Acronyms

Acronym	Name
AASHTO	American Association of State Highway and Transportation Officials
ABMA	American Bearing Manufacturers Association
ABMA	American Boiler Manufacturers' Association
ACI	American Concrete Institute
ACMA	American Composites Manufacturers Association
AGA	American Gas Association
AGMA	American Gear Manufacturers Association
AHRI	Air-conditioning, Heating, and Refrigeration Institute
AIA	Aerospace Industries Association
AIAA	American Institute of Aeronautics and Astronautics
AISC	American Institute of Steel Construction
AISI	American Iron and Steel Institute
AITC	American Institute of Timber Construction
ANS	American National Standards
ANS	American Nuclear Society
ANSI	American National Standards Institute
API	American Petroleum Institute
ASA	Acoustical Society of America
ASABE	American Society of Agricultural and Biological Engineers
ASCE	American Society of Civil Engineers
ASHRAE	American Society of Heating, Refrigerating and Air-Conditioning Engineers

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Acronym	Name
ASME	American Society of Mechanical Engineers
ASNT	American Society for Nondestructive Testing
ASTM	American Society for Testing and Materials
ATIS	Alliance for Telecommunications Industry Solutions
AWC	American Wood Council
AWEA	American Wind Energy Association
AWS	American Welding Society
AWWA	American Water Works Association
BPVC	Boiler and Pressure Vessel Code
CGA	Compressed Gas Association
CISPI	Cast Iron Soil Pipe Institute
COPV	Composite Overwrapped Pressure Vessels
CPSC	Consumer Product Safety Commission
CSB	Chemical Safety Board
DOD	US Department of Defense
DOE	US Department of Energy
DOT	US Department of Transportation
EJMA	Expansion Joint Manufacturers Association
EPA	US Environmental Protection Agency
EPRI	Electrical Power Research Institute
FAA	US Federal Aviation Administration
FDA	US Food and Drug Administration
FFS	Fitness for Service
HI	Hydraulic Institute
HPVA	Hardwood Plywall and Veneer Association
HTRI	Heat Transfer Research Institute
IBC	International Building Code
ICC	International Code Council
IEEE	Institute of Electrical and Electronics Engineers
LCS	Limited Consensus Standards
MRB	Material Review Board
NACE	National Association of Corrosion Engineers
NASA	National Aeronautics and Space Administration
NBBI	National Board of Boiler and Pressure Vessel Inspectors
NBIC	National Board Inspection Code
NCS	National Consensus Standards
NEC	National Electric Code
NEI	Nuclear Energy Institute
NETA	InterNational Electrical Testing Association
NFPA	National Fire Protection Association
NIST	National Institute of Standards and Technology
NRC	US Nuclear Regulatory Commission

Acronym	Name
NRS	Nameplate, Records, and Stamping
NSF	National Science Foundation
NSTC	National Science and Technology Council
NTTAA	National Technology Transfer and Advancement Act
OMB	Office of Management and Budget
OSHA	US Occupational Safety and Health Administration
PCA	Portland Cement Association
PSM	Process Safety Management
SAE	Society of Automotive Engineers
SDO	Standards Developing Organization
TEMA	Tubular Exchanger Manufacturers Association
TMS	The Masonry Society
UL	Underwriters Laboratories
USB	Universal Service Buss
VCS	Voluntary Consensus Standards

Appendix A

Deciding Not to Use a Standard

A.1 Introduction

This book has dealt with the many aspects of standards, including their benefits. If a standard is available for an application, it is generally wise, and it is sometimes required, to use it. A number of benefits of doing so are outlined in Chapter 3. In spite of these benefits, there will be cases in which use of a standard may not be the most effective way to produce a particular product or perform a particular task. Before a decision is made not to use an available standard, however, the need, the consequences, and the mitigations for not complying with the standard should be carefully considered.

If a standard is required by law or regulation (e.g., OSHA, DOT, or FAA regulations) that fact should not be ignored. A decision not to comply with those regulations may well involve legal consequences and the jurisdictional organization should be consulted before moving forward. Even if the decision is technically justifiable, a waiver or other documentation may be needed in order to avoid regulatory consequences.

In Chapter 3, it was noted that use of a standard can provide benefits of improved reliability, interchangeability, reduced costs, confidence in the product, process, or design approach. In the event of a failure it may bolster the argument that the product was manufactured responsibly. These benefits should not be given up lightly.

