

## NULCA STANDARDS FOR LOCATING TECHNICIANS

### OVERVIEW

The National Utility Locating Contractors Association (NULCA) was formed in 1995 to maintain standards and practices that contribute to improved safety, quality and performance within the contract locating industry.

From its beginnings NULCA members recognized the need for a common set of standards and practices directing the training and development of contract utility locators. With this need in mind, the NULCA Board of Directors mandated the original NULCA training standards in 1995. Representatives from the contract locating industry, one call system, utility companies and others involved in the damage prevention process were involved. In 1996 NULCA published the *NULCA Locator Training Standards and Practices*. This formed the basis for the training programs currently in use by NULCA members performing contract locates.

In 1998 the NULCA Board requested a review and evaluation of the existing *NULCA Locator Training Standards and Practices*. It was determined that industry and regulatory changes within the industry dictated the need for a new revised training standard for contract utility locators. A committee was formed to develop the new training standards in 1999. As a result of these efforts NULCA published *Professional Competence Standards for Locating Technicians 2001 First Edition* which was reviewed and adopted by the NULCA Board in 2001 and publicly presented in February 2002.

In 2007 the NULCA Board requested a review and evaluation of the *Professional Competence Standards for Locating Technicians 2001 First Edition*.

NULCA has developed these industry Standards for Locating Technicians (Standards) as an educational tool and general reference aid. The Standards have been developed by volunteers within NULCA based on their collective experience in the industry, not the individual judgment of any one person. NULCA members include representatives from the contract locating industry, utility companies, excavators, equipment suppliers and others dedicated to the protection of the utility infrastructure.



[www.nulca.org](http://www.nulca.org)

## **NULCA Mission Statement**

The mission of NULCA is to define, establish and maintain standards and practices performed by the underground utility locating industry. Our highest priority is the safety of the general public, excavators and our employees in the protection of North America's underground infrastructure. As an Association, we will accomplish our mission by partnering with utility owners, excavators, one-call centers, suppliers and regulatory agencies, as well as other interested parties determined to provide a leadership role in the reduction of underground facility damages. Any questions or recommendations related to the Standards should be sent to NULCA.

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## **NULCA Standards for Locating Technicians 2009 Second Edition**

### **Chapter 1 Administration 1 General**

**Scope:** This standard identifies the basic level of competence required of a Locating Technician. It specifically covers the competencies for basic level locators who are involved in buried facility locating. The locator must demonstrate knowledge and understanding of the practices and procedures through formal closed book examination, obtaining a passing grade, together with demonstrating in actual or simulated scenarios and demonstrating the ability to use locating equipment effectively and efficiently.

**Purpose:** The purpose of this standard is to specify the minimum competencies for those individuals who will respond to the request for the location of facilities which are below the surface of the ground. It is not the intent of this standard to restrict any jurisdiction from exceeding those minimum requirements.

The purpose of these competencies is assist in safer excavation practice, with the goal of minimizing the possibility of causing damage to underground facilities.

#### **1-2 Definitions**

**Authority Having Jurisdiction:** The “authority having jurisdiction” is the organization, office or individual responsible for “approving” equipment, procedure, legislation or regulation.

**CFR 191.614(b)(5):** Subpart of US DOT Pipeline Safety Rule that addresses locating pipelines.

**APWA Uniform Color Code:** System of colors used for marking and recognition of various types of facilities located below the ground.

**Circuit:** Complete path of electrical current including the power source (transmitter), facility being located, grounding system, and soil.

**Competence:** Possessing knowledge, understanding, skill and judgment needed to perform specific tasks and/or objectives satisfactorily, with little or no supervision.

**Electromagnetic Location:** Detection of Electromagnetic fields emitted by a transmitter and applied to buried metallic facilities.

**Element of Competence:** What individuals have to do to demonstrate or prove the Unit of Competence.

**Facility:** Any structure buried below the surface of the ground.

**Locating Device:** Any of a number of electronic instruments designed, manufactured and distributed for the purpose of finding buried metallic conductors as part of a utility system.

