Sizing, Selection, and Installation of Pressure-Relieving Devices in Refineries

Part I—Sizing and Selection

API RECOMMENDED PRACTICE 520
SEVENTH EDITION, JANUARY 2000

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- To participate with government and others in creating responsible laws, regulations and standards to safeguard the community, workplace and environment.
- To promote these principles and practices by sharing experiences and offering assistance to others who produce, handle, use, transport or dispose of similar raw materials, petroleum products and wastes.

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Downstream Segment

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FOREWORD

API Recommended Practice 520, *Sizing, Selection, and Installation of Pressure-Relieving Devices in Refineries*, is the result of several years' work by engineers in the petroleum industry.

The information in this recommended practice is intended to supplement the information contained in Section VIII, "Pressure Vessels," of the ASME *Boiler and Pressure Vessel Code*. The recommendations presented in this publication are not intended to supersede applicable laws and regulations.

Users of this recommended practice are reminded that no publication of this type can be complete, nor can any written document be substituted for qualified engineering analysis.

The current edition of this recommended practice, published in two parts, has been updated with respect to the practices generally used in the installation of all devices covered in the previous editions; the current edition also contains additional information based on revisions suggested by many individuals and several organizations.

The first edition of this recommended practice was issued in 1955. The second edition was published in two parts: Part I, "Design," in 1960 and Part II, "Installation," in 1963. The third edition of Part I was issued in November 1967 and reaffirmed in 1973. The fourth edition was issued in December 1976, the fifth edition was issued in July 1990, and the sixth edition was issued in March 1993.

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1.1 SCOPE

This recommended practice 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 recommended practice are intended to protect unfired pressure vessels and related equipment against overpressure from operating and fire contingencies.

This recommended practice 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.

Pressure relief devices protect a vessel against overpressure only; they do not protect against structural failure when the vessel is exposed to extremely high temperatures such as during a fire. See API Recommended Practice 521 for information about appropriate ways of reducing pressure and restricting heat input.

Atmospheric and low pressure storage tanks covered in API Standard 2000 and pressure vessels used for the transportation of products in bulk or shipping containers are not within the scope of this recommended practice.

The rules for overpressure protection of fired vessels are provided in Section I of the ASME *Boiler and Pressure Vessel Code* and ASME B31.1, and are not within the scope of this recommended practice.

1.2 DEFINITION OF TERMS

Terms used in this recommended practice relating to pressure relief devices and their dimensional and operational characteristics are defined in 1.2.1 through 1.2.3. The terms are covered more specifically in the applicable sections of text and accompanying illustrations.

1.2.1 Pressure Relief Devices

1.2.1.1 pressure relief device: Actuated by inlet static pressure and designed to open during emergency or abnormal conditions to prevent a rise of internal fluid pressure in excess of a specified design value. The device also may be designed to prevent excessive internal vacuum. The device may be a pressure relief valve, a non-reclosing pressure relief device, or a vacuum relief valve.

1.2.1.2 pressure relief valve: A pressure relief device designed to open and relieve excess pressure and to reclose and prevent the further flow of fluid after normal conditions have been restored.

a. A *relief valve* is a spring loaded pressure relief valve actuated by the static pressure upstream of the valve. The valve opens normally in proportion to the pressure increase over the opening pressure. A relief valve is used primarily with incompressible fluids.
b. A *safety valve* is a spring loaded pressure relief valve actuated by the static pressure upstream of the valve and characterized by rapid opening or pop action. A safety valve is normally used with compressible fluids.
c. A *safety relief valve* is a spring loaded pressure relief valve that may be used as either a safety or relief valve depending on the application.
d. A *conventional pressure relief valve* is a spring loaded pressure relief valve whose operational characteristics are directly affected by changes in the back pressure.
e. A *balanced pressure relief valve* is a spring loaded pressure relief valve that incorporates a bellows or other means for minimizing the effect of back pressure on the operational characteristics of the valve
f. A *pilot operated pressure relief valve* is a pressure relief valve in which the major relieving device or main valve is combined with and controlled by a self actuated auxiliary pressure relief valve (pilot).

1.2.1.3 non-reclosing pressure relief device: A pressure relief device which remains open after operation. A manual resetting means may be provided.

1.2.1.4 rupture disk device: A non-reclosing pressure relief device actuated by static differential pressure between the inlet and outlet of the device and designed to function by the bursting of a rupture disk. A rupture disk device includes a rupture disk and a rupture disk holder.

a. A *rupture disk* is a pressure containing, pressure and temperature sensitive element of a rupture disk device.
b. A *rupture disk holder* is the structure which encloses and clamps the rupture disk in position. (Some disks are designed to be installed between standard flanges without holders.)
c. A *nonfragmenting rupture disk* is a rupture disk designed and manufactured to be installed upstream of other piping components, such as pressure relief valves, and will not impair the function of those components when the disk ruptures.