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A.2 Reasons Not to Use a Standard

There are a number reasons why a standard may not be used, divisible into a few general categories.

- Lack of a standard.
- The most applicable standard is overly constraining.
- The product or process is unique and the standard is not a good match.
- The product or application is so basic as to be generally recognized as not requiring a standard.
- Cost.
- The product is patented. Hence, there is no need for a standard.

A.2.1 Lack of a Standard

There may not be an applicable standard, and while a company could choose then to develop its own standard, it might also decide that such an effort is not warranted because of limited need. Also, related to this is the situation in which there may be a standard that could be applied, but the match is not good. An example of a case in which there is no standard is the design of strakes in slender towers and chimneys for preventing the formation of wind vortex shedding, and hence vibration.

A.2.2 Overly Constraining

The most applicable standard may be too constraining. For example, the standard might specify acceptable materials, and those allowed may not meet the special needs of the customer, such as chemical compatibility, heat transfer characteristics, or strength, resulting in a product that might react with its contents, one that overheats because it cannot transfer energy out quickly enough, or weighs too much. This case might be represented by dimpled jackets on pressure or vacuum shells, for which the design is based on testing rather than using very conservative rules found in many international codes and standards. Another example is vessels constructed for use in high vacuum applications, for which the ASME Boiler and Pressure Vessel Code (BPVC) could be used, but for which certain important design details (e.g., intermittent welds on the outside of nozzles) are not accepted by that code.

A.2.3 Unique Product or Application

Sometimes, the uniqueness or the low volume of a particular product combined with a perceived lack of need makes the use of a standard unnecessary or undesirable. In this case, there may still be some standards that apply and are used for particular aspects (e.g., materials), but the overall product may be constructed without reference to a specific standard.

An example of such a case might be a pasta machine. The making of pasta may be considered by some to be more of an art than a science, with the thickness and width of individual pieces a matter of personal preference. There are many pasta machines on the market, with a wide range of capabilities, features, characteristics, and levels of quality. Electrically driven ones will almost certainly be listed with Underwriters Laboratory and meet certain standards for their drive and electrical systems. The steels used for the cutters may well be ASTM listed products. Safety requirements of the CPSC will need to be met. But the major features that actually produce the pasta are most likely not constructed to a standard. Indeed, there is probably no such standard, whether for home or industrial pasta machines.

Similarly, in process equipment there are many geometries and components that are not covered by standards. This is due to their limited use or limited applications. These include cylindrical shells with elliptical cross sections, seal-weld gaskets, and special configuration bolts.

A.2.4 Basic Services

Many services do not require compliance with a standard. These include tasks such as mowing a lawn or running a car wash.

A.2.5 Patented Products

Since a patented product is intended to be used by one company or its licensees, the need to develop a standard to have uniformity in design is not warranted.

A.3 Consequences of Not Using a Standard

The consequences of not using a standard can include the loss of any of the benefits of using it. Which ones apply will depend on the particular case in question. A product built for in-house use by a company's employees, for example, must meet any OSHA regulations, including referenced standards, but if there are no mandatory standards then the compliance aspect is not relevant. Similarly, in this case there is no need to develop credibility with the public or a customer base. Other aspects, however, such as confidence in the design and interchangeability of components may be lacking. If the same product were built for sale, then customer confidence and a potential credible defense in the case of a failed product would be factors.

A.4 Mitigations for Not Using a Standard

As previously noted, there are often distinct advantages to the user of a standard, as well as to the purchaser of the resulting products or services. Failure to work to a standard typically gives up some or all of these advantages. In order to ensure that the product is not deficient, or perceived to be deficient, in some way – a role typically played by standards – it may be necessary to apply mitigations. What mitigations should be applied depends on what is lost by not working in accordance with a standard.

