

Assurance Of Hazardous Liquid Pipeline System Integrity

API RECOMMENDED PRACTICE 1129
FIRST EDITION, AUGUST 1996



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Manufacturing, Distribution and Marketing Department

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Assurance Of Hazardous Liquid Pipeline System Integrity

SECTION 1—GENERAL

1.1 Scope and Purpose

This recommended practice is a basic guide and information resource for activities to assist in providing increased assurance of a pipeline system's integrity. It covers design and construction considerations; system monitoring and controls; corrosion controls; inspections, reviews and audits; and damage prevention. The purpose of this recommended practice is twofold: to compile a wide base of current industry experience, knowledge, information, and management practices into a cohesive document comprising a range of best practices and to assist pipeline operators in increasing the integrity of their pipeline systems.

The facilities covered by this recommended practice include pipelines and pipeline segments, pumping stations, metering facilities, tankage facilities, and other facilities that may be integral to the operation of a hazardous liquid pipeline.

Information is presented in this recommended practice in the form of recommendations (designated by the use of the word "should") and in the form of mandates (designated by the use of the word "shall"). This recommended practice incorporates by reference a number of other standards, as well as the requirements set forth in 49 *Code of Federal Regulations (CFR)* 195 and other recommended practices. The distinctions in the referenced documents are not changed by the nature of their reference in this recommended practice.

It is the intent that this recommended practice supplement the minimum requirements of DOT 49 *CFR* 195 where applicable and be applied to those facilities outside the scope of these regulations as well.

Some monitoring, reporting, testing, and inspection intervals referenced in 49 *CFR* 195 as establishing requirements may not necessarily be justified on a risk assessment analysis.

1.2 Definitions

1.2.1 bond or continuity bond: A metallic connection that provides electrical continuity.

1.2.2 carrier pipe: A steel pipe for transporting gas or liquids.

1.2.3 cased pipeline or cased pipe: A carrier pipe inside a casing that typically crosses beneath a railroad, roadway, berm, or dike.

1.2.4 casing: A conduit through which the carrier pipe may be placed.

1.2.5 cathodic protection: The prevention or mitigation of corrosion by making the pipeline a cathode by means of an impressed direct current or attachment of a galvanic anode.

1.2.6 certification: Documentation of an individual's qualification.

1.2.7 code: A standard or system of principles or rules developed to meet national industry or regulatory standards which assure the protection of the general public and the environment and which follow sound engineering practices.

1.2.8 commodity: The material being transported through a pipeline.

1.2.9 component: A general term for any item that is part of a pipeline other than straight pipe or field bend.

1.2.10 corrosion: The deterioration of a material, usually a metal, due to a chemical or electrochemical reaction with its environment.

1.2.11 corrosion inhibitor: A chemical compound, either organic or inorganic, which when added to the commodity in the proper concentration, controls or reduces internal corrosion of a pipeline system under most operating conditions.

1.2.12 deadlegs: Components of a piping system that normally have no significant flow under certain operating conditions. Examples include the following: lines with normally closed block valves, spare pump piping, drains, bleeders, instrument connections, stagnant control valve bypass piping and relief valve inlet.

1.2.13 defect: An imperfection of sufficient magnitude to warrant rejection based on the requirements of industry standards.

1.2.14 design pressure: The maximum pressure permitted as determined by the design and testing procedures applicable to the materials and locations involved.

1.2.15 dike liner: A system or device, such as a membrane, installed beneath the storage tank and throughout the containment area, that will contain any accidental release of product from the tank and prevent it from reaching the groundwater.

1.2.16 electrical isolation: The condition of being electrically separated from other metallic structures or the environment.

1.2.17 electrolyte: An ionic conductor usually mixed with water. The electrolyte is normally the soil in pipeline applications.

1.2.18 erosion: Deterioration of the surface occurring as the result of the abrasive action of moving fluids accelerated by the presence of solid particles or gas bubbles in suspension.

