Instructions to Voters/Comments on API 520 Part I Ballot – "Removal of Requirements/Guidance from Definitions"

1. Your comments should be limited to the **red-line portions of the ballot only.**
2. This ballot addresses 520 Action Item 2022-06 and removes general guidance or requirements from the definitions and moves them to the main text.
3. If you are voting negative, please indicate which of your comment or comments are the reason for your negative vote. API's Balloting system will categorize all of your comments as Negative.

Thanks to Jeremy Grace and his work group for their efforts.

Phil Henry
API 520 Task Force Chair

BALLOT FOR ACTION ITEM AI-2022-06

Sizing, Selection, and Installation of Pressure-relieving Devices

Part I—Sizing and Selection

API STANDARD 520, PART I
TENTH EDITION, OCTOBER 2020

American Petroleum Institute

3 Terms, Definitions, Acronyms, and Abbreviations

3.1 Terms and Definitions

For the purposes of this document, the following definitions apply. Many of the terms and definitions are taken from ASME PTC 25.

3.1.1
accumulation
The pressure increase over the MAWP of the vessel, expressed in pressure units or as a percentage of MAWP or design pressure. Maximum allowable accumulations are established by applicable codes for emergency operating and fire contingencies.

3.1.2
actual orifice area/actual discharge area
The cross-sectional area (based on the measured diameter) within the pressure-relief device flow path that limits the fluid flow through the pressure-relief device.

NOTE The value is normally measured and recorded as part of the certification test by an independent organization following the procedures specified in the device's code of construction.

3.1.3
backpressure
The pressure that exists at the outlet of a pressure-relief device as a result of the pressure in the discharge system. Backpressure is the sum of the superimposed and built-up backpressures.

3.1.4
balanced pressure-relief valve
A spring-loaded pressure-relief valve that incorporates a bellows or other means for minimizing the effect of backpressure on the operational characteristics of the valve.

3.1.5
blowdown
The difference between the set pressure and the closing pressure of a pressure-relief valve, expressed as a percentage of the set pressure or in pressure units.

3.1.6
bore area/nozzle area/nozzle throat area/throat area
The minimum cross-sectional flow area of a nozzle in a pressure-relief valve.

3.1.7
built-up backpressure
The increase in pressure at the outlet of a pressure-relief device that develops as a result of flow after the pressure-relief device opens.

3.1.8
burst pressure
The value of the upstream static pressure minus the value of the downstream static pressure just prior to when the disk bursts. When the downstream pressure is atmospheric, the burst pressure is the upstream static gauge pressure.

3.1.9
burst pressure tolerance
The variation around the marked burst pressure at the specified disk temperature in which a rupture disk shall burst.

3.1.10
capacity/relieving capacity
The flow rate of a fluid through a pressure-relief device or a pressure-relief system under a given set of conditions and fluid properties.

3.1.11
certified capacity/certified relieving capacity
The capacity of a pressure-relief device determined using the certification test fluid (commonly air, steam, or water), at the certification test overpressure, with the certified coefficient of discharge, and with the actual orifice area, all in accordance with the applicable code of construction.

NOTE 1 It does not include any derating factors based on the physical installation such as a rupture disk upstream of a pressure-relief valve or backpressure on a balanced bellows valve. This capacity is provided by the pressure- relief device vendor and is stamped on the pressure-relief device nameplate.

NOTE 2 The certification overpressure for ASME *BPVC*, Section VIII valves is typically the greater of 10 % or 3psi.

3.1.12
certified coefficient of discharge
The published value for the ratio of the measured relieving capacity to the theoretical relieving capacity of an ideal nozzle, multiplied by a capacity derating factor if required by the code of construction.

NOTE This value is determined by an independent organization following the capacity certification requirements in the device's code of construction.

3.1.13
chatter
The opening and closing of a pressure-relief valve at a very high frequency (on the order of the natural frequency of the valve's spring mass system).

3.1.14
closing pressure
The value of decreasing inlet static pressure at which the valve disc reestablishes contact with the seat or at which lift becomes zero as determined by seeing, feeling, or hearing.

