If you have any questions or comments regarding API standards, please visit https://www.api.org/standards.

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**INSPECTION OF REFINERY EQUIPMENT**

**API 510**
Pressure Vessel Inspection Code: In-Service Inspection, Rating, Repair, and Alteration
(includes Addendum 1 dated May 2017 and Addendum 2 dated March 2018)

Covers the in-service inspection, repair, alteration, and rerating activities for pressure vessels and the pressure-relieving devices protecting these vessels. This inspection code applies to all hydrocarbon and chemical process piping covered in this code but has lost its nameplate or stamping. Pages: 71

10th Edition | May 2014 | Product Number: C51010 | Price: $232.00

**API 510**
Pressure Vessel Inspection Code: In-Service Inspection, Rating, Repair, and Alteration—Chinese

Chinese translation of API 510.

10th Edition | May 2014 | Product Number: C51010C | Price: $163.00

**API 510**
Pressure Vessel Inspection Code: In-Service Inspection, Rating, Repair, and Alteration—Spanish

Spanish translation of API 510.

10th Edition | May 2014 | Product Number: C51010S | Price: $232.00

**API 570**
Piping Inspection Code: In-Service Inspection, Rating, Repair, and Alteration of Piping Systems
(includes Addendum 1 dated May 2017, Addendum 2 dated March 2018, and Errata dated April 2018)

Covers inspection, rating, repair, and alteration procedures for metallic and fiberglass reinforced plastic (FRP) piping systems and their associated pressure-relieving devices that have been placed in service. This inspection code applies to all hydrocarbon and chemical process piping covered in 1.2.1 that have been placed in service unless specifically designated as optional per 1.2.2. This publication does not cover inspection of specialty equipment including instrumentation, exchanger tubes, and control valves. However, this piping code could be used by owner/users in other industries and other services at their discretion. Process piping systems that have been retired from service and abandoned in place are no longer covered by this “in-service inspection” Code. However abandoned in place piping may still need some amount of inspection and/or risk mitigation to assure that it does not become a process safety hazard because of continuing deterioration. Process piping systems that are temporarily out of service but have been mothballed (preserved for potential future use) are still covered by this Code. Pages: 88

4th Edition | February 2016 | Product Number: C57004 | Price: $185.00

**RP 571**
Damage Mechanisms Affecting Fixed Equipment in the Refining Industry

Provides background information on damage that can occur to equipment in the refining process. It is intended to supplement Risk-Based Inspection (RP 580 and Publ 581) and Fitness-for-Service (API 579-1/ASME FFS-1) technologies developed in recent years by API to manage existing refining equipment integrity. It is also an excellent reference for inspection, operations, and maintenance personnel. This RP covers over 60 damage mechanisms. Each write-up consists of a general description of the damage, susceptible materials, construction, critical factors, inspection method selection guidelines, and control measures. Wherever possible, pictures are included and references are provided for each mechanism. In addition, generic process flow diagrams have been included that contain a summary of the major damage flow mechanism expected for typical refinery process units. Pages: 362

Product Number: C57102 | Price: $339.00

**RP 572**
Inspection Practices for Pressure Vessels

Supplements API 510 by providing pressure vessel inspectors with information that can improve skills and increase basic knowledge of inspection practices. This recommended practice (RP) describes inspection practices for the various types of pressure vessels (e.g. drums, heat exchangers, columns, reactors, air coolers, spheres) used in petroleum refineries and chemical plants. This RP addresses vessel components, inspection planning processes, inspection intervals, methods of inspection and assessment, methods of repair, records, and reports. API 510 has requirements and expectations for inspection of pressure vessels. Pages: 154

4th Edition | December 2016 | Product Number: C57204 | Price: $237.00

**RP 573**
Inspection of Fired Boilers and Heaters

Covers the inspection practices for fired boilers and process heaters (furnaces) used in petroleum refineries and petrochemical plants. The practices described in this document are focused to improve equipment reliability and plant safety by describing the operating variables which impact reliability and to ensure that inspection practices obtain the appropriate data, both on-stream and off-stream, to assess current and future performance of the equipment. Pages: 109

3rd Edition | October 2013 | Product Number: C57303 | Price: $155.00

**RP 574**
Inspection Practices for Piping System Components

Supplements API 570 by providing piping inspectors with information that can improve skill and increase basic knowledge of inspection practices. This recommended practice describes inspection practices for piping, tubing, valves (other than control valves), and fittings used in petroleum refineries and chemical plants. Common piping components, valve types, pipe joining methods, inspection planning processes, inspection intervals and techniques, and types of records are described to aid the inspectors in fulfilling their role implementing API 570. This publication does not cover inspection of specialty items, including instrumentation, furnace tubulars, and control valves. Pages: 113

4th Edition | November 2016 | Product Number: C57404 | Price: $216.00

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RP 575 ◆
Inspection Practices for Atmospheric and Low-Pressure Storage Tanks
Covers the inspection of atmospheric and low-pressure storage tanks that have been designed to operate at pressures from atmospheric to 15 psig. Includes reasons for inspection, frequency and methods of inspection, methods of repair, and preparation of records and reports. This recommended practice is intended to supplement Std 653, which covers the minimum requirements for maintaining the integrity of storage tanks after they have been placed in service. Pages: 96
3rd Edition | April 2014 | Product Number: C57503 | Price: $137.00

RP 576 ◆
Inspection of Pressure-Relieving Devices
Describes the inspection and repair practices for self-actuated pressure-relieving devices commonly used in the oil/gas and petrochemical industries. As a guide to the inspection and repair of these devices in the user’s plant, it is intended to ensure their proper performance. This publication covers self-actuated devices such as direct acting spring loaded valves, pilot operated pressure-relief valves, rupture disks, pin actuated devices, and weight-loaded pressure vacuum vents.

The recommendations in this publication are not intended to supersede requirements established by regulatory bodies. This publication excludes tank weak seams and/or sections or tank brittle hinges, explosion domes, fusible plugs, control valves, pressure regulating devices, integral rotating equipment components, other devices that either depend on an external source of power for operation or are manually operated or devices not designed to be inspected or recertified. Inspections and tests made at manufacturers’ plants, which are usually covered by codes or purchase specifications, are not covered by this publication.

This publication does not cover training requirements for personnel involved in the inspection and repair of pressure-relieving devices. Those seeking these requirements should see API 510/570, which gives the requirements for a quality control system and specifies that the repair organization maintain and document a training program ensuring that personnel are qualified. Pages: 80
4th Edition | April 2017 | Product Number: C57604 | Price: $216.00

RP 577 ◆
Welding Processes, Inspection, and Metallurgy
Provides guidance to the API authorized inspector on welding inspection as encountered with fabrication and repair of refinery and chemical plant equipment and piping. Common welding processes, welding procedures, welder qualifications, metallurgical effects from welding, and inspection techniques are described to aid the inspector in fulfilling their role implementing API 510, API 570, Std 653, and RP 582. The level of learning and training obtained from this document is not a replacement for the training and experience required to be an American Welding Society (AWS) Certified Welding Inspector (CWI). Pages: 145
2nd Edition | December 2013 | Product Number: C57702 | Price: $232.00

API 579-1/ASME FFS-1
Fitness-For-Service
Fitness-For-Service (FFS) assessments are quantitative engineering evaluations that are performed to demonstrate the structural integrity of an in-service component that may contain a flaw or damage or that may be operating under a specific condition that might cause a failure. This standard provides guidance for conducting FFS assessments using methodologies specifically prepared for pressurized equipment. The guidelines provided in this standard can be used to make run-repair-replace decisions to help determine if components in pressurized equipment containing flaws that have been identified by inspection can continue to operate safely for some period of time. These FFS assessments are currently recognized and referenced by the API Codes and Standards (510, 570, and 653), and by NB-23 as suitable means for evaluating the structural integrity of pressure vessels, piping systems, and storage tanks where inspection has revealed degradation and flaws in the equipment. The methods and procedures in this standard are intended to supplement and augment the requirements in API 510, API 570, Std 653, and other post-construction codes that reference FFS evaluations such as NB-23.

The assessment procedures in this standard can be used for FFS assessments and/or rerating of equipment designed and constructed to the following codes: (a) ASME BP&PV Code, Section VIII, Division 1; (b) ASME BP&PV Code, Section VIII, Division 2; (c) ASME BP&PV Code, Section I; (d) ASME B31.1 Piping Code; (e) ASME B31.3 Piping Code; (f) ASME B31.4 Piping Code; (g) ASME B31.8 Piping Code; (h) ASME B31.12 Piping Code; (i) Std 650; (j) Std 620; and (k) Std 530. The assessment procedures in this standard may also be applied to pressure-containing equipment constructed to other recognized codes and standards, including international and internal corporate standards.

This standard has broad applications since the assessment procedures are based on allowable stress methods and plastic collapse loads for non-crack-like flaws, and the Failure Assessment Diagram Approach for crack-like flaws. The FFS assessment procedures in this standard can be used to evaluate flaws commonly encountered in pressure vessels, piping, and tankage. The procedures are not intended to provide a definitive guideline for every possible situation that may be encountered. However, flexibility is provided to the user in the form of an advanced assessment level to handle uncommon situations that may require a more detailed analysis.

Copies may be purchased in hard copy, CD, or together for the prices listed below. Please note that the CD product is read-only and cannot be copied or printed. Pages: 1292
3rd Edition | June 2016 | Product Number: C57903
Hard Copy Only Price: $1,102.00
CD Only Price: $1,313.00
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◆ This publication is a new entry in this catalog.
◆ This publication is related to an API licensing, certification, or accreditation program.
API 579-2/ASME FFS-2
Fitness-For-Service Example Problem Manual

Fitness-For-Service (FFS) assessments in API 579-1/ASME FFS-1 are engineering evaluations that are performed to demonstrate the structural integrity of an in-service component that may contain a flaw or damage or that may be operating under specific conditions that could produce a failure. API 579-1/ASME FFS-1 provides guidance for conducting FFS assessments using methodologies specifically prepared for pressurized equipment. The guidelines provided in this standard may be used to make run-repair-replace decisions to help determine if pressurized equipment containing flaws that have been identified by inspection can continue to operate safely for some period of time. These FFS assessments of API 579-1/ASME FFS-1 are currently recognized and referenced by the API Codes and Standards (510, 570, and 653), and by NB-23 as a suitable means for evaluating the structural integrity of pressure vessels, piping systems, and storage tanks where inspection has revealed degradation and flaws in the equipment or where operating conditions suggest that a risk of failure may be present.

Example problems illustrating the use and calculations required for Fitness-For-Service assessments described in API 579-1/ASME FFS-1 are provided in this document. Example problems are provided for all calculation procedures in both SI and U.S. customary units.

An introduction to the example problems in this document is described in Part 2 of this standard. The remaining parts of this document contain the example problems. These parts in the document coincide with the parts in API 579-1/ASME FFS-1. For example, example problems illustrating calculations for local thin areas are provided in Part 5 of this document. This coincides with the assessment procedures for local thin areas contained in Part 5 of API 579-1/ASME FFS-1. Pages: 366

1st Edition | August 2009 | Product Number: C57921 | Price: $160.00

RP 580 ◆
Risk-Based Inspection

Provides users with the basic minimum and recommended elements for developing, implementing, and maintaining a risk-based inspection (RBI) program. It also provides guidance to owner-users, operators, and designers of pressure-containing equipment for developing and implementing an inspection program. These guidelines include means for assessing an inspection program and its plan. The approach emphasizes safe and reliable operation through risk-prioritized inspection. A spectrum of complementary risk analysis approaches (qualitative through fully quantitative) can be considered as part of the inspection planning process. RBI guideline issues covered include an introduction to the concepts and principles of RBI for risk management and individual sections that describe the steps in applying these principles within the framework of the RBI process. Pages: 94

3rd Edition | February 2016 | Product Number: C58003 | Price: $273.00

RP 581
Risk-Based Inspection Methodology

Provides quantitative procedures to establish an inspection program using risk-based methods for pressurized fixed equipment including pressure vessel, piping, tankage, pressure relief devices (PRDs), and heat exchanger tube bundles. RP 580 provides guidance for developing Risk-Based Inspection (RBI) programs on fixed equipment in refining, petrochemical, chemical process plants, and oil and gas production facilities. The intent is for RP 580 to introduce the principles and present minimum general guidelines for RBI while this recommended practice provides quantitative calculation methods to determine an inspection plan.

The calculation of risk outlined in API RP 581 involves the determination of a probability of failure (POF) combined with the consequence of failure (COF). Failure is defined as a loss of containment from the pressure boundary resulting in leakage to the atmosphere or rupture of a pressurized component. Risk increases as damage accumulates during in-service operation as the risk tolerance or risk target is approached and an inspection is recommended of sufficient effectiveness to better quantify the damage state of the component. The inspection action itself does not reduce the risk; however, it does reduce uncertainty and therefore allows more accurate quantification of the damage present in the component. Pages: 632

3rd Edition | April 2016 | Product Number: C58103 | Price: $891.00

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API Risk-Based Inspection Software

API RBI software, created by petroleum refinery and chemical plant owner/users for owner/users, finds its basis in API Publication 581, Base Resource Document—Risk-Based Inspection. Practical, valuable features are built into the technology, which is based on recognized and generally accepted good engineering practices.

The purposes of the Risk-Based Inspection Program are:
• screen operating units within a plant to identify areas of high risk;
• estimate a risk value associated with the operation of each equipment item in a refinery or chemical process plant based on a consistent methodology;
• prioritize the equipment based on the measured risk;
• design a highly effective inspection program; and
• systematically manage the risks associated with equipment failures.

The RBI method defines the risk of operating equipment as the combination of two separate terms: the consequence of failure and the likelihood of failure.

For more information: e-mail rbi@api.org or call 281-537-8848

RP 582
Welding Guidelines for the Chemical, Oil, and Gas Industries

Provides supplementary guidelines and practices for welding and welding related topics for shop and field fabrication, repair, and modification of the following:
• pressure-containing equipment, such as pressure vessels, heat exchangers, piping, heater tubes, and pressure boundaries of rotating equipment and attachments welded thereto;
• tanks and attachments welded thereto;
• non-removable internals for process equipment;
• structural items attached and related to process equipment;
• other equipment or component items, when referenced by an applicable purchase document.

This document is general in nature and augments the welding requirements of ASME BPVC Section IX and similar codes, standards, specifications, and practices, such as those listed in Section 2. The intent of this document is to be inclusive of chemical, oil, and gas industry standards, although there are many areas not covered herein, e.g. pipeline welding and offshore structural welding are intentionally not covered. This document is based on industry experience, and any restrictions or limitations may be waived or augmented by the purchaser.

