Standards, Codes, Specifications, and Regulations

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What is a Standard?

"Think of them as a formula that describes the best way of doing something." – www.iso.org/standards.html

"They're developed by thousands of engineers and experts around the world to ensure the products, processes, and systems we rely on every day are safe, reliable, efficient, and work effectively together." – www.ansi.org/education/standards-education-training

"Simply put, standards are documents that establish an agreed upon way of doing something." – www.standards.ieee.org/beyond-standards/what-are-standards-why-are-they-important/

A Standard is an agreed upon

- Definition of terms
- Classification of components
- Delineation of procedures
- Specification of
  - Dimensions
  - Materials
  - Processes
  - Products
  - Systems
  - Services or Practices
    - Test methods and sampling procedures
  - Descriptions of
    - Fit
    - Measurement of size or strength

Source: www.nist.gov

Standards

Are documented agreements that are readily available

Contain technical specifications and/or precise criteria

Are to be used consistently as

Requirements
Guidelines
Definitions of characteristics

Ensure that materials, products, processes, and services are fit for purpose

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Examples of What Standards Can Address

The process that is to be used to complete a task

- Tensile testing of metallic materials – ASTM E8/E8M
- Lightweight Survey and Inclining Experiment – ASTM F1321-21

The physical configuration of a component

- USB plugs and ports – USB.org
- Standard steel pipe sizes – ASME B36.10M

The functional requirements of a system

- Shipboard electrical installations – IEEE 45.1-2023

Examples of a well-used standard – Credit Card Size

Dimensions	Standard Size
Width	85.66 mm
Height	53.98 mm
Thickness	0.76 mm

Governing standard is ISO/IEC 7810

Adhering to these standard dimensions allows the cards to be used to make purchases worldwide.

Why Standards?

Safety

Risk Reduction

Economic Efficiency

Establishment of industry and consumer confidence
Facilitation of International trade
Compatibility across industries and products

Lifecycle Commercial Efficiency

Design
Construction/Production
Operations
Decommissioning

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Both national and international standards simplify everyday life and increase the reliability and effectiveness of the goods and services we use.

What is a Code?

Codes are sets of requirements that:

- Are based on laws or regulations
- Address health, safety, and environmental concerns
- Define minimum requirements
- ***Are typically prescriptive***
- ***Are not optional***

What is a specification?

A documented list of requirements for a specific product, task, or process.

A precise description of a purchaser's requirements.

A contractual agreement between a product, task, or service purchaser and the contractor, vendor, or service provider.

Not legal, regulatory, or standards organization-based.

Specification Types

Design Specifications

Describes what a system/component is to be

Performance Specifications

Describes how a system/component is to perform

Procedural Specifications

Describes how a process/task is to be performed

Specifications may include aspects of more than one specification type

Comparison of Standards, Codes, and Specifications

Category	Description	Example	Example Specifics
Standards	An agreed upon specific way of doing something	Tensile test of ductile material	• Specimen shape and size • Strain rate during test • Gripping • Measurements
Codes	A prescriptive set of rules for a specific feature or performing a specific task	Local Residential Building Codes	• Required minimum thermal insulation R-values • Maximum allowable distance between electrical outlets in living spaces
Specifications	Specific, detailed requirements for a component or system's performance	Crane lifting capacity	• Two metric tons at an outreach of two meters

Difference between Regulations and Standards

- Regulations are requirements established by governmental agencies to implement laws.
- As regulations are based on law, they are compulsory.
  - Regulations are typically developed with input from the public.
- Standards are created, maintained, and distributed by standards organizations and followed voluntarily.
  - Standard organizations develop and revise standards with committees assembled from industry, academia, and government representatives.
- Rather than reinventing the wheel, regulations may incorporate standards by reference.
  - Specific standards are called out or referenced in the wording of the regulation
  - This is known as “incorporated by reference”
- Commercial agreements may require that standards be followed.

Example of Standard Incorporated by Reference

US Code of Federal Regulations (CFR)

- 46 CFR Part 56 – Piping Systems and Appurtenances
- Requirements for various ships' and barges' piping systems and appurtenances
- 46CFR56.01-2 Incorporation by Reference

This section includes references to standards issued by the following organizations

- American Petroleum Institute (API) – 1
- ASME – 26
- ASTM – 60
- ISO – 1
- Society of Automotive Engineers (SAE) - 2

Conformity is a key component in the use of Standards

End users need to be confident that required standards have been followed without having to conduct testing and evaluations

Conformity with standards can be supported by

- Policies and Procedures
- Quality Control Efforts and Audits
- Accreditation Organizations and Activities

Conformity Assessment is “the demonstration that specified requirements related to a product, process, system, person or body are fulfilled.” – www.nist.gov/standardsgov/conformity-assessment-basics

Standards Organizations

- Also known as
  - Standards Body
  - Standards Developing Organizations (SDO)
  - Standards Setting Organization (SSO)
- Function is to
  - Develop
  - Promulgate
  - Maintain – revise, edit, update, and
  - Interpret standards for the benefit of industries, governments, consumers, and society

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Standards Organizations Functions

Develop

- Organizational structure in place to support a formalized process of standards creation.
- Committees made up of volunteers from industry, academia, consumers, and government with specific expertise formed to create standards based on voluntary consensus

Promulgate

- Standards are published once the development process is completed
- Standard may be purchased in several forms

Maintain

- Standards committees are assembled regularly to review and update standards as needed

Interpret standards

- Provide guides, manuals, and training to guide individuals and organizations on the use of the standards

Review Questions – Standards, Codes, and Regulations

1. Who develops standards?
2. How are codes different from standards?
3. What is the difference between design and performance standards?
4. Give examples of how conformity with a standard may be verified.
5. How can a standard be related to a regulation?

Resources – Standards Organizations

- www.nist.gov
- www.iso.org
- www.ansi.org
- www.astm.org
- www.ieee.org

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