



PDH-Pro.com

## In-Line Inspections of Pipelines

**Course Number:** ME-02-602

**PDH:** 3

**Approved for:** AK, AL, AR, DE, FL, GA, IA, ID, IL, IN, KS, KY, LA, MD, ME, MI, MN, MO, MS, MT, NC, ND, NE, NH, NJ, NM, NV, NY, OH, OK, OR, PA, SC, SD, TN, TX, UT, VA, VT, WI, WV, and WY

### State Board Approvals

Florida Provider # 0009553 License #868

Indiana Continuing Education Provider #CE21800088

Maryland Approved Provider of Continuing Professional Competency

New Jersey Professional Competency Approval #24GP00025600

North Carolina Approved Sponsor #S-0695

NYSED Sponsor #274

### How Our Written Courses Work

This document is the course text. You may review this material at your leisure before or after you purchase the course.

After the course has been purchased, review the technical material and then complete the quiz at your convenience.

A Certificate of Completion is available once you pass the exam (70% or greater).

If a passing grade is not obtained, you may take the quiz as many times as necessary until a passing grade is obtained).

If you have any questions or technical difficulties, please call (508) 298-4787 or email us at [admin@PDH Pro.com](mailto:admin@PDH Pro.com).





## Module 1: Design Fundamentals

### Learning Objectives

By the end of this section, you will be able to:

- **Identify** the specific pipeline materials and service fluids compatible with NACE ILI standards.
- **Evaluate** the applicability of the standard to various inspection tool configurations and pipeline facilities.
- **Select** the appropriate industry standards for personnel certification and ILI system qualification.

*Executive Summary:* This standard establishes a comprehensive framework for the in-line inspection (ILI) of carbon steel pipelines using industry-proven practices. It primarily governs free-swimming tools across a wide array of service fluids while integrating with specialized standards for personnel and system qualification.

### Scope and Applicability

The NACE standard for in-line inspection is designed for **carbon steel pipeline systems**. It addresses the complexities of transporting various substances, ensuring the service environment does not compromise the stability or function of the ILI tools.

### Compatible Service Fluids

- **Natural Gas and Liquefied Petroleum Gases (LPG).**
- **Hazardous Liquids**, including those containing **anhydrous ammonia** or **carbon dioxide**.
- **Water and Brine.**
- Other non-detrimental services.

### Tool and Facility Specifications

- **Free-Swimming Tools:** This standard is primarily applicable to **free-swimming ILI tools**.
- **Exclusions:** It is **not applicable** for tethered or remotely controlled inspection devices.
- **Line Pipe Specificity:** While specific to line pipe installed along a **right-of-way**, the general methodology is adaptable to other facilities.

### Adaptable Pipeline Facilities

- Hydrocarbon distribution and gathering systems.
- Water injection systems.
- Station piping.



- Isolated crossings (railroads, highways, or waterways).

### Regulatory and Industry Standard Integration

The successful execution of an ILI project requires adherence to broader qualification standards for both the workforce and the technology used.

**Personnel Qualification (ANSI/ASNT ILI-PQ):** This standard establishes the **minimum requirements** for the qualification and certification of ILI personnel. It ensures staff possess technical knowledge regarding:

- ILI principles and technologies.
- Field operations.
- Regulatory requirements and industry standards.

**System Qualification (API 1163):** This serves as an **umbrella document** covering the performance-based requirements for ILI systems used onshore and offshore.

Feature	Standard Reference	Focus Area
Personnel	ANSI/ASNT ILI-PQ	Certification and technical knowledge.
Systems	API 1163	Qualification of procedures, equipment, and software.
Assessment	NACE Standard	Industry-proven practices and recommendations.

**⚠ Safety Constraint:** Users must confirm that the pipeline service fluid is not detrimental to the function and stability of the selected ILI tool before beginning operations.

**💡 Design Tip:** Although the standard excludes tethered devices, engineers should refer to API 1163 for requirements regarding the qualification of tethered systems for metal loss and crack detection.