**Locating Technician:** An individual competent in the activity of locating buried facilities.

**Hertz:** Unit of measuring an alternating current. One Hertz is equal to one complete electronic cycle in one second; abbreviated Hz.

**Locating:** The practice of identifying and designating the position of a facility buried below the surface of the ground.

**Manhole:** Entry points to a vault and/or space below the surface of the ground.

**NULCA:** National Utility Locating Contractors Association

**Performance Criteria:** Precisely describes the Element of Competence.

**Receiver:** Equipment that receives a detectable signal for the purpose of identifying a buried facility.

**Signal:** A moving magnetic field capable of being detected by a receiver; typically applied deliberately by a transmitter for the purpose of locating.

**S.U.E.:** “Subsurface Utility Engineering” pre-project planning to determine the physical position and identity of buried facilities prior to project commencement.

**Transmitter:** Equipment that transmits a detectable signal for the purpose of identifying an underground facility.

**Unit of Competence:** A key area which has to be carried out if the key purpose is to be achieved.

## Chapter 2 Competencies for Locator Technician

### 2 General

**Introduction:** The Locator Technician shall be trained to meet Federal, State, Provincial and local health occupation and safety regulatory requirements, whichever are appropriate for their jurisdiction.

Locator Technicians are those persons who, in the course of their normal duties will be required to identify and designate the appropriate horizontal position of buried facilities, subject to the applicable tolerance zone under applicable law.

Locator Technicians are expected to identify and indicate the position of buried facilities, protect the general public and themselves from harm, and call for support when necessary.

The key purpose of the Units of Competence is to provide Locator Technicians with the Skill, Knowledge and Understanding to complete the following tasks and activities safely and professionally.

The Locator Technician shall satisfy the performance criteria of all Elements and Units of Competence outlined herein by using locating equipment to locate a minimum of one or all of the various buried facilities (in rural or urban settings as it pertains to a geographical area of responsibility) under actual or simulated conditions such as:

1. Electrical Systems (electric power lines, cables, conduit, & Lighting Cables)
2. Gas, oil, steam, petroleum, or gaseous materials
3. Communication systems (alarm or signal lines, cables, or conduit)
4. Potable water
5. Reclaimed water, irrigation, and slurry lines
6. Sewer and draw lines
7. Other underground structures

The Locator Technician must demonstrate the knowledge and understanding in the Units of Competency for every type of facility the Locator Technician is required to Locate. Locator Technicians are to demonstrate their knowledge and understanding through formal and informal questioning.

### 2-2 Competencies

#### Units of Competence:

1. Basic Locating Theory
2. Use of the Transmitter
3. Use of the Receiver
4. Marking Procedures
5. Knowledge of Facilities
6. Visual Observation Skills
7. Safe Work Practices and Regulations
8. One-Call Regulation, Requests, & Documentation
9. Excavator & Customer Relations
10. Locating Pipelines (US)

## Unit 1 “Basic Locating Theory”

The Locator Technician shall, given various simulated or actual site situations or by diagram, demonstrate basic competency in the knowledge of Basic Locating Theory.

### Elements of Competence:

- 1.1 Demonstrate a basic knowledge and understanding of electromagnetic theory as it applies to utility locating.
- 1.2 Demonstrate a basic knowledge and understanding of a simple circuit as it applies to utility locating.
- 1.3 Demonstrate a basic knowledge and understanding of signal frequency as it applies to utility locating.
- 1.4 Demonstrate a basic knowledge and understanding of signal power as it applies to utility locating.
- 1.5 Demonstrate a basic knowledge and understanding regarding signal distortion.