Pages: 38

3rd Edition | May 2016 | Product Number: C58203 | Price: $141.00

RP 583 ◆
Corrosion Under Insulation and Fireproofing

Covers the design, maintenance, inspection, and mitigation practices to address external corrosion under insulation (CUI) and corrosion under fireproofing (CUF). The document discusses the external corrosion of carbon and low alloy steels under insulation and fireproofing, and external chloride stress corrosion cracking (ECSCC) of austenitic and duplex stainless steels under insulation. The document does not cover atmospheric corrosion or corrosion at uninsulated pipe supports, but does discuss corrosion at insulated pipe supports.

The purpose of this RP is to:
• help owner/users understand the complexity of the many CUI/CUF issues,
• provide owner/users with understanding the advantages and limitations of the various NDE methods used to identify CUI and CUF damage,
• provide owner/users with an approach to risk assessment (i.e. likelihood of failure, and consequence of failure) for CUI and CUF damage, and
• provide owner/users guidance on how to design, install, and maintain insulation systems to avoid CUI and CUF damage.

Pages: 88

1st Edition | May 2014 | Product Number: C58301 | Price: $175.00

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RP 584 ✷
Integrity Operating Windows

Explains the importance of IOWs for process safety management and to guide users in how to establish and implement an IOW program for refining and petrochemical process facilities for the express purpose of avoiding unexpected equipment degradation that could lead to loss of containment. It is not the intent of this document to provide a complete list of specific IOWs or operating variables that might need IOWs for the numerous types of hydrocarbon process units in the industry (though some generic examples are provided in the text and in Appendix A), but rather to provide the user with information and guidance on the work process for development and implementation of IOWs for each process unit. Pages: 35

1st Edition | May 2014 | Product Number: CS8401 | Price: $124.00

RP 585 ✷
Pressure Equipment Integrity Incident Investigation

Provides owner/operators with guidelines and recommended practices for developing, implementing, sustaining, and enhancing an investigation program for pressure equipment integrity incidents. This recommended practice describes characteristics of an effective investigation and how organizations can learn from pressure equipment integrity incident investigations. This RP is intended to supplement and provide additional guidance for the OSHA Process Safety Management (PSM) Standard 29 CFR 1910.119 (m) incident investigation requirements, with a specific focus on incidents caused by integrity failures of pressure equipment. Pages: 41

1st Edition | April 2014 | Product Number: CS5801 | Price: $129.00

Std 653 ✷
Tank Inspection, Repair, Alteration, and Reconstruction (includes Addendum 1 dated April 2018)

Covers steel storage tanks built to Std 650 and its predecessor Spec 12C. It provides minimum requirements for maintaining the integrity of such tanks after they have been placed in service and addresses inspection, repair, alteration, relocation, and reconstruction.

The scope is limited to the tank foundation, bottom, shell, structure, roof, attached appurtenances, and nozzles to the face of the first flange, first threaded joint, or first welding-end connection. Many of the design, welding, examination, and material requirements of Std 650 can be applied in the maintenance inspection, rating, repair, and alteration of in-service tanks. In the case of apparent conflicts between the requirements of this standard and Std 650 or its predecessor Spec 12C, this standard shall govern for tanks that have been placed in service.

This standard employs the principles of Std 650; however, storage tank owner/operators, based on consideration of specific construction and operating details, may apply this standard to any steel tank constructed in accordance with a tank specification.

This standard is intended for use by organizations that maintain or have access to engineering and inspection personnel technically trained and experienced in tank design, fabrication, repair, construction, and inspection.

This standard does not contain rules or guidelines to cover all the varied conditions which may occur in an existing tank. When design and construction details are not given, and are not available in the as-built standard, details that will provide a level of integrity equal to the level provided by the current edition of Std 650 must be used.

This standard recognizes fitness-for-service assessment concepts for evaluating in-service degradation of pressure containing components. API 579-1/ASME FFS-1, Fitness-For-Service, provides detailed assessment procedures or acceptance criteria for specific types of degradation referenced in this standard. When this standard does not provide specific evaluation procedures or acceptance criteria for a specific type of degradation or when this standard explicitly allows the use of fitness-for-service criteria, API 579-1/ASME FFS-1 may be used to evaluate the various types of degradation or test requirements addressed in this standard. Pages: 162


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Std 682
Pumps—Shaft Sealing Systems for Centrifugal and Rotary Pumps

Specifies requirements and gives recommendations for sealing systems for centrifugal and rotary pumps used in the petroleum, natural gas, and chemical industries. See A.1.1 and A.1.2. It is the responsibility of the purchaser or seal vendor to ensure that the selected seal and auxiliaries are suitable for the intended service condition. It is applicable mainly for hazardous, flammable, and/or toxic services where a greater degree of reliability is required for the improvement of equipment availability and the reduction of both emissions to the atmosphere and life-cycle sealing costs. It covers seals for pump shaft diameters from 20 mm (0.75 in.) to 110 mm (4.3 in.). This standard is also applicable to seal spare parts and can be referred to for the upgrading of existing equipment. A classification system for the seal configurations covered by this standard into categories, types, arrangements, and orientations is provided.

This standard is referenced normatively in Std 610. It is applicable to both new and retrofitted pumps and to pumps other than Std 610 pumps (e.g. ASME B73.1, ASME B73.2, and Std 676 pumps). This standard might also be referenced by other machinery standards such as other pumps, compressors, and agitators. Users are cautioned that this standard is not specifically written to address all of the potential applications that a purchaser may specify. This is especially true for the size envelope specified for Std 682 seals. The purchaser and seal vendor shall mutually agree on the features taken from this standard and used in the application. Pages: 256

4th Edition | May 2014 | Product Number: C68204 | Price: $263.00

Std 682 *
Pumps—Shaft Sealing Systems for Centrifugal and Rotary Pumps—Chinese

Chinese translation of Std 682.


RP 684

Describes, discusses, and clarifies the section of the API Standard Paragraphs that outline the complete lateral and torsional rotodynamics and rotor balancing acceptance program designed by API to ensure equipment mechanical reliability. Background material on the fundamentals of these subjects (including terminology) along with rotor modeling utilized in this analysis is presented for those unfamiliar with the subject. This document is an introduction to the major aspects of rotating equipment vibrations that are addressed during a typical lateral dynamics analysis. Pages: 303

2nd Edition | August 2005 | Reaffirmed: November 2010

Product Number: C68402 | Price: $181.00

Std 685
Sealless Centrifugal Pumps for Petroleum, Petrochemical, and Gas Industry Process Service

Specifies the minimum requirements for sealless centrifugal pumps for use in petroleum, heavy duty petrochemical and gas industry services. This standard is applicable to single stage overhung pumps of two classifications: magnetic drive pumps and canned motor pumps. Pages: 170

2nd Edition | February 2011 | Product Number: C68502 | Price: $212.00

RP 686
Recommended Practice for Machinery Installation and Installation Design

Provides recommended procedures, practices, and checklists for the installation and precommissioning of new, existing, and reapplied machinery and to assist with the installation design of such machinery for petroleum, chemical, and gas industry services facilities. In general, this RP is intended to supplement vendor instructions and the instructions provided by the original equipment manufacturer (OEM) should be carefully followed with regard to equipment installation and checkout. Most major topics of this RP are subdivided into sections of “Installation Design” and “Installation” with the intent being that each section can be removed and used as needed by the appropriate design or installation personnel. Pages: 254


Product Number: C68602 | Price: $193.00

RP 687
Rotor Repair

Covers the minimum requirements for the inspection and repair of special purpose rotating equipment rotors, bearings and couplings used in petroleum, chemical, and gas industry service. Pages: 540


Product Number: C68701 | Price: $275.00

RP 688
Pulsation and Vibration Control in Positive Displacement Machinery Systems for Petroleum, Petrochemical, and Natural Gas Industry Services

Provides guidance on the application of pulsation and vibration control requirements found in the API purchasing specifications for positive displacement machinery. The fundamentals of pulsation and piping system analysis are presented in Part 1. Part 2 deals specifically with reciprocating compressors and provides commentary regarding each paragraph of Section 7.9 of Std 618, 5th Edition. Pages 128

1st Edition | April 2012 | Product Number: C68801 | Price: $161.00

Std 689/ISO 14224:2006
Collection and Exchange of Reliability and Maintenance Data for Equipment

(ANSI/API Std 689)

Provides a comprehensive basis for the collection of reliability and maintenance (RM) data in a standard format for equipment in all facilities and operations within the petroleum, natural gas, and petrochemical industries during the operational life cycle of equipment. It describes data-collection principles and associated terms and definitions that constitute “reliability language” that can be useful for communicating operational experience. The failure modes defined in the normative part of this standard can be used as a “reliability thesaurus” for various quantitative as well as qualitative applications. This standard also describes data quality control and assurance practices to provide guidance for the user. Std 689 establishes requirements that any inhouse or commercially available RM data system is required to meet when designed for RM data exchange. Examples, guidelines, and principles for the exchange and merging of such RM data are addressed.

This edition of API Std 689 is the identical national adoption of ISO 14224:2006. Pages: 171


RP 691
Risk-Based Machinery Management

Defines the minimum requirements for the management of health, safety, and environmental (HSE) risks across the machinery life cycle. It shall be applied to the subset of operating-company- and/or vendor-defined high-risk machinery. Pages: 198

1st Edition | June 2017 | Product Number: C69101 | Price: $168.00

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EQUIPMENT DATASHEETS

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STORAGE TANKS

Impact of Gasoline Blended with Ethanol on the Long-Term Structural Integrity of Liquid Petroleum Storage Systems and Components

Summarizes the results of a literature review conducted for the American Petroleum Institute on the impact of gasoline blended with ethanol on the long-term structural integrity of liquid petroleum storage systems and components. It is anticipated that the use of ethanol in motor fuels will continue to increase. This has generated interest about the potential long-term structural effects of ethanol on liquid petroleum storage systems, including underground storage tanks (USTs), underground piping, and associated components. The objective of the literature review is to determine the state of industry knowledge and research on the effects of ethanol/gasoline blends on the long-term structural integrity of UST systems and components. This review is intended to assist decision-makers on further research requirements and needed changes or supplements to existing standards for underground storage system components used for storing and dispensing gasoline blended with ethanol. Appendix A may be purchased separately as an electronic database file. The database synopsis' and bibliographic information for all articles reviewed for the project. The report is organized by article index number. Reference numbers cited in this report refer to the article index number. Pages: 25

16th Edition | November 2014
Product Number: G12D116 | Price: $124.00

Spec 12B

Specification for Bolted Tanks for Storage of Production Liquids

Covers material, design, fabrication, and testing requirements for vertical, cylindrical, aboveground, closed and open top, bolted steel storage tanks in various standard sizes and capacities for internal pressures approximately atmospheric. This specification is designed to provide the oil production industry with tanks of adequate safety and reasonable economy for use in the storage of crude petroleum and other liquids commonly handled and stored by the production segment of the industry. This specification is for the convenience of purchasers and manufacturers in ordering and fabricating tanks. Pages: 29

12th Edition | October 2008 | Effective Date: April 1, 2009
Product Number: G12F12C | Price: $100.00

Spec 12D

Specification for Field-Welded Tanks for Storage of Production Liquids

Covers material, design, fabrication, and testing requirements for vertical, cylindrical, aboveground, closed top, welded steel storage tanks with internal pressures approximately atmospheric at various sizes and capacities ranging from 500 to 10,000 barrels. This specification is designed to provide the oil production industry with tanks of adequate safety and reasonable economy for use in the storage of crude petroleum and other liquids commonly handled and stored by the production segment of the industry. This specification is for the convenience of purchasers and manufacturers in ordering and fabricating tanks. Pages: 29

12th Edition | June 2017 | Effective Date: December 1, 2017
Product Number: G12D12 | Price: $111.00

Spec 12F

Specification for Shop Welded Tanks for Storage of Production Liquids

Covers material, design, fabrication, and testing requirements for shop-fabricated vertical, cylindrical, aboveground, closed top, welded steel storage tanks with internal pressures approximately atmospheric at various sizes and capacities ranging from 90 to 750 barrels. Tanks covered by this specification have been designed using established engineering calculations to determine minimum metal thickness and bolting specifications for each size tank filled with water. This specification is designed to provide the oil production industry with tanks of adequate safety and reasonable economy for use in the storage of crude petroleum and other liquids commonly handled and stored by the production segment of the industry. Pages: 25

2-Year Extension: November 2015
Product Number: G12F12 | Price: $100.00

Spec 12F *

Specification for Shop Welded Tanks for Storage of Production Liquids—Chinese

Chinese translation of Spec 12F.

12th Edition | October 2008 | Product Number: G12F12C | Price: $70.00

* These translated versions are provided for the convenience of our customers and are not officially endorsed by API. The translated versions shall neither replace nor supersede the English-language versions, which remain the official standards. API shall not be responsible for any discrepancies or interpretations of these translations. Translations may not include any addenda or errata to the document. Please check the English-language versions for any updates to the documents.
This standard is applicable to tanks that (a) hold or store liquids with gases or vapors above their surface or (b) hold or store gases or vapors alone. These rules do not apply to lift-type gas holders.

Although the rules in this standard do not cover horizontal tanks, they are not intended to preclude the application of appropriate portions to the design and construction of horizontal tanks designed in accordance with good engineering practice. Pages: 288

12th Edition | October 2013 | Product Number: C62012 | Price: $448.00

Std 620 *
Design and Construction of Large, Welded, Low-Pressure Storage Tanks—Chinese
Chinese translation of Std 620.

12th Edition | October 2013 | Product Number: C62012C | Price: $314.00

Std 625
Tank Systems for Refrigerated Liquefied Gas Storage
(includes Addendum 1 dated July 2013, Addendum 2 dated November 2014, and Addendum 3 dated June 2018)

Covers low pressure, aboveground, vertical, and cylindrical tank systems storing liquefied gases requiring refrigeration. This standard provides general requirements on responsibilities, selection of storage concept, performance criteria, accessories/appurtenances, quality assurance, insulation, and commissioning of tank systems. Included are tank systems having a storage capacity of 800 cubic meters (5000 bbls) and larger. Stored product shall be liquids which are in a gaseous state at ambient temperature and pressure and require refrigeration to less than 5 °C (40 °F) to maintain a liquid phase. Also covered are tank systems with a minimum design temperature of –198 °C (–325 °F), a maximum design internal pressure of 50 kPa (7 psig), and a maximum design uniform external pressure of 1.75 kPa (0.25 psig).

