Recommended Practice for Classification of Locations for Electrical Installations at Petroleum Facilities Classified as Class I, Zone 0, Zone 1, and Zone 2

API RECOMMENDED PRACTICE 505
FIRST EDITION, NOVEMBER 1997

American Petroleum Institute

One of the most significant long-term trends affecting the future vitality of the petroleum industry is the public's concerns about the environment. Recognizing this trend, API member companies have developed a positive, forward looking strategy called STEP: Strategies for Today's Environmental Partnership. This program aims to address public concerns by improving industry's environmental, health and safety performance; documenting performance improvements; and communicating them to the public. The foundation of STEP is the API Environmental, Health and Safety Mission and Guiding Principles. API standards, by promoting the use of sound engineering and operational practices, are an important means of implementing API's STEP program.

API ENVIRONMENTAL, HEALTH AND SAFETY MISSION AND GUIDING PRINCIPLES

The members of the American Petroleum Institute are dedicated to continuous efforts to improve the compatibility of our operations with the environment while economically developing energy resources and supplying high quality products and services to consumers. We recognize our responsibility to work with the public, the government, and others to develop and to use natural resources in an environmentally sound manner while protecting the health and safety of our employees and the public. To meet these responsibilities, API members pledge to manage our businesses according to the following principles using sound science to prioritize risks and to implement cost-effective management practices:

- To recognize and to respond to community concerns about our raw materials, products and operations.
- To operate our plants and facilities and to handle our raw materials and products in a manner that protects the environment, and the safety and health of our employees and the public.
- To make safety, health and environmental considerations a priority in our planning, and our development of new products and processes.
- To advise promptly, appropriate officials, employees, customers and the public of information on significant industry-related safety, health and environmental hazards, and to recommend protective measures.
- To counsel customers, transporters and others in the safe use, transportation and disposal of our raw materials, products and waste materials.
- To economically develop and produce natural resources and to conserve those resources by using energy efficiently.
- To extend knowledge by conducting or supporting research on the safety, health and environmental effects of our raw materials, products, processes and waste materials.
- To commit to reduce overall emissions and waste generation.
- To work with others to resolve problems created by handling and disposal of hazardous substances from our operations.
- To participate with government and others in creating responsible laws, regulations and standards to safeguard the community, workplace and environment.
- To promote these principles and practices by sharing experiences and offering assistance to others who produce, handle, use, transport or dispose of similar raw materials, petroleum products and wastes.

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Exploration and Production Department
Manufacturing, Distribution and Marketing Department

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FOREWORD

This Recommended Practice is under the joint jurisdiction of the API Exploration and Production (E&P) Department Committee on Production Equipment Standards, the API Manufacturing Distribution and Marketing (MDM) Department, Committee on Refinery Equipment, and the Pipeline Operations Technical Committee. It is based upon a level of knowledge gained through experience and through the successful application of this practice in the refining, drilling and producing, and pipeline segments of the petroleum industry.

Recommended Practice 505 was prepared as a supplement to the 1996 Edition of the National Electrical Code (NEC) Article 505, with a scope limited to those petroleum facility locations classified as Class I, Zone 0, Zone 1, and Zone 2. Efforts were coordinated with the work of the ISA SP12 committee, which concurrently normalized the International Electrotechnical Commission (IEC) Standard 79-10 that addresses the zone area classification scheme in general. RP 505 will serve the petroleum industry, essentially as an supplement to both ISA 12.24.01 (IEC 79-10 Mod) and NEC Article 505. RP 500 is presently referenced by Article 500 of the NEC; it is anticipated that the 1999 NEC will also reference RP 505 in Article 505.

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Suggested revisions are invited and should be submitted to the Director of the Manufacturing, Distribution and Marketing Department, American Petroleum Institute, 1220 L Street, N.W., Washington, D.C. 20005.

