

Waste Treatment Plant Project

Lessons Learned Construction Electrical

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Syllabus

- Project Inspection Records
- Material Acquisitions (Procurement)
- Sub-Contractor Equipment
- NEC Common Pitfalls
- Arc-Flash
- Grounding Assurance
- Conex Box Electrical Violations
- Medium Voltage Program
- Performance Improvements



Project Records

- Project Start/Stop
 - Lost or missing inspection records
 - Time loss
 - Re-work



Material Acquisitions (Procurement)

- Supplier compliance with NEC requirements
 - Lack of UL or other NRTL listings for equipment
 - Code compliant issues with components and assemblies
 - Foreign equipment (i.e., Potain Cranes/Material Lifts)
 - NRTL inspections and corresponding corrective actions for supplier equipment





Sub-Contractor Equipment

- NEC code requirements issues
 - Concrete batch plant
 - OCPD sizing
 - Conductor sizing
 - Grounding
 - Aging equipment



NEC Common Pitfalls

- Article 110.3(B) requires listed or labeled equipment to be installed and used in accordance with any instructions included in the listing or labeling.
- Article 110.22 requires each disconnecting means to be legibly marked to indicate its purpose.
- Article 110.26(A)(1) requires a three-foot working clearance in front of the panelboards. (A)(2) Requires width of the working space in front of the electric equipment to be the width of the equipment or 30 inches, whichever is greater. (A)(3) Requires the work space to be clear and extend from the grade, floor, or platform to 6½ feet, or where the equipment exceeds 6½ feet, the minimum headroom shall not be less than the height of the equipment.



NEC Common Pitfalls (cont)

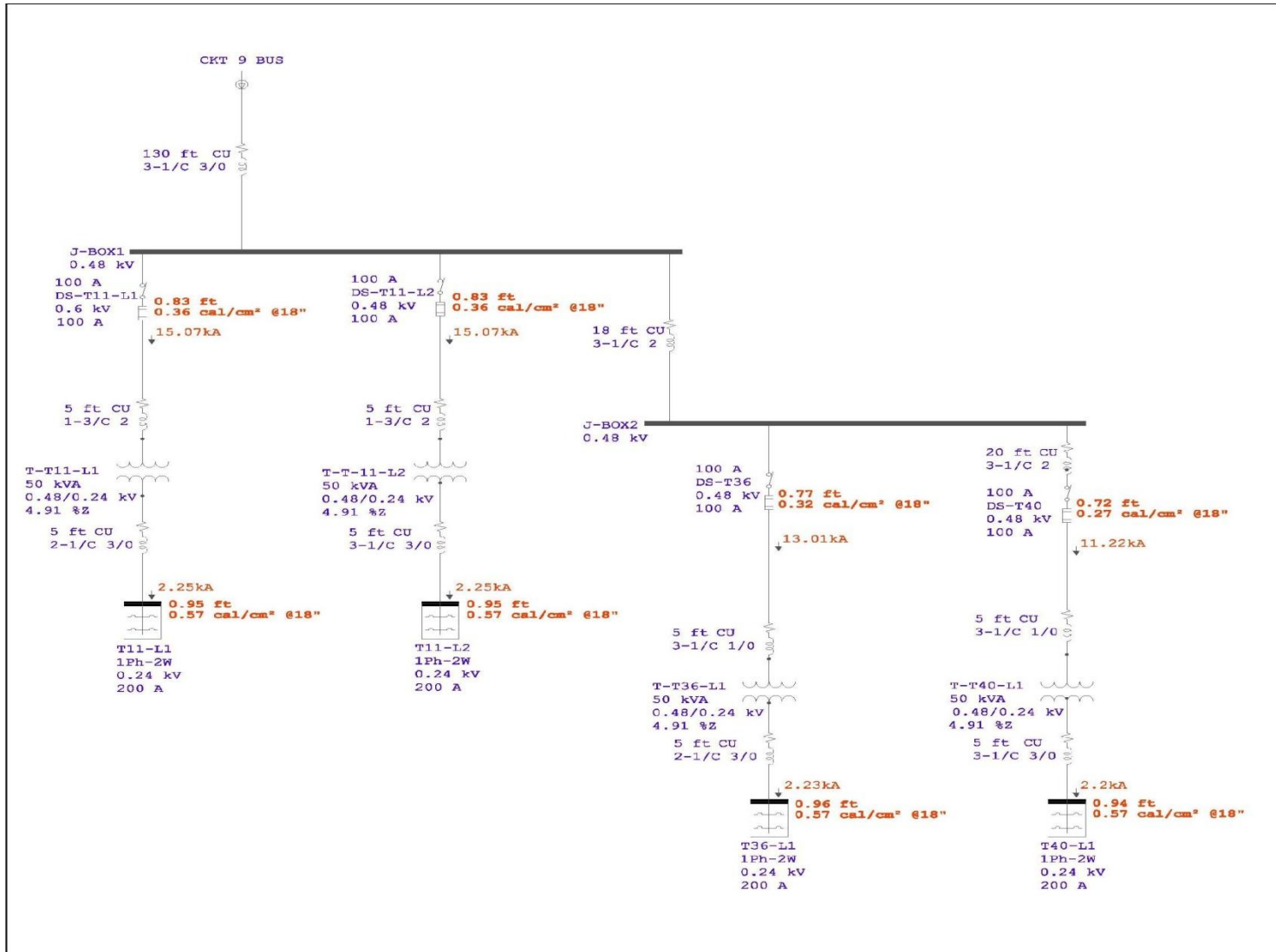
- Article 240.5 requires flexible cord and flexible cable to be protected by an overcurrent device in accordance with their ampacity as specified in Table 400.5(A) and Table 400.5(B).
- Article 250.122 requires the equipment grounding conductor to be sized based off the overcurrent device ahead of the equipment.
- Article 700.12(E)(4) requires the branch circuit feeding the emergency lighting to be the same branch circuit as that serving the normal lighting in that area.
- Article 725 (A) requires cables and conductors of Class 2 and Class 3 circuits to not be placed in any cable, cable tray, compartment, enclosure, manhole, outlet box, raceway, or similar fitting with conductors of electric light, power, and Class 1 circuits.



