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High Voltage Training Criteria

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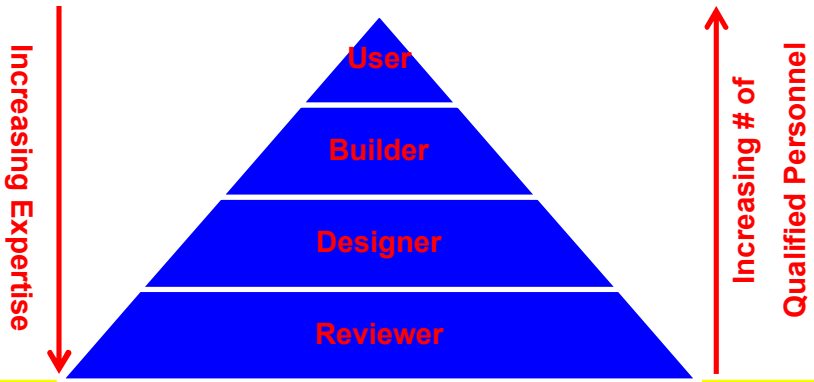
Background

- **December 2013, Explosive Accident**
- **Significant Review of Established Processes**
- **Training Criteria Became a Question**
  - How do we know our people are trained?
  - OJT
    - How do we know the quality is good?
    - Is OJT consistent from one trainer to the next?
  - How can we track it easily?
    - EIMS can be a challenge
    - Job Certification Training Record can be a challenge

High Voltage Operating Procedure

- High Voltage OP was coming due.
- Want to "…provide management and MOW with confidence that qualified personnel are safely conducting high voltage operations."
- Multistep process to become qualified.
- Qualification levels include:
  - User
  - Builder
  - Designer
  - Reviewer



User

- **Requirements**
  - Written Exam (20 questions), ELC 200, 3 year cycle, Document high voltage equipment usage
- **Purpose**
  - Users will have a fundamental understanding of high voltage
  - Prior to OJT with high voltage test equipment (hi-potter and leakage tester) this qualification is required

Builder

- **Requirements**
  - User qualified + ELC 125 (3 year cycle)+ practical exam (3 year cycle) + observe a high voltage system build (one time) + build a high voltage system (1 year cycle) + Maintain a copy of system review.
  - Cannot power on the circuit the first time without reviewer approval.
- **Purpose**
  - Demonstrate capability to SME.
  - Engage with reviewers.
  - Understand electrical safety concepts.

Builder

- **Practical Exam has the candidate perform fundamental tasks with building high voltage circuits**
- **Observe**
  - Shadow a qualified Builder

Builder Practical Exam

Observed Builder, Designer, or Reviewer _____ Signature (Builder, Designer, or Reviewer) _____ Date _____

Item	Demonstration	Performance (1 – Poor, 5 – Excellent)
	Low Voltage	
	Using a FLUKE, measure the voltage of a 9 V battery.	
	Using a FLUKE, measure the current in a circuit with a 9 V battery in series with 1 kΩ resistor.	
	Draw a schematic for a low-voltage firing system.	
	Build the low-voltage schematic using available parts.	
	Demonstrate the proper use of a current viewing transformer.	
	Measure the current to the load using an oscilloscope.	
	Build a 10:1 voltage divider.	
	High Voltage	
	Draw a schematic for the 1000:1 voltage divider.	
	Draw a schematic for a HV firing system.	
	Demonstrate proper use of the voltage divider.	
	Provide the energy-storage equation for the capacitor provided.	
	Given 3 kV and 2 μF, how much energy is available?	
	Given 10 J and 1 kV, how much capacitance?	
	Given 10 J and 1 μF, how much voltage?	
	Build the HV firing system schematic using available parts.	
	Measure the current to the load using an oscilloscope.	