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1.1 PURPOSE

1.1.1 The purpose of this recommended practice is to provide guidelines for classifying locations Class I, Zone 0, Zone 1, and Zone 2 locations at petroleum facilities for the selection and installation of electrical equipment. Basic definitions given in the 1996 edition of NFPA 70, the National Electrical Code (NEC), have been followed in developing this recommended practice. This publication is only a guide and requires the application of sound engineering judgment.

Note: Recommendations for determining the degree and extent of classified locations Class I, Division 1 and Division 2 are addressed in API RP 500, Recommended Practice for Classification of Electrical Installations at Petroleum Facilities Classified as Class I, Division 1 and Division 2.

1.1.2 Electrical installations in areas where flammable liquids, gases, or vapors are produced, processed, stored or otherwise handled can be suitably designed if the locations of potential sources of release and accumulation are clearly defined. Once a location has been classified, requirements for electrical equipment and associated wiring should be determined from applicable publications. Applicable publications may include NFPA 70 (NEC) or API RP 14F. Reference Section 2 for publications for other possible applications.

1.2 SCOPE

1.2.1 This document applies to the classification of locations for both temporarily and permanently installed electrical equipment. It is intended to be applied where there may be a risk of ignition due to the presence of flammable gas or vapor, mixed with air, under normal atmospheric conditions. Normal atmospheric conditions are defined as conditions that vary above and below reference levels of 101.3 kPa (14.7 psia) and 20°C (68°F) provided that the variations have a negligible effect on the explosion properties of the flammable materials.

The following items are beyond the scope of this document:

a. Piping systems used for odorized natural gas used as fuel for cooking, heating, air conditioning, laundry and similar appliances;
b. catastrophes such as well blowouts or process vessel ruptures. Such extreme events are not predictable and require emergency measures at the time of occurrence;
c. the suitability of locations for the placement of non-electrical equipment;
d. classification for locations containing combustible dust, ignitible fibers, or flyings;
e. installations underground in mines;
f. areas for the processing and manufacture of explosives; and,
g. areas where the presence of flammable mist may give rise to an unpredictable risk and that require special consideration.

1.2.2 Recommendations for determining the degree and extent of classified locations for specific examples of situations commonly encountered in petroleum facilities are given in Sections 8 through 14. While it is important for area classifications at refineries, production and drilling facilities, and pipeline facilities to agree to some extent, there are differences in production, drilling, transportation and refining facilities. Some differences include the process conditions, types and quantities of products handled, the physical size of typical facilities, and varying housing and sheltering practices.

1.2.3 Section 8 includes applications that are common to several of the facility types described in Sections 9 through 14.

1.2.4 Section 9 is applicable to locations in which flammable petroleum gases and vapors and volatile flammable liquids are processed, stored, loaded, unloaded, or otherwise handled in petroleum refineries.

1.2.5 Section 10 is applicable to locations surrounding oil and gas drilling and workover rigs and production facilities on land and on marine fixed (bottom-founded, non-floating) platforms where flammable petroleum gas and volatile liquids are produced, processed (for example, compressed), stored, transferred (for example, pumped), or otherwise handled prior to entering the transportation facilities.

1.2.6 Section 11 is applicable to locations on Mobile Offshore Drilling Units (MODUs).

1.2.7 Section 12 is applicable to locations surrounding oil and gas drilling and workover rigs and production facilities on floating production units (FPUs) such as, but not limited to, tension leg platforms (TLPs), floating production systems (FPSs), floating production systems with off-loading (FPSOs), single anchor leg mooring buoys (SALMs), caisson structures, spars, and other floating structures where flammable petroleum gas and volatile liquids are produced, processed (for example, compressed), stored, transferred (for example, pumped) or otherwise handled prior to entering the transportation facilities.

1.2.8 Section 13 is reserved for future use.

1.2.9 Section 14 is applicable to onshore and offshore facilities handling the delivery of flammable or combustible petroleum liquids or flammable gases. Pipeline facilities may

include pump and compressor stations, storage facilities, manifold areas, valve sites and pipeline right-of-way areas.

