

Job and Task Analysis  
for  
Commissioning Engineer  
and  
Test Technician



**LLG CONSULTING**

**Task List** TRAINING SOLUTIONS

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## Introduction

This document presents the results of a job and task analysis for the job of Commissioning Engineering and Test Technician at TRC Solutions. The document lists the duty areas and tasks performed, followed by the skills and knowledge required to perform the adjoining tasks. The sources, structure, and scope of the task list are described below.

## JTA Terminology

**Duty Area** - A subcategory of a specific job. Duty areas are made up of a group of related tasks that collectively serve a very specific function. There are typically 6-10 duty areas that make up a job. Some larger Duty Areas are divided into Sub-Duty Areas.

**Task** - A statement that details an activity performed. The statement should describe an activity from start to finish and you should be able to observe the activity. There are usually anywhere from 8 – 12 tasks associated with each duty area.

**Knowledge/Skills/Abilities (KSA)** - The specific knowledge, skill, or ability that an individual must possess to perform a job task effectively.

## Sources

Based on data provided by TRC's Testing and Commissioning Qualifications and the 17000 series Testing and Commissioning processes and procedures. Subject Matter Experts were as follows:

- Tim Tennimon – Cypress, CA
- Brian Moores – Augusta, ME
- Justin Perry – Augusta, ME
- Peter Avery – Rocky Hill, CT
- Benjamin Fox – Lancaster, PA
- Seth Vincent – Augusta, ME
- Tony Ortiz – Chicago, IL

## Structure of Duty Areas

Commissioning Engineer and Test Technician tasks are organized into the following duty areas:

- Safety, Support, and Performing Ancillary Tasks
- Off Site Pre-Commissioning Planning and Preparation
- On Site Pre-Commissioning Planning and Preparation
- Testing & Commissioning Documentation
- Testing and Commissioning Protection and Controls
- Testing and Commissioning High-Voltage Substation Equipment
- Outage & Energization Planning and Execution
- Post-Commissioning Project Closeout

## References to TRC Processes and Procedures

References to TRC Processes and Procedures (e.g., 17000), Health and Safety Plans (HASP), Job Hazard Analysis (JHA), APPA Safety Manual and related documents that identify the procedures for performing a given task or relate to specific Skills/Knowledge are provided where applicable.

## 1. [Duty Area] Safety, Support, and Performing Ancillary Tasks

- 1.1. [Sub-Duty] Use TRC's Health and Safety processes and procedures
  - 1.1.1. [Task] Prepare a Health and Safety Plan (HASP)
  - 1.1.2. [Task] Use safety tailboards
  - 1.1.3. [Task] Participate in the Safe Catch Program
  - 1.1.4. [Task] Use safe practices when performing any work
- 1.2. [Sub-Duty] Interface with Regional Managers and Project Managers
  - 1.2.1. [Task] Support potential projects with preparation of proposals, estimates, and schedules
  - 1.2.2. [Task] Support booked project budgets, schedules and deliverables
  - 1.2.3. [Task] Provide support to identify Estimates to Complete (ETC), Requests for Information (RFI)
  - 1.2.4. [Task] Provide support for development of change orders and backup documentation
- 1.3. [Sub-Duty] Provide support in areas of high technical complexity
  - 1.3.1. [Task] Serve as the interface for the group with other Company departments, outside consultants, contractors, suppliers, and manufacturers on technically related matters
  - 1.3.2. [Task] Serve as technical reviewer on assigned projects [document 17000.03 and 17000.05]
- 1.4. [Sub-Duty] Use TRC's Testing and Commissioning standard documentation
  - 1.4.1. [Task] Use TRC's documentation management system (ProjectWise) to locate required documentation, upload, and review project-specific files

## 2. [Duty Area] Off Site Pre-Commissioning Job Planning and Preparation

- 2.1. [Sub-Duty] Review Engineering Package
  - 2.1.1. [Task] Review Engineering Package to become familiar with the details (design intent) of the project and identify any potential issues (17000.01 see 3.1.1).
  - 2.1.2. [Task] Lead/Participate in Kick Off Meeting (17000.01 see 3.1.2)
  - 2.1.3. [Task] Based on Scope of Work (SOW), create the Site Binder and Equipment Binder (17000.01 see 3.1.1 Project Documents, (17000.07, 17000.01 see 3.1.2)
  - 2.1.4. [Task] Review and follow project-specific and unique requirements (e.g., SOW, trainings, budgets, schedules, deliverables)
- 2.2. [Sub-Duty] Develop Commissioning, Outage & Energization Plans
  - 2.2.1. [Task] Develop a responsibility matrix to identify which parties are responsible for each aspect of the project

- 2.2.2. [Task] Develop an isolation and restoration plan for equipment and systems to safely perform work
- 2.2.3. [Task] Develop Commissioning Plan
- 2.2.4. [Task] Develop Outage and Energization (O&E) Plan that include a review of the protection, switching, special recording equipment, overall energization schedule, and hold points needed for testing. (17000.01 see 3.1.4)