1.2.19 foreign structure: Any metallic structure that is not intended as part of the cathodic protection system of interest.

1.2.20 galvanic anode: A metal which, because of its relative position in the galvanic series, provides sacrificial protection to metals that are more noble in the series, when coupled in an electrolyte. These anodes are the source of current in one type of cathodic protection.

1.2.21 half-cell reference electrode: Another name for a reference electrode (normally copper/copper sulfate when used on land).

1.2.22 holiday: A discontinuity of coating that may expose the metal surface to the environment.

1.2.23 integrity: The state of a system which, when operating within its operating parameters or envelope, fulfills the design intent.

1.2.24 in-line tool (instrumented internal inspection device) or smart pig: One of a variety of instrumented tools using one or more physical or electromechanical principles for measuring and recording information (positioning and relative severity) in a pipeline.

1.2.25 interference bond: A metallic connection designed to control cathodic protection current interchange between pipeline components.

1.2.26 interference current or stray current: Current flowing through paths other than the intended circuit.

1.2.27 insulating flange: A flanged joint between adjacent lengths of pipe in which the nuts, bolts, and piping are electrically isolated from one or both of the flanges and the joining gasket is nonconducting so that an electrical barrier exists in the pipeline between the flange set.

1.2.28 job description: A specific definition of pertinent project details such as location, physical dimensions, construction/fabrication requirements and other information needed to fully delineate a particular project or function.

1.2.29 maximum allowable operating pressure (MAOP): The maximum pressure at which a pipeline or segment of a pipeline may be operated, as determined by applicable design codes and/or regulations to the particular pipe specification.

1.2.30 pigging: The operation of transporting a device or combination of devices (scraper, sphere, flexible or rigid materials (foam, plastic, etc.), instrumented tool, etc.) through a pipeline for the purpose of clearing, cleaning, sizing, separation, or anomaly measurement.

1.2.31 pipeline, in-service: A pipeline that is being used for the transportation of fluid.

1.2.32 pipeline, offshore: A pipeline laid under maritime waters and estuaries, below the high water mark.

1.2.33 pipeline, onshore: A pipeline laid on or in land whose surface is above high water mark, including those sections laid under inland waterways.

1.2.34 pipeline operator: The company or other entity which has responsibility for operating and maintaining the pipeline system.

1.2.35 pipe-to-soil potential (see structure-to-electrolyte voltage).

1.2.36 polarized potential: The electrical potential across the structure/electrolyte interface that is the sum of the corrosion potential and the cathodic polarization.

1.2.37 pipeline system: All parts of a pipeline facility through which a hazardous liquid or carbon dioxide moves in transportation, including, but not limited to, line pipe, valves, and other appurtenances connected to line pipe, pumping units, fabricated assemblies associated with pumping units, metering and delivery stations and fabricated assemblies therein, and breakout tanks.

1.2.38 rectifier: A device for converting alternating current to direct current for cathodic protection purposes.

1.2.39 risk (of failure): The product of the probability of an event occurring and the consequence of the event when it has occurred.

1.2.40 reference electrode: A device whose open circuit potential is constant under similar conditions of measurement.

1.2.41 SCADA: The Supervisory Control and Data Acquisition system to control and monitor pipeline systems.

1.2.42 shielding: The preventing or diverting of the cathodic protection current from its intended path.

1.2.43 shorted pipeline casing: A casing that has a metallic contact with the carrier pipe.

1.2.44 specification: A detailed, precise presentation of requirements for a particular activity or procedure, which may include material composition and properties and dimensional requirements of components.

1.2.45 standard: A document that establishes a system of general principles, specifies dimensions, methods and characteristics, defines terms and gives guidance.

1.2.46 stray current corrosion: Corrosion resulting from direct current flow through paths other than the intended circuit.

1.2.47 structure-to-electrolyte voltage (also structure-to-soil potential or pipe-to-soil potential): The voltage difference between a metallic structure and the electrolyte which is measured with a reference electrode in contact with the electrolyte.