3.1.15
cold differential test pressure
CDTP
The pressure at which a pressure-relief valve is adjusted to open on the test stand. The CDTP includes corrections for the service conditions of backpressure or temperature or both.

3.1.16
conventional pressure-relief valve
A spring-loaded pressure-relief valve whose operational characteristics are directly affected by changes in the backpressure.

3.1.17
curtain area
The area of the cylindrical or conical discharge opening between the seating surfaces above the nozzle seat created by the lift of the disc.

3.1.18
cycling
The relatively low frequency (a few cycles per second to a few seconds per cycle) opening and closing of a pressure-relief valve.

3.1.19
design pressure
Pressure, together with the design temperature, used to determine the minimum permissible thickness or physical characteristic of each vessel component as determined by the ~~vessel~~ design rules of the pressure design code.

NOTE: The design pressure is selected by the user to provide a suitable margin above the most severe pressure expected during normal operation at a coincident temperature. ~~It is the~~, and it is typically specified ~~pressure specified~~ on the purchase order. ~~This pressure may be used in place of the MAWP in all cases where the MAWP has not been established.~~ The design pressure is equal to or less than the MAWP (the design pressure can be used as the MAWP in cases where the MAWP has not been established).

3.1.20
dual certified pressure-relief valves
Pressure-relief valves that are both vapor flow certified and liquid flow certified where dual certification is achieved without making any modifications or adjustments to the relief device when switching fluids during the flow testing.

3.1.21
effective coefficient of discharge
The value for the ratio of the estimated relieving capacity to the theoretical relieving capacity of an ideal nozzle.

NOTE API 520 provides effective coefficients of discharge.

3.1.22
effective discharge area/effective orifice area
A nominal cross-sectional area within the pressure-relief device flow path that limits the fluid flow through the pressure-relief device.

NOTE API 526 provides effective orifice areas for a range of valve sizes in terms of letter designations, “D” through “T” that allow calculations to be performed per the preliminary sizing equations.

3.1.23
flutter
The abnormal, rapid reciprocating motion of the moveable parts of a pressure-relief valve, during which the disk does not contact the seat or the upper stop.

3.1.24
huddling chamber
An annular chamber located downstream of the seat of a pressure-relief valve for the purpose of assisting the valve to achieve lift.

3.1.25
inlet size
The nominal pipe size (NPS) of the device at the inlet connection, unless otherwise designated.

3.1.26
leak test pressure
The specified inlet static pressure at which a seat leak test is performed.

3.1.27
lift
The actual travel of the disc from the closed position when a valve is relieving.

3.1.28
lot of rupture disks
Disks manufactured at the same time and of the same size, material, thickness, type, heat, and manufacturing process, including heat treatment.

Commented [GJ1]: Modified to exact wording in API 521 7th ed

3.1.29
manufacturing design range
The pressure range in which the rupture disk shall be marked.

NOTE: Manufacturing design ranges are usually catalogued by the manufacturer as a percentage of the specified burst pressure. ~~Catalogued manufacturing design ranges may be modified by agreement between the user and the manufacturer.~~

3.1.30
marked burst pressure/rated burst pressure
The burst pressure established by tests for the specified temperature and marked on the disk tag by the manufacturer. ~~The marked burst pressure may be any pressure within the manufacturing design range unless otherwise specified by the customer.~~
NOTE: The marked burst pressure is applied to all of the rupture disks of the same lot.

3.1.31
maximum allowable working pressure
MAWP
The maximum gauge pressure permissible at the top of a completed vessel in its normal operating position at the designated coincident temperature specified for that pressure.

NOTE: The pressure is the least of the values for the internal or external pressure as determined by the vessel design rules for each element of the vessel using actual nominal thickness, exclusive of additional metal thickness allowed for corrosion and loadings other than pressure. ~~The MAWP is the basis for the pressure setting of the pressure relief devices that protect the vessel.~~ The MAWP is normally greater than the design pressure but can be equal to the design pressure when the design rules are used only to calculate the minimum thickness for each element and calculations are not made to determine the value of the MAWP.

3.1.32
maximum operating pressure
The maximum pressure expected during normal system operation.