### 3. [Duty Area] On Site Pre-Commissioning Job Planning and Preparation

- 3.1. [Task] Mobilize to Site
- 3.2. [Task] Complete Mobilization Checklist
- 3.3. [Task] Conduct a Risk Assessment
- 3.4. [Task] Prepare a Mitigation Plan
- 3.5. [Task] Participate in the Site Kick-Off Meeting to review risk assessment, mitigation plan, and site-related concerns
- 3.6. [Task] Review Site Documentation and existing design drawings
- 3.7. [Task] Review and refine commissioning plan and OE plan per site conditions
- 3.8. [Task] Develop plan and requirements for equipment rental (e.g., need dates)

### 4. [Duty Area] Testing & Commissioning Documentation

- 4.1. [Task] Create daily and weekly work plans prior to starting commissioning including testing and commissioning activities, affected systems, and personnel involved for work that day/week
- 4.2. [Task] Perform design document control to ensure Working/Field copy of project drawings are updated continuously throughout the project and ensure they accurately reflect the as-left condition of the project at the end of each day
- 4.3. [Task] Prepare and conduct a daily (and more often, as needed) Safety Tailboard meeting with all site personnel that will be working on or have access to the project site while testing and commissioning activities are conducted
- 4.4. [Task] Review and update the tailboard anytime the work scope or work zone changes or new personnel changes [document 17000.11A]
- 4.5. [Task] Document all yard and control house equipment nameplate data. Data should be recorded prior to the commencement of testing/commissioning to ensure that all on-site equipment is installed as designed (e.g., correct part numbers, firmware revisions)

- 4.6. [Task] Ensure all reference material is on site (e.g., relay manuals, NETA procedures, IEEE/ANSI)
- 4.7. [Task] Provide Daily and Weekly Commissioning Reports to TRC management (different than work plans)
- 4.8. [Task] Notify client operations or designated authority daily, or as directed by client, to ensure approval to proceed with work (e.g., Substation Entry Procedure)
- 4.9. [Task] Check battery ground measurement daily and track any deviations, notifying operations/designated authority when an issue is found
- 4.10. [Task] Document and track RFIs and approved engineering changes
- 4.11. [Task] Walk down equipment outages, verify/approval and hold clearance
- 4.12. [Task] Provide real-time support for emergent equipment failure, alarms, and/or unexpected equipment operation
- 4.13. [Task] Provide oversight and on-the-job training for support and assistant tech/engineers
- 4.14. [Task] Track assistant and subcontractor hours
- 4.15. [Task] Perform equipment isolation per isolation procedure
- 4.16. [Task] Install robust barriers and flagging for each work evolution
- 4.17. [Task] Document and track changes to system with isolation plan or other client specific tools
- 4.18. [Task] Track and document SCADA and relay settings
- 4.19. [Task] Perform logistics for testing equipment and track test equipment test dates and serial numbers

## 5. [Duty Area] Testing and Commissioning Protection and Controls

- 5.1. [Sub-Duty] Testing and Commissioning Protection Schemes
  - 5.1.1. [Task] Test/commission Bus Protection
  - 5.1.2. [Task] Test/commission Transmission Line Protection
  - 5.1.3. [Task] Test/commission Distribution Feeder Protection
  - 5.1.4. [Task] Test/commission Transformer Protection
  - 5.1.5. [Task] Test/commission Capacitor Bank Protection
  - 5.1.6. [Task] Test/commission Breaker Protection
  - 5.1.7. [Task] Test/commission Generator Protection
  - 5.1.8. [Task] Test/commission Reactor Protection
  - 5.1.9. [Task] Test/commission Pilot Schemes

## 5.2. [Sub-Duty] Testing and Commissioning Single Function Protection

### 5.2.1. [Sub-Sub-Duty] Overcurrent Protection

5.2.1.1. [Task] Test/commission non-directional overcurrent relays (e.g., IAC, CO, SEL, GE)

### 5.2.2. [Sub-Sub-Duty] Voltage Protection

### 5.2.3. [Sub-Sub-Duty] Frequency Protection

### 5.2.4. [Sub-Sub-Duty] Distance/Impedance Protection

5.2.4.1. [Task] Test/ commission distance/impedance relays (e.g., KD, GCX, GCY, CEY, SEL, GE)

### 5.2.5. [Sub-Sub-Duty] Differential Protection

5.2.5.1. [Task] Test/commission transformer differential relays (e.g., HU, STD, SEL, GE)

5.2.5.2. [Task] Test/ commission line differential relays and terminal equipment (e.g., HCB, SEL, GE)

5.2.5.3. [Task] Test/commission bus differential relays (PVD, SEL, GE)

### 5.2.6. [Sub-Sub-Duty] Directional Protection

5.2.6.1. [Task] Test/commission directional overcurrent relays (e.g., JBCG, IBCG, IBC, SEL, GE)

### 5.2.7. [Sub-Sub-Duty] Timing Protection

5.2.7.1. [Task] Test/ commission timing relays (e.g., TD5, SAM)

### 5.2.8. [Sub-Sub-Duty] Auxiliary Protection

5.2.8.1. [Task] Test/ commission auxiliary relays (e.g., HAA, SC-1, LOR, HEA)

