

# Engineering Standards and the Design Process

by

Frederick T. Elder, Adjunct Professor  
University of Wisconsin-Madison

# Why Use Standards

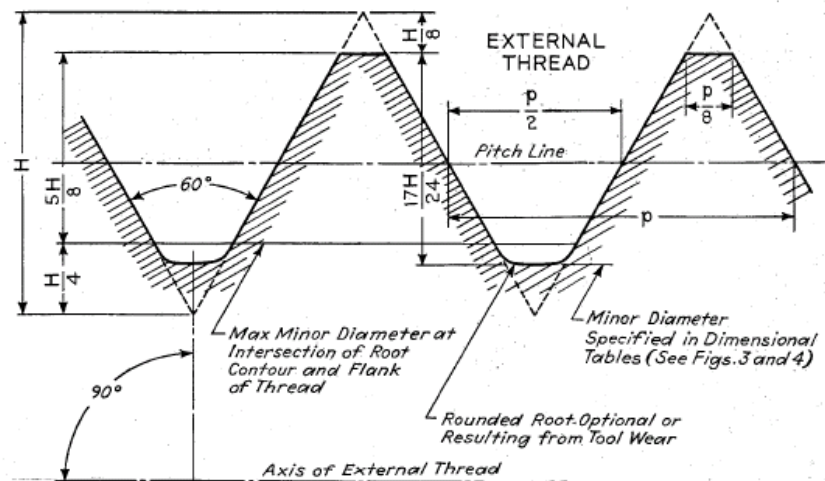
- Legal Necessity
- Consensus of the Design Community
- Many common objects have already been designed very well
- Greatly simplify drawings and callouts
- More control over your design and purchasing



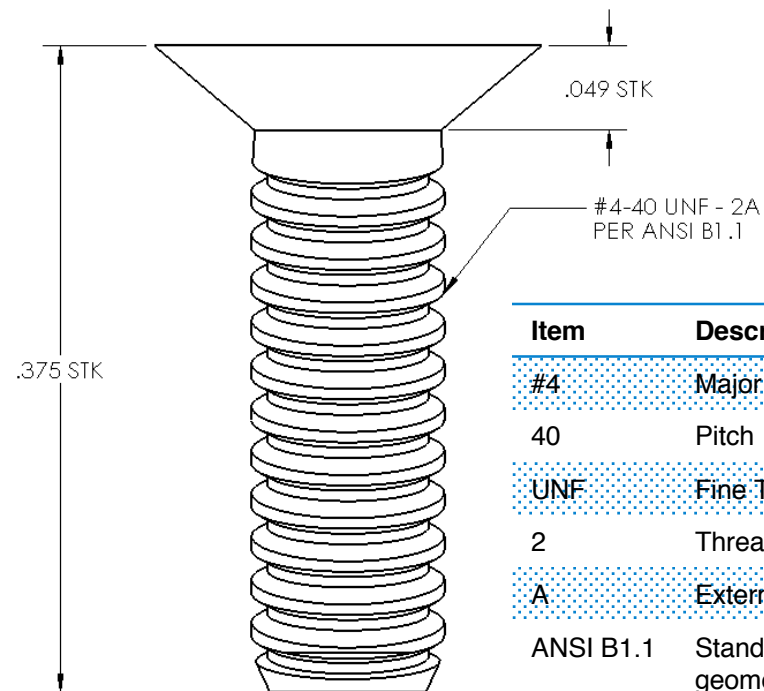


# Standard Comparison

## Without Standard



## With Standard



# What is a standard?

A standard is a:

written description of the criteria for a specific product, process, test, or procedure that is agreed to by formal processes

## Document Abstract

[Back to Top](#)

### Scope:

This Standard is intended to cover the complete general and dimensional data for the various types of inch series square and hex nuts recognized as "American National Standard." Also included are appendices covering gaging of slots in slotted nuts, wrench openings for nuts, and formulas on which dimensional data are based. It should be understood, however, that where questions arise concerning acceptance of product, the dimensions in the Tables shall govern over recalculation by formula.