3.1.33
minimum net flow area
The calculated net area after a complete burst of a rupture disk with appropriate allowance for any structural members that ~~may~~ reduce the net flow area through the rupture disk device.

3.1.34
modulating pressure-relief valve
A pressure-relief valve that opens and flows in proportion to the inlet pressure for some or all parts of the valve's operating range from set pressure to overpressure at full lift.

3.1.35
nonfragmenting rupture disk
A rupture disk designed and manufactured to be installed upstream of other piping components. Nonfragmenting rupture disks do not impair the function of pressure-relief valves when the disk ruptures.

3.1.36
nonreclosing pressure-relief device
A pressure-relief device that remains open after operation with or ~~.~~ Awithout manual reset capability.~~ting means may be provided.~~

3.1.37
normal cubic meters per minute, Nm^3/min
SI unit for volumetric flow rate of gas at a temperature of 0 °C and an absolute pressure of 101.3 kPa, expressed in cubic meters per minute.

3.1.38
opening pressure
The value of increasing inlet static pressure at which there is a measurable lift of the disc or at which

Commented [GJ2]: Note: Addressed in should / shall ballot. "The pressure range in which the rupture disk is marked."

Commented [GJ3]: Moved to main body 4.3.6.2 rupture disk selection.

Commented [GJ4]: Content located in 4.3.6.2 already and relocated sentence from 3.1.29 covers customer agreement.

Commented [GJ5]: Removed due to appearance of requirement that is not accurate (MAWP not necessarily the basis for setting of PRD).

discharge of the fluid becomes continuous, as determined by seeing, feeling, or hearing.

3.1.39
operating ratio of a pressure-relief valve
The ratio of maximum system operating pressure to the set pressure.

3.1.40
operating ratio of a rupture disk
The ratio of the maximum system operating pressure to a pressure associated with a rupture disk (see Figure 27 and Figure 29). For marked burst pressures above 40 psi, the operating ratio is the ratio of maximum system operating pressure to the disk marked burst pressure. For marked burst pressures between 15 psi and 40 psi, the operating ratio is the ratio of maximum system operating pressure to the marked burst pressure minus 2 psi. For marked burst pressures less than 15 psi, the operating ratio should be determined by consulting the manufacturer.

3.1.41
outlet size
The NPS of the device at the discharge connection, unless otherwise designated.

3.1.42
overpressure
The pressure increase over the set pressure of the relieving device. Overpressure is expressed in pressure units or as a percentage of set pressure. Overpressure is the same as accumulation only when the relieving device is set to open at the MAWP of the vessel.

3.1.43
pilot-operated pressure-relief valve
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).

3.1.44
pin-actuated device
A nonreclosing pressure-relief device actuated by static pressure and designed to function by buckling or breaking a pin, which holds a piston or a plug, in place. Upon buckling or breaking of the pin, the piston or plug instantly moves to the full open position.

3.1.45
pressure-relief device
PRD
A device actuated by inlet static pressure and designed to open during emergency or abnormal conditions to prevent a rise of internal fluid pressure or vacuum 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 nonreclosing pressure-relief device, or a vacuum-relief valve.~~

Commented [GJ6]: Removed permissive and redundant body information (devices are listed in section 4).

3.1.46
pressure-relief valve
PRV
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.

3.1.47
rated capacity/rated relieving capacity
The capacity of the pressure-relief device determined using the properties of the actual fluid flowing through the pressure-relief device at the certification test overpressure. The overpressure is specified by the applicable code of construction. This capacity can be determined using the effective coefficient of discharge and effective orifice area, or the certified coefficient of discharge and actual orifice area (see 5.2).

NOTE 1 The certification test overpressure for ASME *BPVC*, Section VIII valves is typically the greater of 10 % or 3 psi.

NOTE 2 The rated capacity retains the code-required capacity derating.

3.1.48
relief valve
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.

3.1.49
relieving conditions
The inlet pressure and temperature on a pressure-relief device during an overpressure condition. The relieving pressure is equal to the valve set pressure (or rupture disk burst pressure) plus the overpressure.