Builder Candidate (Print) _____ Signature _____ Date _____

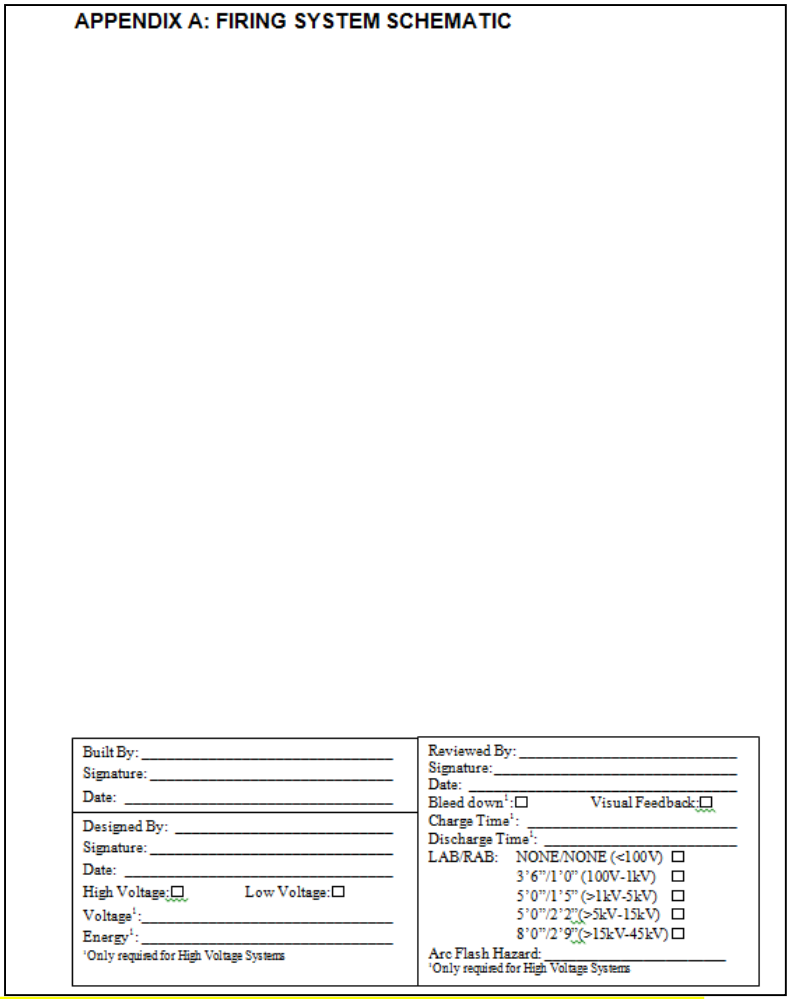
Reviewer (Print) _____ Signature _____ Date _____

Manager (Print) _____ Signature _____ Date _____

PASSED ☐

Builder

- Build with oversight from qualified builder
- Requires a schematic, or block diagram, or wiring diagram that can be followed
- Cannot operate until reviewed
- Schematic is archived



APPENDIX A: FIRING SYSTEM SCHEMATIC

Built By: _____
Signature: _____
Date: _____

Designed By: _____
Signature: _____
Date: _____
High Voltage:☐ Low Voltage:☐
Voltage[1]: _____
Energy[1]: _____
[1]Only required for High Voltage Systems

Reviewed By: _____
Signature: _____
Date: _____
Bleed down[1]:☐ Visual Feedback:☐
Charge Time[1]: _____
Discharge Time[1]: _____
LAB/RAB: NONE/NONE (<100V) ☐
3'6"/1'0" (100V-1kV) ☐
5'0"/1'5" (>1kV-5kV) ☐
5'0"/2'2" (>5kV-15kV) ☐
8'0"/2'9" (>15kV-45kV) ☐
Arc Flash Hazard: _____
[1]Only required for High Voltage Systems

