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

Part II—Installation

API RECOMMENDED PRACTICE 520
FIFTH EDITION, AUGUST 2003

REAFFIRMED, FEBRUARY 2011

AMERICAN PETROLEUM INSTITUTE

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Downstream Segment

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CONTENTS

Page

Figures

Sizing, Selection, and Installation of Pressure-relieving Devices in Refineries
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1 Scope

This recommended practice covers 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 103 kPA) 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. As used in this recommended practice, 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. This recommended practice covers gas, vapor, steam, two-phase and incompressible fluid service; it does not cover special applications that require unusual installation considerations.

2 References

The current editions of the following standards, codes, and specifications are cited in this recommended practice:

API

RP 520 *Sizing, Selection, and Installation of Pressure-Relieving Devices in Refineries, Part I—Sizing and Selection*

RP 521 *Guide for Pressure-Relieving and Depressuring Systems*

RP 576 *Inspection of Pressure-Relieving Devices*

ASME[1]

B31.3 *Process Piping*

Boiler and Pressure Vessel Code, Section VIII, "Pressure Vessels"

3 Definition of Terms

The terminology for pressure-relief devices that is used in this recommended practice is in general agreement with the definitions given in API Recommended Practice 520 Part I.

4 Inlet Piping to Pressure-Relief Devices

4.1 GENERAL REQUIREMENTS

For general requirements for inlet piping, see Figures 1 through 3.

4.1.1 Flow and Stress Considerations

Inlet piping to the pressure-relief devices should provide for proper system performance. This requires design consideration of the flow-induced pressure drop in the inlet piping. Excessive pressure losses in the piping system between the protected vessel and a pressure-relief device will adversely affect the system-relieving capacity and can cause valve instability. In addition, the effect of stresses derived from both pressure-relief device operation and externally applied loads must be considered. For more complete piping design guidelines, see ASME B31.3.

4.1.2 Vibration Considerations

Most vibrations that occur in inlet piping systems are random and complex. These vibrations may cause leakage at the seat of a pressure-relief valve, premature opening, or premature fatigue failure of certain valve parts, inlet and outlet piping, or both. Vibration in inlet piping to a rupture disk may adversely affect the burst pressure and life of the rupture disk.

Detrimental effects of vibrations on the pressure-relief device can be reduced by minimizing the cause of vibrations, by additional piping support, by use of either pilot-operated relief valves or soft-seated pressure-relief valves, or by providing greater pressure differentials between the operating pressure and the set pressure.

4.2 PRESSURE-DROP LIMITATIONS AND PIPING CONFIGURATIONS

For pressure-drop limitations and piping configurations, see Figures 1, 2, 4, and 5.

4.2.1 Pressure Loss at the Pressure-Relief Valve Inlet

Excessive pressure loss at the inlet of a pressure-relief valve can cause rapid opening and closing of the valve, or chattering. Chattering will result in lowered capacity and damage to the seating surfaces. The pressure loss that affects valve performance is caused by non-recoverable entrance losses (turbulent dissipation) and by friction within the inlet piping to the pressure-relief valve.

Chattering has sometimes occurred due to acceleration of liquids in long inlet lines.

4.2.2 Size and Length of Inlet Piping to Pressure-Relief Valves

When a pressure-relief valve is installed on a line directly connected to a vessel, the total non-recoverable pressure loss

[1]ASME International, Three Park Avenue, New York, NY 10016-5990, www.asme.org.