NOTE: The temperature of the flowing fluid at relieving conditions ~~may~~ can be higher or lower than the operating temperature.

3.1.50
required capacity/required relieving capacity/required relief rate/required relief load
The fluid flow rate that is required to pass through the pressure-relief device for a particular overpressure scenario.

3.1.51
rupture disk
A pressure-containing, pressure- and temperature-sensitive element of a rupture disk device.

3.1.52
rupture disk device
A nonreclosing 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.

3.1.53
rupture disk holder
The structure that encloses and clamps the rupture disk in position. Some disks are designed to be installed between standard flanges without holders.

3.1.54
safety relief valve
A spring-loaded pressure-relief valve that ~~may~~ can be used as either a safety or relief valve depending on the application.

3.1.55
safety valve
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.

3.1.56
set pressure
The inlet gauge pressure at which the pressure-relief device is set to open under service conditions.

3.1.57
simmer
The audible or visible escape of compressible fluid between the seat and disc of a pressure-relief valve that ~~may~~ can occur at an inlet static pressure below the set pressure prior to opening.

3.1.58
specified burst pressure
The burst pressure specified by the user. ~~The marked burst pressure may be greater than or less than the specified burst pressure but shall be within the manufacturing design range. The user is cautioned to consider manufacturing design range, superimposed backpressure, and specified temperature when determining a specified burst pressure.~~ See 4.3.6.2.1.

Commented [GJ7]: Addressed by should / shall ballot. "See 4.3.6.2.1".

3.1.59
specified disk temperature
The temperature of the disk when the disk is expected to burst. The specified disk temperature is the temperature the manufacturer uses to establish the marked burst pressure.

NOTE: The specified disk temperature is rarely ever the design temperature of the vessel and ~~may~~ sometimes is not even ~~be~~ the operating temperature or relief temperature, depending on the relief system configuration.

Commented [GJ8]: Removed so it doesn't sound like "may not" as in "not permissible to be"...

3.1.60
standard cubic feet per minute
SCFM
USC unit for volumetric flow rate of gas at a temperature of 60 °F and an absolute pressure of 14.7 psi, expressed in cubic feet per minute.

3.1.61
superimposed backpressure
The static pressure that exists at the outlet of a pressure-relief device at the time the device is required to operate. Superimposed backpressure is the result of pressure in the discharge system coming from other sources and ~~may be~~is constant or variable.

3.2 Acronyms and Abbreviations

BPVC	*Boiler and Pressure Vessel Code*
CDTP	cold differential test pressure
HEM	Homogeneous Equilibrium Model
MAWP	maximum allowable working pressure
NPS	nominal pipe size
PRD	pressure-relief device
PRV	pressure-relief valve
SI	International System of units
USC	United States customary units

