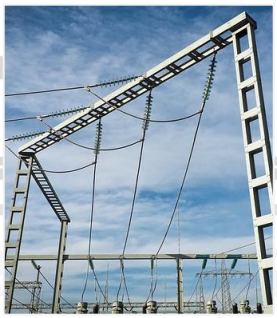
17000 T&C Process and Procedures

Design Document

Prepared for:

Testing & Commissioning Services






PRODUCT PROTECTED

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Process and Procedures Overview

Description

The Process and Procedures training course is designed to provide Testing & Commissioning (T&C) Services employees with the knowledge and skills needed to fully plan, document, execute, and closeout a project.

Training Need/Goal

Understanding TRC Process and Procedures is a fundamental skill for T&C Services employees. It is a prerequisite to attending the AC & DC Commissioning classroom training courses. The 17000 T&C Process and Procedures course will provide learners with the ability to safely and successfully plan, document, execute, and closeout a project.

17000 T&C Process and Procedures is currently offered as a 3.5-day training and is delivered as an Instructor-Led Training (ILT) to prepare learners before they attend other more complex training courses.

Scope

The training will provide Testing & Commissioning Services employee with modules on:

- Module 1: Introduction to Testing and Commissioning and begin Site Commissioning Binder
- Module 2: Pre-Commissioning Documentation
- Module 3: Onsite Commissioning Documentation (IN LAB)
- Module 4: Testing & Commissioning (IN LAB)
- Module 5: Final Documentation

Reference information will be included, such as an Instructor Guide (IG), Participant Guide (PG), job aids and other performance support content.

Out-of-Scope

The scope of this course is limited to topics relating to the documentation processes and procedures used by TRC T&C for its clients and vendors. While the course may refer to other TRC and/or T&C skills, those skills will not be covered in depth in the course.

Audience

The target audience for the course are Testing & Commissioning Services new hires and employees who have not completed the updated Testing & Commissioning Services training course.

Training Strategy, Structure, and Estimated Times

Training Method

The participants will typically complete the Power Fundamentals, Understanding Prints, _____, _____ courses prior to attending the 17000 T&C Process and Procedures course that is delivered in Lancaster, Pennsylvania.

Training Deliverables

The training materials developed for this project will be delivered in-person and consist of:

- **Instructor-Led Training (ILT)** – Facilitated by an instructor in a classroom to a group of learners. Benefits include:
    - Learning from experts.
    - Provides opportunities for instructor-learner and learner-learner interactions.
    - Peer learning and network-building.
    - The ability to ask questions and receive immediate feedback.
    - Adaptability—the ability of instructors to tailor courses to learners' needs, even on the fly.
    - Focus and attention—learning is not constantly interrupted by ringing phones, emails, etc.
- **Performance Support** – Content from training modules, plus job aids and additional reference information, organized into an online help library that is indexed, cross-referenced, searchable, and hosted through TRCNET, so updates are available to everyone instantly. This performance support tool will be used throughout training and when back on the job.

The training content to be developed for the Process and Procedures training will be in six separate modules:

ILT Modules	Content Description
• Pre-Commissioning Documentation • Site Commissioning Binder • Isolation Plan • Onsite Commissioning Documentation • Testing & Commissioning • Final Documentation	• Instructor Guide • Participant Guide • Interactive PowerPoint • Knowledge Checks • Scenario-based Assessments • Performance Support – online help / job aids

Estimated Times

17000 T&C Process and Procedures	Estimated Time
Module 1: Commissioning Procedures Overview	4 hours
Module 2: Construct Site Commissioning Binder	4 hours
Module 3: Pre-Commissioning Documentation	8 hours
Module 4: Onsite Commissioning Documentation (IN LAB)	8 hours
Module 5: Testing & Commissioning (IN LAB)	12 hours
Module 6: Final Documentation	4 hours

Total estimated time: Five Days

About Assessments

Assessments are used in grading, but offer other important purposes:

- Establish a reference point
- Identify a learner's needs and strengths
- Prompt metacognition (i.e., Encourage students to monitor and reflection on their learning)
- Measure progress
- Provide feedback and guidance
- Establish accountability

This course will include both knowledge and performance assessments.