The inclusion of dimensional data in this Standard is not intended to imply that all of the products described herein are stock production sizes. Consumers are requested to consult with manufacturers concerning lists of stock production sizes.



# Types of standards

- Consensus standards
  - Agreed to by formal consensus
- Defacto (adhoc) standards
  - Developed outside formal procedures (by the marketplace) – example Adobe acrobat pdf
- Government regulations
  - Adopted by government and written into law



# Who Generates Standards

- IEEE Standards Board

- Chair: Bob Grow

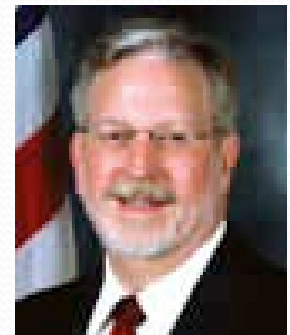
- 29 members

- Cost Accounting Standards Board

- 5 members

- ASTM International

- 2007 Chairman of the Board: Gregory E. Saunders





# American Society of Mechanical Engineers (ASME)

**spends over \$20 million/year on standards development**

*Francis Dietz. Mechanical Engineering.* New York: Mar  
2003.Vol. 125, Iss. 3; pg. 28

## ASME digital store

[Home](#) > [Codes and Standards](#) > [Elevators and Escalators](#)

### ASME A17.1/CSA B44 Handbook - 2004 Safety Code from Elevators and Escalators Handbook



Product Type: E-Book  
No. of pages: 578

Price: \$225.00

[Get more information](#)

Add to Cart

## MadCat

**Author:** American Society of Mechanical Engineers.

**Title:** Safety code for existing elevators and escalators : includes re  
escalators.

**Publisher:** New York, N.Y. : American Society of Mechanical Engineers

**Description:** xvi, 82 p. : ill. ; 28 cm.

**Location:** Wendt Library Standards Section, 2nd Floor, Noncirculating

Where is this Location?

**Catalog:** UW Madison

**Call Number:** ASME A17.3-2002

**Status:** Not Checked Out

ANSI/ASME A17.1-  
2007



Safety Code for Elevators and Escalators (Bi-national  
standard with CSA B44-07)



American National Standards Institute

>> go

- eStandards Store
- About ANSI
- Membership
- Standards Activities
- Accreditation Services
- Consumer Affairs
- Government Affairs
- News & Publications
- Meetings & Events
- Education & Training
- Other Services
- Library
- Internet Resources
- Career Opportunities



#### LATEST HEADLINES

- New Voluntary Standard Supports Security and Risk ....
- Tributes Mark Tenth Anniversary of the National ....
- "Options for Action Summit" to Address U.S. ....

[Purchase Standards](#) [Contact Us](#) [Help](#) [Sign-In](#) [Join ANSI](#)



Unsafe food is a  
health hazard!

ANSI w

ANSI doesn't write standards. Most standards in the US (and the Western World) are written by — trade and professional associations, consortia, and private businesses that see a need for standards to simplify business and life, to protect health and the environment.





## □ 1300 members

- Societies (ASME...)
- Government agencies
- Laboratories and testing organizations
- Academia

## □ 200 Accredited developers

- ASME (American Society of Mechanical Engineers)
- ASCE (American Society of Civil Engineers)
- SAE (Society of Automotive Engineers)



## □ US process for standards development

1. Accredited Developer submits statement of need
2. If project is approved by ANSI, draft test is written
3. Draft is reviewed by many, rewritten, reviewed....
4. Developer submits request for final review
5. ANSI approves and publishes it
6. Standard is reviewed every 5 years for possible update or removal.





- ANSI is the sole US representative in the ISO (International Standards Organization)





International  
Organization for  
Standardization

**157 countries**



Japan



France



*American National Standards Institute*

United  
States



United  
Kingdom



Germany



China



## Caterpillar's CEO on the need for International Standards

2006-11-09



"Caterpillar supports the ISO goal of one standard, one test accepted globally," says, **Jim Owens, Chairman and Chief Executive Officer of Caterpillar Inc.**, in an exclusive interview in the November 2006 issue of *ISO Focus* ([www.iso.org/isofocus](http://www.iso.org/isofocus)), the magazine of the International Organization for Standardization.