4 Pressure-relief Devices

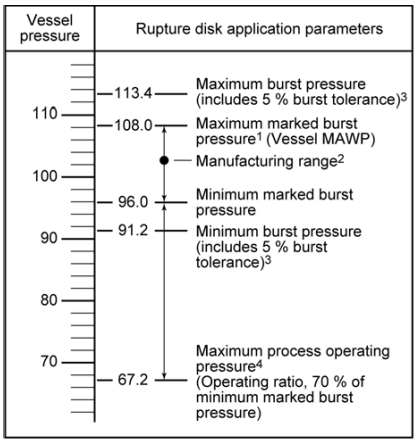
4.3 Rupture Disk Devices

4.3.6 Rupture Disk Selection and Specification

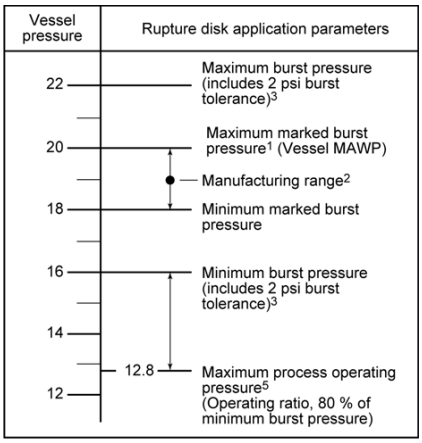
4.3.6.1 General

4.3.6.2 Rupture Disk Selection

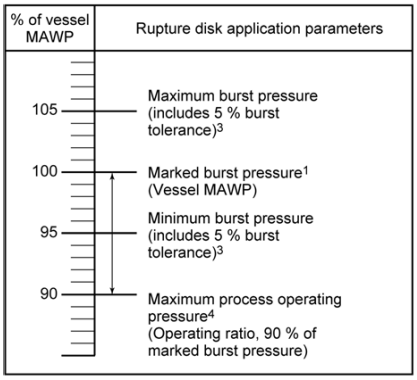
4.3.6.2.1 Rupture disk types and basic performance characteristics are described in 4.3.3 and may be used as a basis for selection. The relationship between system pressures and the operating characteristics of a rupture disk device are shown in Figure 27. Since the marked burst pressure of a rupture disk can be anywhere within its manufacturing design range, the user is cautioned to make sure that the upper limit of the manufacturing design range does not exceed the MAWP of the equipment being protected. As shown in Figure 28, when the disk has a positive manufacturing design range, the marked burst pressure of the disk can actually be greater than the specified pressure. Catalogued manufacturing design ranges may be modified by agreement between the user and the manufacturer.



A. Example of a rupture disk with a specified burst pressure of 100 psig, manufacturing range of +8/-4 %, burst tolerance of ±5 %, and a 70 % operating ratio.



C. Example of a rupture disk with a specified burst pressure of 20 psig, manufacturing range of +0/-10 %, burst tolerance of ± 2 psig, and an 80 % operating ratio.



B. Example of a rupture disk with a specified burst pressure of 100 psig, zero manufacturing range, burst tolerance of ±5 %, and a 90 % operating ratio.

NOTE 1 See Figure 19 for limits on marked burst pressure.

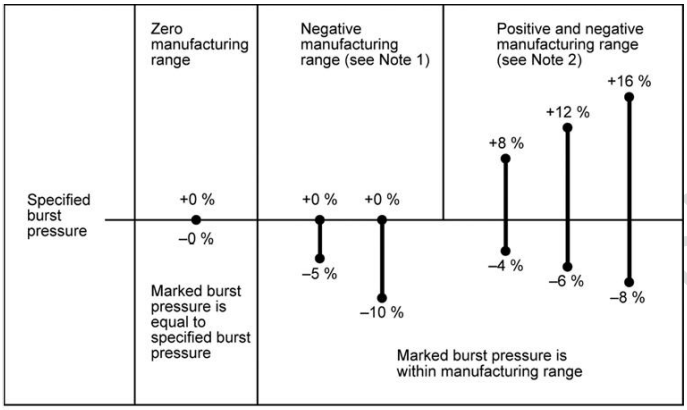
NOTE 2 Marked burst pressure may be any pressure within the manufacturing range, see Figure 28.

NOTE 3 For marked burst pressures above 40 psig, the burst tolerance is ±5 %. For marked burst pressures at 40 psig and below, the burst tolerance is ±2 psi.

NOTE 4 For marked burst pressures above 40 psig, the maximum process operating pressure is calculated by multiplying the minimum marked burst pressure by the operating ratio.

NOTE 5 For marked burst pressures at 40 psig and below, the maximum process operating pressure is calculated by subtracting the burst tolerance from the minimum marked burst pressure, then multiplying the difference by the operating ratio.

Figure 27—Rupture Disk Application Parameters Assuming No Superimposed Backpressure



NOTE 1 The marked burst pressure will not exceed the specified burst pressure.

NOTE 2 Positive manufacturing range may result in a marked burst pressure exceeding the specified burst pressure.

Figure 28—Common Types of Manufacturing Ranges and Corresponding Burst Pressure Marking

4.3.6.2.2 The maximum pressure at which a rupture disk may be marked to burst is the upper limit of its manufacturing design range. The minimum pressure at which a rupture disk may be marked to burst is the lower limit of its manufacturing design range. Figure 27 provides graphical examples of common relationships between burst pressure, manufacturing design range, burst tolerance, and operating pressure.