---

*Checkpoint Quiz*

---

**1. Which of the following pipeline materials is specifically addressed by the NACE standard for ILI?**

- a) High-density polyethylene (HDPE)
- b) Carbon steel
- c) Stainless steel
- d) Cast iron

**Answer:** (b). The standard explicitly states it is applicable to carbon steel pipeline systems.



**2. A Professional Engineer is planning an inspection for a remotely controlled inspection device.**

**Does this NACE standard apply?**

- a) Yes, it covers all ILLI devices.
- b) Yes, provided the pipeline is carbon steel.
- c) No, it is not applicable to remotely controlled devices.
- d) Only if the pipeline is offshore.

**Answer:** (c). The standard is primarily for free-swimming tools and specifically excludes tethered or remotely controlled devices.



## Module 2: Technical Definitions

### Learning Objectives

By the end of this section, you will be able to:

- **Distinguish** between anomalies, imperfections, and defects using physical examination criteria.
- **Identify** various types of pipeline pigs and their specific utility in cleaning, dimensioning, and inspection.
- **Evaluate** technical sensing technologies, including Magnetic Flux Leakage (MFL) and Ultrasonic Testing (UT), for pipeline assessment.

*Executive Summary:* Precise technical terminology is the foundation of pipeline integrity management. This section defines the physical features, sensing technologies, and infrastructure components essential for standardizing communication between operators, vendors, and regulators.

### Integrity Assessment Terminology

Pipeline integrity depends on a clear hierarchy of findings, moving from initial detection to physical verification.

- **Indication:** A signal from an in-line inspection system. It may be further classified as an anomaly, imperfection, or component.
- **Anomaly:** An unexamined deviation from the norm in pipe material, coatings, or welds.
- **Imperfection:** An anomaly with characteristics that do **not** exceed acceptable limits.
- **Defect:** A physically examined anomaly with dimensions or characteristics that **exceed** acceptable limits.

### Examination and Evaluation

- **Examination:** A direct physical inspection of a pipeline or anomaly by a person, often utilizing NDT techniques.
- **Evaluation:** A review process following characterization to determine if an anomaly meets specified acceptance or rejection criteria.
- **Data Analysis:** The evaluation process through which indications are classified and characterized.

### Pipeline Infrastructure and Components

Pipeline systems consist of more than just line pipe; they include various attachments and specialized facilities for maintenance.

- **Pipeline System:** All portions of physical facilities through which product moves, including compressor units, metering stations, and tanks.



- **Component:** Any physical part of the pipeline other than line pipe, such as valves, welds, tees, and flanges.
- **Appurtenance:** A component attached to the pipeline, such as a valve, casing, or instrument connection.
- **Pup Joint:** A short piece of pipe, typically **3 m (10 ft)** or less in length.

### Launching and Receiving Facilities

- **Trap:** A generic term for a pipeline facility designed for launching or receiving tools and pigs.
- **Launcher:** A device used to insert an ILI tool into a pressurized pipeline.
- **Receiver:** A facility used for removing a pig from a pressurized pipeline.
- **Kicker Line:** Piping and valving that connects the pressurizing pipeline to the launcher or receiver.

### Tool and Technology Definitions

#### Pig Classifications

- **Pig:** A generic term for any independent, self-contained, or tethered device moving through a pipeline for inspecting, dimensioning, or cleaning.
- **Cleaning Pig:** A utility pig using cups, discs, or brushes to remove debris and increase operating efficiency.
- **Gauging Pig:** A pig mounted with flexible metal plates to gauge the internal diameter and identify bore restrictions.
- **Caliper Pig (Geometry Tool):** Designed to record geometric conditions like buckles, dents, ovality, and bend radius.
- **In-Line Inspection (ILI) Tool:** A device (intelligent or smart pig) that uses nondestructive testing (NDT) to inspect from the inside.

#### Inspection Technologies

- **Magnetic Flux Leakage (MFL):** An ILI technology where a magnetic field is induced in the pipe wall; the leakage pattern detects and characterizes anomalies.
- **Ultrasonic Testing (UT):** An inspection technology that uses ultrasound to inspect the pipe.
- **Shear Wave:** A technique generating ultrasonic pulses in the pipe wall at approximately a **45° angle** to detect radial-oriented, surface-breaking cracks.



Purchase this course to  
see the remainder of  
the technical materials.