"This approach offers a level field of competition across the world, so that companies can compete based on the value they can offer customers no matter where in the world those customers may live and do business," he tells *ISO Focus*.

Owens goes on to affirm his appreciation of how ISO standards help reduce non-tariff barriers to trade, whilst making industry more efficient. "It is not economical to develop products to meet different requirements in each country," he says. "Thus, the ISO standards are very valuable for promoting global requirements to minimize the time and costs of developing and testing new products."

International Standards also bring a great many benefits to new technology, Owens emphasizes: "Standards help establish acceptance criteria and test methods for the introduction of new technology. Particularly in the safety area, International Standards provide performance criteria that can be used as a baseline for adopting new innovations and technology."

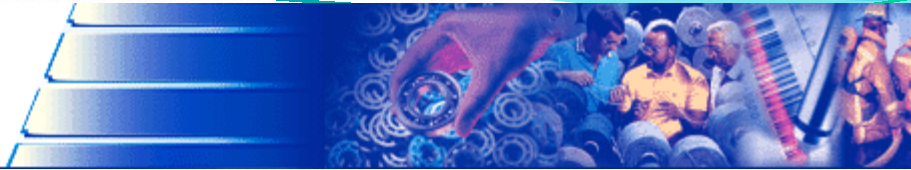
Level Competition  
Worldwide

Economical:  
minimizes cost in  
development and  
testing

Baseline for  
adopting new  
technologies



International  
Organization for  
Standardization



## □ International Standards

- Ensure quality, safety, compatibility
- Facilitate trade
- Climate change, energy





# International Organizations



International  
Organization for  
Standardization

- 16,500 standards
- 192 technical committees
- 541 subcommittees
- 2,188 working groups
- Annual operational budget
  - \$120 million US
- ANSI participates in 80% of ISO committees

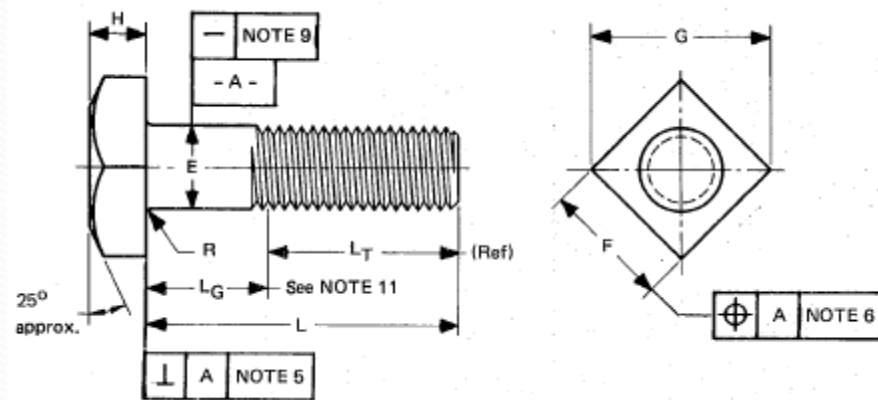


Commission Electrotechnique Internationale  
International Electrotechnical Commission  
Международная Электротехническая Комиссия

- 4,840 standards (electronics, magnetics, telecommunications, multimedia)
- 179 technical committees and subcommittees
- 700 project teams
- ANSI participates in 91% of IEC committees

# Example

## Bolt Standard



- Standard covers all dimensions and tolerances
- 17 additional requirements also covered by standard including: Surface condition, head taper, straightness, threads, etc...