Tank system configurations covered consist of a primary liquid and vapor containment constructed of metal, concrete, or a metal/concrete combination and, when required, a secondary liquid containment. Pages: 63

1st Edition | August 2010 | Product Number: C62501 | Price: $239.00

Std 650 *
Welded Tanks for Oil Storage
(includes Errata 1 dated July 2013, Addendum 1 dated September 2014, Errata 2 dated December 2014, Addendum 2 dated January 2016, and Addendum 3 dated August 2018)

Establishes minimum requirements for material, design, fabrication, erection, and testing for vertical, cylindrical, aboveground, closed- and open-top, welded carbon, or stainless steel storage tanks in various sizes and capacities for internal pressures approximating atmospheric pressure (internal pressures not exceeding the weight of the roof plates), but a higher internal pressure is permitted when addition requirements are met. This standard applies only to tanks whose entire bottom is uniformly supported and to tanks in non-refrigerated service that have a maximum design temperature of 93 °C (200 °F) or less. Pages: 498

12th Edition | March 2013 | Product Number: C65012 | Price: $489.00

Std 650 *
Welded Tanks for Oil Storage—Chinese
Chinese translation of Std 650.

12th Edition | March 2013 | Product Number: C65012C | Price: $343.00

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RP 651 Cathodic Protection of Aboveground Petroleum Storage Tanks

Presents procedures and practices for achieving effective corrosion control on aboveground storage tank bottoms through the use of cathodic protection. This RP contains provisions for the application of cathodic protection to existing and new aboveground storage tanks. Corrosion control methods based on chemical control of the environment or the use of protective coatings are not covered in detail.

When cathodic protection is used for aboveground storage tank applications, it is the intent of this RP to provide information and guidance specific to aboveground metallic storage tanks in hydrocarbon service. Certain practices recommended herein may also be applicable to tanks in other services. It is intended to serve only as a guide to persons interested in cathodic protection. Specific cathodic protection designs are not provided. Such designs should be developed by a person thoroughly familiar with cathodic protection practices for aboveground petroleum storage tanks.

This RP does not designate specific practices for every situation because the varied conditions in which tank bottoms are installed preclude designs should be developed by a person thoroughly familiar with cathodic protection practices for aboveground petroleum storage tanks.

This RP does not designate specific practices for every situation because the varied conditions in which tank bottoms are installed preclude standardization of cathodic protection practices. Pages: 46

4th Edition | September 2014 | Product Number: C65104 | Price: $129.00

RP 651 * Cathodic Protection of Aboveground Petroleum Storage Tanks—Chinese

Chinese translation of RP 651.

4th Edition | September 2014 | Product Number: C65104C | Price: $91.00

RP 652 Linings of Aboveground Petroleum Storage Tank Bottoms (includes Errata 1 dated August 2016)

Provides guidance on achieving effective corrosion control by the application of tank bottom linings in aboveground storage tanks in hydrocarbon service. It contains information pertinent to the selection of lining materials, surface preparation, lining application, cure, and inspection of tank bottom linings for existing and new storage tanks. In many cases, tank bottom linings have proven to be an effective method of preventing internal corrosion of steel tank bottoms.

Provides information and guidance specific to aboveground steel storage tanks in hydrocarbon service. Certain practices recommended herein may also be applicable to tanks in other services. This recommended practice is intended to serve only as a guide and detailed tank bottom lining specifications are not included.

This recommended practice does not designate specific tank bottom lining specifications for every situation because of the wide variety of service environments. Pages: 24

4th Edition | September 2014 | Product Number: C65104C | Price: $134.00

RP 652 * Linings of Aboveground Petroleum Storage Tank Bottoms—Chinese

Chinese translation of RP 652.

4th Edition | September 2014 | Product Number: C65104C | Price: $94.00

Std 653 Tank Inspection, Repair, Alteration, and Reconstruction (includes Addendum 1 dated April 2018)

Covers steel storage tanks built to Std 650 and its predecessor Spec 12C. It provides minimum requirements for maintaining the integrity of such tanks after they have been placed in service and addresses inspection, repair, alteration, relocation, and reconstruction.

The scope is limited to the tank foundation, bottom, shell, structure, roof, attached appurtenances, and nozzles to the face of the first flange, first threaded joint, or first welding-end connection. Many of the design, welding, examination, and material requirements of Std 650 can be applied in the maintenance inspection, rating, repair, and alteration of in-service tanks. In the case of apparent conflicts between the requirements of this standard and Std 650 or its predecessor Spec 12C, this standard shall govern for tanks that have been placed in service.

This standard employs the principles of Std 650; however, storage tank owner/operators, based on consideration of specific construction and operating details, may apply this standard to any steel tank constructed in accordance with a tank specification.

This standard is intended for use by organizations that maintain or have access to engineering and inspection personnel trained and experienced in tank design, fabrication, repair, construction, and inspection.

This standard does not contain rules or guidelines to cover all the varied conditions which may occur in an existing tank. When design and construction details are not given, and are not available in the as-built standard, details that will provide a level of integrity equal to the level provided by the current edition of Std 650 must be used.

This standard recognizes fitness-for-service assessment concepts for evaluating in-service degradation of pressure containing components. API 579-1/ASME FFS-1, Fitness-For-Service, provides detailed assessment procedures or acceptance criteria for specific types of degradation referenced in this standard. When this standard does not provide specific evaluation procedures or acceptance criteria for a specific type of degradation or when this standard explicitly allows the use of fitness-for-service criteria, API 579-1/ASME FFS-1 may be used to evaluate the various types of degradation or test requirements addressed in this standard. Pages: 162


Std 653 * Tank Inspection, Repair, Alteration, and Reconstruction—Chinese

Chinese translation of Std 653.

5th Edition | November 2014 | Product Number: C65305C | Price: $170.00

Publ 937 Evaluation of Design Criteria for Storage Tanks with Frangible Roof Joints

Describes research that evaluated the ability of the present Std 650 tank design criteria to ensure the desired frangible joint behavior. Particular questions include:

- evaluation of the area inequality as a method to predict the buckling response of the compression ring,
- effect of roof slope, tank diameter, and weld size on the frangible joint, and
- effect of the relative strength of the roof-to-shell joint compared to the shell-to-bottom joint. Pages: 73

1st Edition | April 1996 | Product Number: C93701 | Price: $139.00

Publ 937-A Study to Establish Relations for the Relative Strength of API 650 Cone Roof, Roof-to-Shell and Shell-to-Bottom Joints

Investigates the relative strengths of the roof-to-shell and shell-to-bottom joints, with the goal of providing suggestions for frangible roof design criteria applicable to smaller tanks. Pages: 68

1st Edition | August 2005 | Product Number: C937A0 | Price: $126.00

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Refriging

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Online Orders: global.ihs.com

TR 939-D
Stress Corrosion Cracking of Carbon Steel in Fuel Grade Ethanol—Review, Experience Survey, Field Monitoring, and Laboratory Testing (includes Addendum 1 dated October 2013)
Addresses stress corrosion cracking (SCC) in carbon steel equipment used in distribution, transportation, storage, and blending of denatured fuel ethanol. API, with assistance from the Renewable Fuels Association (RFA), conducted research on the potential for metal cracking and product leakage in certain portions of the fuel ethanol distribution system. TR 939-D contains a review of existing literature, results of an industry survey on cracking events and corrosion field monitoring, and information on mitigation and prevention. Pages: 172

2nd Edition | May 2007 | Product Number: C939D0 | Price: $165.00

Std 2015 ◆
Requirements for Safe Entry and Cleaning of Petroleum Storage Tanks
Applicable to stationary atmospheric and low-pressure (up to and including 15 psig) aboveground petroleum storage tanks used in all sectors of the petroleum and petrochemical industry, including crude oil and gas production; refining; petrochemicals; pipelines and terminals; bulk storage; and ethanol facilities. This standard provides requirements for safety planning, coordinating, and conducting tank entry and cleaning operations, from removal from service through return to service. Pages: 146

8th Edition | January 2018 | Product Number: K20158 | Price: $204.00

RP 2026 ◆
Safe Access/Egress Involving Floating Roofs of Storage Tanks in Petroleum Service
Provides information to enable safe access/egress involving floating roofs of storage tanks used in petroleum service and identifies common hazards and potentially hazardous conditions associated with these activities. The objective of this recommended practice (RP) is to establish general precautionary measures appropriate for individual situations. It provides the appropriate precautions for preventing accidents and injuries. This RP is intended primarily for those persons who are required to perform inspections, service, maintenance, and/or repair activities that involve descent onto floating roofs of in-service petroleum tanks.

This RP does not cover general considerations that apply to climbing onto petroleum storage tanks and other structures. Pages: 28

3rd Edition | June 2017 | Product Number: K20263 | Price: $94.00

RP 2027 ◆
Ignition Hazards and Safe Work Practices for Abrasive Blasting of Atmospheric Storage Tanks in Hydrocarbon Service
Provides safe work practices for the prevention and control of vapor, ignition, and other potential hazards during abrasive blasting of aboveground storage tanks in liquid hydrocarbon service at atmospheric pressure. It also provides assistance to employers in developing operating procedures that provide for hazard recognition to significantly reduce ignition risks during abrasive blasting of hydrocarbon storage tanks in service that may contain or have the potential to develop a flammable atmosphere in the vapor space. This RP applies to safe work practices required for abrasive blasting of exterior shells and exterior roofs of all aboveground atmospheric storage tanks in liquid hydrocarbon service. It also applies to safe work practices for abrasive blasting conducted on the roofs and inner portions of the exposed surfaces of shells (that portion of the shell above the roof level) on open-top (external) floating roof tanks. This RP also covers recognition and control of ignition hazards that are specific to and may be present during abrasive blasting of aboveground storage tanks in liquid hydrocarbon service at atmospheric pressure. The ignition sources covered in this RP include static electricity, internal combustion engines, electric motors, friction sparks, hot metal surfaces, and external-to-the-work ignition sources. Pages: 27

4th Edition | November 2018 | Product Number: C20274 | Price: $125.00

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PRESSURE-RELIEVING SYSTEMS FOR REFINERY SERVICE

Std 520, Part I
Sizing, Selection, and Installation of Pressure-Relieving Devices—Part I—Sizing and Selection

Applies to the sizing and selection of pressure relief devices used in refineries and related industries for equipment that has a maximum allowable working pressure of 15 psig (103 kPag) or greater. The pressure relief devices covered in this standard are intended to protect unfired vessels and related equipment against overpressure from operating and fire contingencies.

This standard includes basic definitions and information about the operational characteristics and applications of various pressure relief devices. It also includes sizing procedures and methods based on steady state flow of Newtonian fluids. Atmospheric and low-pressure storage tanks covered in Std 2000 and pressure vessels used for the transportation of products in bulk or shipping containers are not within the scope of this standard. See Std 521 for information about appropriate ways of reducing pressure and restricting heat input. The rules for overpressure protection of fired vessels are provided in ASME Section I and ASME B31.1 and are not within the scope of this standard. Pages: 143


Std 520, Part I *
Sizing, Selection, and Installation of Pressure-Relieving Devices—Part I—Sizing and Selection—Russian

Russian translation of Std 520, Part I.


RP 520, Part II
Sizing, Selection, and Installation of Pressure-Relieving Devices—Part II—Installation

Covers the methods of installation for pressure relief devices for equipment that has a maximum allowable working pressure (MAWP) of 15 psig (1.03 bar g) or greater. Pressure relief valves or rupture disks may be used independently or in combination with each other to provide the required protection against excessive pressure accumulation. The term “pressure relief valve” includes safety relief valves used in either compressible or incompressible fluid service, and relief valves used in incompressible fluid service. Covers gas, vapor, steam, and incompressible fluid service. Pages: 5


Std 521
Pressure-Relieving and Depressing Systems

Applies to pressure-relieving and vapor depressuring systems. Although intended for use primarily in oil refineries, it is also applicable to petrochemical facilities, gas plants, liquefied natural gas (LNG) facilities, and oil and gas production facilities. The information provided is designed to aid in the selection of the system that is most appropriate for the risks and circumstances involved in various installations. This standard specifies requirements and gives guidelines for the following:

- examining the principal causes of overpressure;
- determining individual relieving rates;
- selecting and designing disposal systems, including such component parts as piping, vessels, flares, and vent stacks.

This standard does not apply to direct-fired steam boilers. Pages: 248


Std 526
Flanged Steel Pressure-Relief Valves (includes Errata 1 dated September 2018)

Purchase specification for flanged steel pressure-relief valves. Basic requirements are given for direct spring-loaded pressure-relief valves and pilot-operated pressure-relief valves as follows:

- orifice designation and area;
- valve size and pressure rating, inlet and outlet;
- materials;
- pressure-temperature limits;
- center-to-face dimensions, inlet and outlet.

Nameplate nomenclature and requirements for stamping are detailed in Annex A. Pages: 53

7th Edition | September 2017 | Product Number: C52607 | Price: $216.00

Std 527
Seat Tightness of Pressure Relief Valves

Describes methods of determining the seat tightness of metal- and soft-seated pressure relief valves, including those of conventional, bellows, and pilot-operated designs.

The maximum acceptable leakage rates are defined for pressure relief valves with set pressures from 103 kPa gauge (15 psig) to 41,379 kPa gauge (6,000 psig). If greater seat tightness is required, the purchaser shall specify it in the purchase order.

The test medium for determining the seat tightness—air, steam, or water—shall be the same as that used for determining the set pressure of the valve. For dual-service valves, the test medium—air, steam, or water—shall be the same as the primary relieving medium.

To ensure safety, the procedures outlined in this standard shall be performed by persons experienced in the use and functions of pressure relief valves. Pages: 5


RP 576 ◆
Inspection of Pressure-Relieving Devices

Describes the inspection and repair practices for self-actuated pressure-relieving devices commonly used in the oil/gas and petrochemical industries. As a guide to the inspection and repair of these devices in the user’s plant, it is intended to ensure their proper performance. This publication covers self-actuated devices such as direct acting spring loaded valves, pilot operated pressure-relief valves, rupture disks, pin actuated devices, and weight-loaded pressure vacuum vents.

The recommendations in this publication are not intended to supersede requirements established by regulatory bodies. This publication excludes tank weak seams and/or sections or tank thief hatches, explosion doors, fusible plugs, control valves, pressure regulating devices, integral rotating equipment components, other devices that either depend on an external source of power for operation or are manually operated or devices not designed to be inspected or recertified. Inspections and tests made at manufacturers’ plants, which are usually covered by codes or purchase specifications, are not covered by this publication.

This publication does not cover training requirements for personnel involved in the inspection and repair of pressure-relieving devices. Those seeking these requirements should see API 510/570, which gives the requirements for a quality control system and specifies that the repair organization maintain and document a training program ensuring that personnel are qualified. Pages: 80

4th Edition | April 2017 | Product Number: C57604 | Price: $216.00

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This International Standard does not apply to external floating-roof tanks.