### Performance Criteria:

- 1.1a Demonstrate a basic knowledge and understanding of the relationship between electricity and magnetism.
- 1.1b Demonstrate a basic knowledge and understanding of what "signal" is and how it is produced.
- 1.1c Demonstrate a basic knowledge and understanding of the relative conductivity of various utility structures.
- 1.2a Demonstrate a basic knowledge and understanding of how signal flows through a locating circuit.
- 1.2b Demonstrate a basic knowledge and understanding of common obstacles to signal flow in a locating circuit.
- 1.3a Demonstrate an understanding of common frequency measurement terms (i.e., Hz & kHz).
- 1.3b Demonstrate an understanding that instruments offer a variety of signal frequencies and each frequency has situational advantages and disadvantages.
- 1.3c When presented with a variety of common locating scenarios (actual or simulated), demonstrate the ability to select the most effective frequency from among at least two choices.
- 1.4a Demonstrate an understanding that instruments offer a variety of output power settings and that each has situational advantages and disadvantages.
- 1.5a Demonstrate a basic knowledge and understanding of how signal distortion is created.
- 1.5b Demonstrate knowledge of at least one technique used to recognize the presence of signal distortion.
- 1.5c Demonstrate a basic knowledge of how to overcome signal distortion when it is detected.

## **Unit 2 “Use of the Transmitter”**

The Locator Technician shall, given various simulated or actual site situations with different buried facilities, identify and indicate the position of those facilities correctly using their equipment as per the manufacturer’s instructions, accessing all other reference material available and in an effective and safe manner. The Locator Technician shall be able to:

### **Elements of Competence**

- 2.1 Demonstrate a basic knowledge and understanding of the three methods of signal application (direct connect, close induction/clamp & induction).
- 2.2 Demonstrate knowledge of basic transmitter operation.
- 2.3 Demonstrate proper equipment maintenance procedures.

### **Performance Criteria**

- 2.1a Demonstrate the knowledge of how to apply a signal by direct connection, close induction/clamp, and induction.
- 2.1b Demonstrate a knowledge and understanding of the situational advantages and disadvantages of each method of signal application.
- 2.2a Demonstrate how to determine what frequencies are available on a given transmitter and how to select from among them.
- 2.2b Demonstrate how to determine what power output settings are available on a given transmitter and how to select from among them.
- 2.2c Demonstrate how to determine the relative quality of the circuit created (where applicable).
- 2.2d Demonstrate the knowledge and understanding of proper transmitter use by accurately indicating the presence of pre-selected buried facilities.
- 2.3a Demonstrate basic knowledge of proper storage, maintenance and cleaning of a transmitter.
- 2.3b Demonstrate the ability to check for continuity in direct connect leads.
- 2.3c Demonstrate the knowledge of the transmitter's power source and how to maintain useful power.

## **Unit 3 “Use of the Receiver”**

The Locator Technician shall, given various simulated or actual site situations with different buried facilities, identify and designate the position of those facilities correctly, use locating equipment as per the manufacturer’s instructions, accessing all other reference material available in an effective and safe manner. The Locator Technician shall be able to:

### **Elements of Competence**

- 3.1 Demonstrate knowledge and understanding of common receiver antenna configurations

- 3.2 Demonstrate knowledge of basic receiver operation.
- 3.3 Demonstrate proper equipment maintenance procedures.

### **Performance Criteria**

- 3.1a Demonstrate a basic understanding of peak, null and directional receiver responses and how they are achieved.
- 3.1b Demonstrate a knowledge and understanding of the situational advantages and disadvantages of peak, null and directional receiver responses.
- 3.2a Demonstrate how to determine what frequencies are available on a given transmitter and how to select from among them.
- 3.2b Demonstrate how to determine which types of receiver response (peak, null or directional) are available on a receiver and how to select from among them.
- 3.2c Demonstrate a knowledge and understanding of how to perform an electronic or manual depth measurement.
- 3.2d Demonstrate a basic knowledge and understanding of receiver gain and how to adjust it.
- 3.2e Demonstrate the knowledge and ability to recognize and avoid air coupling.
- 3.2f Demonstrate the ability to conduct both circle and blind sweeps.
- 3.2g Demonstrate a knowledge and understanding of proper receiver use by accurately indicating the presence of pre-selected buried facilities.
- 3.3a Demonstrate a basic knowledge of proper storage, maintenance and cleaning of a receiver.
- 3.3b Demonstrate knowledge of the receiver's power source and how maintain useful power.

