



Comprehensive Staking Technician Certification Program

Phase 3: Underground Distribution Design, Transformer and Conductor Sizing, Basic Sectionalizing & Contract Administration

January 27-30, 2026

Registration Information

Online registration is available at <https://www.ndarec.com/ndarec-education-programs>. The registration deadline is Jan. 13. Class size is limited to 40 participants, and registrations will be honored on a first come, first served basis.

The registration fee is \$1,500/person and includes all meals, refreshment breaks and course materials. No advance payment is necessary. NDAREC will bill back to participating cooperatives after the program.

Contact

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Location

NDAREC Headquarters
3201 Nygren Drive NW
Mandan, ND 58554

Course Schedule (All Times Central Time)

Jan. 27-29 8:30 a.m.- 4:00 p.m.

Jan 30 8:30 a.m.- 2:00 p.m.

Sponsored by:



Courses conducted by:



Who Should Attend? Engineers • Staking Technicians • Power Line Workers • Contractors

Note: Phases 1-3 of this program do not have to be taken in order.

Course Descriptions

UNDERGROUND DISTRIBUTION DESIGN: The components of underground distribution systems, along with their application and limitations, will be discussed. Participants will learn how to lay out subdivisions, specify pad-mounted equipment, and design sectionalizing systems. This course will also cover conduit systems and the correct methods for calculating pulling tensions relative to conduit bends and cable runs.

1. Underground Cable
 - a) Solid, stranded, and strand-filled conductors
 - b) Purpose and limitations of conductor shield
 - c) Types and comparisons of conductor insulations
 - d) Concentric neutrals, tape shields and neutral ampacity
2. Components
 - a) Separable connectors - 200 and 600 amp elbows, ANSI 386
 - b) Cable terminators and potheads
 - c) Joints - small and large cable splices
 - d) Proper grounding of the cable and its components
3. Pad-mounted Switchgear
 - a) Purpose and types of switchgear in the complete underground system
 - b) Insulating mediums - air, oil, gas and vacuum
 - c) Application of pad-mounted switchgear in vaults and open areas
4. Over-Voltage Protection
 - a) Causes of cable failures due to treeing and lightning
 - b) Controlling over-voltage and maintaining BIL with lightning arresters
 - c) Ferroresonance and how to prevent its occurrence
5. Cable Pulling in Conduit Systems
 - a) Calculations for bending radius, clearance, jamming ratios and pulling tensions
 - b) Use of lubricants to reduce the coefficient of friction
 - c) Designing conduit pull for single- and three-phase installations
 - d) Using computer programs to calculate pulling tensions
6. Designing Underground Systems
 - a) Radial and looped primary cable layout
 - b) Proper electrical loading of a looped single- and three-phase system
 - c) Correct fusing of underground cable systems
 - d) Use of fault indicators and their application

SIZING TRANSFORMERS AND CONDUCTORS: The course will focus on basic electric theory and methodology to correctly size transformers and service conductors for standard residential and small commercial loads. Participants will learn how to perform basic calculations for current, voltage, power and voltage drop.

1. Basic Electric Theory
 - a) Voltage, current and resistance
 - b) Power and voltage drop equations
2. Transformers
 - a) Theory of transformer operation
 - b) Understanding ANSI C57.12 requirements
 - c) Transformer connections and wiring
 - d) Transformer construction and loading standards
3. Transformer Sizing
 - a) Sizing transformers based on panel size and/or load diversity
 - b) Single- and three-phase application using lookup tables
 - c) Using pad-mounted transformers for large industrial loads
4. Service Voltage Drop
 - a) Voltage drop and flicker theory calculations
 - b) Sizing conductors based on amps and length
5. Computer Programs
 - a) Spreadsheet analysis
 - b) Vendor programs

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Course Descriptions

BASIC SECTIONALIZING AND LINE EQUIPMENT: The course will give participants a basic understanding of fault currents, sectionalizing devices, voltage regulators and capacitors. The focus of this section will be to teach the staking technician how to apply and locate these devices on the distribution system when the line is being staked.

1. Principles of Over-Current Protection
 - a) Isolation of faulted components
 - b) Outage time benchmarking
2. Fault Current Calculations
 - a) Basic equations and symmetrical components
 - b) Maximum available fault currents (primary & secondary)
3. Over-Current Protection
 - a) Breakers, reclosers, fuses and sectionalizers
 - b) Interrupting mediums (vacuum, gas or oil)
4. Transformer Protection
 - a) Peak loads and inrush current
 - b) Current limiting fuses
5. Line Coordination
 - a) Transformer/fuse, breaker/recloser, recloser/recloser and recloser/fuse
 - b) Duty cycles and minimum fault recognition
5. Regulators
 - a) Basic theory of operation
 - b) Placement in circuit
6. Capacitors
 - a) Basic theory of operation
 - b) Placement in circuit

CONSTRUCTION CONTRACTS: Accurate accounting of materials and close monitoring of the contractor's progress are essential to completing a project on time and on budget. Participants will learn how the construction contract affects every aspect of the project, how to prepare special conditions and units, and how to administer the contract terms and conditions for a successful outcome.

1. RUS Construction Contracts
 - a) Anatomy of labor and materials contracts (RUS 830)
 - b) Anatomy of labor only contracts (RUS 792)
 - c) Holding pre-bid and pre-construction meetings
2. Plans and Specifications
 - a) Specifying and using standard construction units
 - b) Developing and identifying special construction units
 - c) Preparing and adhering to special conditions and instructions
 - d) Understanding and adhering to the specifications in the contract
3. Staking for a Construction Contract
 - a) Need for accurate staking sheets and reliance on the units by the contractor
 - b) Preparing well-defined drawings and notes, and marking the line route
4. Materials Control
 - a) Methodology of preparing material issue and return tickets
 - b) Verifying and accounting for returned and salvaged materials
5. Contractor Observation
 - a) Submission of prices for construction units not included in the original contract
 - b) Reviewing, accounting and approving the contractor's invoices
 - c) Establishing and tracking project milestones
 - d) Making periodic inspections of the contract work
 - e) Documenting changes, agreements, outages and accidents
6. Contract Closeout
 - a) Performing the final inspection of the completed lines and facilities
 - b) Preparing change orders including units, changes and reasons
 - c) Preparing the final inventory of the as-built remove and install construction units

Note: Phases 1-3 of this program do not have to be taken in order.