600 standards.



Elevator ridership in the United States is conservatively estimated at more than 200 billion passenger rides per year, a

figure that makes it easy to appreciate the critical role that codes and standards play in public safety. Dynamic change defines the world of technical applications and ASME's standards are constantly updated to keep abreast of changes in technology.

Starting with basic design principles relating to public safety, these codes and standards establish guidelines and requirements for equipment design, installation, operation, inspection, and maintenance. Even if the end result is invisible—a normal convenience in everyday life functioning without incident—the underlying complexities of the system present stimulation and challenge to the engineering mind. Some professionals spend their careers in this industry.

The next time you ride an elevator or escalator, remember the engineers who have dedicated their careers to giving you a safe arrival!

What are Performance Test Codes?

by Philip M. Gerhart, Ph.D. and Sam J. Korellis, P.E.

ASME Performance Test Codes (PTC) provide rules and procedures for planning, preparing, executing, and reporting performance tests. A performance test is an engineering evaluation; its results indicate how well the equipment performs its functions.

Performance Test Codes originated as “Power Test Codes” and emphasized energy-conversion equipment. The first ASME Code was Rules for Conducting Boiler Tests, published in 1884. Today, nearly 50 PTCs are available; they cover individual components (steam generators, turbines, pumps, compressors), systems (flue gas desulfurization, fuel cells), and complete plants (cogeneration plants). In addition to equipment codes, supplements on instruments and apparatus cover measurement systems (temperature, pressure, flow) and techniques (uncertainty analysis) common to several codes.



For more than a century, ASME PTC tests have provided results with the highest level of accuracy, based on current engineering knowledge and practices, and taking into account the costs of the tests and the value of the information obtained. All ASME codes are developed using input from a range of parties, who may be interested in the code and/or in the associated equipment or process. Codes have the force of a legal document when cited in contracts, as they frequently are, for determining the method by which equipment performs as guaranteed.

PTCs are used by equipment owners, equipment suppliers, and test engineers. ASME PTCs protect users from poorly performing products and enable suppliers to compete fairly by offering reliable products. Purchase specifications are greatly strengthened by citing the results of PTC tests. When buying new equipment, purchasers may specify that the equipment guarantee will be based on the results of a specific ASME PTC test. Design engineers consult PTC documents to ensure that proper instrument connections will be available. Test engineers install the required instrumentation and use the code's procedures and calculation methods to conduct tests on the new equipment. Representatives of all parties to the test ensure that the test methods are in compliance with the code. Finally, the test results are compared to the performance criteria.

Sometimes manufacturers and suppliers want to determine the exact performance of their equipment to understand the design margins or the effects of manufacturing tolerances on performance. In this case, code tests are conducted outside of any performance guarantees.

To ensure that ASME PTCs best serve global industries, additional products and services always are being evaluated. As the preeminent provider of standardized methods for performance testing; monitoring; and analysis of energy conversion and industrial processes, systems, and equipment, ASME continues to develop and add new codes.

A Look at ASME's Boiler and Pressure Vessel Code (BPVC)

by Domenic Canonico, Ph.D.

The ASME Boiler and Pressure Vessel Code (BPVC) is a standard that provides rules for the design, fabrication, and inspection of boilers and pressure vessels. A pressure component designed and fabricated in accordance with this standard will have a long, useful service life, and one that ensures the protection of human life and property. Volunteers, who are nominated to its committees based on their technical expertise and on their ability to contribute to the writing, revising, interpreting, and administering of the document, write the BPVC.



Photo courtesy of the Nooter Corporation, St. Louis, MO.

The idea for the BPVC arose in 1911 out of the need for public safety, following the invention of the steam engine in the late 18th century. Throughout the 19th century there were thousands of boiler explosions in the United States and Europe, some of which resulted in many deaths.

