

Design Standards, Writing Specifications

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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

	Professional Societies	Trade Associations	Government & Regulatory	Misc.
Appliances		AHAM	CPSC	UL
Communication	IEEE	EIA, ECSA	FCC	
Computer	IEEE	CBEMA	NIST	
Electronics	IEEE	EIA		
Home Entertain.	IEEE, SMPTE	EIA, NCTA	FCC, CPSC	
Industry Appl.	IEEE			
Instrumentation	IEEE, ISA		NIST	
Energy, Power	IEEE/NESC	NEMA, IPCEA	NRC, FERC	ASTM, NERC
Wiring & Cables	IEEE	NEMA, IPCEA	OSHA	NEC, UL
Other		AAMI		ASTM, FDA

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 Administrating 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.