Judgment whenever this International Standard is applied to other liquids.

Vacuum; determination of venting requirements; means of venting; selection, installation of venting devices; and testing and marking of relief devices.

This International Standard is intended for tanks containing petroleum and petroleum products but it can also be applied to tanks containing other liquids; however, it is necessary to use sound engineering analysis and judgment whenever this International Standard is applied to other liquids.

This International Standard does not apply to external floating-roof tanks.

This publication is a new entry in this catalog.

This publication is related to an API licensing, certification, or accreditation program.

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This standard sets forth the requirements for the following gate valve features:

- bolted bonnet,
- outside screw and yoke,
- rising stems,
- non-rising handwheels,
- single or double gate,
- wedge or parallel seating,
- metallic seating surfaces,
- flanged or butt-welding ends.

It covers valves of the nominal pipe sizes DN:

- 25, 32, 40, 50, 65, 80, 100, 150, 200, 250, 300, 350, 400, 450, 500, 600, 650, 700, 750, 800, 850, 900, 950, 1000, 1050;
- corresponding to nominal pipe sizes NPS:
  - 1, 1 1/4, 1 1/2, 2, 2 1/2, 3, 4, 6, 8, 10, 12, 14, 16, 18, 20, 24, 26, 28, 30, 32, 34, 36, 38, 40, 42;
- and applies to pressure class designations:
  - 150, 300, 600, 900, 1500, 2500.

This publication is applicable to valve end flanges in accordance with ASME B16.5, valve body ends having tapered pipe threads to ASME B120.1 or ISO 7-1, valve body ends having socket weld end to ASME B16.11, and butt-weld connections per the requirements described within this standard. It is applicable to extended body construction in sizes 1/2 NPS 2 (15 DN 50) and pressure designations of Class 800 and Class 1500, and to bellows and bellows assembly construction as may be adaptable to gate or globe valves in sizes 1/4 NPS 2 (8 DN 50). It covers bellows stem seal type testing requirements. Pages: 57

Product Number: C60210 | Price: $129.00

Std 602 *
Gate, Globe, and Check Valves for Sizes DN 100 (NPS 4) and Smaller for the Petroleum and Natural Gas Industries—Russian
Russian translation of Std 602.
10th Edition | May 2015 | Product Number: C60210R | Price: $100.00

Std 603 *
Corrosion-Resistant, Bolted Bonnet Gate Valves—Flanged and Butt-Welding Ends
Specifies the requirements for corrosion-resistant bolted bonnet gate valves meeting the requirements of ASME B16.34, Standard Class, for valves having flanged or butt-weld ends in sizes NPS 1/4 through 24, corresponding to nominal pipe sizes in ASME B36.10M, and Classes 150, 300, and 600. This standard covers the requirements for corrosion-resistant gate valves for use in process piping applications. Covered are requirements for outside-screw-and-yoke (OS&Y) valves with rising stems, non-rising hand-wheels, bolted bonnets, and various types of gate configurations.

9th Edition | September 2018 | Product Number: C60309 | Price: $98.00

Std 607 Fire Test for Quarter-Turn Valves and Valves Equipped with Nonmetallic Seats
Specifies fire type-testing requirements and a fire type-test method for confirming the pressure-containing capability of quarter-turn valves and other valves with nonmetallic seating under pressure during and after the fire test. It does not cover the testing requirements for valve actuators other than manually operated gear boxes or similar mechanisms when these form part of the normal valve assembly. Other types of valve actuators (e.g., electrical, pneumatic, or hydraulic) may need special protection to operate in the environment considered in this valve test, and the fire testing of such actuators is outside the scope of this standard.

7th Edition | June 2016 | Product Number: C60707 | Price: $100.00
Butterfly Valves: Double-Flanged, Lug- and Wafer-Type

Provides general guidance on valve selection for the hydrocarbon processing industry, which includes refineries and petrochemical, chemical, and liquefied natural gas plants and their various associated processes. Selection guidance is provided for valve types covered by ASME B16.34 and API Valve Standards for the Downstream Segment, which include gate, ball, plug, butterfly, check, and globe valves. Modulating control valves and pressure-relief valves are outside the scope of this recommended practice. Pages: 36

2nd Edition | August 2016 | Product Number: C61502 | Price: $91.00
Refining

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Std 624
Type Testing of Rising Stem Valves Equipped with Flexible Graphite Packing for Fugitive Emissions

This publication is related to an API licensing, certification, or accreditation program.

Provides guidelines for determining the degree and extent of Class I, Zone 0, and Division 2—Kazakh and Division 2—Zone 1, and Zone 2 locations at petroleum facilities for the selection and installation of electrical equipment. The standard may 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. Pages: 177

2nd Edition | August 2018 | Product Number: C50502 | Price: $224.00

RP 540
Electrical Installations in Petroleum Processing Plants

This publication is related to an API licensing, certification, or accreditation program.

Provides information on electrical installations in petroleum processing plants. It is intended for all individuals and organizations concerned with the safe design, installation, and operation of electrical facilities in petroleum processing plants. Pages: 107


Product Number: C54004 | Price: $194.00

Std 541
Form-Wound Squirrel Cage Induction Motors—375 kW (500 Horsepower) and Larger

This publication is related to an API licensing, certification, or accreditation program.

Includes investigative tests on the lightning protection of submerged shunts with lightning simulation testing to determine the required characteristics for roof bonding cables and parallel roof bonding cables. Pages: 193


Product Number: C54603 | Price: $214.00

This publication is related to an API licensing, certification, or accreditation program.

Verifies the minimum requirements for all form-wound squirrel-cage induction motors 500 Horsepower and larger for use in petroleum industry services. This standard may be applied to adjustable speed motors and induction generators with appropriate attention to the specific requirements of such applications. Pages: 160

5th Edition | December 2014 | Product Number: C54105 | Price: $196.00

RP 545
Recommended Practice for Lightning Protection of Aboveground Storage Tanks for Flammable or Combustible Liquids

This publication is related to an API licensing, certification, or accreditation program.

Collates a number of research reports investigating the lightning phenomena and the adequacy of lightning protection requirements on above ground hydrocarbon storage tanks. These are as follows:

- review of lightning phenomena and the interaction with above ground storage tanks;
- review of tank base earthing and test current recommendations,
- lightning tests to tank shell/shunt samples,
- visits to oil refinery A and B,
- review of burn-through and hot-spot effects on metallic tank skins from lightning strikes,
- lightning simulation testing to determine the required characteristics for roof bonding cables on external floating roof above ground storage tanks;
- investigative tests on the lightning protection of submerged shunts with parallel roof bonding cables.

Pages: 193

This publication is related to an API licensing, certification, or accreditation program.


This publication is related to an API licensing, certification, or accreditation program.

TR 545-A
Verification of Lightning Protection Requirements for Above Ground Hydrocarbon Storage Tanks

This publication is related to an API licensing, certification, or accreditation program.

Provides information on electrical installations in petroleum processing plants. It is intended for all individuals and organizations concerned with the safe design, installation, and operation of electrical facilities in petroleum processing plants. Pages: 107

This publication is related to an API licensing, certification, or accreditation program.


Product Number: C54004 | Price: $194.00

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Std 546
Brushless Synchronous Machines—500 kVA and Larger

This publication is related to an API licensing, certification, or accreditation program.

Covers the minimum requirements for form- and bar-wound brushless synchronous machines in petroleum-related industry service. The standard has been updated to include both synchronous motors and generators with two different rotor designs:

- the conventional salient-pole rotor with solid or laminated poles, and
- the cylindrical rotor with solid or laminated construction.

Also included are new datasheet guides to help clarify the datasheet requirements. Pages: 191


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Product Number: C54603 | Price: $214.00
intended to imply that other burner types are not available or recommended.
The burner types discussed are those currently in industry use. It is not available to the designer/user for purposes of selecting the appropriate burner for a given application.

This document does not provide rules for design, but indicates areas that need attention and offers information and descriptions of burner types available to the designer/user for purposes of selecting the appropriate HRSG. Annex A describes a technique for estimating the life remaining for a heater tube. Pages: 264

2nd Edition | May 2017 | Effective Date: November 1, 2017
Product Number: C53703 | Price: $247.00

Std 536
Post-Combustion NOx Control for Equipment in General Refinery and Petrochemical Services

Specifies requirements and provides guidance for the selection, design specification, mechanical description, operation, maintenance, and test procedures for post-combustion NOx control equipment and related mechanical systems and components used for fired equipment in petrochemical and general refinery service.

This document covers the following methods of post combustion NOx reduction for both new and retrofit applications:

• Selective Non-catalytic Reduction (SNCR), and
• Selective Catalytic Reduction (SCR).

This standard is primarily intended for direct application to fired process heaters, reformers, industrial, and power boilers in petrochemical and general refinery services. The same fundamental NOx control technologies and systems may also be applied to Fluid Catalytic Cracking Units (FCCUs), incinerators, gas turbine exhaust, and other exhaust gas process systems however SORs may require additional considerations beyond the scope of this standard to address unique aspects, such as high particulate content and corrosive chemicals, in the flue gas stream.

This document does not cover:

• Reduced NOx formation through combustion controls and design techniques such as low NOx burners, flue gas recirculation (FGR), and staged combustion; and
• Non-selective Catalytic Reduction (NSCR) for the control of NOx and other pollutant emissions. Pages: 117

3rd Edition | September 2017 | Product Number: C53603 | Price: $173.00

Std 537
Flare Details for Petroleum, Petrochemical, and Natural Gas Industries (ANSI/API Std 537)

Specifies requirements and provides guidance for the selection, design specification, operation, and maintenance of flares and related combustion and mechanical components used in pressure-relieving and vapor-depressurizing systems for petroleum, petrochemical, and natural gas industries. While this standard is primarily intended for onshore facilities, guidance related to offshore applications is included.

Annexes A through D provide further guidance and best practices for the selection, specification, and mechanical details for flares and on the design, operation, and maintenance of flare combustion and related equipment. Annex E explains how to use the data sheets provided in Annex F; it is intended that these data sheets be used to communicate and record design information. Pages: 170

3rd Edition | March 2017 | Product Number: C53703 | Price: $247.00

RP 534
Heat Recovery Steam Generators

Provides guidelines for the selection and evaluation of heat recovery steam generator (HRSG) systems. Details of related equipment designs are considered only where they interact with the HRSG system design. The document does not provide rules for design, but indicates areas that need attention and offers information and descriptions of HRSG types available to the designer/user for purposes of selecting the appropriate HRSG. Pages: 60

2-Year Extension: April 2013 | Product Number: C53402 | Price: $98.00

RP 535
Burners for Fired Heaters in General Refinery Services

Provides guidelines for the selection and/or evaluation of burners installed in fired heaters in general refinery services. Details of fired heater and related equipment designs are considered only where they interact with the burner selection. This RP does not provide rules for design, but indicates areas that need attention. It offers information and descriptions of burner types available to the designer/user for purposes of selecting the appropriate burner for a given application.

The burner types discussed are those currently in industry use. It is not intended to imply that other burner types are not available or recommended. Many of the individual features described in these guidelines are applicable to most burner types.

In addition to specification of burners, this RP has been updated to include practical guidelines for troubleshooting in service burners as well as including considerations for safe operation. Pages: 84

3rd Edition | May 2014 | Product Number: C53503 | Price: $155.00

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Std 547
General Purpose Form-Wound Squirrel Cage Induction Motors—185 kW (250 hp) Through 2240 kW (3000 hp)

Covers the requirements for form-wound induction motors for use in general-purpose petroleum, chemical, and other industrial severe duty applications. These motors:

• are rated 250 hp (185 kW) through 3000 hp (2250 kW) for 4, 6, and 8 pole speeds.
• are rated less than 800 hp (600 kW) for two-pole (3000 or 3600 RPM) motors of totally-enclosed construction.
• are rated less than 1250 hp (930 kW) for two-pole motors of WP-II type enclosures,
• drive centrifugal loads,
• drive loads having inertia values within those listed in NEMA MG 1 Part 20),
• are not induction generators. Pages: 62

2nd Edition | May 2017 | Effective Date: November 1, 2017
Product Number: C54702 | Price: $121.00

Std 530
Calculation of Heater-Tube Thickness in Petroleum Refineries

Specifies the requirements and gives recommendations for the procedures and design criteria used for calculating the required wall thickness of new tubes and associated component fittings for fired heaters for the petroleum, petrochemical, and natural gas industries. These procedures are appropriate for designing tubes for service in both corrosive and non-corrosive applications. These procedures have been developed specifically for the design of refinery and related fired heater tubes (direct-fired, heat-absorbing tubes within enclosures). These procedures are not intended to be used for the design of external piping. This standard does not give recommendations for tube retirement thickness; Annex A describes a technique for estimating the life remaining for a heater tube. Pages: 264

7th Edition | April 2015 | Product Number: C53007 | Price: $299.00
Std 560  
**Fired Heaters for General Refinery Service**

Specifies requirements and gives recommendations for the design, materials, fabrication, inspection, testing, preparation for shipment, and erection of fired heaters, air preheaters (APHs), fans, and burners for general refinery service. This standard does not apply to the design of steam reformers or pyrolysis furnaces. Pages: 327  
5th Edition  |  February 2016  |  Product Number: C56005  |  Price: $345.00

RP 573  
**Inspection of Fired Boilers and Heaters**

Covers the inspection practices for fired boilers and process heaters (furnaces) used in petroleum refineries and petrochemical plants. The practices described in this document are focused to improve equipment reliability and plant safety by describing the operating variables which impact reliability and to ensure that inspection practices obtain the appropriate data, both on-stream and off-stream, to assess current and future performance of the equipment. Pages: 109  
3rd Edition  |  October 2013  |  Product Number: C57303  |  Price: $155.00

Std 660  
**Shell-and-Tube Heat Exchangers**

Specifies requirements and gives recommendations for the mechanical design, material selection, fabrication, inspection, testing, and preparation for shipment of shell-and-tube heat exchangers for the petroleum, petrochemical, and natural gas industries. This standard is applicable to the following types of shell-and-tube heat exchangers: heaters, condensers, coolers, and reboilers. This standard is not applicable to vacuum-operated steam surface condensers and feed-water heaters. Pages: 62  

Std 661  
**Petroleum, Petrochemical, and Natural Gas Industries—Air-Cooled Heat Exchangers for General Refinery Service (ANSI/API Std 661)**