Example: If a special flange or fitting is produced, and the bolt circle is reduced to reduce tooling and material costs with a more efficient design, then

1. interchangeability and direct mating with the standard product does not exist. Special adapters could perhaps be developed as a mitigation to allow mating this product with the standard one, but it must be recognized that simple interchangeability does not exist;
2. because the product is not the same trustworthy product that has been sold for a generation or more, credibility is likely reduced. Customers will be wary of the product until it has a sufficiently demonstrated track record. This aspect can be mitigated to some extent by ensuring that the quality control program of the producer (e.g., ISO compliance) is well publicized, by publication of test results, and by a strong sales and marketing effort involving rapid response to any reported problems;
3. the robustness of the design might be questioned, again in light of the track record of the product that is being replaced. A thorough qualification test program and a series of finite element analyses with clear graphics showing reduced stresses, well publicized, might address this problem;
4. lack of known capabilities can be addressed by a suitable series of cut sheets.

One by one, the advantages lost by not having a standard product can be reviewed and addressed. At the end, the reduced costs and the reduced space requirements of the new product might be enough to justify its production anyway. Usually the mitigations involve using a well-defined and well-documented process in place of the standard. Often, they involve one or more company standards in lieu of use of a VCS. Sometimes they involve using as much of the standard as can reasonably be used, taking exceptions only for those aspects for which compliance is impossible, and, even for those aspects, following processes similar to those in the standard itself.

Example: The use of a wind tunnel nozzle in a high temperature wind tunnel. While another standard (the ASME B31.3 Process Piping Code) might be a better fit, the customer wishes to have an ASME BPVC “Code Stamp” so has to ensure quality and have a visible indication of compliance with a recognized standard. The particular tunnel operates at high temperature with high heat flux. In order to control the temperature and ensure that the nozzle does not burn up, a high heat transfer coefficient is required. Only certain materials will do the job, and these particular materials happen not to be listed in the ASME BPVC.

It happens that the copper alloy that was selected as most suitable had in the past been the subject of a code case (the process provided to gain interim approval of designs or products not permitted by the ASME BPVC, pending further consideration and possible inclusion in the code), but the code case was annulled, essentially because of lack of use. The customer has the option of asking for reinstatement of the code case, but this would likely take about a year, delaying critical tests in the wind tunnel.

If the customer cannot either wait or switch to another material, it will not be possible to have an ASME Code stamped nozzle. There are two credible alternatives, neither of which involves a code stamp.

Since the wind tunnel nozzle has a (high) flow through it, one reasonable approach is to design and construct the nozzle in accordance with the ASME B31.3 Process Piping Code, which has provisions for the use of unlisted materials and unlisted components. By following this standard, including the provisions for unlisted materials, a component fully compliant with this standard could be produced (It would not be code stamped because this standard has no provisions for code stamping.).

The other approach would be to follow the ASME BPVC in all respects except for using material and material properties from it. In this situation, because there had previously been a code case for this material, material properties could probably be taken from that code case. Otherwise the material properties could be determined following the same process as is used for listed materials, but since this code does not provide for the use of unlisted materials the component would not be in full compliance with the standard, again resulting in a product that does not have a code stamp.

There does not appear to be any specific regulation that addresses this application, other than the general duty clause of OSHA, so there is no immediate regulatory compliance issue with either approach. Either approach would likely result in a product with adequate structural integrity and that met the needs of the customer. There may be a stronger argument for using the Process Piping Code than for the BPVC for two reasons: first, the wind tunnel nozzle is truly a flow component, so it could be argued that the Process Piping Code is a better fit; second, this standard can be fully complied with. While the component would likely end up with essentially the same design in either case, there is probably a lesser chance of criticism if the standard that can be fully complied with is followed and documented.

A.5 Summary

In some cases, it makes sense to produce products without reference to a standard even if one exists. There are many instances where a standard is not needed or desirable. However, it is important to consider what is being given up by not using an available standard. Any mandatory requirements need to be understood and fully addressed. Caution must be exercised to assure safety and reliability in the product. Issues of interchangeability need to be considered. Customer confidence in the product must be evaluated. Potential increased liability resulting from a "noncompliant" product should be addressed. These aspects are then weighed against any potential benefits.

If reduced cost (sometimes there is no reduction in cost), weight, product lead time, greater flexibility, etc. balanced against any drawbacks of not following a standard still encourage a decision not to use a standard, it may make sense. If this is the decision, then proceed carefully, as if a standard were being applied, documenting decisions and designs so as to get as many of the benefits as possible of using a standard, even without one.