1.2.48 test lead: An electrically conductive wire or cable attached to a structure and leading to a convenient location, used for the measurement of structure-to-electrolyte potentials or current measurements.

1.2.49 test pressure: The pressure specified or applied to the pipeline and its components on completion of manufacture and/or on completion of construction or requalification and reclassification to test for strength and integrity.

1.2.50 test station: A station that is used as a termination point for one or more test leads.

1.3 Referenced Publications

Unless otherwise specified, the most recent editions or revisions of the following standards, codes, and specifications shall, to the extent specified herein, form a part of this standard.

API

Spec 5L	<i>Specification for Line Pipe</i>
Spec 5L1	<i>Recommended Practice for Railroad Transportation of Line Pipe</i>
RP 5L8	<i>Recommended Practice for Inspection of Line Pipe</i>
RP 5LW	<i>Recommended Practice for Transportation of Line Pipe on Barges and Marine Vessels</i>
Spec 6D	<i>Specification for Pipeline Valves (Gate, Plug, Ball and Check Valves)</i>
Spec 6H	<i>Specification for End Closures, Connectors and Swivels</i>
Spec 11N	<i>Specification for Lease Automatic Custody Transfer Equipment</i>
RP 500	<i>Recommended Practice for Classification of Locations for Electrical Installations at Petroleum Facilities</i>
Std 541	<i>Form Wound Squirrel Cage Induction Motors—250 HP and Larger</i>
RP 574	<i>Inspection of Piping, Tubing, Valves, and Fittings</i>

Std 598	<i>Valve Inspection and Testing</i>
RP 610	<i>Centrifugal Pumps for Petroleum, Heavy Duty Chemicals, and Gas Industry Services</i>
Std 650	<i>Welded Steel Tanks for Oil Storage</i>
Std 620	<i>Design and Construction of Large, Welded, Low-Pressure Storage Tanks</i>
RP 651	<i>Cathodic Protection of Aboveground Petroleum Storage Tanks</i>
RP 652	<i>Lining of Aboveground Petroleum Storage Tank Bottoms</i>
Std 653	<i>Tank Inspection, Repair, Alteration, and Reconstruction</i>
RP 1102	<i>Steel Pipelines Crossing Railroads and Highways</i>
Std 1104	<i>Welding of Pipelines and Related Facilities</i>
RP 1107	<i>Pipeline Maintenance Welding Practices</i>
RP 1109	<i>Marking Liquid Petroleum Pipeline Facilities</i>
RP 1110	<i>Pressure Testing Liquid Pipelines</i>
RP 1111	<i>Design, Construction, Operation and Maintenance of Offshore Hydrocarbon Pipelines</i>
RP 1113	<i>Developing a Pipeline Supervisory Control Center</i>
RP 1114	<i>Design of Solution-mined Underground Storage Facilities</i>
RP 1115	<i>Operation of Solution-mined Underground Storage Facilities</i>
RP 1117	<i>Lowering In-service Pipelines</i>
RP 1119	<i>Training and Qualification of Liquid Pipeline Operators</i>
RP 1123	<i>Development of Public Awareness Programs by Hazardous Liquid Pipeline Operators</i>
RP 1130	<i>Computational Pipeline Monitoring</i>
Std 2510	<i>Design and Construction of LPG Installations</i>
Std 2610	<i>Design, Construction, Operation, Maintenance and Inspection of Terminal and Tank Facilities</i>
ACI International ¹	
318	<i>Building Code Requirements for Reinforced Concrete</i>
ASME ²	
B31	<i>Code for Pressure Piping</i>
B31G	<i>Manual for Determining the Remaining Strength of Corroded Pipelines</i>

¹ American Concrete Institute, 22400 West Seven Mile Road, P.O. Box 19150, Detroit, MI 48219.