# Bolt Details

- Standards cover even the smallest dimensions
- Without standard most dimensions shown would need to be clearly labeled and dimensioned

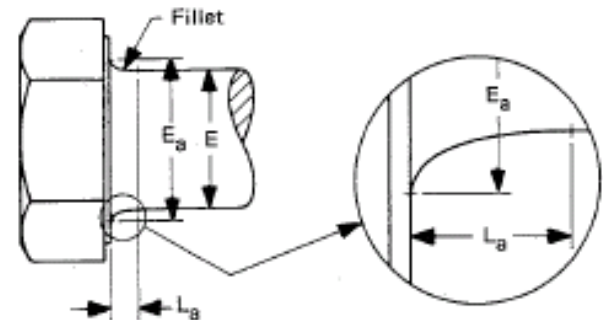
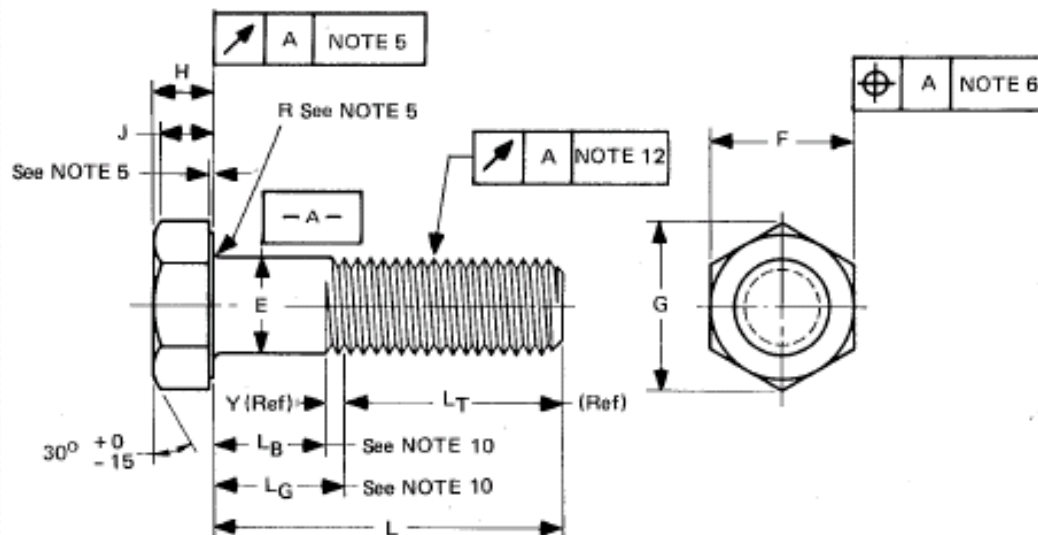
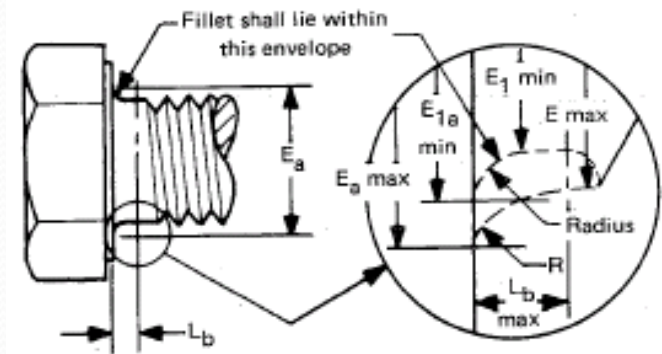


FIG. 1 STYLE 2 ELLIPTICAL SHAPED FILLET



Where:

$$E_{1a} \text{ MIN} = E_a \text{ MIN} - \frac{E_a \text{ MAX} - E_1 \text{ MIN}}{2}$$