Gives requirements and recommendations for the design, materials, fabrication, inspection, testing, and preparation for shipment of air-cooled heat exchangers for use in the petroleum, petrochemical, and natural gas industries. This standard is applicable to air-cooled heat exchangers with horizontal bundles, but the basic concepts can also be applied to other configurations. Pages: 147  
7th Edition  |  July 2013  |  Reaffirmed: November 2018  
Product Number: C66107  |  Price: $258.00

Std 661  
**Petroleum, Petrochemical, and Natural Gas Industries—Air-Cooled Heat Exchangers for General Refinery Service—Russian**

Russian translation of Std 661.  
7th Edition  |  July 2013  |  Product Number: C66107R  |  Price: $206.00

Std 662, Part 1/ISO 15547-1:2005  

Gives requirements and recommendations for the mechanical design, materials selection, fabrication, inspection, testing, and preparation for shipment of plate-and-frame heat exchangers for use in petroleum, petrochemical and natural gas industries. It is applicable to gasketed, semi-welded and welded plate-and-frame heat exchangers.  
This edition of Std 662-1 is an identical national adoption of ISO 15547-1:2005. Pages: 34  
2-Year Extension: May 2016  |  Product Number: CX662101  |  Price: $136.00

Std 663  
**Hairpin-Type Heat Exchangers**

Specifies requirements and gives recommendations for the mechanical design, materials selection, fabrication, inspection, testing, and preparation for shipment of hairpin heat exchangers for use in the petroleum, petrochemical, and natural gas industries. Hairpin heat exchangers include double-pipe and multi-tube type heat exchangers. Pages: 44  
1st Edition  |  May 2014  |  Product Number: C66301  |  Price: $180.00

Std 664  
**Spiral Plate Heat Exchangers**

Specifies the requirements and gives recommendations for the mechanical design, materials selection, fabrication, inspection, testing, and preparation for shipment of spiral plate heat exchangers for the petroleum, petrochemical, and natural gas industries. It is applicable to standalone spiral plate heat exchangers and those integral with a pressure vessel. Pages: 39  
1st Edition  |  March 2014  |  Product Number: C66401  |  Price: $180.00

Std 668  
**Brazed Aluminum Plate-Fin Heat Exchangers**

Gives requirements and recommendations for the mechanical design, materials selection, fabrication, inspection, testing, and preparation for shipment of brazed aluminum plate-fin heat exchangers for use in the petroleum, petrochemical, and natural gas industries. This edition is a revision of the First Edition of Std 662, Part 2. Pages: 49  
1st Edition  |  November 2018  |  Product Number: C66801  |  Price: $140.00

**INSTRUMENTATION AND CONTROL SYSTEMS**

RP 551  
**Process Measurement Instrumentation**

Provides procedures for the installation of the more generally used measuring and control instruments and related accessories. Pages: 233  
2nd Edition  |  February 2016  |  Product Number: C55102  |  Price: $162.00

RP 552  
**Transmission Systems**

Reviews the recommended practices for the installation of electronic and pneumatic measurement and control-signal transmission systems. It does not discuss leased wire, radio, and telemetering transmission. Pages: 39  
1st Edition  |  October 1994  |  Reaffirmed: August 2015  
2-Year Extension: November 2012  
Product Number: C55201  |  Price: $112.00

RP 553  
**Refinery Valves and Accessories for Control and Safety Instrumented Systems**

Addresses the special needs of automated valves in refinery services. The knowledge and experience of the industry has been captured to provide proven solutions to well-known problems. This document provides recommended criteria for the selection, specification, and application of piston (i.e. double-acting and spring-return) and diaphragm-actuated (spring-return) control valves. Control valve design considerations are outlined such as valve selection, material selection, flow characteristic evaluation, and valve accessories. It also discusses control valve sizing, fugitive emissions, and consideration of the effects of flashing, cavitation, and noise. Recommendations for emergency block and vent valves, on/off valves intended for safety instrumented systems, and special design valves for refinery services, such as Fluid Catalytic Cracking Unit (FCCU) slide valves and vapor depressurizing systems, are also included in this recommended practice. Pages: 109  
2nd Edition  |  October 2012  |  Product Number: C55302  |  Price: $149.00

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Addresses the processes required to successfully implement process control systems for refinery and petrochemical services. The major topics addressed in Part 1 is the basic functions that a process control system may need to perform, and recommended methodologies for determining the functional and integration requirements for a particular application. Pages: 32

Product Number: C55402 | Price: $115.00

Process Control Systems, Part 2—Process Control System Design

Addresses the processes required to successfully implement process control systems for refinery and petrochemical services. The major topic addressed in Part 2 is practices to select and design the installation for hardware and software required to meet the functional and integration requirements. Pages: 65

Product Number: C554201 | Price: $143.00

Process Control Systems, Part 3—Project Execution and Process Control System Ownership

Addresses the processes required to successfully implement process control systems for refinery and petrochemical services. The major topic addressed in Part 3 is project organization, skills and management required to execute a process control project and then to own and operate a process control system. Pages: 40

Product Number: C554301 | Price: $110.00

Process Analyzers

Addresses the considerations in the application of analyzers and associated systems, installation, and maintenance. Process monitors that measure and transmit information about chemical composition, physical properties, or chemical properties are known as process analyzer systems. Process analyzers are now used widely in the refining industry for:

- monitoring and controlling product quality,
- implementing advanced control strategies in improving process operations,
- enhancing area safety, and
- continuous emission monitoring and environmental measurement of air and water quality. Pages: 314

3rd Edition | June 2013 | Product Number: C55503 | Price: $196.00

Instrumentation, Control, and Protective Systems for Gas Fired Heaters

Provides guidelines that specifically apply to instrument, control, and protective system installations for gas fired heaters in petroleum production, refineries, petrochemical, and chemical plants. Includes primary measuring and actuating instruments, controls, alarms, and protective systems as they apply to fired heaters. Not covered in this RP are the following; oil fired and combination fired heaters; water tube boilers which consist of single or multiple burners and are designed for utility operation or where the primary purpose is steam generation; fired steam generators used to recover heat from combustion turbines; oven and furnaces used for the primary purpose of incineration, oxidation, reduction, or destruction of the process medium; water bath or oil bath indirect fired heaters; and CO boilers, pyrolysis furnaces, and other specialty heaters. Pages: 66

2nd Edition | April 2011 | Product Number: C55602 | Price: $157.00

Instrumentation, Control, and Protective Systems for Gas Fired Heaters—Russian

Russian translation of RP 556.

2nd Edition | April 2011 | Product Number: C55602R | Price: $126.00

Guide to Advanced Control Systems

Addresses the implementation and ownership of advanced control systems for refinery purposes. The document also described commonly used practices for the opportunity identification, justification, project management, implementation, and maintenance of advanced control system applications in refinery service. Pages: 45

2nd Edition | October 2013 | Product Number: C55702 | Price: $113.00

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1951

- No. 1, Glossary of Mineral Names
- No. 2, Reference Clay Localities-United States
- No. 3, Differential Thermal Analysis of Reference Clay Mineral Specimens
- No. 4, Reference Clay Europe
- No. 5, Occurrence and Microscopic Examination of Reference Clay Mineral Specimens
- No. 6, Electron Micrographs of Reference Clay Minerals
- No. 7, Analytical Data on Reference Clay Minerals
- No. 8, Infrared Spectra of Clay Minerals

**TR 997**

**Comprehensive Report of API Crude Oil Characterization Measurements**

A consortium of API member companies has sponsored a research program consisting of a series of projects on the characterization of crude oils. The goal of this program was to obtain complete sets of assay and thermophysical property data on a few widely varying crude oil refining and refining facilities. This report provides descriptions of the test procedures, discussions of their accuracy, and comprehensive compilation of the data for the crude oils measured under this program. Pages: 129

**1st Edition | August 2000 | Product Number: C99701 | Price: $217.00**

### CHARACTERIZATION AND THERMODYNAMICS

**API Monograph Series**

Each publication discusses the properties of solid, liquid, and gaseous phases of one or a few closely related, industrially important compounds in a compact, convenient, and systematic form. In addition to the basic physical properties, each publication covers density, molar volume, vapor pressure, enthalpy of vaporization, surface tension, thermodynamic properties, viscosity, thermal conductivity, references to properties of mixtures, and spectrographic data.

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- Publ 706, cis- and trans-Decalin, 1978
- Publ 707, Naphthalene, 1978
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- Publ 709, Four-Ring Condensed Aromatic Compounds, 1979
- Publ 710, Pyridine and Phenylpyridines, 1979
- Publ 711, Quinoline, 1979
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- Publ 713, Indianols, 1980
- Publ 714, Indian and Indene, 1980
- Publ 715, Acenaphthylene, Acenaphthene, Fluorene, and Fluoranthenes, 1981
- Publ 716, Carbazole, 9-Methylcarbazole, and Acridine, 1981
- Publ 717, Thiophene, 2,3- and 2,5-Dihydrothiophene, and Tetrahydrothiophene, 1981
- Publ 718, Aniline, 1982
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- Publ 720, 2-, 3-, and 4-Methylaniline, 1983
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- Publ 722, Isopropylbenzene, and 1-Methyl-2-, 3-, and 4-Isopropylbenzene, 1984
- Publ 723, tert-Butyl methyl ether, 1984
- Publ 724, 1- and 2-Methylnaphthalene and Dibenzenanthracenes, 1985

This publication is a new entry in this catalog.

This publication is related to an API licensing, certification, or accreditation program.
Damage Mechanisms Affecting Fixed Equipment in the Refining Industry—Chinese

Chinese translation of RP 571.

TR 932-A
A Study of Corrosion in Hydroprocess Reactor Effluent Air Cooler Systems

Provides technical background for controlling corrosion in hydroprocesses reactor effluent systems based on industry experience and consensus practice. Information for this report has been gathered from open literature, private company reports, and interviews with representatives of major refining companies. The findings in this report are the basis for the guidance in Bull 932-B.

2nd Edition | September 2002 | Product Number: C932A0 | Price: $156.00

Publ 393-B
Design, Materials, Fabrication, Operation, and Inspection Guidelines for Corrosion Control in Hydroprocessing Reactor Effluent Air Cooler (REAC) Systems

(includes Errata 1 dated January 2014)

Provides guidance to engineering and plant personnel on equipment and piping design, material selection, fabrication, operation, and inspection practices to manage corrosion and fouling in the wet sections of hydroprocessing reactor effluent systems. The reactor effluent system includes all equipment and piping between the exchanger upstream of the wash water injection point and the cold, low-pressure separator (CLPS). The majority of these systems have an air cooler; however, some systems utilize only shell-and-tube heat exchangers. Reactor effluent systems are prone to fouling and corrosion by ammonium bisulfide (NH₄HS) and ammonium chloride (NH₄Cl) salts.

2nd Edition | March 2012 | Product Number: C932B02 | Price: $265.00

RP 934-A
Materials and Fabrication of 2 1/4Cr-1Mo, 2 1/4Cr-1Mo-1/4V, 3Cr-1Mo, and 3Cr-1Mo-1/4V Steel Heavy Wall Pressure Vessels for High-Temperature, High-Pressure Hydrogen Service

(includes Addendum 1 dated February 2010 and Addendum 2 dated March 2012)

Presents materials and fabrication requirements for new 2 1/4Cr and 3Cr steel heavy wall pressure vessels for high-temperature, high-pressure hydrogen service. It applies to vessels that are designed, fabricated, certified, and documented in accordance with ASME BPVC, Section VIII, Division 2, including Section 3.4, Supplemental Requirements for Cr-Mo Steels and ASME Code Case 2151, as applicable. This document may also be used as a resource when planning to modify an existing heavy wall pressure vessel.

A newer ASME BPVC, Section VIII, Division 3, is available and has higher design allowables; however, it has much stricter design rules (e.g. fatigue and fracture mechanics analyses required) and material testing requirements. It is outside the scope of this document.

Materials covered by this recommended practice are conventional steels, including standard 2 1/4Cr-1Mo and 3Cr-1Mo steels, and advanced steels, which include 2 1/4Cr-1Mo-1/4V, 3Cr-1Mo-1/4V-Ti-B, and 3Cr-1Mo-1/4V-Nb-Ca steels. This document may be used as a reference for the fabrication of vessels made of enhanced steels (steels with mechanical properties augmented by special heat treatments) at purchaser discretion. However, no attempt has been made to cover specific requirements for the enhanced steels.

Pages: 19

Product Number: C934A02 | Price: $110.00

RP 934-A *

Materials and Fabrication of 2 1/4Cr-1Mo, 2 1/4Cr-1Mo-1/4V, 3Cr-1Mo, and 3Cr-1Mo-1/4V Steel Heavy Wall Pressure Vessels for High-Temperature, High-Pressure Hydrogen Service—Russian

Russian translation of RP 934-A.

2nd Edition | May 2008 | Product Number: C934A02R | Price: $89.00

TR 934-B
Fabrication Considerations for Vanadium-Modified Cr-Mo Steel Heavy Wall Pressure Vessels

Best practice guideline to be used by fabricators, in conjunction with RP 934-A, when constructing new heavy wall pressure vessels with vanadium-modified Cr-Mo steels intended for service in petroleum refining, petrochemical or chemical facilities. These materials are primarily used in high temperature, high pressure services which contain hydrogen. This document provides typical practices to be followed during fabrication, based upon experience and the knowledge gained from actual problems that have occurred during the fabrication of vanadium-modified Cr-Mo steels.

Pages: 29

1st Edition | April 2011 | Product Number: C934B01 | Price: $139.00

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RP 934-C
Materials and Fabrication of 1 1/4/2Cr-1/2Mo Steel Heavy Wall Pressure Vessels for High Pressure Hydrogen Service Operating at or Below 825 °F (441 °C)

Presents materials and fabrication requirements for new 1 1/4/2Cr-1/2Mo steel heavy wall pressure vessels and heat exchangers for high-temperature, high-pressure hydrogen service. It applies to vessels that are designed, fabricated, certified, and documented in accordance with ASME BVPV, Section VIII, Division 1 or Division 2. This document may also be used as a resource for equipment fabricated using 1Cr-1/2Mo Steel. This document may also be used as a resource when planning to modify an existing heavy-wall pressure vessel. The interior surfaces of these heavy-wall pressure vessels may have an austenitic stainless steel or ferritic stainless steel weld overlay or cladding to provide additional corrosion resistance. For this recommended practice, the heavy wall is defined as a shell thickness of 2 in. (50 mm) or greater, but less than or equal to 4 in. (100 mm). Integrity reinforced nozzles, flanges, tubesheets, bolted channel covers, etc. can be greater than 4 in. (100 mm). At shell or head thicknesses greater than 4 in. (100 mm), 1 1/4Cr-1/2Mo has been shown to have difficulty meeting the toughness requirements given in this document. Although outside of the scope of this document, it can be used as a resource for vessels down to 1 in. (25 mm) shell thickness with changes defined by the purchaser. This recommended practice is not intended for use for equipment operating above 825 °F (441 °C) or in the creep range. Pages: 15

Product Number: C934C01 | Price: $110.00

RP 934-C *
Materials and Fabrication of 1 1/4/2Cr-1/2Mo Steel Heavy Wall Pressure Vessels for High Pressure Hydrogen Service Operating at or Below 825 °F (441 °C) – Russian

Russian translation of RP 934-C.