B31.4	<i>Liquid Transportation Systems for Hydrocarbons, Liquid Petroleum Gas, Anhydrous Ammonia, and Alcohols</i>	RP0490	<i>Holiday Detection of Fusion-Bonded Epoxy External Pipeline Coatings of 10 to 30 mils (0.25 to 0.76 mm)</i>
B31.11	<i>Slurry Transportation Piping Systems Metals Handbook, Volume 13: "Corrosion"</i>	RP0274	<i>High-Voltage Electrical Inspection of Pipeline Coatings Prior to Installation</i>
AWWA ³		NAPCA ⁶	
ANSI/AWWA Standard C214	<i>Tape Coatings Systems for the Exterior of Steel Water Pipelines</i>	Bull 1-65-1	<i>NAPCA Specification—Designations for Coal Tar Enamel Coatings</i>
ANSI/AWWA Standard C215	<i>Extruded Polyolefin Coatings for the Exterior of Steel Water Pipelines</i>	NFPA ⁷	
DOT ⁴		30	<i>Flammable and Combustible Liquids Code</i>
49 CFR 40	<i>Procedures for Transportation Workplace Drug and Alcohol Testing Programs</i>	30A	<i>Automobile and Marine Service Station Code</i>
49 CFR 190	<i>Pipeline Safety Program Procedures</i>	70	<i>National Building Code</i>
49 CFR 194	<i>National Preparedness Guidelines</i>	SSPC ⁸	
49 CFR 195	<i>DOT Regulations for Transportation of Liquids by Pipeline</i>	SSPC-SP1	<i>Solvent Cleaning</i>
49 CFR 199	<i>Drug and Alcohol Testing</i>		
NACE International ⁵			
RP0572	<i>Design, Installation, Operation, and Maintenance of Impressed Current Deep Ground Beds</i>		
RP0175	<i>Control of Internal Corrosion in Steel Pipelines and Piping Systems</i>		
RP0675	<i>Control of External Corrosion on Off-shore Steel Pipelines</i>		
RP0286	<i>The Electrical Isolation of Cathodically Protected Pipelines</i>		
RP0188	<i>Discontinuity (Holiday) Testing of Protective Coatings</i>		
RP0169	<i>Control of External Corrosion on Underground or Submerged Metallic Piping Systems</i>		
10A192	<i>State-of-the-Art Report on Steel Cased Pipeline Practices</i>		

1.4 Abbreviations and Acronyms

ACI	American Concrete Institute
AISC	American Institute for Steel Construction
ANSI	American National Standards Institute
API	American Petroleum Institute
ASCE	American Society of Civil Engineers
ASME	American Society of Mechanical Engineers
AWWA	American Water Works Association
CFR	Code of Federal Regulations
CIS	Close Internal Survey
DOT	U.S. Department of Transportation
EPA	U.S. Environmental Protection Agency
MIC	Microbiological Influenced Corrosion
NACE	National Association of Corrosion Engineers
NDE	Non-Destructive Examination
RP	Recommended Practice
ROW	Right-of-Way
SCADA	Supervisory Control and Data Acquisition
Spec	API Specification
SSPC	Steel Structures Painting Council
Std	API Standard
UL	Underwriters Laboratories
USCG	United States Coast Guard

² American Society of Mechanical Engineers, East 47th Street, New York, NY 10017.

³ American Water Works Association, 6666 West Quincy Ave., Denver, CO 80235.

⁴ U.S. Department of Transportation, available from the U.S. Government Printing Office, Washington, D.C. 20402.

⁵ NACE International, 1440 South Creek Drive, P.O. Box 218340, Houston, TX 77218-8340.

⁶ National Association of Pipe Coating Applicators, 333 Texas St. Suite 800, Shreveport, LA 71101-3673.

⁷ National Fire Protection Association, 1 Batterymarch Park, Quincy, MA 02269.

⁸ Steel Structures Painting Council, 40 24th Street, Suite 600, Pittsburgh, PA 15222.