### 5.2.9. [Sub-Sub-Duty] Reclosing Protection

5.2.9.1. [Task] Test/commission reclosing relays (e.g., KSV, TK)

### 5.2.10. [Sub-Sub-Duty] Synchronizing Protection

### 5.2.11. [Sub-Sub-Duty] Thermal Overload Protection

5.2.11.1. [Task] Test/ commission thermal overload relays (e.g., RVAB, BL-1)

## 5.3. [Sub-Duty] Testing and Commissioning Protection Communication

### 5.3.1. [Task] Test/commission Fiber Optic

### 5.3.2. [Task] Test /commission Power Line Carrier equipment (e.g., tuner, wave trap)

### 5.3.3. [Task] Test/commission Audio Tone equipment (e.g., RFL, KFS)

### 5.3.4. [Task] Test/commission IEC-61850

### 5.3.5. [Task] Test/commission station Ethernet routers and switches

## 5.4. [Sub-Duty] Testing and Commissioning Instrument Transformers

### 5.4.1. [Task] Test/commission Coupling Capacitor Voltage Transformers

### 5.4.2. [Task] Test/commission Voltage/Potential Transformers

### 5.4.3. [Task] Test/commission Current Transformers

## 5.5. [Sub-Duty] Testing and Commissioning Control House Systems

### 5.5.1. [Task] Test/commission Batteries

### 5.5.2. [Task] Test/commission Battery Chargers

### 5.5.3. [Task] Test/commission AC Distribution Panels

### 5.5.4. [Task] Test/commission DC Distribution Panels

- 5.5.5. [Task] Test/commission Lighting and Building Ancillary Systems
- 5.5.6. [Task] Test/commission Automatic Transfer Switches
- 5.5.7. [Task] Test/commission Fire Alarm Systems
- 5.5.8. [Task] Test/commission Building HVAC Systems
- 5.5.9. [Task] Test/commission Grounding
- 5.5.10. [Task] Test/commission Station Service Transformers
- 5.5.11. [Task] Test/commission Substation Security Systems
- 5.6. [Sub-Duty] Testing and Commissioning Monitoring Systems
  - 5.6.1. [Task] Test/commission SCADA RTUs
  - 5.6.2. [Task] Test/commission Annunciators
  - 5.6.3. [Task] Test/commission Events/Fault Recorders
  - 5.6.4. [Task] Test/commission transformer monitoring
  - 5.6.5. [Task] Test/commission battery monitoring systems
- 5.7. [Sub-Duty] Testing and Commissioning Control Circuits
  - 5.7.1. [Task] Test/commission Wiring
  - 5.7.2. [Task] Test/commission Interconnection Cabling
  - 5.7.3. [Task] Test/commission DC Control Circuits
  - 5.7.4. [Task] Test/commission AC Control Circuits
  - 5.7.5. [Task] Test/commission AC Current Circuits
  - 5.7.6. [Task] Test/commission AC Voltage Circuits

## 6. [Duty Area] Testing and Commissioning High-Voltage Substation Equipment

- 6.1. [Task] Test and Commission Power Transformers
- 6.2. [Task] Test and Commission Gas Circuit Breakers
- 6.3. [Task] Test and Commission Oil Circuit Breakers
- 6.4. [Task] Test and Commission Vacuum Circuit Breakers
- 6.5. [Task] Test and Commission Air Circuit Breakers
- 6.6. [Task] Test and Commission Airbreak Switches
- 6.7. [Task] Test and Commission Disconnect Switches
- 6.8. [Task] Test and Commission Circuit Switchers
- 6.9. [Task] Test and Commission Loadbreak Switches
- 6.10. [Task] Test and Commission Capacitor Banks
- 6.11. [Task] Test and Commission Surge Arrestor/Lightning Arrestors
- 6.12. [Task] Test and Commission Regulators



- 6.13. [Task] Test and Commission Station Service Transformers
- 6.14. [Task] Test and Commission Outdoor Bus Arrangements
- 6.15. [Task] Test and Commission Recloser and Controls
- 6.16. [Task] Test and Commission Reactors
- 6.17. [Task] Test and Commission Wave Traps

## 7. [Duty Area] Outage & Energization Planning and Execution

- 7.1. [Task] Perform Pre-Energization Walkdowns
- 7.2. [Task] Perform Energization
- 7.3. [Task] Perform In-Service Checks
- 7.4. [Task] Perform End-to-End Fault Simulations
- 7.5. [Task] Resolve Unexpected Results with P&C Engineer

## 8. [Duty Area] Post-Commissioning Project Closeout

- 8.1. [Task] Complete commissioning documentation and process
- 8.2. [Task] Compile and scan field mark drawings (As-Built) and hand over to client, if obligated
- 8.3. [Task] Upload documentation to ProjectWise (i.e., Testing and Commissioning Information Storage)
- 8.4. [Task] Create final commissioning report with results
- 8.5. [Task] Conduct lessons learned
- 8.6. [Task] Provide client all as-left relay and SCADA settings in client specific format.
- 8.7. [Task] Demobilize (e.g., collect tools, clean site, return rentals)