

Power Plant – Relay Replacement Design

Introduction

There are three main parts to this project.

- 1) Relay replacement design, which includes all required schematics and wiring diagrams.
- 2) Arc flash calculations and analysis for the existing metal clad switch gear.
- 3) Engineering solutions to operate the switch gear safely.

Intended users are power plant operators and relay technicians and the information is intended for future operational use.

Design Requirements

Functional and Non-functional Requirements

NOTE: Due to this project being a design without implementation, there are no functional or non-functional requirements. The functionality and relay setting will be tested at installation and is out of the scope for this project.

Project deliverables will be considered functional requirements

Relay Replacement

- For construction package
- Project paper work
- Bill of material
- Construction drawings
- Cost estimates
- Relay functions

Safe Operation of Metal Clad Switchgear

- Identify two possible engineering solutions
- Evaluation of solutions
- Compliance regulation
- Bill of material
- Cost estimates
- Operation guides

Arc Flash

- Calculation per OSHA standards
- Calculation analysis
- Compliance regulations

Excluded from this Project

- Design simulation and testing
- Relay settings and testing

Operating environment

The operating environment will be considered for each part of the project due to the harsh power plant environment. The environment can have large temperature changes along with dust, vibration, audio and electrical noise. These, among other operating constraints, will be considered during the design of this project.

Technical Details

Standards Followed

- OSHA
- NERC
- CIPCO

Equipment

- SEL 351-Microprocessor Relay
- SEL 2800-Fiberoptic Modem
- ABB Test Switch-Panel Test Switch

System Level Design

Relay Replacement

- Relay replacements on 4 sets of metal clad switchgear on panel units 6,7,8, and 9.
- Relays will be replaced with SEL 351 relays.

Arc Flash Calculation Follow

- OSHA 29 CFR 1910.269 standard
- CIPCO standards
- MAD- Minimum Approach Distance

Safe Operation of Metal Clad Switchgear

- Two engineered safety solutions to operate existing switchgear
- Follow compliance and CIPCO standards

Design Approach



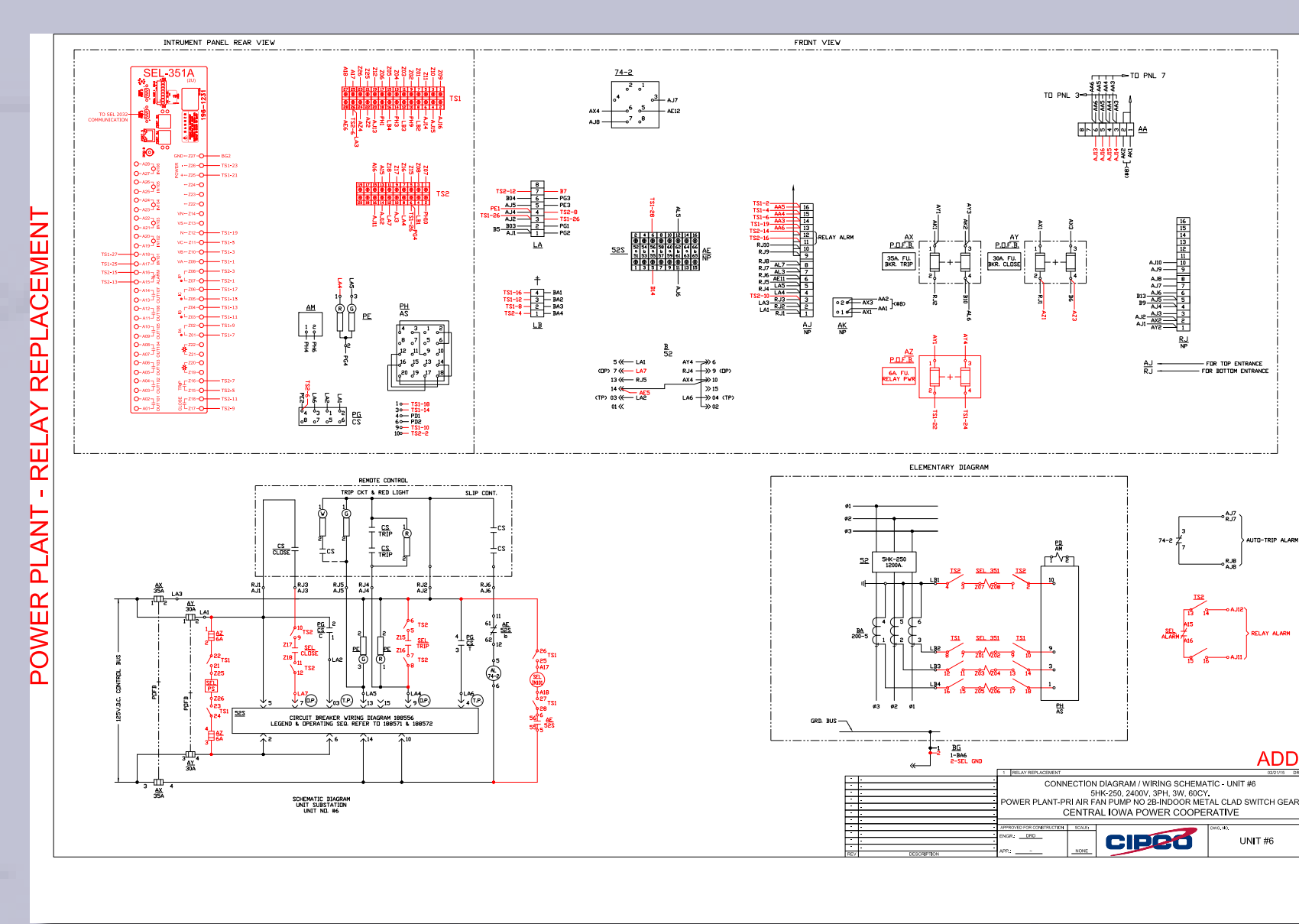
Current State

Arc Flash Calculation

- Phase to Phase
- Phase to Ground
- $MAD = M + D$
 $= 0.02 + 0.61$
 $= 0.63 \text{ m (2.07 ft)}$

Design Diagrams and Schematics
One Line Diagram
Elementary/Current Schematic
Control Schematic

Review



Concept Sketch - Panel Wiring

Design Wiring
Panel Wiring
Communication Wiring

Review

Complete
For Construction Design
Package
Finalize Design
Finalize AutoCAD Drawings

Review

Design Block Diagram

This is a representation of the design process. The relay replacement design has been broken down into several parts to help keep organized and to produce a high quality product. Each step has a review process with the Project Sponsor or senior engineer.

Metal Clad Switchgear

After assessment of project results, a remote control option was chosen over a timed control switch.



Future State

The key component of this project is SAFETY for people and equipment

- The new relay equipment protects the heavy motors and fans by operating the switchgear under fault conditions
- The SEL relay will be used to remotely operate the switchgear keeping people out of harms way
- Arc Flash calculations help identify hazards and to help keep people out of the hazardous areas