Appendix B

Some SDOs developing Voluntary Consensus Standards

	The Aluminum Association	www.aluminum.org
ABMA	American Bearing Manufacturers Association	www.americanbearings.org
ABMA	American Boiler Manufacturers Association	www.abma.com
ACI	American Concrete Institute	www.concrete.org
ACMA	American Composites Manufacturers Association	www.acmanet.org
AENOR	Spanish Association for Standardization and Certification	www.en.aenor.es
AFNOR	Association Francaise de Normalisation	www.afnor.org/en/
AGMA	American Gear Manufacturers Association	www.agma.org

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AHRI	Air-conditioning, Heating, and Refrigeration Institute	www.ahrinet.org
AIA	Aerospace Industries Association	www.aia-aerospace.org
AIAA	American Institute of Aeronautics and Astronautics	www.aiaa.org
AISC	American Institute of Steel Construction	www.aisc.org
AISI	American Iron and Steel Institute	www.steel.org
AITC	American Institute of Timber Construction	www.aitc-glulam.org
ANS	American Nuclear Society	www.ans.org
API	American Petroleum Institute	www.api.org
ASA	Acoustical Society of America	www.acousticalsociety.org
ASABE	American Society of Agricultural and Biological Engineers	www.asabe.org
ASCE	American Society of Civil Engineers	www.asce.org
ASHRAE	American Society of Heating, Refrigerating and Air-Conditioning Engineers	www.ashrae.org
ASME	American Society of Mechanical Engineers	www.asme.org
ASNT	American Society for Nondestructive Testing	www.asnt.org
ASTM	ASTM International	www.astm.org
ATIS	Alliance for Telecommunications Industry Solutions	www.atis.org
AWC	American Wood Council	www.awc.org
AWEA	American Wind Energy Association	www.awea.org
AWS	American Welding Society	www.aws.org
AWWA	American Water Works Association	www.awwa.org
BIS	Bureau of Indian Standards	www.bis.org.in
BSI	British Standards Institute	www.bsigroup.com
CENELEC	European Committee for Electrotechnical Standardization	www.cenelec.eu
CGA	Compressed Gas Association	www.cganet.com
CGSB	Canadian General Standards Board	http://www.tpsgc-pwgsc.gc.ca/ongc-cgsb/index-eng.html
CISPI	Cast Iron Soil Pipe Institute	www.cispi.org
DIN	Deutsches Institut fur Normung e. V.	www.din.de
EPRI	Electrical Power Research Institute	www.epri.com

EU	European Union	https://ec.europa.eu/growth/single-market/european-standards_en
GOST	Russian Federal Agency on Technical Regulating and Metrology	http://www.gost.ru/wps/portal/en
HI	Hydraulic Institute	www.pumps.org
HPVA	Hardwood Plywall and Veneer Association	www.hpva.org
ICC	International Code Council	www.iccsafe.org
IEC	International Electrotechnical Commission	www.iec.ch
IEEE	Institute of Electrical and Electronics Engineers	www.ieee.org
IRAM	Instituto Argentino de Normalizacion y Certificacion	www.Iram.org.ar
ISO	International Organization for Standardization	www.iso.org
JISC	Japanese Industrial Standard Committee	www.jisc.go.jp/eng
KATS	Korean Agency for Technology and Standards	http://www.kats.go.kr/en/main.do
NACE	National Association of Corrosion Engineers	www.nace.org
NBBI	National Board of Boiler and Pressure Vessel Inspectors	www.nationalboard.org
NEI	Nuclear Energy Institute	www.nei.org
NETA	InterNational Electrical Testing Association	www.netaworld.org
NFPA	National Fire Protection Association	www.nfpa.org
PCA	Portland Cement Association	www.cement.org
SAC	Standardization Administration of the People's Republic of China	http://www.sac.gov.cn/sacen/
SAE	SAE International (formerly Society of Automotive Engineers)	www.sae.org
SIS	Swedish Standards Institute	http://www.sis.se/en/
TMS	The Masonry Society	https://masonrysociety.org/
UL	Underwriters Laboratories	www.ul.com
UNI	Italian Organization for Standardization	www.uni.com

Appendix C

Some Industrial Organizations That Publish Limited Consensus Standards

Acronym	Organization	Website	Standard(s)
ABMA	American Boiler Manufacturers Association	www.abma.com	Various boiler publications
EJMA	Expansion Joint Manufacturers Association	www.ejma.org	Expansion joint standards
HEI	Heat Exchange Institute	www.heatexchange.org	Heat exchange and vacuum apparatus
TEMA	Tubular Exchanger Manufacturers Association	www.tema.org	Construction of heat exchangers