## **Unit 4 “Marking Procedures”**

The Locator Technician shall, given various simulated or actual site situations with different buried facilities, mark their position on the surface of the ground using the most appropriate method for the specific task after referencing any Federal, State, Provincial or local requirements or regulations concerning such activities. The Locator Technician shall be able to:

### **Elements of Competence**

- 4.1 Satisfactorily delineate the approximate horizontal location of buried facilities.
- 4.2 Demonstrate knowledge and understanding of different marking systems.

### **Performance Criteria**

- 4.1a Demonstrate the ability to indicate the location of buried facilities within required Federal, State, Provincial and local regulatory requirements.

4.1b Demonstrate the ability to indicate the location of buried facilities as per the facility owner's standards, which may exceed Federal, State, Provincial and local regulatory requirements.

4.2a Demonstrate a knowledge and understanding of Federal, State, Provincial and local color codes.

4.2b Demonstrate a knowledge and understanding of the common types of marking devices and proper application methods for their use.

4.2c Demonstrate the ability to recognize and understand industry symbols used to indicate buried facilities.

## **Unit 5 “Knowledge of Facilities”**

The Locator Technician shall, given various simulated or actual site situations with different buried facilities, correctly identify those facilities and select the most appropriate method of locating such a facility. The Locator Technician shall be able to:

### **Elements of Competence**

5.1 Demonstrate a basic knowledge of the physical utility system(s) being located.

5.2 Demonstrate a basic understanding of the mapping system for the facility(ies) being located.

### **Performance Criteria**

5.1a Demonstrate a basic understanding of how the utility product (communications signal, petroleum, steam, water, power, etc.) travels to the consumer from a source point (power plant, headend, central office, etc.)

5.1b Correctly identify various common surface structures and appropriate signal application points on the facility being located.

5.1c Correctly identify various underground pipe, cable, or wire types commonly used on the assigned system.

5.1d Demonstrate a basic knowledge of the situational advantages and disadvantages of various signal application points and methods.

5.1e Correctly identify proper isolation and or bonding/un-bonding procedures for the facility being located (if applicable).

5.2a Demonstrate the ability to find a specific location on a given facility map.

5.2b Demonstrate the ability to differentiate between aerial and underground facilities on a facility map.

5.2c Demonstrate a basic knowledge and understanding of key mapping symbology.

5.2d Demonstrate the ability to identify the approximate physical location of on-site facilities using a facility map.

5.2e Understand the procedure for reporting mapping errors, omissions & irregularities.

## **Unit 6 “Visual Observation Skills”**

The Locator Technician shall, given various simulated or actual site situations with different buried facilities, correctly identify visible indicators that would lead to the possibility of the existence of an underground facility. The Locator Technician shall be able to:

### **Elements of Competence**

- 6.1 Correctly identify the most common surface structures of each utility system.
- 6.2 Correctly identify different visual evidence of the presence of buried facilities
- 6.3 Demonstrate a basic knowledge regarding private facilities.

### **Performance Criteria**

- 6.1a Recognize different utility plant features (i.e. utility poles, pedestals, gas meters, manhole covers etc.).
- 6.2a Recognize areas where previous excavations may have been taken place.
- 6.2b Recognize trench or excavation scars in paved roadways or highways.
- 6.2c Recognize and reasonably interpret markings from previous locates.
- 6.3a Demonstrate the ability to recognize common private facilities and what procedures are to be followed when they are encountered.