Knowledge Assessments/Checks

A systematic examination procedure by testing and with the goal to establish desired characteristics and gathering proof about the level and quality of the acquired knowledge, skills, or attitudes.

- Cognitive: mental skills (knowledge)
- Affective: growth in feelings or emotional areas (attitude or self)
- Psychomotor: manual or physical skills (skills)

Performance Assessment

A systematic examination procedure in which the test taker demonstrates the knowledge, skills, and abilities. The assessment will be based on a scoring guide (rubric) to evaluate the quality of students' constructed responses when performing a given task. The rubric defines the expectations of quality around a task and defines criteria for grading (e.g., Learning objectives associated with course scenario – building a Site Commissioning Binder).

The test is intended to measure by doing real-world tasks that require those skills, rather than by answering questions asking how to do them. Performance assessments are part of an approach to teaching and learning that values application over rote memorization.

Incorporating both knowledge and performance assessments in the act of learning, people obtain content knowledge, acquire skills, and develop work habits. Then, practice the application of all three to "real world" situations.

Knowledge Assessments in this Course

This course will include interactive Knowledge Checks throughout each module, with a cumulative scenario-based Performance Assessments near the end of the course.

It will also employ the use of the PollEverywhere mobile device application or website for informal knowledge checks. This app offers the ability to visualize learner feedback in real time with a variety of activities, measure engagement, follow up on feedback, and uncover next steps to make content more meaningful to the learners and instructors.

Lastly, the course will include a Web-Based Assessment that includes at minimum three questions per learning and performance objective.

Required Tools/Equipment

Learner

- Desktop or laptop computers
    - MS Edge or Google Chrome
    - MS Office Suite
    - Adobe Acrobat
- Connection to TRCNET, ProjectWise, Skillsoft/Litmos LMS
- Connection to lab printers
- Pencils, colored pencils, markers
- Lab schematics

Development Timeline

Activity	Due Date	Status
Draft Design Document (DD) to reviewers for review/feedback	*Dates defined in Excel schedule*	
DD Feedback received		
Revised DD to Approver for review/sign-off		
Design Document Approval		
17000 T&C Process and Procedures (Instructor-Led Training)		
Module 1: Commissioning Procedures Overview		
Submit first draft modules to SME for review	*Dates defined in Excel schedule*	
Receive SME feedback and make revisions		
Submit final drafts to SME to approve revisions		
Receive SME approval		
Submit final drafts to Approver(s) for sign-off		
Receive sign-off from Approver(s)		
Send final documents to TRC Academy for upload		
Module 2: Construct Site Commissioning Binder		
Submit first draft modules to SME for review	*Dates defined in Excel schedule*	
Receive SME feedback and make revisions		
Submit final drafts to SME to approve revisions		
Receive SME approval		
Submit final drafts to Approver(s) for sign-off		
Receive sign-off from Approver(s)		
Send final documents to TRC Academy for upload		
Module 3: Pre-Commissioning Documentation		
Submit first draft modules to SME for review	*Dates defined in Excel schedule*	
Receive SME feedback and make revisions		
Submit final drafts to SME to approve revisions		
Receive SME approval		
Submit final drafts to Approver(s) for sign-off		

Activity	Due Date	Status
Receive sign-off from Approver(s)		
Send final documents to TRC Academy for upload		
Module 4: Onsite Commissioning Documentation (IN LAB)		
Submit first draft modules to SME for review	*Dates defined in Excel schedule*	
Receive SME feedback and make revisions		
Submit final drafts to SME to approve revisions		
Receive SME approval		
Submit final drafts to Approver(s) for sign-off		
Receive sign-off from Approver(s)		
Send final documents to TRC Academy for upload		
Module 5: Testing & Commissioning (IN LAB)		
Submit first draft modules to SME for review	*Dates defined in Excel schedule*	
Receive SME feedback and make revisions		
Submit final drafts to SME to approve revisions		
Receive SME approval		
Submit final drafts to Approver(s) for sign-off		
Receive sign-off from Approver(s)		
Send final documents to TRC Academy for upload		
Module 6: Final Documentation		
Submit first draft modules to SME for review	*Dates defined in Excel schedule*	
Receive SME feedback and make revisions		
Submit final drafts to SME to approve revisions		
Receive SME approval		
Submit final drafts to Approver(s) for sign-off		
Receive sign-off from Approver(s)		
Send final documents to TRC Academy for upload		

Assumptions, Dependencies, and Risks

Assumptions

Sign-off of this Design Document includes the understanding and full support of the following assumptions that have been identified for this project.