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Appendix D

Some US Government Jurisdictional Agencies

Acronym	Organization	Website
CPSC	Consumer Product Safety Commission	www.cpsc.gov
DOE	Some US Government Department of Energy	www.doe.gov
DOT	Some US Government Department of Transportation	www.dot.gov
EERE	Office of Energy Efficiency and Renewable Energy	www.energycodes.gov
EPA	Some US Government Environment Protection Agency	www.epa.gov
FAA	Federal Aviation Administration	www.faa.gov
FCC	Federal Communications Commission	www.fcc.gov
FDA	Food and Drug Administration	www.fda.gov
FEMA	Federal Emergency Management Agency	www.fema.gov
FHWA	Federal Highway Administration	https://www.fhwa.dot.gov/
FMCSA	Federal Motor Carrier Safety Administration	www.fmcsa.dot.gov

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Acronym	Organization	Website
FRA	Federal Railroad Administration	www.fra.dot.gov/
FTA	Federal Transit Administration	www.fta.dot.gov/
NHTSA	National Highway Traffic Safety Administration	www.nhtsa.gov
NRC	Nuclear Regulatory Commission	www.nrc.gov
OSHA[a]	Occupational Health and Safety Administration	www.osha.gov
PHMSA	Pipeline and Hazardous Materials Safety Administration	www.phmsa.dot.gov/

[a]A number of states have their own occupational safety and health administrations that have been approved by OSHA. These typically have their own version of the OSHA regulations.

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Biography

Owen R. Greulich, M.E., P.E., is a mechanical engineer currently employed as Pressure and Energetic Systems Safety Manager in the Office of Safety and Mission Assurance at NASA Headquarters. His current responsibilities include safety of pressure and vacuum systems while prior work included project management of pressure systems design and implementation, major wind tunnel modifications, fabrication of research hardware, and construction of test stands.

Mr Greulich is responsible for the development and quality of a number of internal standards, including review of standards in a wide range of engineering fields. He is active on the High Pressure Task Group of the American Society of Mechanical Engineers (ASME) Process Piping Code Committee and American Institute of Aeronautics and Astronautics (AIAA) committees on aerospace pressure systems standards. He is Chair of the Fatigue and Fracture subcommittee for aerospace pressure vessels.

Prior to his employment at NASA, Mr Greulich worked in the private sector, designing and managing construction of pressure and vacuum systems and other specialized fabricated and machined hardware. His publications include work on integrity of wiring in aerospace applications, studies regarding rocket propellant safety, and composite structures.

Mr Greulich received his Master of Engineering degree in Mechanical Engineering at the University of California in 1979. He is a registered professional engineer in the State of California.

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Maan H. Jawad, PhD, P.E., is President of Global Engineering & Technology (GE&T). GE&T performs engineering consulting to the pressure vessel industry as well as the power, petrochemical, and nuclear industries. Prior to this, Dr Jawad was on the board of directors and was Director of Engineering of the Nooter Corporation where he was employed from 1968 until he retired in 2002.

Dr Jawad has been active on various technical committees of the ASME Boiler and Pressure Vessel Code since 1972 and has served on numerous committees as a member and chairperson. He was appointed by the Governor of Missouri to the Missouri Board of Boiler and Pressure Vessel Rules and served from 1998 to 2005. He was also a member of the advisory board to the National Board of Boilers and Pressure Vessel Inspectors in Columbus, Ohio, representing The American Boiler Manufacturer's Association from 2000 to 2005.

Dr Jawad obtained his PhD in Structural Engineering from Iowa State University in 1968. He has authored and coauthored five technical books related to pressurized equipment, two of which have been translated into Chinese. He has also authored and coauthored numerous technical research papers in the field of pressure vessels.

Dr Jawad has taught graduate and undergraduate level engineering courses at various universities in topics such as Theory of Plates and Shells, Finite Element Analysis, Advanced Structural Analysis, and Plastic Design. He is a registered professional engineer in the State of Missouri, a Fellow of the ASME, and a member of the American Society of Civil Engineers.

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