## **Unit 7 “Safe Work Practices and Regulations”**

The Locator Technician shall, given various simulated or actual site situations with different buried facilities, create safe working environments for the general public, excavators, themselves and others at the work site, following Federal, State, Provincial and local health safety and environmental regulations and practices. The Locator Technician shall be able to:

### **Elements of Competence**

- 7.1 Demonstrate knowledge and understanding of safe work practices.
- 7.2 Demonstrate knowledge and understanding of emergency response requirements.
- 7.3 Demonstrate knowledge and understanding of the hazards surrounding confined space entry.

### **Performance Criteria**

- 7.1a Demonstrate knowledge and understanding of how to protect themselves at the work site location, protect the general public in and around the work site location, and protect the work area.
- 7.1b Demonstrate knowledge and understanding of the right to refuse and work that is unsafe to themselves or others present at the worksite.
- 7.1c Demonstrate knowledge and understanding of the obligation to stop any work that is unsafe to themselves or others present at the worksite.

- 7.1d Demonstrate knowledge and understanding of how to manage and channel traffic so to minimize the disturbance and inconvenience to the general public, within the Federal, State, Provincial and local regulatory requirements.
- 7.1e Demonstrate the ability identify hazardous environments and practice safe work methods to ensure the safety of the Locator Technician and others.
- 7.1f Demonstrate a knowledge and understanding of common hazards of working with the general public with an emphasis on customer relationships and conflict management.
- 7.1g Demonstrate a knowledge and understanding of common hazards of working outdoors (animals, natural occurrences, etc.) and the necessary steps to protect themselves.
- 7.1h Identify and wear all personal protective equipment as required by Federal, State, Provincial or local regulatory requirements or more stringent company standards.
- 7.1i Demonstrate a knowledge and understanding of basic defensive driving techniques (i.e., National Safety Council or similar program).
- 7.2a Demonstrate knowledge and understanding of how and where to quickly access required emergency information when necessary.
- 7.2b Demonstrate knowledge of how to activate the emergency response system for the geographical area they locate in.
- 7.3a Demonstrate a knowledge and understanding of what constitutes a confined space and the potential consequences of unauthorized entrance.
- 7.3b Demonstrate a knowledge and understanding of the equipment and procedures necessary to safely enter a confined space (where applicable).

## **Unit 8 “One Call Regulation, Requests and Documentation”**

The Locator shall, given various simulated or actual site situations demonstrate a basic understanding of local One-Call regulations, as well as the documentation associated with locate requests and completed locates. The Locator shall be able to:

### **Elements of Competence**

- 8.1 Demonstrate a basic knowledge and understanding of One-Call regulations and processes for the assigned area of responsibility.
- 8.2 Demonstrate knowledge and understanding of locate request documentation.
- 8.3 Demonstrate knowledge and understanding of locate response documentation.
- 8.4 Demonstrate a basic knowledge and understanding of the damage investigation process

### **Performance Criteria**

- 8.1a Demonstrate a knowledge and understanding of the basic local One-Call process from customer request through ticket expiration.
- 8.1b Demonstrate a knowledge and understanding of positive response requirements for locator and excavator (where applicable).
- 8.1c Demonstrate a knowledge and understanding of the various locate request priorities and response requirements in the assigned area of responsibility.
- 8.1d Demonstrate a basic understanding of local One-Call requirements and/or how to reference them.
- 8.2a Demonstrate knowledge and understanding of locate request documentation in their geographical area of responsibility.
- 8.3a Demonstrate ability to create written/computerized documentation of a completed locate.
- 8.3b Demonstrate a basic ability to graphically document a completed locate using a sketch, computer assisted drawing, photograph or video.
- 8.4a Demonstrate a basic knowledge of how to recognize and report facility damages.
- 8.4b Demonstrate a basic knowledge and understanding of the employer's procedure for handling facility damages.