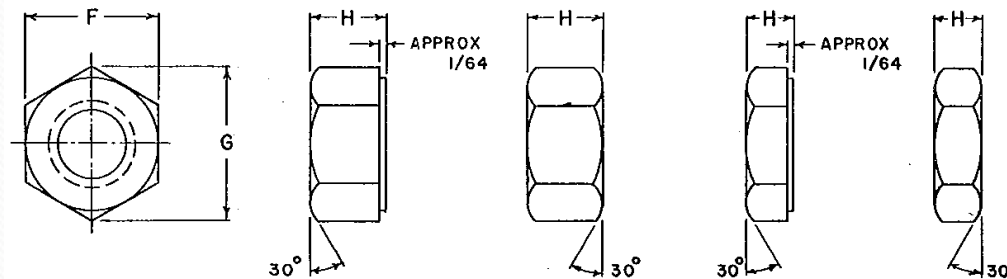
$$L_b \text{ MAX} = \frac{E_a \text{ MAX} - E_1 \text{ MIN}}{2}$$

E<sub>1</sub> MIN = Minimum specified pitch diameter of thread

FIG. 2 UNDERHEAD FILLET FOR SCREWS THREADED FULL LENGTH

# Nut Standards

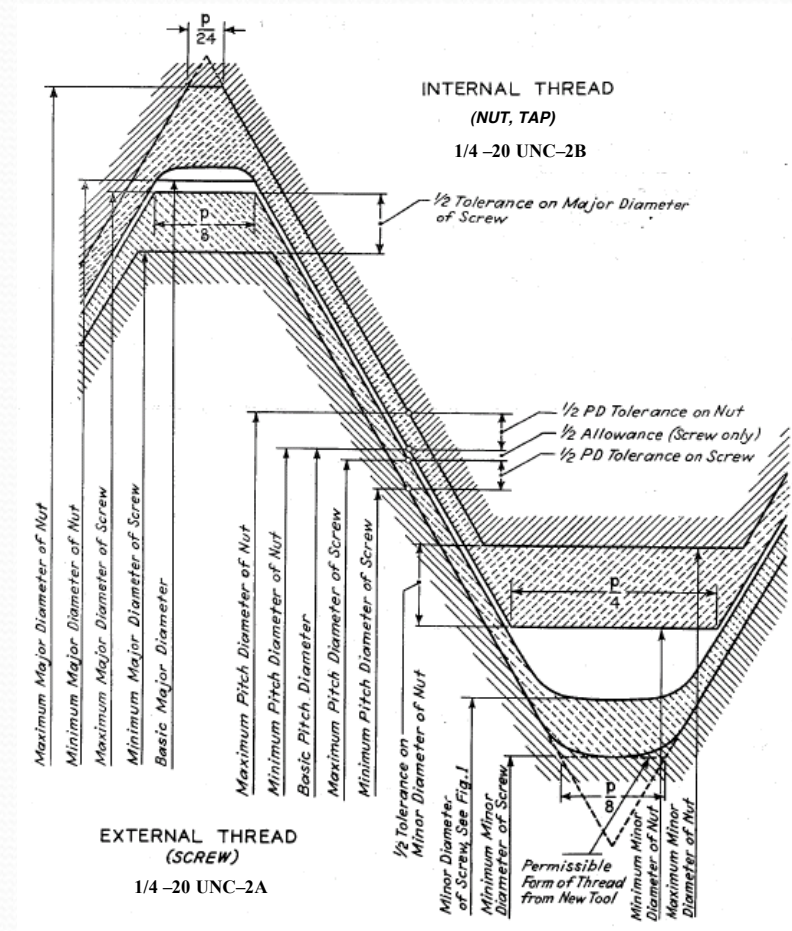
- Standard defines all critical dimensions
- Many nuts covered by standard, greatly simplifying design





# Threads

- Most intricate part of bolts and nuts
- Smallest imperfection can lead to improper fit and failure
- Difference in external and internal threads



# Thread Tolerance Classes

- Classes 1A, 2A, 3A, 1B, 2B, 3B
  - A external
  - B internal
  - Class 1 threads are loosely fitting threads intended for ease of assembly or use in a dirty environment.
  - Class 2 threads are the most common. They are designed to maximize strength considering typical machine shop capability and machine practice.
  - Class 3 threads are used for closer tolerances.