The first Boiler and Pressure Vessel Code (1914 edition) was published in 1915; it was one book, 114 pages long. Today there are 28 books, including twelve dedicated to the construction and inspection of nuclear power plant components and two Code Case books. (The 2001 edition of the Boiler and Pressure Vessel Code is more than 16,000 pages.) The 28 books are either standards that provide the rules for fabricating a component or they are support documents, such as Materials (Section II, Parts A through D), Nondestructive Examination (Section V), and Welding and Brazing Qualifications (Section IX). Code Cases provide rules that permit the use of materials and alternative methods of construction that are not covered by existing BPVC rules.

The BPVC is the largest ASME standard, both in size and in the number of volunteers involved in its preparation. At any one time there are more than 800 volunteers serving on one or more committees. The fact that the BPVC is a committee organized and administered by ASME may give the impression that the volunteers are all mechanical engineers. This is not the case; to write such a standard requires a breadth of knowledge that is not available in any one discipline. Volunteers on the committees have expertise in materials (metallurgical and materials engineering), structures (civil engineering), physics, chemistry (chemistry and chemical engineering), and other disciplines in addition to mechanical engineering.

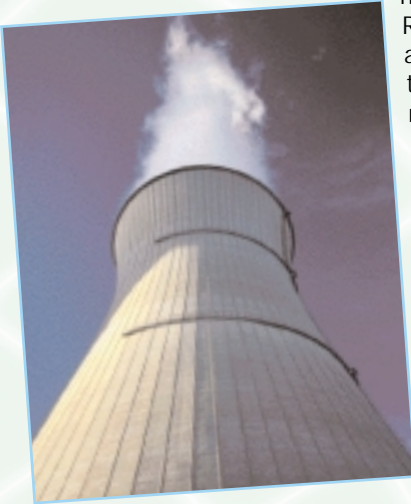
Various sections of the BPVC have been adopted into law in all the Canadian provinces and in 49 of the 50 United States. More than one-quarter of the companies accredited by ASME Codes and Standards to manufacture pressure parts in accordance with various sections of the BPVC are located outside of North America. Internationally, the BPVC is recognized in more than 60 countries.

The record of the BPVC is a testament to its success. The safety record of pressure-containing components manufactured in accordance with the rules of the BPVC is outstanding. The contributions made over the past 90 years by thousands of volunteers, who have participated in the preparation of the BPVC, have made this possible.

U.S. Government Use of ASME Codes and Standards

by Guy A. Arlotto

Your organization wants to construct and operate a nuclear power plant; to supply the reactor steam supply system; to supply architect engineering services; or to supply components (e.g., pressure vessels, piping pumps, valves) for a nuclear power plant. The U.S. Nuclear Regulatory Commission (NRC), the federal agency responsible for issuing construction permits and operating licenses for nuclear power plants, requires conformance with certain ASME codes and standards in its regulations. Therefore, to obtain a construction permit or an operating license, you must meet the requirements of these codes.




In the 1980s the federal government's Office of Management and Budget (OMB) first issued OMB Circular A-119, which required certain government agencies to use applicable national consensus standards wherever practical, in lieu of developing their own regulations to

accomplish their missions. More recently, a public law (PL 104-113) mandates the use of national consensus standards, including ASME codes and standards, by federal agencies where applicable. (The Dept. of Defense, the U.S. Postal Service, and the U.S. Coast Guard routinely use them.)

The U.S. Atomic Energy Commission (AEC), NRC's predecessor, did not need the impetus of OMB A-119 or PL 104-113 to recognize the potential benefits of using ASME codes and standards to work more efficiently and to ensure public health and safety. A decade before OMB A-119 was first issued, the AEC had already endorsed certain ASME codes in its regulations. In fact, AEC involvement with the ASME codes and standards program dates from the mid-1960s, when AEC staff began working on appropriate ASME code committees.

The use of nuclear power in the United States originated with the U.S. Navy program to develop it as the power source for submarines. The Navy took it further by applying it to surface ships and by demonstrating its potential for land-based electrical power generation at the nuclear power plant at Shipping Port, Pennsylvania.