1st Edition | May 2008 | Product Number: C934C01R | Price: $89.00

TR 934-D
Technical Report on the Materials and Fabrication Issues of 1 1/4/2Cr-1/2Mo and 1Cr-1/2Mo Steel Pressure Vessels

Numerous 1 1/4/2Cr-1/2Mo and 1Cr-1/2Mo vessels have been constructed and successfully used in various applications in petroleum industry and in other types of service applications. These vessels have been constructed to the requirements of the ASME Boiler & Pressure Vessel Code, Section VIII, Divisions 1 and 2, and to various international pressure vessel codes and standards. The 1 1/4/2Cr-1/2Mo and 1Cr-1/2Mo vessels are typically used in service conditions (e.g., high temperature and/or high pressure hydrogen), which require heavy walls and cause in service deterioration. As such, the steels are subject to special requirements, such as notch toughness, elevated temperature tensile properties, hardness, fabrication heat treatments, etc., which may limit the maximum thickness to be able to meet the desired properties. Corrosion protection by stainless steel weld overlay or cladding may also be required.

This report provides background information and guidance on the implementation of RP 934-C. In recent years it has been recognized that there are important distinctions that need to be considered for 1 1/4/2Cr-1/2Mo steels. Whereas RP 934-A continues to provide materials and fabrication requirements for new 2 1/4/3Cr-1Mo and 2 1/2/3Cr-3Mo-1/2V steel heavy wall pressure vessels in high temperature, high pressure hydrogen service, different material, and fabrication requirements have been developed for 1 1/4/1Cr-1/2Mo steel heavy wall pressure vessels. These requirements are covered in RP 934-C and 934-E. This document contains a description of key mechanisms that relate specifically to 1 1/4/1Cr-1/2Mo pressure vessels used in a variety of services. These damage mechanisms include elevated temperature damage such as "reheat cracking" or "creep embrittlement," as well as other damage mechanisms that may occur at lower temperatures. This document provides information and guidance on successful practices for fabrication of 1 1/4/1Cr-1/2Mo steel heavy wall pressure vessels for the intended services of both RP 934-C and RP 934-E. The survey of steel producers and vessel fabricators (Annex 1) indicates that there is a need to evaluate the effect of heat treat cycles on materials properties (CVN toughness, tensile and yield strength). Pages: 56

1st Edition | September 2010
Product Number: C934D01 | Price: $139.00

RP 934-E
Recommended Practice for Materials and Fabrication of 1 1/4/2Cr-1/2Mo Steel Pressure Vessels for Service Above 825 °F (440 °C)

Includes materials and fabrication requirements for new 1 1/4/2Cr-1Mo and 1Cr-1/2Mo steel pressure vessels, including heat exchanger shells and channels for elevated temperature service. It applies to vessels that are designed, fabricated, and documented in accordance with ASME Code Section VIII, Division 1, or Division 2 (hereafter referred to as "Code"). This document may also be used as a resource when planning to modify existing pressure vessels. The interior surfaces of these pressure vessels and heat exchangers (i.e., the surfaces exposed to the process) may or may not have an austenitic stainless steel (SS), ferritic SS, or nickel alloy weld overlay or cladding to provide additional corrosion resistance.

This RP is primarily intended for wall thicknesses less than 4 in. (100 mm), and a preferred option for thicker components is to use 2 1/4Cr-1Mo alloys. This RP is applicable to shell thicknesses greater than 1 in. (25 mm). Although outside of the scope, this document can be used as a resource for vessels down to lower shell thicknesses with changes defined by the purchaser. Pages: 27

2nd Edition | January 2018 | Product Number: C934E02 | Price: $140.00

TR 934-F Part 1
Impact of Hydrogen Embrittlement on Minimum Pressurization Temperature for Thick-Wall Cr-Mo Steel Reactors in High-Pressure H2 Service—Initial Technical Basis for RP 934-F

In support of API Recommended Practice 934-F: Guidance for Establishing a Minimum Pressurization Temperature (MPT) for Heavy Wall Reactors in High Temperature Hydrogen Service During Startups and Shutdowns, not yet published, the objective of this study is to establish the technical basis for determining a minimum pressurization temperature necessary to avoid Internal Hydrogen Assisted Cracking (IHAC) of weld metal and base plate of temper embrittled 2 1/4Cr-1Mo steel in high pressure H2 service. The threshold condition for the onset of subcritical crack propagation—and its dependencies on dissolved hydrogen concentration, temperature, and steel purity/temper embrittlement—are targeted as particularly important to pressure vessel safe operations. A second objective is to improve the underlying database for fracture mechanics fitness-for-service (FFS) modeling of IHAC. Both analyses are built on the conservative rising-displacement threshold stress intensity factor for IHAC (KIH). This investigation has accomplished 5 tasks, leading to conclusions that are sufficient to establish RP 934-F on MPT to conservatively avoid IHAC in 2 1/4Cr-1Mo steel.

Task 1—Summarize and clarify the technical approach, assumptions, data, and modeling results used in Phase II JIP research to quantitatively establish the H concentration and temperature dependencies of the threshold stress intensity, KIH, for IHAC and the concentration dependence of MPT for moderate-impurity 2 1/4Cr-1Mo steel.

Task 2—Validate the Phase II correlation of KIH and critical temperature vs H concentration, based on new analyses of post-Phase-II IHAC data.

Task 3.0—Enhance the Phase II analysis of KIH vs crack tip H concentration, and thus MPT, by describing the interaction between temper embrittlement and IHAC using JIP Phase I data so as to predict the influence of modern steel purity.

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Task 4.0—Build on the hydrogen-damage-mechanism-based master correlation between KIH and crack tip stress field/microstructure-trapped H to develop a H concentration similitude parameter that is useful in engineering analysis of thick-wall reactor FFS and MPT.

Task 5.0—Validate the empirically based trends and predictions of the effects of temperature and steel purity on the threshold stress intensity through consideration of state-of-the art theory and micromechanical modeling of IHAC. Pages: 118

1st Edition | September 2017
Product Number: C934F101 | Price: $192.00

TR 934-F Part 2
Literature Review of Fracture Mechanics-Based Experimental Data for Internal Hydrogen-Assisted Cracking of Vanadium-Modified 2-1/4Cr-1Mo Steel

Documents a critical assessment of the existing literature on IHAC of V-modified Cr-Mo steels for use in interpreting the results of the present laboratory work and so as to establish a definitive characterization of the H cracking resistance of this steel class. Since these modern Cr-Mo-V steels are of relatively high purity, and thus retain a low FATT after laboratory simulation of in-service temper embrittlement, the database for 2-1/4Cr-1Mo provides a context for assessment of the IHAC performance of V-modified grades. Hydrogen cracking of less pure V-modified Cr-Mo steels was not considered in this review. The content that follows is chronologically organized into initial and more modern works, as justified by improvement in test execution, data analysis, and reporting, as well as the evolution from laboratory to commercial scale heats of Cr-Mo-V. Pages: 46

1st Edition | August 2017 | Product Number: C934F201 | Price: $128.00

TR 934-F Part 3
Subcritical Cracking of Modern 2-1/4Cr-1Mo-1/4V Steel Due to Dissolved Internal Hydrogen and H2 Environment, Research Report

Conveys the results of API-sponsored research to: (a) quantitatively characterize the internal hydrogen assisted cracking (IHAC) resistance of modern 2-1/4Cr-1Mo-1/4V steel, in both base metal and weld metal product forms and including the effect of stressing temperature, (b) scope the hydrogen environment assisted cracking (HEAC) resistance of 2-1/4Cr-1Mo-1/4V base metal, (c) understand the mechanism(s) for the IHAC and HEAC behaviors of Cr-Mo and Cr-Mo-V steels, centered on H interactions with microstructure-scale trap sites, and (d) assess application of data and understanding of IHAC and HEAC to determine the role of subcritical H-assisted cracking on a minimum pressurization temperature estimate relevant to thick-wall hydro-treating reactor vessels. Pages: 170

1st Edition | December 2017 | Product Number: C934F301 | Price: $180.00

TR 934-F Part 4
The Effects of Hydrogen for Establishing a Minimum Pressurization Temperature (MPT) for Heavy Wall Steel Reactor Vessels

Hydrogen, dissolved in the thick wall of a steel pressure vessel during steady-state operation in elevated temperature, high-pressure H2, can cause both slow-subcritical crack advance as well as unstable-catastrophic fracture during shutdown and startup. This behavior is defined in Section 2. It follows that modern fracture-mechanics assessments of the minimum pressurization temperature (MPT) and fitness for service (FFS) must include the deleterious effect of H on both subcritical and unstable internal hydrogen assisted cracking (IHAC). Two approaches are in draft stage to develop standard procedures that address this need; an API 934-F recommended practice and a WRC Bulletin 562 basis for ASME/ API 579. The objective of this technical report is to establish the technical basis necessary to enable and validate these best practices for quantifying the effects of hydrogen on (a) the MPT and (b) FFS of a thick wall hydroprocessing reactor. Pages: 112

1st Edition | November 2018
Product Number: C934F401 | Price: $180.00

RP 934-G
Design, Fabrication, Operational Effects, Inspection, Assessment, and Repair of Coke Drums and Peripheral Components in Delayed Coking Units

Includes information and guidance on the practices used by industry practitioners on the design, fabrication, operation, inspection, assessment, and repair of coke drums and peripheral components in delayed coking units. The guidance is general and does not reflect specific details associated with a design offered by licensors of delayed coking technology, or inspection tools, operating devices/components, repairs techniques, and/or engineering assessments offered by contractors. For details associated with the design offered by a licensor or services provided by contractors, the licensor or contractor should be consulted for guidance and recommendations for their design details and operating guidance. This document is a technical report and as such provides generally used practices in industry and is not an API recommended practice for coke drums in delayed coking units. Pages: 57

1st Edition | April 2016 | Product Number: C934G01 | Price: $155.00

Publ 935
Thermal Conductivity Measurement Study of Refractory Castables

Compares the differences between measurement techniques used to develop thermal conductivity of refractory castables. The following procedures were examined: Water Calorimeter, Calorimeter-Pilkington Method, Hot Wire Method, Comparative Thermal Conductivity Method, and Panel Test. The refractory industry uses various methods for measuring and reporting thermal conductivity. The accuracy of reporting and understanding thermal conductivity is vital to developing the most cost effective, efficient, and reliable equipment. The study makes no attempt to rank, classify or assign accuracy to each of the measurement techniques. Pages: 22

1st Edition | September 1999 | Product Number: C93501 | Price: $62.00

Std 936
Refractory Installation Quality Control—Inspection and Testing Monolithic Refractory Linings and Materials

Provides installation quality control procedures for monolithic refractory linings and may be supplemented by owner specifications. Materials, equipment, and personnel are qualified by the methods described, and applied refractory quality is closely monitored, based on defined procedures and acceptance criteria. The responsibilities of inspection personnel who monitor and direct the quality control process are also defined. In addition, this standard provides guidance for the establishment of quality control elements necessary to achieve the defined requirements. Pages: 49


Publ 937-A
Study to Establish Relations for the Relative Strength of API 650 Cone Roof, Roof-to-Shell and Shell-to-Bottom Joints

Investigates the relative strengths of the roof-to-shell and shell-to-bottom joints, with the goal of providing suggestions for frangible roof design criteria applicable to smaller tanks. Pages: 68

1st Edition | August 2005 | Product Number: C937A0 | Price: $126.00

Publ 938-A
An Experimental Study of Causes and Repair of Cracking of 1-1/4Cr-1/2Mo Steel Equipment

Gives the results of an experimental study conducted to provide the petroleum industry with solutions to recurring incidents of cracking in the application of welded 1-1/4Cr-1/2Mo steel for hydrogen processing equipment. Pages: 220

1st Edition | May 1996 | Product Number: C93801 | Price: $169.00
equipment in refineries, petrochemical, and chemical facilities in which
of heavy wall pressure vessels. This recommended practice applies to
and testing conducted by independent manufacturers, fabricators, and users
services. It summarizes the results of industry experience, experimentation,
heavy wall pressure vessels for high temperature, high pressure hydrogen

treatment requirements, for use of 9Cr-1Mo-V alloy steel in oil refinery

discusses stress corrosion cracking (SCC) of carbon steel equipment used

A discussion of both proper and improper refinery service
applications for these steels is also provided. Pages: 40

TR 938-C
Use of Duplex Stainless Steels in the Oil Refining Industry
Covers many of the “lean,” “standard,” “super,” and “hyper” grades of duplex
stainless steels (DSSs) most commonly used within refineries. DSSs are
finding increasing use in the refining industry, primarily because they often
offer an economical combination of strength and corrosion resistance. These
stainless steels typically have an annealed structure that is generally half
ferrite and half austenite, although the ratios can vary from approximately
35/65 to 55/45. Most refinery applications where DSSs are used are
corrosive, and DSSs or other higher alloys are required for adequate
corrosion resistance. However, some plants are also starting to consider DSS
as a “baseline” material. These plants are using DSS in applications where
carbon steel may be acceptable, but DSSs have been shown to be more
economical considering their higher strength and better long-term reliability.
The product forms within the scope are tubing, plate, sheet, forgings, pipe,
and fittings for piping, vessel, exchanger, and tank applications. The Third
Edition of this report has added castings and hot isostatically-pressed (HIP)
components for pumps, valves, and other applications. The limited use of
DSSs as a cladding is also briefly covered within the document. Pages: 59
3rd Edition | February 2015 | Product Number: C938C03 | Price: $185.00

Publ 939-A
Research Report on Characterization and Monitoring of Cracking in
Wet H₂S Service
Demonstrates the ability to characterize and monitor various aspects of

crack propagation in pressurized process equipment exposed to wet
hydrogen sulfide environments. It represents one of several significant
industry-wide efforts to study and to better understand this phenomenon.