# Finding Standards - Diligence

- ❑ Expensive
- ❑ Not a single organizing agency
- ❑ Very difficult to find full text online
- ❑ Must work hard to find the standards you need

## B31.3 - 2006 Process Piping



This Code contains requirements for piping typically found in petroleum refineries; chemical, pharmaceutical, textile, paper, semiconductor, & cryogenic plants, & related processing plants terminals.

List Price: **\$320.00**

Format: [Buy Print](#) or [Buy PDF](#)

# Where do you find standards

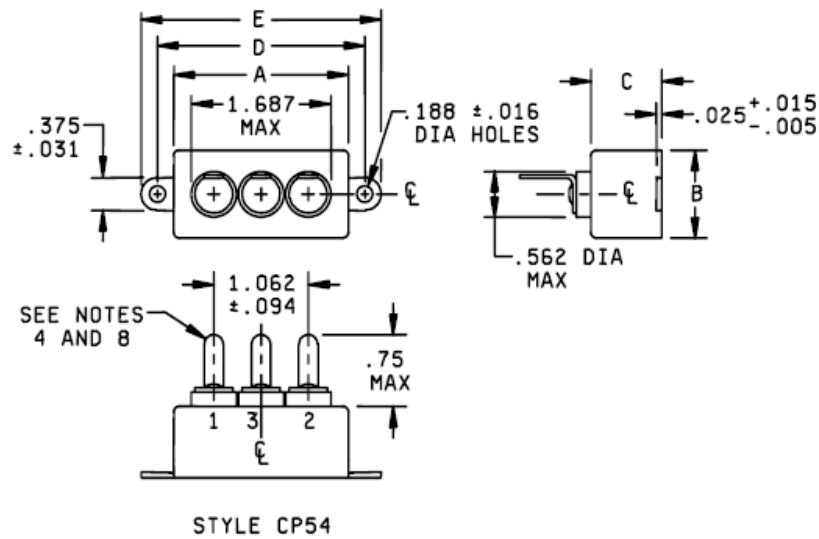
- ☐ Assist Military Database – on line – full text – limited
  - ☐ <http://assist.daps.dla.mil>
- ☐ NSSN data base from ANSI – not full text
  - ☐ <http://www.nssn.org/>
- ☐ Your library and your reference librarian
- ☐ Large research library in your area
- ☐ Large commercial library in your area
- ☐ Specific Organizations' web sites





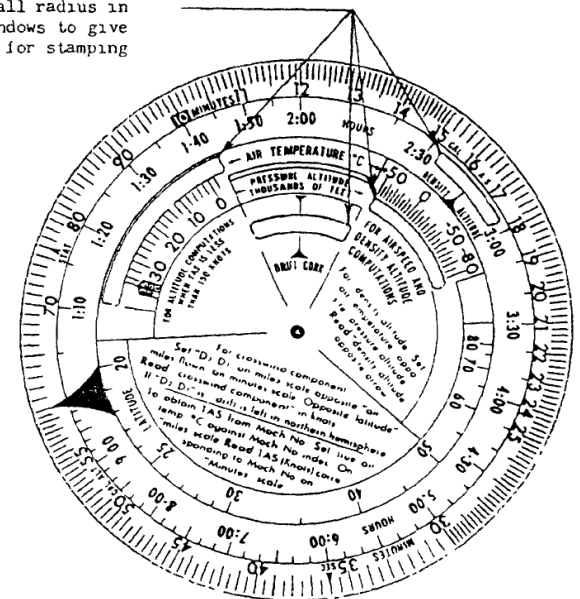
# Conclusion

- Save design and testing time
- Eliminate tedious drawing callouts
- Worldwide unification



CAPACITORS, FIXED, PAPER OR PLASTIC DIELECTRIC, DIRECT CURRENT (HERMETICALLY SEALED IN METAL CASES), STYLES CP53, CP54, AND CP55

Leave small radius in these windows to give strength for stamping purposes



COMPUTER, AIR NAVIGATION, DEAD RECKONING  
TYPE MB-4A AND TYPE CPU-26A/P