Design Standards,
Writing Specifications

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EE 4900 – Design Methods
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What We’ll Discuss Today

- Standards
- Design Criteria, Specifications, and Constraints
- Writing Specifications
- Need for Documentation
- Engineering Forensics

Standards Commonly Used by Electrical Engineers

<table>
<thead>
<tr>
<th>Professional Societies</th>
<th>Trade Associations</th>
<th>Government &amp; Regulatory</th>
<th>Misc.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Appliances</td>
<td>AHAM</td>
<td>CPSC</td>
<td>UL</td>
</tr>
<tr>
<td>Communication</td>
<td>IEEE</td>
<td>EIA, ECSA</td>
<td>FCC</td>
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<tr>
<td>Computer</td>
<td>IEEE</td>
<td>CBEMA</td>
<td>NIST</td>
</tr>
<tr>
<td>Electronics</td>
<td>IEEE</td>
<td>EIA</td>
<td></td>
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<tr>
<td>Home Entertain.</td>
<td>IEEE, SMPTE</td>
<td>EIA, NCTA</td>
<td>FCC, CPSC</td>
</tr>
<tr>
<td>Industry Appl.</td>
<td>IEEE</td>
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<tr>
<td>Instrumentation</td>
<td>IEEE, ISA</td>
<td></td>
<td>NIST</td>
</tr>
<tr>
<td>Energy, Power</td>
<td>IEEE/NESC</td>
<td>NEMA, IPCEA</td>
<td>NRC, FERC, ASTM, NERC</td>
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<tr>
<td>Wiring &amp; Cables</td>
<td>IEEE</td>
<td>NEMA, IPCEA</td>
<td>OSHA, NEC, UL</td>
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<tr>
<td>Other</td>
<td></td>
<td>AAMI</td>
<td>ASTM, FDA</td>
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Why Do We Need Standards?

STANDARDIZED COMPONENTS
- Standardized discrete sizes, values
- Predictable Performance and Ratings
- Parts will fit and work together, regardless of manufacturer
- Allows modular design (interchangeability)

Standardized Procedures
- Manufacturing
- Assembling
- Testing
Why Do We Need Standards?

- Reassurance of good design (standards are hopefully written by experts)
- Avoid wasted time of wheel reinvention - use standard design approaches and procedures for routine situations.
- Components can be built at any manufacturing facility with same result.
- Standardized testing/conformance of custom-built equipment.
- Allows system-level design, i.e. break into subparts. Must coordinate design on system level, not just on modular (subpart) level!

Design Criteria

The “-ilities” pretty much sum it up:
- Designability (time is money)
- Operability (ease of use, quickly train user)
- Manufacturability (unit cost, time)
- Marketability
- Reliability
- Disposability, recyclability, remanufacturability
- Liability
- Maintainability, supportability, repairability
- Others?

Writing, Understanding, and Administering a “Spec”

- A spec for design, manufacture, or construction is really:
  - Legal Contract (Agreement)
  - Procedure for administrating contract
  - General Requirements of the work
  - Detailed Technical Specifications.

Need for a Specification

Specifications fill several needs:
- Owner or Purchaser gets a chance to review proposed work or equipment purchase.
- Documentation needed for bidding purposes.
- Documentation to refer to when evaluating bid.
  - Technical specs met?
  - Contractual requirements met?
- Document that Contract is built around.
- Specification to be met during manufacture, delivery, and installation of equipment.
- Guarantee of equipment and workmanship.
Outline of an Equip Spec
- Letters of Understanding (in executed contract)
- Contract Addendum (with executed contract)
- Bidding Instructions
- General Conditions
- General Requirements (Standards, Typical Requirements)
- Specific Requirements (site/application-specific)
- Data to be provided with proposal
- Appendices - drawings & other information

Engineering Forensics
Why is an Expert needed?
- When legal system, insurance companies, or arbitrators needs technical knowledge not available to the average person.

Who does the expert work for?
- Attorneys on behalf of plaintiff or defendant. (More often defendant).
- Insurance Companies
- The Court can hire expert as “friend of the court.”
- Individuals who claim wrongful injury.

Engineering Forensics (cont’d)
What Does an “Expert” do?
- Preliminary investigation to determine merits or lack thereof.
- Scientific or technical investigations.
- Pre-trial “discovery procedures.” (depositions, etc.)
- Examination and cross-examination during trial.

Qualifications
- Licensed Professional Engineer
- Prominent or at least well-established in field of question
- No conflict of interest
- No history of testimony that is contradictory
- Balance of forensic work and keeping up to date in field.