1st Edition | October 1994 | Product Number: C93901 | Price: $161.00

Publ 939-B
Repair and Remediation Strategies for Equipment Operating in Wet
H₂S Service
Presents data relative to the fabrication requirements for 2½/₄ 3Cr alloy steel
heavy wall pressure vessels for high temperature, high pressure hydrogen
services. It summarizes the results of industry experience, experimentation,
and testing conducted by independent manufacturers, fabricators, and users
of heavy wall pressure vessels. This recommended practice applies to
equipment in refineries, petrochemical, and chemical facilities in which
hydrogen or hydrogen-containing fluids are processed at elevated temperature and pressure. Pages: 239
1st Edition | June 2002 | Product Number: C939B0 | Price: $176.00
RP 941
Steels for Hydrogen Service at Elevated Temperatures and Pressures in Petroleum Refineries and Petrochemical Plants

Summarizes the results of experimental tests and actual data acquired from operating plants to establish practical operating limits for carbon and low alloy steels in hydrogen service at elevated temperatures and pressures. The effects on the resistance of steels to hydrogen at elevated temperature and pressure that result from high stress, heat treating, chemical composition, and cladding are discussed. This recommended practice (RP) does not address the resistance of steels to hydrogen at lower temperatures (below about 400 °F [204 °C]), where atomic hydrogen enters the steel as a result of an electrochemical mechanism.

This RP applies to equipment in refineries, petrochemical facilities, and chemical facilities in which hydrogen or hydrogen-containing fluids are processed at elevated temperature and pressure. The guidelines in this RP are generally applicable to hydrogenation plants such as those that manufacture ammonia, methanol, edible oils, and higher alcohols.

The steels discussed in this RP resist high temperature hydrogen attack (HTHA) when operated within the guidelines given. However, they may not be resistant to other corrosives present in a process stream or to other metallurgical damage mechanisms that can occur in the operating HTHA range. This RP also does not address the issues surrounding possible damage from rapid cooling of the metal after it has been in high temperature, high pressure hydrogen service (e.g. possible need for outgassing hydroprocessing reactors). This RP will discuss in detail only the resistance of steels to HTHA.

Presented in this document are curves that indicate the operating limits of temperature and hydrogen partial pressure for satisfactory resistance of carbon steel and Cr-Mo steels to HTHA in elevated temperature, hydrogen service. In addition, it includes a summary of inspection methods to evaluate equipment for the existence of HTHA. Pages: 45

8th Edition | February 2016 | Product Number: C94108 | Price: $144.00

TR 941
The Technical Basis Document for API RP 941

Even before the first edition of API Publ 941, Steels for Hydrogen Service at Elevated Temperatures and Pressures in Petroleum Refineries and Petrochemical Plants appeared in 1970, there had been fundamental questions regarding the technical basis for the material performance curves contained in the document (1-6). Based upon sparse laboratory data combined with plant experience, with only a few exceptions, the curves have done an exceptionally good job at safely directing the refining industry in selecting materials based upon operating temperature, hydrogen partial pressure, and the metallurgy of the equipment being considered. Pages: 301

1st Edition | September 2008 | Product Number: C94100 | Price: $240.00

TR 942-A
Materials, Fabrication, and Repair Considerations for Hydrogen Reformer Furnace Outlet Pigtails and Manifolds

Addresses materials, fabrication, and repair issues related to hydrogen and syngas reformer furnace outlet pigtails and manifolds. High reliability of outlet pigtails and manifold components, such as headers, tees, and fittings, is important to the successful long-term operation of hydrogen and syngas reformer furnaces. These components typically operate at high temperatures in the range of 750 to 950 °C (1382 to 1742 °F) where they are potentially subject to high-temperature creep, stress relaxation, hot corrosion, and thermal fatigue damage. In recent years a number of reformer furnace operators have encountered problems of in-service degradation and cracking of outlet pigtails and manifold components, while others have had little or no problems of this type. Both direct experience in addressing specific cases of outlet pigtail and manifold cracking problems and indirect experience gained from surveying industry with regard to these problems were used in preparing this report. The objective of the project was to develop an understanding, based on published literature and industry experience, of why some reformer furnaces have had problems with embrittlement and cracking of outlet pigtails and manifold components in service, while others have not had such problems. Pages: 53

1st Edition | June 2014 | Product Number: C942A01 | Price: $144.00

TR 942-B
Material, Fabrication, and Repair Considerations for Austenitic Alloys Subject to Embrittlement and Cracking in High Temperature 565 °C to 760 °C (1050 °F to 1400 °F) Refinery Services

Focuses on the materials, fabrication, and repair of austenitic stainless steels and nickel-iron-chromium alloys in high temperature 565 °C to 760 °C (1050 °F to 1400 °F) refinery services. Many of these alloys are subject to embrittlement and cracking after prolonged exposure to these temperatures. Susceptible components in the following processing units are addressed: fluid catalytic cracking units, hydrogen/syngas plants, catalytic reformers,okers, and hydrotreating reactors. This report summarizes industry experience and recommends methods to improve reliability and process safety, and increases industry awareness to high temperature embrittlement issues.

As a basis of this report, technical literature, industry experience, and published case studies were reviewed. The review included materials of construction, damage mechanisms, and component-specific fabrication and repair issues. The scope of this report includes the following wrought austenitic alloys: Alloys 800, 800H, 800HT, and 300 series austenitic stainless steels, and corresponding weld consumables. Limits in chemical composition, microstructural requirements, and heat treating practices that mitigate susceptibility to embrittlement and cracking are identified. Potentially viable upgrades to commonly used alloys are identified where applicable.

The remainder of this report is organized as follows: Section 3, Process Units, gives a brief process overview followed by an explanation of the various damage mechanisms found in that unit. Component specific considerations and examples of in-service damage are also included. Inspection recommendations and general repair method considerations are also included. Section 4, Damage Mechanisms, contains detailed discussions of high-temperature damage mechanisms, including fundamental details of the solid state reactions, their rate of reaction, and recommended mitigation measures. Section 4 also incorporates fabrication and repair practices that can be used for cracked or embrittled equipment. Pages: 88

1st Edition | May 2017 | Effective Date: November 1, 2017 | Product Number: C942B01 | Price: $178.00

TR 945
Avoiding Environmental Cracking in Amine Units

Discusses environmental cracking problems of carbon steel equipment in amine units. This publication provides guidelines for carbon steel construction materials, including, fabrication, inspection, and repair, to help ensure safe and reliable operation. The steels referred to in this document are defined by the ASTM designation system, or equivalent materials contained in other recognized codes or standards. This description is based on current engineering practices and insights from recent industry experience. Pages: 25


Publ 959
Characterization Study of Temper Embrittlement of Chromium-Molybdenum Steels

Evaluates the temper embrittlement characteristics of Cr-Mo pressure vessel steels. The steels are designated A387 in Part 4 of the ASTM Book of Standards. Most of the samples studied were of Grade 22 (2.1–1.4% Mo) and a few samples of Grades 11 and 21 were also included, (1.7–1.5% Mo, 2.2–1.4% Mo, 3.3–1.1% Mo). The 64 samples studied represented a wide range of commercially available steel, including qualification welds in 1-in. and 6-in. steel plate, large nozzle cut-outs, and randomly-shaped pieces of forging material. These materials received heat treatment typical of hydro-treater reactor fabrication. The objective of this program was to characterize typical commercial reactor steels and weldments in terms of toughness and other physical properties prior to being placed in service and the changes anticipated in toughness due to long-time service at elevated temperatures.

It is important to note that the materials studied were typical of commercial production and fabrication up to about 1975 and are not representative of plate, forgings, and weld metal having low temper embrittlement susceptibility, generally available after 1975. Pages: 145

1st Edition | January 1982 | Product Number: C95900 | Price: $162.00

This publication is a new entry in this catalog. This publication is related to an API licensing, certification, or accreditation program.
RP 970
Corrosion Control Documents
Provides users with the basic elements for developing, implementing and maintaining a Corrosion Control Document (CCD) for refining, and at the owner's discretion, may be applied at petrochemical and chemical process facilities. A CCD is a document or other repository or system that contains all the necessary information to understand materials damage susceptibility issues in a specific type of operating process unit at a plant site. CCDs are a valuable addition to an effective Mechanical Integrity Program. They help to identify the damage mechanism susceptibilities of pressure containing piping and equipment, factors that influence damage mechanism susceptibilities, and recommended actions to mitigate the risk of loss of containment or unplanned outages. This recommended practice serves as the basis for tracking CCD development, implementation, and maintenance to maintain consistency and to integrate the CCD work process with other plant integrity programs, such as Management of Change (MOC), Process Hazards Analysis (PHA), and Reliability Centered Maintenance (RCM). Some of these programs have significant overlap with the development of CCDs, including Risk-Based Inspection studies (see RP 580 and RP 581), Integrity Operating Windows (see RP 584), in-house unit corrosion reviews, circuitization/systemization programs, and similar types of corrosion studies. Development of CCDs can serve as a useful starting point for establishing these programs if they have not been undertaken. This recommended practice provides the owner/user with information and guidance on the work processes for development and implementation of CCDs for the owners/users' process units. Pages: 59
1st Edition | December 2017 | Product Number: C97001 | Price: $139.00

Std 976
Refractory Installation Quality Control—Inspection and Testing of AES/RCF Fiber Linings and Materials
Provides installation quality control procedures and lining system design requirements for AES/RCF fiber linings and may be used to supplement owner specifications. Materials, equipment, and personnel are qualified by the methods described, and applied refractory quality is closely monitored, based on defined procedures and acceptance criteria. The responsibilities of inspection personnel who monitor and direct the quality control process are also defined. The lining described in this standard is for internal refractory linings on the process side of the equipment. External insulation and jacketing are not covered in this standard. Pages: 34
1st Edition | March 2018 | Product Number: C97601 | Price: $124.00

TR 977
ASTM C704 Test Variability Reduced to Allow Further Optimization of Erosion-Resistant Refractories for Critical Oil Refining Applications
Documents the results of a joint project conducted by the API CRE Subcommittee on Refractory Materials and the ASTM C08 Committee to improve the reproducibility of the 2015 edition of ASTM C704/C704M, Standard Test Method for Abrasion Resistance of Refractory Materials at Room Temperature. Erosion-resistant refractories are used in many oil refining applications, such as Fluid Catalytic Cracking Units (FCCUs), to resist the wearing effects of solids particles circulating at elevated velocities in a high-temperature process environment. This technical report also reviews the drivers for continuing improvement in erosion-resistant refractories and the role of ASTM C704/C704M for the selection and installation quality control of refractories used in these installations. This report documents changes made to the setup and procedures to improve the reproducibility of the test. These changes are designed to achieve this end, while providing a rough equivalency consistent with historical data before the changes were made. These results are validated by the results of extensive international round-robin and ruggedness testing, and are reported herein. Pages: 27
1st Edition | February 2018 | Product Number: C97701 | Price: $114.00

TR 979
Applications of Refractory Lining Materials
Covers the use of refractory concrete (castables), plastics, and ramming mixes for applications for the hydrocarbon processing industry (HPI). Its content is complemented by the two other reports in this series:
- API TR 978, Monolithic Refractories: Manufacture, Properties and Selection;
- API TR 980, Monolithic Refractories: Installation and Dryout.
These technical reports update and add to the original reports written by Committee 547 of the American Concrete Institute (ACI) in 1979 and 1989. These are ACI 547.1R-79, State-of-the Art Report: Refractory Concrete, and ACI 547.1R-89, State-of-the Art Report: Refractory Plastics and Ramming Mixes. TR 979 focuses specifically on the information on the applications of refractories contained in ACI 547.1R-79 and ACI 547.1R-89. The original content of these reports was focused primarily on steel- and glass-making applications, which represent the largest refractory markets. API, in tailoring the revision of this content to the HPI, has greatly expanded the text pertaining to the specialized oil-refining and petrochemical-processing applications. At the same time, API has retained and updated the information covering applications outside of the HPI (see Section 5) because of the similarities and applicability that this information has for refractory professionals in these other industries. Pages: 63
1st Edition | October 2018 | Product Number: C97901 | Price: $135.00

TR 980
Monolithic Refractories: Installation and Dryout
Covers the installation and dryout of monolithic refractory lining materials for hydrocarbon processing industry (HPI) applications. It discusses the best practice procedures and techniques used in the installation of refractory concrete, as well as those for air-and heat-setting plastics and ramming mixes. In addition, it discusses the need for curing and dryout and procedures to achieve successful results. This instruction is consistent with Std 936, which is the HPI industry standard for the installation quality control of monolithic refractories. It also serves as the body of knowledge document for the API 936 Refractory Personnel Certification Program. This report is the last in a series of three API reports covering the use of refractory concrete (castables), plastics, and ramming mixes for applications for the hydrocarbon processing industry. Its content is complemented by the two other reports in this series:
- API TR 978, Monolithic Refractories: Manufacture, Properties and Selection;
- API TR 979, Applications of Refractory Lining Materials.
Pages: 66
1st Edition | April 2018 | Product Number: G98001 | Price: $149.00

PETROLEUM PRODUCTS AND PETROLEUM PRODUCT SURVEYS

API/NPRA Survey
A survey of industry refining data for the period May 1 through August 31, 1996. The report includes information on domestically produced gasoline and diesel product quality as well as aggregate domestic refining capacity and average operating data. Pages: 190
1st Edition | July 1997 | Product Number: F10001 | Price: $67.00
Aviation Turbines Fuels, 2001 | Price: $96.00
Heating Oils, 2002 | Price: $106.00
Motor Gasolines, Summer 2001 | Price: $128.00
Diesel Fuel Oils, 2002 | Price: $106.00
Magnetic computer tapes of raw data are available upon request. Reports from previous years are also available. Order these petroleum product surveys from:
TRW Petroleum Technologies
918-338-4419

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Publ 4261
Alcohols and Ethers: A Technical Assessment of Their Application as Fuels and Fuel Components
Summarizes information from the technical literature on producing and applying alcohols and ethers as fuels and fuel components for the transportation sector. It assesses the technical advantages and disadvantages of alcohols and ethers with respect to hydrocarbon fuels. Since the amendment of the Clean Air Act in 1977, and subsequently in 1990, public interest in the role of oxygenates in transportation has significantly increased. This edition of Publ 4261 has been updated and expanded to include a review of the oxygenate regulations and the technical literature that has been published since 1988. It provides a technical assessment suitable for policy discussions related to alcohols and ethers in transportation. Pages: 119
3rd Edition | June 2001 | Product Number: C42613 | Price: $167.00

Publ 4262
Methanol Vehicle Emissions
December 1990 | Product Number: F42620 | Price: $129.00

PROCESS SAFETY STANDARDS

RP 752
Management of Hazards Associated with Location of Process Plant Permanent Buildings
Provides guidance for managing the risk from explosions, fires and toxic material releases to on-site personnel located in new and existing buildings intended for occupancy. This RP was developed for use at refineries, petrochemical and chemical operations, natural gas liquids extraction plants, natural gas liquefaction plants, and other onshore facilities covered by the OSHA Process Safety Management of Highly Hazardous Chemicals, 29 CFR 1910.119.
Buildings covered by this RP are rigid structures intended for permanent use in fixed locations. Tents, fabric enclosures and other soft-sided structures are outside the scope of this document. This 3rd Edition of RP 752:2009 supersedes all previous editions, including the technical data provided in those documents.
Significant research and development of technology pertinent to building siting evaluations has been performed since the publication of the previous editions of RP 752. Examples of updated technology include prediction of blast damage to buildings, determination of occupant vulnerabilities, and estimates of event frequencies. Prior versions of RP 752 and the technical data included in them should not be used for building siting evaluations. The 2nd Edition of RP 752 covered all building types both permanent and portable. This 3rd Edition of RP 752 does not cover portable buildings. Portable buildings are now covered by RP 753. It is recognized, however, that portable buildings specifically designed for significant blast load represent a potential area of overlap between RP 753 and RP 752. In accordance with 1.3 of this document:

“Buildings described in API RP 753, Management of Hazards Associated with Location of Process Plant Portable Buildings, First Edition, June 2007, as ‘portable buildings specifically designed to resist significant blast loads’ and intended for permanent use in a fixed location are covered in this document (API RP 752). All other portable buildings are covered by API RP 753.” Pages: 27
3rd Edition | December 2009 | Product Number: K75203 | Price: $145.00

RP 753
Management of Hazards Associated with Location of Process Plant Portable Buildings
Provides guidance for reducing the risk to personnel located in portable buildings from potential explosion, fire and toxic release hazards. While occupied permanent buildings (e.g. control rooms, operator shelters) located near covered process area are typically constructed to be blast and fire resistant, conventional portable buildings (i.e. light wood trailers) are typically not constructed to be blast and fire resistant. Past explosion accidents have demonstrated that occupants of conventional portable buildings are susceptible to injuries from structural failures, building collapse, and building debris and projectiles.
Guidance is provided based on the following principles.