### **Unit 9 “Excavator & Customer Relations”**

The Locator Technician shall, given various simulated or actual site situations, interact with customers and others in a professional and effective manner. The Locator Technician shall be able to:

#### **Elements of Competence**

- 9.1 Promote positive working relationships with excavators & the public.

#### **Performance Criteria**

- 9.1a Correctly identify most commonly used excavation equipment.
- 9.1b Demonstrate a basic knowledge of how to professionally interact with excavators in the field.
- 9.1c Demonstrate knowledge of how to professionally address common customer concerns about the locating process.
- 9.1d Demonstrate knowledge and understanding of the employer's procedure for handling an escalating conflict in the field.
- 9.1e Demonstrate the knowledge of how to refer a customer to the One-Call center or company customer service department.
- 9.1f Demonstrate an understanding of the importance of communicating an incomplete locate attempt.
- 9.1g Demonstrate a basic understanding of the CGA's Best Practices for Locating & Marking, and the National Dig Safely Message / 811 Campaign.

## **Unit 10 “Locating Pipelines (US)”**

The Locator Technician shall, if locating pipelines in the U.S., comply with CFR 192.614(b)(5).

### **Elements of Competence**

Provide for temporary marking of buried pipelines in the area of excavation activity before, as far as possible, the activity begins.

#### **Locating Pipeline Steps**

1. Perform equipment operation check
2. Verify scope of locate request
3. Visually inspect locate area
4. Locate and mark the facility(ies)
5. Recognize and react to Abnormal Operating Conditions

#### **Step 1: Perform equipment operation check**

##### **Abnormal Operating Conditions**

(None Identified)

##### **Evaluation Criteria**

The individual will, before the first locate, be able to:

- a. Perform equipment operation check in accordance with manufacturer instructions,
- b. Verifying battery strength, if required
- c. Initiate corrective action for equipment out of specification

#### **Step 2: Verify scope of locate request**

##### **Abnormal Operating Conditions**

(None Identified)

##### **Evaluation Criteria**

The individual will be able to utilize maps/records and engage in discussion with the excavator to:

1. Determine type of pipe being located
2. Verify location of job site
3. Verify extent of locate request

#### **Step 3: Visually inspect locate area**

##### **Abnormal Operating Conditions**

Damaged pipe

Damaged pipe coating

Excavation activities (including blasting) started prior to locating

#### **Evaluation Criteria**

The individual will be able to:

- a. Identify facilities that may affect locate
- b. Compare records to existing conditions and identify and communicate discrepancies

#### **Step 4: Locate and mark the facility(ies)**

##### **Abnormal Operating Conditions**

Damaged pipe

Damaged pipe coating

Excavation activities (including blasting) started prior to locating

Missing or broken tracing wire

Unable to locate pipeline

##### **Evaluation Criteria**

The individual will be able to:

- a. Select type of locating method:
  1. Conductive
  2. Inductive
  3. Measurement
- b. Operate locate equipment in accordance with manufacturer instructions
- c. Initiate action if signal is lost or insufficient
- d. Locate within scope of the request
- e. Mark (paint, flag or stake) the location of the facilities:
  1. Mark changes in direction
  2. Place marks so there is no doubt about the location of facilities
- f. Compare records to existing conditions and identify and communicate discrepancies

#### **Step 5: Recognize and react to Abnormal Operating Conditions**

##### **Abnormal Operating Conditions**

(None Identified)

##### **Evaluation Criteria**

The individual will be able to:

- a. Recognize Abnormal Operating Condition(s) that may be encountered while performing the task
- b. React to the Abnormal Operating Condition(s) by:
  1. Initiating remedial action
  2. Reporting for analysis by:

- i. Determining if remedial action is required
- ii. Determining a remedial action to correct the Abnormal Operating Condition(s)
- c. Describe the Abnormal Operating Condition(s) that an individual could reasonably expect to encounter while performing this covered task(s)
- d. Describe the response required for each Abnormal Operating Condition