ASME recognized the need for enhanced codes and standards because the technology was new and had no tested codes and standards available, and because the consequences of component failures could have a serious impact on public safety. It created a committee to develop design and construction requirements to ensure the integrity, first of the reactor pressure vessel, and then of other important pressure-retaining components. This resulted in what is today called BPVC's Section III. It covers an array of nuclear components, including pressure vessels, piping, pumps, valves, supports, core support structures, pressure relief, containment systems for spent fuel and high-level waste transport packaging, and concrete components.

At the same time that Section III was being created by ASME in the late 1960s and early 1970s, the AEC was receiving applications monthly from electric utilities in the United States for permits to construct nuclear power plants. It was at that time that the AEC committed resources to the ASME Codes and Standards program by supporting expert staff members to work on ASME committees developing nuclear codes. This gave the AEC the confidence to accept the finished code because its own staff had direct input in the development of the requirements, and it understood the contents of the code and the bases for the requirements. More important, the AEC decided to endorse portions of ASME codes in its regulations, thus making it a requirement to satisfy the code as a condition for obtaining a construction permit.

Federal (AEC/NRC) regulations require first that one obtain a construction permit allowing construction to begin. After construction is complete, the utility must apply for and receive an operating license before beginning operation. As nuclear power plants progressed from the construction phase to the operating phase, ASME developed and published Section XI, Rules for Inservice Inspection of Nuclear Power Plant Components, to ensure that continued safe operation was maintained over the life of the plant. This also was endorsed in NRC regulations, making the periodic inspection and testing of components and meeting acceptance standards a requirement for maintaining a license to continue operation. This gives the NRC and the public a level of confidence that any degradation of the plant during the period of operation has not reduced safety below an acceptable level.

The NRC's use of ASME codes and standards benefits ASME, the NRC, and most important, the public. ASME's codes and standards gain increased visibility and stature through government use, its volunteers see the fruits of their efforts, and public safety is maintained. The NRC benefits because by using ASME codes, it can be a more efficient government agency, both in its decision-making and during various phases of the licensing process. The better the NRC functions, the better the health and safety of the public is protected.

ASME Codes and Standards in China

by John Ferguson

For several years The American Society of Mechanical Engineers has worked to advance the use of ASME codes and standards in China, most notably, standards for nuclear power plant equipment and for boilers and pressure vessels. Beginning in October 2000, several successful workshops were held in Beijing in cooperation with various Chinese organizations.



ASME's goals are to have China's nuclear power plants, facilities, and associated equipment designed and constructed to ASME codes, and to have existing facilities use ASME standards for operation and maintenance. Chinese engineers and regulatory personnel respect the technical content of these codes and standards and, in the absence of having their own technical standards, have expressed an interest in establishing

ASME standards as the standard for their nuclear programs.

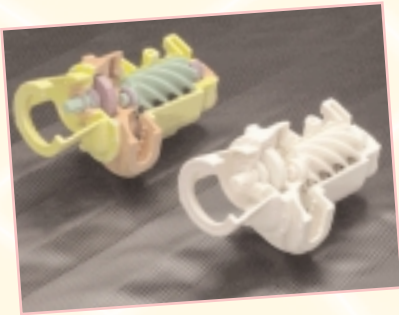
In the last decade, ASME's Boiler and Pressure Vessel Code (BPVC) has begun to get wider use in China, and the Chinese government accepts imported equipment constructed to its requirements. Greater use of the BPVC in the construction of fossil-fuel-fired power boilers and in the petroleum and chemical industries is being pursued.

With the increased use of ASME codes and standards in China, U.S. manufacturers and engineering service companies will have the opportunity to undertake jobs and participate in the current expansion and new construction taking place, particularly in the nuclear area. It also provides opportunities for the sale of U.S.-made components. By having common technical requirements for equipment and services based on ASME codes and standards, barriers to trade are reduced and public safety is enhanced.

A Global Highway for Mechanical Engineering Communications: ASME Y14.5, Dimensioning and Tolerancing


by Lowell W. Foster

ASME Y14.5M-1994, Dimensioning and Tolerancing, which specifies engineering drawing requirements, originated in the 1950s. Over the years it has incorporated technical innovations such as the new electronic compatible systems. Its original goal was to delineate and define mechanical part hardware and to create a common technical drawing language for standardized drawing practices.



