

2019 ME 490



# *Standards, Codes, and Regulations*

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# Why are engineering standards important?

- For quality control/product reliability
- For compatibility/consistency
- **FOR SAFETY!**
  
- Standards are helpful to design engineers.

There are two principal objectives of today's presentation:

- to promote thinking about safety in your engineering designs
- to make you technically literate when it comes to standards

# Standards vs. Standards of Practice



- **Engineers must adhere to published engineering standards that pertain to their products, but also must abide by standards of professional practice.**

# The most important standard of practice in engineering design is:



- The “Safety Hierarchy”

Engineering Controls

- Eliminate the hazard
- Reduce the hazard level
- Provide safety devices
- Provide warnings
- Provide safety procedures (including PPE)

Administrative Controls

**If you do not follow the safety hierarchy you may be held liable for injuries associated with you product.**

# Safety in engineering design



- **“Foreseeable misuse”**
  - It is the responsibility of the design engineer to anticipate the different ways that his/her product can be used incorrectly by the user.
  - The product must be safe when misused in ways that are foreseeable.
  - For example: Keyless ignition “foreseeable” incidents.

# Regulations vs. Standards



- **Regulations are compulsory**
  - You are breaking the law if you don't follow the relevant regulations.
- **Engineering standards are “voluntary”**
  - The professional standards organizations do not have any enforcement authority, but not following the standards may expose your company to civil legal action.
  - States and municipalities often adopt the “voluntary” standards as state/local codes and ordinances (e.g. ANSI Z221.3 The National Fuel Gas Code) and this is an always changing landscape.
  - Thus, following the standards is akin to an insurance policy and they are almost universally followed by industry.



# Types of Engineering Standards

- **Material/Fluid Standards**
  - e.g. Standard for Biodiesel fuel (ASTM D7467)
- **Manufacturing/Product Standards**
  - e.g. Standard for Gas-fired Central Furnaces (*ANSI Z21.47*)
- **Testing Standards**
  - e.g. Solar PV panels are tested according to IEC 61215 (International Electrotechnical Commission)
- **Emission Standards**
  - e.g. Motor vehicle emissions of hydrocarbons, CO, NO<sub>x</sub>, and PM are set by EPA
- **Installation and maintenance standards**
  - e.g. installation—ANSI Z221.3 National fuel gas code  
maintenance—ANSI/ASHRAE/ACCA Standard 180-2018



# Federal and State Regulatory Agencies

- **Executive Branch**
  - NIST, DOD, NIOSH, OSHA, FAA, NHTSA
- **Independent Agencies**
  - CPSC, EPA, NTSB, NRC
- **State Agencies**
  - e.g. California Air Resources Board
  - Building codes
  - Fire safety regulations
  - Construction regulations
  - Equipment and machinery (e.g. boilers, PPE, etc.)
  - Licensing of professions (e.g. medicine, law, eng.)
- Major cities usually have their own unique regulations and codes whereas most municipalities adopt national or professional standards.





# Standards Organizations (those that are important for Mes)

- Professional Organizations
  - ANSI
  - ASTM
  - ASME
  - SAE
  - ASHRAE
  - NFPA
- Private Laboratories
  - Underwriters Laboratories (UL)



# How you find the relevant standards

- A google search is the best place to start.
  - This will take you to relevant standards organizations websites where you can do further investigation.
- Generally standards need to be purchased
  - They are expensive (I've paid anywhere from \$40 to \$600 for standards I needed for my work)—the money allows the standards organization to continue to set and revise standards.
- Engineering companies will have purchased relevant standards for their products.
- Libraries can often track down standards for you.
- There is no expectation in ME 490/491/492 that you purchase standards.

# Closing thoughts



- **Keep in mind that standards are far from perfect and are sometimes flawed.**  
(e.g. UL 2034 standard for CO alarms)
- **It's important that new engineers get involved on standards panels so that standards are not static (if you get the opportunity—take it!)**
- **The expectation for ME 490 is that you've investigated what standards/codes pertain to your project and reference them in your “proposal.” Some groups may have to become very familiar with particular standards while others may not.**