General Assumptions

- The client will provide the TRC Instructional Designers (IDs) relevant source documents and test scripts.
- The IDs will use the Applied training templates for the developing WBTs, but will modify the template to meet the needs of TRC Solutions.
- There will be at least two reviews: First draft review and a final review by all appropriate parties, including Subject Matter Experts (SMEs) and other designated Project Team members prior to the delivery of the final training materials.
- The specific objectives, outline content, and other details will evolve and change as additional source information is provided.

Subject Matter Experts (SMEs) Assumptions

- SMEs will meet with the TRC IDs to provide needed content and to review materials.
- SMEs have read relevant source documents to become familiar with the project.
- SMEs will be available (as needed) to respond to any questions the design team may have about this project.
- SMEs will be available to answer content questions, review deliverables, provide feedback, and note approvals in a negotiated timeframe.

Training Development Assumptions

- IDs will have access to the applicable systems and training region(s).
- IDs will have access to historical training materials and images.
- Training materials may need to be updated or supplemented post implementation as updates to processes and procedures may change.

Dependencies

Development of training materials for the Process and Procedures course are dependent on the following:

- IDs having access to the applications, functionalities, training region (if applicable) and SMEs to identify, perform, review system navigation and capture screen shots to develop training materials.
- IDs having adequate time to incorporate client feedback as outlined in the Timeline section above.

Risks

Below are the key risks that can jeopardize the completion of accurate and effective training materials.

General Risks

- The SME, the ID, or both take unexpected time off.
- The SME is unavailable to dedicate time to the project and no backup is available.
- SMEs are not prepared or are unable to provide adequate content support.
- The project scope changes or content changes are provided after approval of the Training Design Document.
- Requested feedback is not provided on time.
- Training material review responses and approvals are delayed or received at the last minute.

System Risks

- The required screen shots are not provided or delayed.
- System content changes are made late in the process.
- System development is delayed and/or changes are made late in the process.
- Access to training environment and system is delayed or denied, thereby hindering the:
    - Procurement of screen shots and procedures.
    - Validation of process steps and results prior to final approval of training materials.

Roles and Responsibilities

Role	Responsibilities	Individuals
Approver(s)	Approves this Design Document and all training deliverables, indicating acceptance.	• Jason Hostetter • Brian Moores • Anna Campbell • Tom Cohenno
Reviewer(s)	Reviews this Design Document and all training deliverables to ensure the content is accurate and complete.	• Tim Tennimon • Brian Moores • Anna Campbell • Tom Cohenno
Subject Matter Experts (SMEs)	• Provides the ID content, information, and expertise as needed. • Meets with the ID and answers questions as needed.	• Tim Tennimon • Brian Moores •
Instructional Designer (ID)	• Reviews and researches all source material related to project. • Meets with SMEs, reviewers, and approvers as needed. • Schedules and coordinates meetings for information gathering, reviews, and approvals. • Designs, creates, updates, and produces training deliverables using the ADDIE process.	• Gregory Cole

Course and Module Outline

Course: 17000 T&C Process and Procedures

Module 1: Commissioning Procedures Overview

Duration: ***TBD min during dry run***

Summary: Description of the module learning objectives:

- Define the Lead Commissioning Engineer responsibilities required for the testing and commissioning of electric power system construction projects.
- Define the TRC processes required for the testing and commissioning of electric power system construction projects.
- Define the TRC concepts required for the successful testing and commissioning of electric power system construction projects.