2 References

2.1 INDUSTRY CODES, GUIDES, AND STANDARDS

Various organizations have developed numerous codes, guides and standards that have substantial acceptance by industry and governmental bodies. Codes, guides, and standards useful in the classification of locations and in the design and installation of electrical systems are listed below. These references are not to be considered a part of this recommended practice except for those specifically referenced.

API

API RP 2G	*Recommended Practice for Production Facilities on Offshore Structures*
API RP 11S3	*Recommended Practice for Electric Submersible Pump Installations*
API RP 14C	*Recommended Practice for Analysis Design Installation and Testing of Basic Surface Safety Systems on Offshore Production Platforms*
API RP 14F	*Recommended Practice for Design and Installation of Electrical Systems for Offshore Production Platforms*
API RP 14G	*Recommended Practice for Fire Prevention and Control on Open Type Offshore Production Platforms*
API RP 500	*Recommended Practice for Classification of Locations for Electrtical Installations at Petroleum Facilities Classified as Class I, Division 1 and Division 2*
API RP 521	*Guide for Pressure-Relieving and Depressuring Systems*
API RP 540	*Recommended Practice for Electrical Installations in Petroleum Processing Plants*
API Pub 4322	*Fugitive Hydrocarbon Emissions from Petroleum Production Operations, Volume I and Volume II*
API Pub 4589	*Fugitive Hydrocarbon Emissions from Oil and Gas Production Operations*
API Pub 4615	*Emission Factors for Oil and Gas Production Operations*
API PSD 2216	*Ignition Risk of Hot Surfaces in the Open Air*

ABS[1]

Rules for Building and Classing Mobile Offshore Drilling Units

Rules for Building and Classing Steel Vessels

AGA[2]

XF0277 *Classification of Gas Utility Areas for Electrical Installations*

ANSI[3]

C2 *National Electrical Safety Code (NESC)*

ASHRAE[4]

ASHRAE Fundamentals Handbook

ASTM[5]

D-323-82 *Standard Test Method for Vapor Pressure Of Petroleum Products (Reid Method)*

CSA[6]

Hazardous Locations—Guide for the Design, Testing, Construction, and Installation of Equipment in Explosive Atmospheres, John A. Bossert

C22.1 *Canadian Electrical Code, Part I*

IEC[7]

IEC 50 (426)	(*1990), International Electrotechnical Vocabulary (IEV)—Chapter 426—Electrical apparatus for explosive atmospheres*
IEC 79-1A	*(1975-Amendment No. 1, 1993), Construction and verification tests of flameproof enclosures of electrical apparatus*
IEC 79-2	*(1983), Electrical apparatus for explosive gas atmospheres—Part 2: Electrical apparatus, type of protection "p"*
IEC 79-3	*(1990), Electrical apparatus for explosive gas atmospheres—Part 3: Spark-test apparatus for intrinsically-safe circuits*
IEC 79-4	(*1975), Electrical apparatus for explosive gas atmospheres—Part 4: Method of test for ignition temperature*
IEC 79-4A	(*1970), First supplement to IEC 79-4 (1966)*
IEC 79-10	*Electrical apparatus for explosive gas atmospheres—Part 10: Classifications of hazardous areas*
IEC 79-11	(*1991), Electrical apparatus for explosive gas atmospheres—Part 11: Intrinsic safety "i"*

[1]American Bureau of Shipping, Two World Trade Center, 106th Floor, New York, New York 10048.

[2]American Gas Association, 1515 Wilson Blvd., Arlington, VA 22209

[3]American National Standards Institute, 11 West 42 Street, New York, New York 10036.

[4]American Society of Heating, Refrigerating and Air Conditioning Engineers, Inc., 1791 Tullie Circle, NE, Atlanta, Georgia 30329.

[5]American Society of Testing and Materials, 100 Barr Harbor Drive, West Conshohocken, Pennsylvania 19428.

[6]Canadian Standards Association, 178 Rexdale Boulevard, Etobicoke (Toronto), Canada, M9W 1R3.

[7]International Electrotechnical Commission, 3 rue de Varembé, P.O. Box 131, 1211 Geneva 20, Switzerland