It was also recognized that representing a perfect part on the drawing must include a permitted “tolerance” as a deviation from the perfect part (because perfection cannot be achieved in real production). This explains the dimensions and tolerances emphasis of Y14.5M. This standard is designated as an “Internationally Recognized Standard,” the standard of choice throughout much of the world.

ASME Y14.5M predominantly illustrates the Geometric Dimensioning and Tolerancing (GD&T) language to capture the “function and relationships” of part features. This shows that the design requirements and dynamics of part features (e.g., holes, pins, slots, surfaces), as they relate in part function, fit, or assembly with mating parts, can be captured and specified with “geometric characteristics,” “datum references,” and the other tools of the system. For example, in a mating part situation where four pins on one part are to assemble with four mating part holes, would it not stand to reason that if a hole (any one of them and each individually) was produced away from its worst case low limit size as an individual feature (i.e., be larger within its size tolerance), that any permitted error (tolerance) of *location* of that hole could be increased an equal amount? In other words, *size* of features can have an effect on, compensate for, and assist in meeting the location tolerance. This is known as the “maximum material condition” principle and increases possible location tolerances, brings down costs of production, and makes using functional gaging principles possible, which ensures assembly and other advantages. The product designer can select this option or decide on a more stringent method (called “regardless of feature size”) when this dynamic is prohibited. Other



controls delineate part form, orientation, profile, and location of features relative to design requirements. This is all done through the system's symbolic language and the rules and guidelines provided in the standard. This useful, powerful, and widely recognized GDT language is now established as the best method for communicating design requirements. Through use of the GDT system, production, quality, inspection, tooling, programming, and all other supporting operations can meet the requirements using a greater range of methods.

Cranes for Nuclear Facilities

by James E. Nelson

It would be difficult to overstate the importance of using the safest crane design for handling heavy loads in nuclear facilities—it is critical. Dropping or losing control of a load—a dreaded scenario—could result in damage to safety-critical equipment or spent fuel. It is unthinkable and it is impermissible.



With this in mind, the ASME Committee on Cranes for Nuclear Facilities (CNF) has written standards for overhead cranes, the equipment that handles the majority of heavy loads.

The Committee on Cranes was established in 1976, shortly after the U.S. Nuclear Regulatory Commission (NRC) first issued written guidelines for safety-critical or single-failure-proof (SFP) cranes. In 1980, the committee's scope was broadened from nuclear power plants to nuclear (and other critical load handling) facilities. Its first standard, ASME NOG-1, Rules for Construction of Overhead and Gantry Cranes, was issued in 1983. The committee's

second standard, NUM-1, Rules for Construction of Cranes, Monorails, and Hoists, followed in 1996. Committee members represent a range of power plant and nuclear facility owners and operators, engineers, regulatory personnel, constructors, equipment suppliers, and crane manufacturers.

No other industry or government standards have addressed important issues for nuclear facility cranes such as quality assurance, dynamic seismic analysis, and SFP crane features. NOG-1 and NUM-1 cover all of these and more.

In a *Nuclear News* magazine article,¹ NRC Commissioner Jeffrey Merrifield said, "I believe that the future of the nuclear industry does not hinge on corporate decisions about new plants, it hinges on the safety of the existing fleet of reactors," and "Anyone who believes that safety and economic value are mutually exclusive goals is simply blind to the realities that history has unmistakably, and sometimes painfully, taught this industry." Today, construction of new nuclear plants in the United States is being encouraged and numerous operating plants are applying for operating life extensions. A heavy load drop would be disastrous for the industry, even without an offsite release of radioactive materials.

The NRC defines a heavy load as anything weighing more than a nuclear fuel assembly (approximately one ton). A spent fuel cask can weigh 100 to 150 tons or more, and if dropped into the spent fuel pool, it could cause serious damage to the pool and/or the fuel, resulting in a radioactive release. Dropped elsewhere, it could damage safe shutdown equipment or rupture the cask itself. The empty hook block on such a crane can weigh four or five tons and can itself cause severe damage if it falls into the fuel pool or onto safety-related equipment.