Training Solutions: Web-Based Training (WBT)

Training Materials: Performance Support Documents (Job Aids)

Required Equipment: PC with IE or Chrome connected to TRCNET

Knowledge Check: Yes

Performance Exercises: Yes

Performance Support: Basic structure of online help topics aligned with course topics

Outline of Module Topics

1. Lead Commissioning Engineer responsibilities required for the testing and commissioning of electric power system construction projects. *(Source: 17000.01)*
    a. Identify general requirements of the Lead Commissioning Engineer during the testing and commissioning process.
        i. Safety
            1. Health and Safety Plan
            2. Safety Tailboards
            3. Safe Catch Program
                a. 17000.11B
            4. High Voltage Work
            5. Low Voltage Work
        ii. Quality Assurance – Quality Control (QA-QC)
            1. Human Performance Tools
            2. Isolation Plans and Wire Logs
                a. Isolation Plans

i. 17000.02D
b. Wire Logs
3. Project Commissioning and Safety Audits
a. 17000.02E
b. 17000.02F
iii. Site Commissioning and Equipment Binders
1. 17000.07
iv. Design Intent
v. Switching and Tagging
vi. Change Notices and Request For Information
1. 17000.15

2. Define the Lead Commissioning Engineer (LCE) responsibilities to ensure that all testing and commissioning has been safely and successfully completed for all equipment and systems prior to energization in accordance with the guidelines and procedures.
a. 17000.02A
b. Off-Site Pre-Commissioning
i. Project Documents
ii. Project Kickoff Meeting
iii. Testing and Commissioning Plan
1. 17000.02D
2. Cheat Sheet
iv. Outage and/or Energization Plan
1. Cheat Sheet
c. Mobilization and On-Site Commissioning
i. Site Kickoff Meeting
ii. Site Risk Assessment
1. 17000.02B
iii. Active Site Commissioning
1. Weekly and Daily Commissioning Work Plans
a. 17000.02C
b. Weekly Commissioning Work Plan
i. Weekly Commissioning Report (see Section 3.2.3.7)
2. Daily Pre-Job Safety Briefing (Tailboard)
a. 17000.11A
3. Commissioning Concepts and Specific Methods
a. General concepts
i. Isolation checklist (see Section 2.2.2)
ii. TRC Human Performance Tools (see Section 2.2.1)
b. Specific methods
i. 17000.03
4. Commissioning Drawings
a. Requirements must be kept

b. Working copy
c. Major changes
    i. Design Change Notice (DCN)
    ii. Field Change Notice (FCN)
d. Protective Relay Testing
    i. Isolation Verification Form 17000.02D
    ii. Numerical Relay Requirements & Procedures 17000.10
e. Primary Equipment Power Testing
    i. Testing and Commissioning Guidelines 17000.03
f. Daily and Weekly Activity Reporting
    i. 17000.12A Daily Commissioning Report Form
    17000.13A Weekly Commissioning Report Form
g. Testing and Commissioning Documentation
    i. Binder requirement 17000.01 Section 3.3
    ii. Equipment Data Sheets
        1. 17000.04A through 17000.04FF shall be utilized to document information
        2. 17000.04 has an index of the TRC Equipment Data Sheets.
    iii. Test Certification Sheets
        1. 17000.05A through 17000.05KK shall be utilized to document information
        2. 17000.05 has an index of the TRC Test Certification Sheets.
        3. Test Results
    iv. Owner Inventory Forms

3. Energization
    a. Prior to energization, the Lead Commissioning Engineer is responsible for:
        i. Final review and signoff
        ii. Review of O&E Plan and owner Switching Orders
        iii. Development of diagrams and data tables
        iv. 17000.06 Pre-Energization Walkdown Documents
        v. 17000.06A through 17000.06Q shall be utilized to document information
    b. Voltage and Phasing Checks
    c. Load Checks
    d. Follow-up Checks
4. Post-Commissioning
    a. Field Marked Drawings (As-Builts)
    b. Testing and Commissioning Information Storage
        i. 17000.08
    c. Commissioning Report and Test Results
        i. 17000.09 Post-Commissioning Documentation and Project Closeout

d. Lessons Learned

Module 2: Site Commissioning Documentation (Lecture)

