Guide For Pressure Relief And Depressuring Systems

API RP 521
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Refining Department

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FOREWORD

This publication has been developed as a guide for plant engineers in the design, installation, and operation of pressure relief and depressuring systems. The text, based on accumulated knowledge and experience of qualified engineers in petroleum processing and related industries, recommends economically sound and safe practices for pressure relief.

Prior to publication of this Guide, no collected source of information of this type had been available for reference. The development of *API RP 520: Design and Installation of Pressure-Relieving Systems in Refineries* disclosed the existence of detailed information in the files of participating individuals; the Guide is a compilation of these pertinent data and is published as an adjunct to API RP 520.

As modern processing units become more complex in design and operation, the levels of energy stored in these units point to the importance of reliable, carefully designed pressure-relieving systems. Suggested solutions to the immediate design, economic, and safety problems involved in pressure-relieving discharge systems are presented. Users of the Guide, however, are reminded that no publication of this type can be complete, nor can any written document be substituted for qualified engineering analysis.

CONTENTS

GUIDE FOR PRESSURE RELIEF AND DEPRESSURING SYSTEMS

SECTION 1—GENERAL

1.1 SCOPE

This Guide presents recommended practices applicable to pressure-relieving and vapor depressuring systems. The information provided herein is designed to aid in the selection and type of system most appropriate for the risks and circumstances involved in the various installations. It is intended to supplement the practices set forth in API RP 520 [1]* for establishing a basis of design.

Guidelines are provided for the examination of the principal causes of overpressure; for the determination of individual relieving rates; for selection of disposal systems; and for the design of disposal systems including such component parts as vessels, flares, and vent stacks.

Piping information pertinent to pressure-relieving systems is presented in Sect. 5, Par. 5.3(A); however, the actual piping is to be designed in accordance with USAS B31.3 [2] or other applicable codes.

1.2 DEFINITIONS

A glossary of terms used in pressure-relieving systems follows; each term is defined as it relates to pressure relief. Many of the terms and definitions are taken from API RP 520, see Part I—"Design"; USASI proposed standard, *Terminology for Pressure Relief Devices;* and ASME PTC-25.2.[3]

Accumulation: Accumulation is the pressure increase over the maximum allowable working pressure of the vessel during discharge through the pressure relief valve, expressed as a percent of that pressure, or in pounds per square inch.

Atmospheric discharge: Atmospheric discharge is the release of vapors and gases from pressure relief and depressuring devices to the atmosphere.

Back pressure: Back pressure is the pressure existing at the outlet of the pressure relief device due to pressure in the discharge system; see, also, *built-up back pressure* and *superimposed back pressure.*

Balanced safety relief valve: A balanced safety relief valve incorporates means for minimizing the effect of back pressure on the performance characteristics—opening pressure, closing pressure, lift and relieving capacity.

Blowdown: Blowdown is the difference between the set pressure and the reseating pressure of a pressure relief valve, expressed as a percent of the set pressure, or in pounds per square inch.

Built-up back pressure: Built-up back pressure is the static pressure existing at the outlet of a pressure relief device caused by flow from that particular device into a discharge system. Where more than one device discharges into a common system, built-up pressure resulting from the operation of one device will act as superimposed back pressure on the other devices. This type of back pressure is variable.

Burst pressure: Burst pressure is the value of inlet static pressure at which a rupture disk device functions.

Closed bonnet pressure relief valve: The spring of a closed bonnet pressure relief valve is totally encased in a metal housing. This housing protects the spring from weather and environmental corrosive agents, and is a means for collecting leakage around the stem or disk guide. The bonnet may or may not be sealed against leakage of pressure existing in the bonnet to the surrounding atmosphere, depending on the type of cap or lifting lever assembly employed, or specific handling of bonnet venting.

Closed disposal system: A closed disposal system is capable of containing pressures different from atmospheric pressure without leakage.

Cold differential test pressure: Cold differential test pressure, in pounds per square inch gage, is the inlet static pressure at which the pressure relief valve is adjusted to open on the test stand. This pressure includes the corrections for service conditions of back pressure or temperature, or both.

Conventional safety relief valve: A conventional safety relief valve is a closed bonnet pressure relief valve that has the bonnet vented to the discharge side of the valve. The performance characteristics—opening pressure, closing pressure, lift and relieving capacity—are directly affected by changes of the back pressure on the valve.

Design pressure: Design pressure is the pressure used in the design of a vessel to determine the minimum permissible thickness or physical characteristics of the different parts of a vessel; see, also, *maximum allowable working pressure.*

Flare: A flare is a means for safe disposal of waste gases by combustion. With an *elevated flare* the combustion is carried out at the top of a pipe or stack where the burner and igniter are located. A *ground flare* is similarly equipped except that combustion is carried out at or near ground level. A *burn pit* differs from a flare in that it is normally designed to handle both liquids and vapors.

Lift: Lift is the actual travel of the disk away from closed position when the valve is relieving.

* REFERENCES on p. 7.