The NRC identified two primary causes of load drops as being severe types of overload: "two blocking" or "load hangup." Two blocking occurs when control malfunction or maintenance error permits unintentional overhoisting, resulting in solid contact between the hook block and the head block or its supporting structure. Immediate failure results with the wire rope and the dropping of the load or empty hook block.

Load hangup is abrupt snagging of the moving load, resulting in similarly severe effects on the equipment. Other causes of dropped loads include "mis-reeving" of the hoist wire rope and failure of the hoisting machinery itself.

The NRC guidelines for SFP cranes, as well as ASME NOG-1 "Type I" and NUM "Type I" SFP standards, specify cranes to be designed either to withstand all such incidents without damage or loss of load, or to make the likelihood of their occurrence extremely small. Type I NOG-1 and NUM-1 crane standards in particular incorporate design requirements specific to these concerns, and well beyond the requirements of other crane standards.

The work of the CNF Committee of ASME and the application of its standards has never been more relevant. In the last few years there has been a tremendous increase in the handling of spent fuel casks to move fuel from plant fuel pools to independent spent fuel storage installations. Many operating plants have reached or are approaching the time when they must remove spent fuel from their pools in order to continue operation, but have delayed making heavy load handling (crane) decisions. Now the need is imminent. In the handling of spent fuel, both operating plants and decommissioning plants face many of the same issues.

¹ "Safety: The foundation upon which economic value is built," *Nuclear News*, August 2001.

Codes and Standards *at a Glance*

Why are there codes and standards...?

The Industrial Revolution profoundly changed the way people lived by introducing machinery that transformed daily life. Farm implements no longer had to be made by hand—they could be manufactured. Affordable manufactured goods of all kinds would transform home life—textiles, dishware, reading material. A coal-burning furnace and boiler could heat the water in your home. Transportation began to move at unimagined speeds, far exceeding that of a horse. Slowly, handmade items were being replaced with manufactured items; human strength and horsepower were being replaced by machinery driven by steam power—steam engines, boilers.

...Because it's a catastrophe when a screw doesn't fit.

The most serious problem facing 19th century engineers was exploding boilers. Heating water to produce steam and converting that steam into energy to power machinery revolutionized the production of goods. To build up pressure, steam must be contained in some type of vessel; but uncontrolled, pressurized steam can burst a vessel even if it's made of steel. For want of reliably tested materials, secure fittings, and proper valves, boilers of every description, on land and at sea, were exploding with terrifying regularity. (They would continue to do so into the 20th century.) Although engineers could take pride in America's strides in technology, they could not ignore the 50,000 dead and 2 million injured annually by such accidents. Thus, mechanical engineers in the 1880s began seeking reliable methods for testing steam boilers.

Lack of interchangeability was also becoming a problem. A consumer couldn't buy a bolt in California and use it on a nut acquired in New Jersey because the threading didn't match. Therefore, the farm implement, shotgun, or pipe was rendered useless, unreliable, or dangerous.

When The American Society of Mechanical Engineers (ASME) was founded in 1880, discussion began immediately on establishing standards; it focused on shop drawing symbols, pulleys, line shafting, machine screws, key seats, and drawing boards. At its annual meeting in 1883, a committee on standards and gages was created and a paper was presented urging the adoption of a set of rules for conducting boiler tests that could be accepted as a standard code of practice by engineers. The paper emphasized the prevailing lack of uniformity in which "every engineer who performs a boiler test makes a rule for himself, which may be varied from time to time to suit the convenience or interests of the party for whom the test is made."²

The result was the formation of a committee to study the subject of a uniform test code. In 1884 a test code for boilers was published; it was ASME's first standard. (Establishing a universally accepted construction standard would still take many years.) Shortly thereafter, the Society decided that pipes and pipe threads should also be standardized. The composition of this standards committee was "men representative of pipe manufacturers and pipe users, with perhaps one representative of sprinkling systems and certainly one of the manufacturers of taps and dies."³ This balanced approach to committee composition became the norm for subsequent ASME standards committees.