Duration: ***TBD min during dry run***

Summary: Short description of Process and Procedures course goal

Description of the module learning objectives:

- Create Commissioning Plan/Responsibility Matrix
- Create Health and Safety Plan (HASP)
- Create Project Contact List

Training Solutions: Instructor-Led Training (ILT)

Training Materials: Instructor Guide, Participant Guide, PowerPoint, Performance Support Documents (Job Aids),

Required Equipment: PC with IE or Chrome connected to TRCNET

Knowledge Check: Yes

Performance Exercises: Yes

Performance Support: Basic structure of online help topics aligned with course topics

Outline of Module Topics

1. Pre-Commissioning Documentation Overview
    a. Prerequisite training
        i. Understanding Prints WBT
2. Create Commissioning Plan/Responsibility Matrix
    a. Define the steps required to energize the substation components
        i. Commissioning Plan
            1. Purpose
            2. Lead Commissioning Engineer Responsibilities
            3. Pre-Commissioning Check
            4. Mobilization
            5. Site Documentation
            6. Additional Requirements
            7. Control House (DC System A, DC System B, AC System, General)
            8. Equipment Testing (e.g., 115kV SF6 BREAKERS)

        ii. Responsibility Matrix
            1. Equipment List with:
                a. HV Testing

b. IUSA Test Certification Sheets
c. Point-to-point Wiring Verification
d. Functional Circuit Checks
e. Relay Testing
f. Relay Test Plans
g. Automation Supervision

b. Define energizing phases.
c. Define the cutover sequence process.

3. Create Health and Safety Plan (HASP) (use/modify go-by)
   a. Define the criteria for drafting a HASP
      i. Scope
      ii. Schedule
      iii. Activities
      iv. General Safety Guidelines
      v. Accident/Incident Procedures
      vi. Additional Comments
      vii. JSA Worksheets
      viii. Contacts
      ix. Acknowledgement/Sign-off
      x. Daily Tailboard for Safety

4. Create Project Contact List (use/modify go-by)
   a. Not sure where to find this source (to define learning objectives).

Module 3: Site Commissioning Binder (Lecture)

Duration: ***TBD min***

Summary: Description of why it is important to create a thorough Site Commissioning Binder.

Description of the module learning objectives:

- Define the types of binders (i.e., Site Binder and Equipment-specific binder)
    - Define the necessary information to be included in the commissioning binders
- Define required layout and formatting of binder
- Define the maintenance requirements of each binder.

Training Solutions: Instructor-Led Training (ILT)

Training Materials: Instructor Guide, Participant Guide, PowerPoint, Performance Support Documents (Job Aids),

Required Equipment: PC with IE or Chrome connected to TRCNET

Knowledge Check: Yes

Performance Exercises: Yes

Performance Support: Basic structure of online help topics aligned with course topics

Outline of Module Topics

1. Site Commissioning Binder Overview
    a. Learning objectives:
        i. Define the types of binders (i.e., Site Binder and Equipment-specific binder)
            1. Define the necessary information to be included in the commissioning binders
        ii. Define required layout and formatting of binder
        iii. Define the maintenance requirements of each binder.
2. Site Binder
    a. Project/Site Commissioning Plan
    b. Scope of Work (SOW)
    c. Outage & Energization (O&E) Plan
    d. Pre-Energization Walkdown Sheets
    e. Operational Descriptions
    f. Site Risk Assessment
    g. Contact Lists
    h. Tailboard Forms
    i. Commissioning Audit Checklist

j. Isolation Verification Forms
k. Daily Work Plans
l. Weekly Construction /Commissioning Report
m. Daily Construction /Commissioning Report
n. Health & Safety Plans (HASP)

3. Equipment Binder
    a. Relay Settings and Test Results
    b. Test Certification Sheets
    c. Equipment Data Sheets and Test Results
    d. Keysheets/Cascade Sheets
4. Define required layout and formatting of binder
    a. 17000.07
        i. (Use completed example shared by Brian. This includes 18 types of areas that are associated with this lab scenario).
5. Define the maintenance requirements of each binder.
    a. 17000.07
    b. The binders are living documents and must be maintained and up to date at all times DURING the commissioning. The commissioning report effort should be minimal upon commissioning completion, if the onsite binder process is completed correctly.