Designer

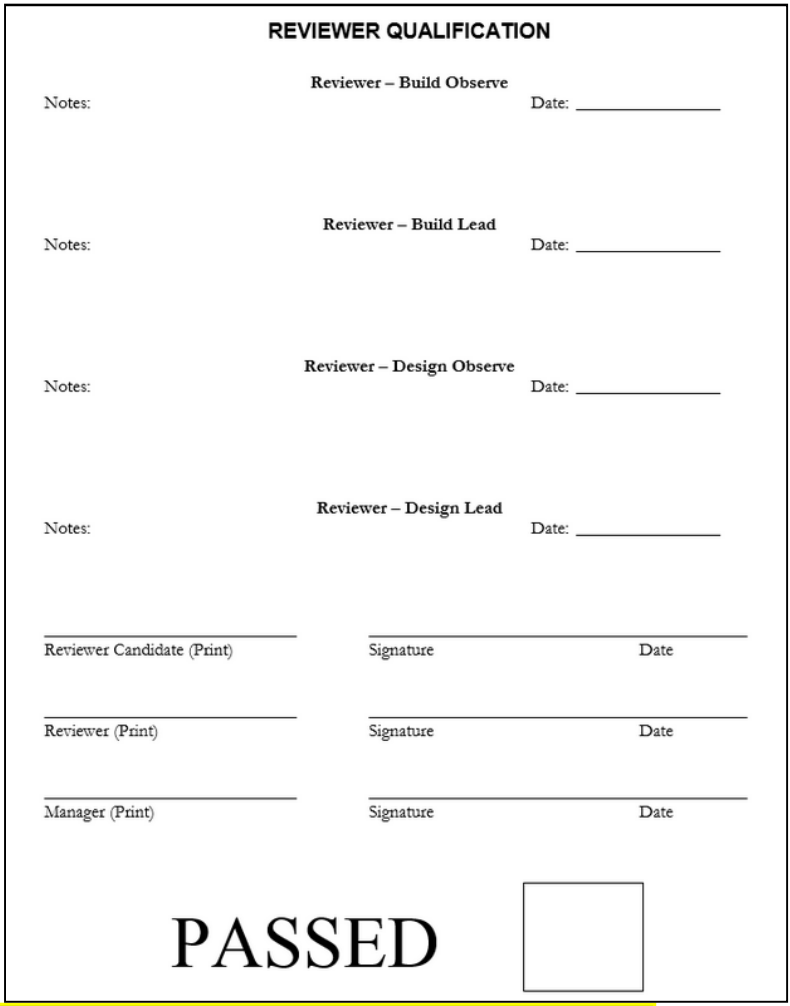
- **Requirements**
  - User qualified + Builder qualified + design a high voltage system to a design specification (1 year cycle) + review + maintain a copy of design system review + build (qualified builder) + review + maintain copy of build review.
  - A qualified design **IS NOT** required to be built
  - A qualified build **IS** required to have a qualified design
- **Purpose**
  - Demonstrate capability to SME, engage with reviewers, understand electrical safety concepts.

Reviewer

- **Requirements**
  - User + Builder + Designer + BIT100 + OJT100 + Observe a Build Review + Observe a Design Review + Perform a Build Review + Perform a Design Review + ELC920 + Maintain copies of all reviews.
- **Purpose**
  - Provide review and technical SME regarding high voltage to Designers and Reviewers

Reviewer

- Instincts and experience are critical to the reviewer qualification
- The schematic template prompts Reviewer to get the required information
- Intended to get builder and designers to engage with an impartial SME



REVIEWER QUALIFICATION

Reviewer – Build Observe

Notes: Date: _____

Reviewer – Build Lead

Notes: Date: _____

Reviewer – Design Observe

Notes: Date: _____

Reviewer – Design Lead

Notes: Date: _____

Reviewer Candidate (Print)	Signature	Date
Reviewer (Print)	Signature	Date
Manager (Print)	Signature	Date

PASSED ☐

Benefits

- **Captures Training Criteria**
  - Consistent, Engages Experts, Encourages Mentoring
- **Demonstrates and Captures Critical Thinking Process**
  - Archive Ready Documentation of HV Systems
- **Allows Personnel and Management to Easily Recognize Qualified vs. Unqualified**
- **Allows Management To Easily Review the Qualifications of Existing Personnel**

Summary

- Accident Encouraged a Review of HV Procedure
- Updated and Introduced New Training Criteria
- Created an Archive System
- Created a Qualification Tracking System
- Allows Members of the Workforce and Management to Easily Recognize Qualifications