² The American Society of Mechanical Engineers, "Introduction to ASME Codes and Standards" (New York: The American Society of Mechanical Engineers, 2000). Unattributed source.

³ See note 1 above.

What is a standard?

A standard can be defined as a set of technical definitions and guidelines that function as instructions for designers, manufacturers, operators, or users of equipment. Depending on the subject, a standard can run from a few pages to hundreds of pages, and is written by professionals in a particular technical field, who serve on an ASME committee.

Standards, not having the force of law, are considered voluntary and serve as guidelines. ASME publishes standards and accredits users of standards to ensure that they are capable of manufacturing products that meet those standards. It also provides stamps that accredited manufacturers affix onto their products to indicate that a product was manufactured according to the particular standard. ASME cannot, however, force any manufacturer, inspector, or installer to follow ASME standards. Their use is voluntary.

Why then are standards effective? The 1991 Annual Report of the American Society for Testing and Materials (ASTM) said it best: "Standards are the vehicle of communication for producers and users. They serve as a common language, defining quality and establishing safety criteria. Costs are lower if procedures are standardized; training is also simplified. And consumers accept products more readily when they can be judged on intrinsic merit." A standard may also be incorporated into a business contract.

What is a code?

A standard is a code when it has been adopted by one or more governmental bodies and is enforceable by law, or when it has been incorporated into a business contract.

What is the involvement of ASME in codes and standards today?

Since its creation in 1880, ASME and many other standards-developing organizations have worked to produce standards through a voluntary consensus process as the need for them increased. In addition to developing standards, ASME provides conformity assessment processes for use in industry. These help ensure both that manufacturers comply with equipment specifications and that personnel are properly trained in specialized equipment operation.

ASME, ASTM, and the Society of Automotive Engineers (SAE) are three of the more than 200 volunteer organizations in the United States that follow the procedures accredited by the American National Standards Institute (ANSI) for the development of standards. These procedures must reflect openness, transparency, balance of interest, and due process.

ASME is one of the oldest and most respected standards-developing organizations in the world. It produces approximately 600 codes and standards, covering many technical areas, such as boiler components, elevators, measurement of fluid flow in closed conduits, cranes, hand tools, fasteners, and machine tools.

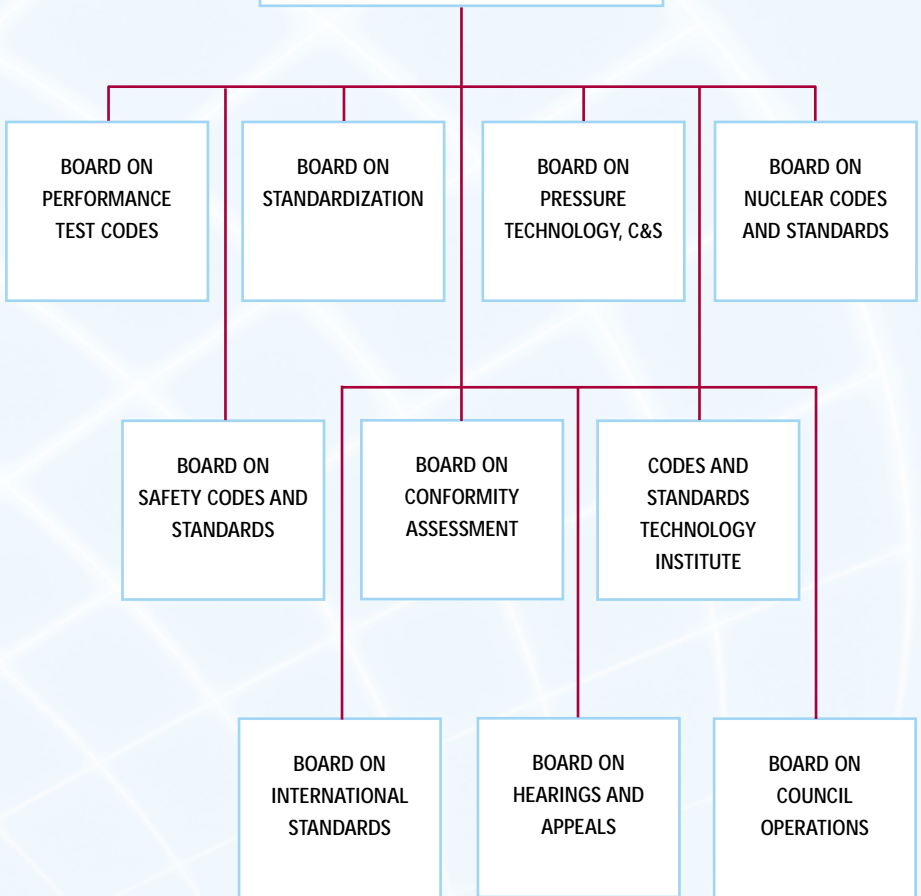
How does ASME produce codes and standards?