Arc-Flash

- Evolution of WTP Arc-Flash
 - Hanford Calculator
 - ETAP Software
- Field evaluations
 - Identify equipment type
 - Fuse studies
 - Circuit breaker studies
 - Single-line verification
- ETAP software data Input
 - Cross checking performed during data input

ETAP Arc-Flash Network





ETAP Arc-Flash Report

Project: SUB 9 Short Circuit Study
 Location: RPP-WTP
 Contract: 24590
 Engineer:
 Filename: SUB-9

ETAP
 5.5.5C

Page: 9
 Date: 09-29-2009
 Revision: Base

Low Voltage Circuit Breaker Settings

CB: SUB 9 MAIN

MFR: General Electric	Tag #:	3-Phase kA: 0.00 Asym. (Calc.)
Model: SS 2500	Rating: 100 kA, 0.48 kV	LG kA: 0.00 Asym. (Calc.)
Size: 2500	Cont. Amp: 2500.000	Base kV: 0.000 (Calc.)

LV Solid State Trip Device

MFR: General Electric
 Model: MVT-Plus (SS,SH)
 Sensor: 2500 (LIG)
 Rating Plug: 1600.00

	<u>Phase Setting</u>	<u>Ground Setting</u>
Long-Time Pickup	1.000	Pickup 0.240
Band	1	Band Int Ft=OUT
INST Pickup	7.000	

SUB 9 MAIN
 0.48 kV
 2500 A

} 121.19 ft
 774.26 cal/cm² @18"



Grounding Assurance

- Grounding requirements for 240 and 480 volt cord sets
 - 480 volt heater cord set wiring
 - Manufacturer cord and cap (burned in field)
 - Replaced with a 30A cord cap and #10 wire

Grounding Assurance



WTP Conex



WTP Conex





Conex Box Electrical Violations

- Systematic control of temporary power to these types of temporary structures
 - Multiple source feeds to conex
 - Extension cords being ran through door ways or windows
 - Bonding/grounding not in accordance to NEC
 - No proper disconnecting means
 - No procedure in place to control temporary power in these conex's



Medium Voltage Program

- WTP Substations 1-16
- OSHA 29 CFR 1910.269
 - Medium Voltage training (Manual/Non-Manual)
 - Use of 13.8KV testing equipment
 - Installation of Grounding clusters
- LO/TO (Capacitive Test Points) – In ability of voltage verification during LO/TO process
 - Replacement of dead breaks (allows for voltage measurement on each feeder and the ability to install a grounding cluster)

WTP Substation and Switchboard



WTP Substation





Summary

- Implementing of enhanced supplier electrical equipment code inspection oversight
 - NEC inspectors designated to each facility
 - NRTL certified inspector designated for construction equipment
- Implementing NEC code compliant inspections of temporary power and sub-contractor electrical installations; this includes developing a comprehensive NEC inspection training program that has emphasized lessons learned from past problems at the WTP
- Improving electrical design code compliance performance by emphasizing code requirements and providing lessons-learned feedback from previous WTP compliance issues

Summary

- Procuring medium voltage equipment and implementing medium voltage training to electrical craft and supervision
- Improving the WTP LO/TO program to go beyond typical required construction LO/TO to that required by operation organizations (29 CFR 1910 vs. 29 CFR 1926)
- Fully implementing the NFPA worker safety requirements



WTP August 2009