Module 4: Isolation Plan (Lecture)

Duration: ***TBD min***

Summary: Description of the module learning objectives: 17000.02D

- Define the precautions and special considerations for functional testing of control circuits and or metering verifications.

Per the FS QA/QC process, these forms are required to identify and log isolation points to remove equipment or systems from service. The intent is to provide a detailed list of all isolated circuitry onsite. This list prevents possible oversights when returning equipment or systems to service and requires a signature and date acknowledging who was responsible for both the isolation and restoration of the circuit.

Training Solutions: Instructor-Led Training (ILT)

Training Materials: Instructor Guide, Participant Guide, PowerPoint, Performance Support Documents (Job Aids),

Required Equipment: PC with IE or Chrome connected to TRCNET

Knowledge Check: Yes

Performance Exercises: Yes

Performance Support: Basic structure of online help topics aligned with course topics

Outline of Module Topics

1. Create and Isolation Plan

    a. Define the Isolation Verification Form
        i. Purpose
        ii. Trip Circuit Isolation
        iii. Schematic Review
        iv. Two Person Verification and Review System
            1. Step with:
                a. Brief Description of circuit to be Isolated
                b. Points of Isolation (Knife blades, Feeder Breakers, Fusing)
                c. Drawing Reference Number(s)
                d. Isolated (Initial and Date)
                e. Restored (Initial and Date)

Module 5: Onsite Commissioning Documentation (Lab)

Duration: ***TBD min***

Summary: Description of the module learning objectives:

-

Training Solutions: Instructor-Led Training (ILT)

Training Materials: Instructor Guide, Participant Guide, PowerPoint, Performance Support Documents (Job Aids),

Required Equipment: PC with IE or Chrome connected to TRCNET

Knowledge Check: Yes

Performance Exercises: Yes

Performance Support: Basic structure of online help topics aligned with course topics

Outline of Module Topics

1. Create Isolation Plan Overview
    a. Learning objectives:
        i. TBD
2. Performance Observation (IN LAB)
    a. Perform isolation of relay (use isolation plan)
    b. Read and save as-found relay settings with AcSELerator (Review 17000.10 – Numerical Relay Requirements and Procedures and 17000.10B – Schweitzer Relay Connection Procedure)
    c. Make settings changes using terminal window in AcSELerator
    d. Compare as-found relay settings to settings changes using AcSELerator
    e. Connect relay test set to relay test switches (review lab drawings)
    f. Test relay settings changes, record test results
    g. Ensure settings modified for testing restored back (outputs, SER).
    h. Read as-left relay settings with AcSELerator
    i. Compare as-found relay settings to as-left relay settings with AcSELerator
    j. Verify expected changes (should only be what was identified on settings change notice)
    k. Save as-found and as-left settings (filed later)
    l. Save compare file (filed later)
    m. Fill out equipment data sheet
    n. Fill out test certification sheet
    o. Restore relay (use isolation plan)
    p. Remove Human Performance Barriers, Identification, Tape, Etc

q. Fill out daily commissioning report

r. Fill out weekly commissioning report

Module 6: Final Documentation (Lecture)

Duration: ***TBD min***

Summary: Description of the module learning objectives:

-

Training Solutions: Instructor-Led Training (ILT)

Training Materials: Instructor Guide, Participant Guide, PowerPoint, Performance Support Documents (Job Aids),

Required Equipment: PC with IE or Chrome connected to TRCNET

Knowledge Check: Yes

Performance Exercises: Yes (Use rubric)

Performance Support: Basic structure of online help topics aligned with course topics

Outline of Module Topics

2. Create Onsite Commissioning Documentation (IN LAB)
    a. Learning objectives:
        i. TBD
3. Performance Observation
    a. Peer review / check
    b. File all documentation in project folders per procedures
4. Performance and Knowledge Assessments
    a. Site Commissioning Binder scored using the rubric
5. Knowledge Assessment
    a. Students complete web-based knowledge assessment
        i. Includes minimum of three questions per learning and performance objective.