ASME's Council on Codes and Standards oversees six standards-developing supervisory boards and three advisory boards, which manage more than 100 committees and 3,600 volunteer members (see figure on next page). The supervisory boards are responsible for pressure technology, nuclear installations, safety codes, performance test codes, conformity assessment, and standardization. The advisory boards deal with international standards, hearings and appeals, and council operations.

ASME formed the Codes and Standards Technology Institute (CSTI) in November 2001 to ensure that ASME standards committees are provided with a continuing source of research in the technologies that they cover. CSTI provides the research and technology development needed to establish and maintain the technical relevance of codes and standards. CSTI has its own Board of Directors, which also reports to the Council on Codes and Standards. Visit the CSTI web page at www.csti.asme.org for more information.

A request for a code or standard may come from an individual, a committee, a professional organization, a government agency, an industry group, a public interest group, or from an ASME division or section. First, the request is referred to the appropriate supervisory board for consideration. The board assigns the request to an existing committee or determines that a new standards committee must be formed. Once a committee has concluded that there is enough interest and need, the standards development process begins.

COUNCIL ON CODES AND STANDARDS





The standards committee is composed of engineers and other interested parties with knowledge and expertise in a particular field. They represent users, manufacturers, consultants, academia, testing laboratories, and government regulatory agencies. The committee maintains a balance of members among the various interest classifications so that no one group dominates. Committee volunteers agree to adhere to the ASME Policy on Conflict of Interest and the Engineer's Code of Ethics.

Committee meetings must be open to the public, and procedures are used to govern deliberations and voting. All comments on technical documents during the approval process must be considered. Any individual may appeal any action or inaction of a committee relating to membership, or a code or standard promulgated by the committee.

Content is approved through consensus voting as defined by ANSI. Balloting is conducted at standards committee meetings and votes are also sent by mail and email; members can even review ballots and submit their votes online on ASME's Web-Based Process Management System (<http://cstools.asme.org>). Repeated voting may be necessary to resolve negative votes. If an individual member feels that due process was not observed, appeals may be made to the standards committee, supervisory board, and finally, to the Board on Hearings and Appeals.

Once consensus is reached, the proposed standard in draft form is submitted to a public review online. Anyone may submit comments during the public review period, to which the committee must respond. The draft is also submitted for approval to the supervisory board and to ANSI. When all comments and considerations have been satisfactorily addressed, the document is approved as an American National Standard and published by ASME. But the work doesn't end there; codes and standards are living documents that are constantly being updated, revised, and reissued to reflect new developments and technical advances.

Conclusion

Televisions, computers, hand tools, medical devices, elevators, boilers—virtually all modern mechanical devices involve one or more engineering standards in their manufacture. ASME is one of several professional and technical organizations that work together to maintain the machinery of the modern world. The fact that the general public is unaware of their work is the best tribute to the success of their achievement—bringing stability to the systems of daily life through the production of voluntary codes and standards.



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