- Locate personnel away from covered process areas consistent with safe and effective operations.
- Minimize the use of occupied portable buildings in close proximity to covered process areas.
- Manage the occupancy of portable building especially during periods of increased risk including unit start up or planned shut-down operations.
- Design, construct, install, and maintain occupied portable buildings to protect occupants against potential hazards.
- Manage the use of portable buildings as an integral part of the design, construction, and maintenance operation of a facility.

1st Edition | June 2007 | Reaffirmed: January 2012
Product Number: K75301 | Price: $145.00

RP 754
Process Safety Performance Indicators for the Refining and Petrochemical Industries (ANSI/API RP 754)
Identifies leading and lagging process safety indicators useful for driving performance improvement. As a framework for measuring activity, status, or performance, this document classifies process safety indicators into four tiers of leading and lagging indicators. Tiers 1 and 2 are suitable for nationwide public reporting, and Tiers 3 and 4 are intended for internal use at individual facilities. Guidance on methods for development and use of performance indicators is also provided. This recommended practice (RP) was developed for the refining and petrochemical industries, but may also be applicable to other industries with operating systems and processes where loss of containment has the potential to cause harm. Applicability is not limited to those facilities covered by the OSHA Process Safety Management Standard, 29 CFR 1910.119, or similar national and international regulations. To enable consistent application of this RP to other refining and petrochemical industry sub segments, informative annexes have been created to define the Applicability and Process definition for those subsegments. The user would substitute the content of those annexes for the referenced sections of this RP: Annex A—Petroleum Pipeline and Terminal Operation, Annex B—Retail Service Stations, and Annex C—Oil and Gas Drilling and Production Operations. Performance indicators identified in this recommended practice are based on the following guiding principles.

- Indicators should drive process safety performance improvement and learning.
- Indicators should be relatively easy to implement and easily understood by all stakeholders (e.g. workers and the public).
- Indicators should be statistically valid at one or more of the following levels: industry, company, and facility. Statistical validity requires a consistent definition, a minimum data set size, a normalization factor, and a relatively consistent reporting pool.
- Indicators should be appropriate for industry, company, or facility level benchmarking.

2nd Edition | April 2016 | Product Number: K75402 | Price: $155.00

As a result of the U.S. Chemical Safety and Hazard Investigation Board (CSB) investigation of the 2005 BP Texas City incident, the CSB issued several recommendations including the development of an American National Standards Institute standard that develops fatigue prevention guidelines for the refining and petrochemical industries that, at a minimum, limit hours and days of work and address shift work.

Provides guidance to all stakeholders (e.g. employees, managers, supervisors) on understanding, recognizing, and managing fatigue in the workplace. Owners and operators should establish policies and procedures to meet the purpose of this document.

Developed for refineries, petrochemical and chemical operations, natural gas liquefaction plants, and other facilities such as those covered by the OSHA Process Safety Management Standard, 29 CFR 1910.119. This document is intended to apply to a workforce that is commuting daily to a job location.

Applies to all employees working night shifts, rotating shifts, extended hours/day, or call outs involved in process safety sensitive actions. It should also be considered for others making process safety-sensitive decisions. On-site contractors involved in process safety sensitive actions shall have fatigue risk management systems equivalent to the criteria outlined in this document.

Identifies and explains the scientific and operational issues considered during the preparation of RP 755. By providing the reasoning behind the specific wording in the RP 755 document, this document supports each key statement in RP 755 in sequence so that it can be used in parallel with the RP 755 text. To make this document accessible and manageable, key scientific sources and references are provided to help readers gain access to the scientific literature.

Fatigue Risk Management Systems (FRMS) have emerged and been widely recognized as a more effective approach to managing and mitigating employee fatigue risk in the 24/7 workplace. The core feature of the FRMS is that it is a data-driven, risk-informed, safety performance-based system. The FRMS implementation process first identifies all sources of fatigue risk in the business operation, then introduces mitigating policies, technologies, and procedures to reduce the risk, and most importantly then maintains them in a proactively managed continuous improvement system. The history of FRMS was recently summarized.

This method represents a significant step change from the traditional approaches of either relying on maximum limits to hours of work or minimum limits to hours of rest (variously called Hours of Service, Work-Rest Rules, Working Time Directives), or adopting intermittent or piece-meal solutions (e.g. a fatigue training program or a shift schedule redesign), depending on the interests and initiative of local site managers.

One essential feature of FRMS is that it is a system meant to be improved upon on a regular and continuous basis. It is not a set of guidelines designed for one-time compliance but instead provides a framework that will evolve over time, driven by the collection of data on fatigue risk and fatigue outcomes (e.g. fatigue-related incidents).

Management of Hazards Associated with Location of Process Plant Tents

Provides guidance for managing the risk from explosions, fires and toxic material releases to on-site personnel located in tents. The term “tent” is used to describe a wide range of structures and is defined in §3.15. This RP was developed for use at refineries, petrochemical and chemical operations, natural gas liquids extraction plants, natural gas liquefaction plants, and other onshore facilities covered by OSHA 29 CFR 1910.119.

The focus of this RP is primarily on process related hazards. However, non-process related hazards may exist which could present risks to tent occupants. Previous accidents have demonstrated that tent occupants are susceptible to injuries from fires originating inside the tent, from tent collapse due to extreme weather, and from falling objects. Some of these hazards are addressed by tent design standards, manufacturer’s recommendations, and local regulations.

Safe Operation of Hydrofluoric Acid Alkylation Units

The refining industry has long demonstrated that HF acid alkylation units can be operated safely and responsibly. Like many industrial processes, the HF acid alkylation process presents operational risk and must be properly designed, well-maintained and operated to assure safe operation. RP 751 is an industry document that communicates proven industry practices to support the safe operation of an HF acid alkylation unit. The philosophy of this 4th Edition is to build upon the previous editions’ base of recommendations for HF acid leak prevention, detection, and mitigation with the document section topics of hazard management, operating procedures and worker protection, material inspection and maintenance, transportation and inventory control, relief and utility systems, and risk mitigation. This edition changes some previous provisions from recommendations (should) to requirements (shall) based on regulatory requirements, broad industry acceptance and proven effective industry practices along with the addition of some new recommendations and requirements. The recommendations presented in the document are those that have been found effective or those that are advised for safe operations.

Cumulative Impact of Environmental Regulations on the U.S. Petroleum Refining, Transportation and Marketing Industries

Provides guidance for managing the potential explosion hazards that may be present at refineries, petrochemical and chemical operations, natural gas and other onshore process facilities covered by OSHA 29 CFR 1910.119. The testing was conducted to provide data for use by the API committee developing RP 756. This publication, TR 756-1, contains information on the results of the API tent testing program.

Safe Operation of Hydrofluoric Acid Alkylation Units

The refining industry has long demonstrated that HF acid alkylation units can be operated safely and responsibly. Like many industrial processes, the HF acid alkylation process presents operational risk and must be properly designed, well-maintained and operated to assure safe operation. RP 751 is an industry document that communicates proven industry practices to support the safe operation of an HF acid alkylation unit. The philosophy of this 4th Edition is to build upon the previous editions’ base of recommendations for HF acid leak prevention, detection, and mitigation with the document section topics of hazard management, operating procedures and worker protection, material inspection and maintenance, transportation and inventory control, relief and utility systems, and risk mitigation. This edition changes some previous provisions from recommendations (should) to requirements (shall) based on regulatory requirements, broad industry acceptance and proven effective industry practices along with the addition of some new recommendations and requirements. The recommendations presented in the document are those that have been found effective or those that are advised for safe operations.

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<td><strong>Std 2350</strong> Overfill Protection for Storage Tanks in Petroleum Facilities (ANSI/API Std 2350)</td>
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<td>Applies to storage tanks associated with marketing, refining, pipeline, and terminals operations with tanks containing Class I or Class II petroleum liquids and use is recommended for Class III petroleum liquids. This standard addresses overfill protection for petroleum storage tanks. It recognizes that prevention provides the most basic level of protection, thus using both terms “protection” and “prevention,” the document emphasizes prevention. The standard's scope covers overfill (and damage) prevention practices for aboveground storage tanks in petroleum facilities, including refineries, marketing terminals, bulk plants, and pipeline terminals that receive flammable and combustible liquids. The fourth edition continues to build on experience and new technology through the use of management systems. Since operations are the primary overfill prevention safeguard, new definitions and requirements are established for alarms. Risk reduction is also addressed by current and generally accepted industry practices. The essential elements of this document are based on current industry safe operating practices and existing consensus standards. Federal, state, and local regulations or laws may contain additional requirements for tank overfill protection programs. For existing facilities, the results of a risk-based analysis of aboveground atmospheric petroleum storage tanks may indicate the need for more protection against overfilling. In such cases, some provisions from this standard may be suitable. The purpose of this standard is to assist owner/operators and operating personnel in the prevention of tank overfills by implementation of a comprehensive overfill prevention process (OPP). The goal is to receive product into the intended storage tank without overfill or loss of containment. This standard does not apply to: underground storage tanks; aboveground tanks of 1320 U.S. gallons (5000 liters) or less; aboveground tanks which comply with PEI 600; pressure vessels; tanks containing non-petroleum liquids; tanks storing LPG and LNG; tanks at service stations; tanks filled exclusively from wheeled vehicles (i.e. tank trucks or railroad tank cars); and tanks covered by OSHA 29 CFR 1910.119 and EPA 40 CFR 68, or similar regulations. Pages: 47</td>
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<tr>
<td><strong>Pubi 422</strong> Groundwater Protection Programs for Petroleum Refining and Storage Facilities: A Guidance Document</td>
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<td>Reflects continuing industry action and commitment to positively address groundwater protection by developing and implementing individual groundwater protection plans. Provides additional guidance to help petroleum facilities identify the types of issues that may need to be addressed in a groundwater protection plan. Intended to help refiners, terminals associated with transportation pipelines, product distribution terminals, and other downstream petroleum storage units develop groundwater protection plans that are tailored to their individual circumstances. Pages: 9</td>
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<td><strong>Pubi 800</strong> Literature Survey: Subsurface and Groundwater Protection Related to Petroleum Refinery Operations</td>
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<td>This report is the principal product of an API-sponsored project to prepare a background basis for the development of further information on subsurface and groundwater protection at refineries. It contains an explanation of how the literature survey was conducted; annotations for pertinent articles; a discussion of applicable federal statutes and regulations; and annotations for pertinent regulatory programs under the 5 principal statutes that apply to refinery operations. Pages: 145</td>
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**SECURITY**

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<td><strong>Std 780</strong> Security Risk Assessment Methodology for the Petroleum and Petrochemical Industries</td>
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<td>Prepared by a Security Risk Assessment (SRA) Committee of the American Petroleum Institute (API) to assist the petroleum and petrochemical industries in understanding security risk assessment and in conducting SRAs. The standard describes the recommended approach for assessing security risk widely applicable to the types of facilities operated by the industry and the security issues the industry faces. The standard is intended for those responsible for conducting security risk assessments and managing security at these facilities. The method described in this standard is widely applicable to a full spectrum of security issues from theft to insider sabotage to terrorism. The API SRA Methodology was developed for the petroleum and petrochemical industry, for a broad variety of both fixed and mobile applications. This recommended practice describes a single methodology, rather than a general framework for SRAs, but the methodology is flexible and adaptable to the needs of the user. This methodology constitutes one approach for assessing security vulnerabilities at petroleum and petrochemical industry facilities. However, there are other risk assessment techniques and methods available to industry, all of which share common risk assessment elements. Pages: 113</td>
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<td><strong>RP 781</strong> Facility Security Plan Methodology for the Oil and Natural Gas Industries</td>
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<td>Provides the framework to establish a secure workplace. The plan provides an overview of the threats facing the facility and describes the security measures and procedures designed to mitigate risk and protect people, assets, operations, and company reputation. This API standard was prepared with guidance and direction from the API Security Committee, to assist the petroleum and petrochemical industries in the preparation of a Facility Security Plan (FSP). This standard specifies the requirements for preparing an FSP as well as a discussion of the typical elements included in an FSP. This standard is intended to be flexible and adaptable to the needs of the user. It is noted that the content of an FSP can vary depending on circumstances such as facility size, location, and operations. This methodology is one approach for preparing an FSP at petroleum and petrochemical industries; there are other security plan formats available for the industry. It is the responsibility of the user to choose the format and content of the FSP that best meets the needs of a specific facility. The format and content of some FSPs should be dictated by government regulations for covered facilities. This standard is not intended to supersed the requirements of any regulated facility but may be used as a reference document. Pages: 82</td>
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