
**Safety devices for protection against
excessive pressure —**

**Part 7:
Common data**

AMENDMENT 1

*Dispositifs de sécurité pour protection contre les pressions
excessives —*

Partie 7: Données communes

AMENDEMENT 1





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Safety devices for protection against excessive pressure —

Part 7: Common data

AMENDMENT 1

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Formula 9

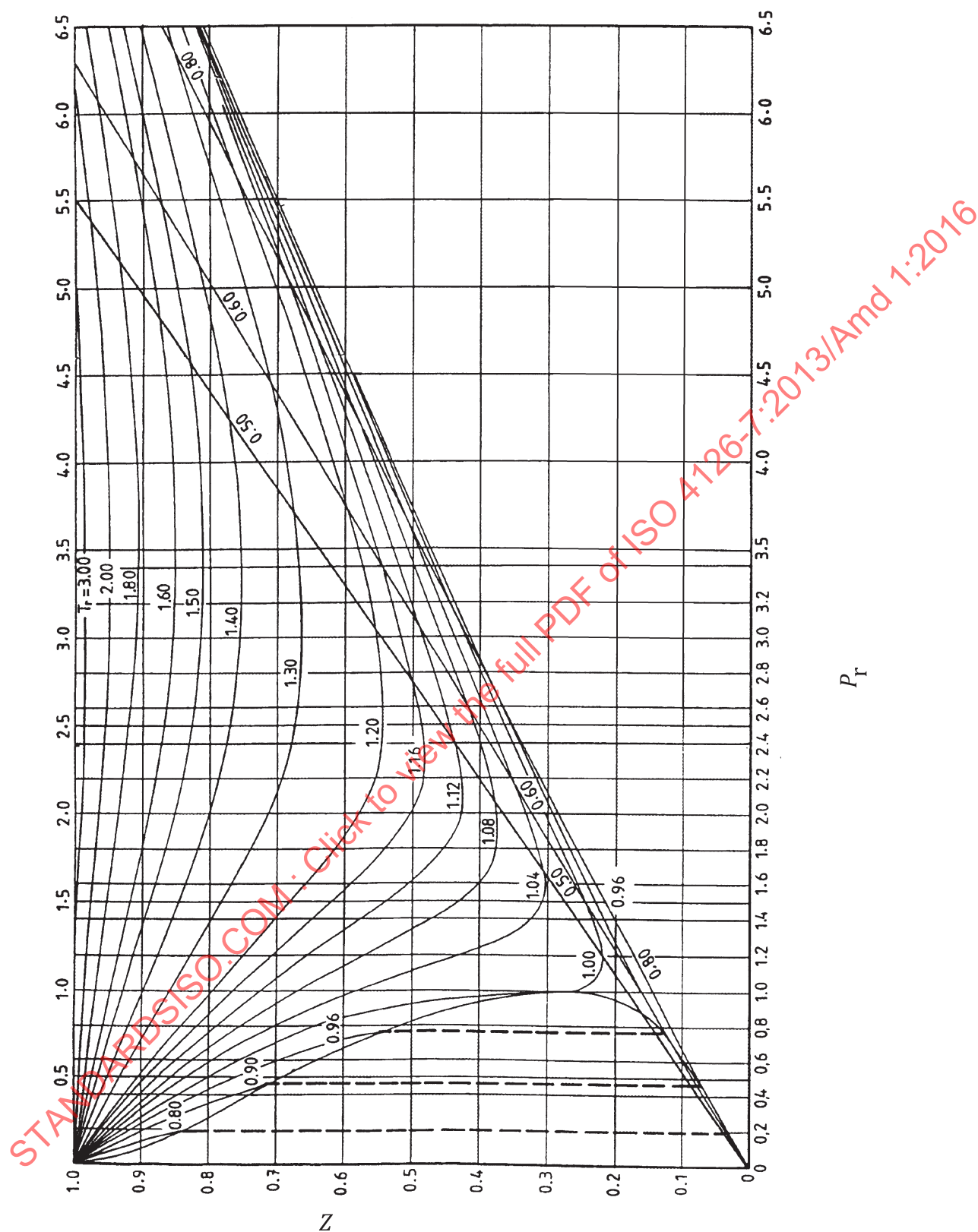
Delete the equation and substitute:

$$3,948 = \frac{3600}{\sqrt{10^5} \times \sqrt{R}}$$

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Figure 1

Delete the figure and substitute new figure on following page.



Key

- P_r reduced pressure
- T_r reduced temperature
- Z compressibility factor

Figure 1 — Estimating chart for compressibility factor, Z

Clause A.1 Capacity calculations for gaseous media at critical flow (6.3.3.1)

Delete A.1 Example 1 and substitute:

EXAMPLE 1 Calculate the flow area of a safety valve to be used on a vessel holding nitrogen gas with a maximum allowable pressure, PS of 10 bar gauge (1,0 MPa).

Safety valve certified de-rated coefficient of discharge [K_{dr}] at 10 % overpressure	= 0,87
Molar mass of the gas [M]	= 28,02
Isentropic exponent of the gas [k]	= 1,40
Gas relieving temperature	= 20 °C
Required gas flow capacity	= 18 000 kg/h
Set pressure	= 10 bar (1,0 MPa)
Back pressure	atmospheric
T_o	= 20 + 273 = 293 K
p_o	= [10 × 1,1] + 1 = 12 bar (abs)

Since $\frac{p_b}{p_o} \leq \left(\frac{2}{k+1}\right)^{(k/(k-1))}$ the flow is critical.

The required area, $A = \frac{Q_m}{p_o CK_{dr} \sqrt{\frac{M}{ZT_o}}}$

$$C = 3,948 \sqrt{1,4 \times \left(\frac{2}{1,4+1}\right)^{(1,4+1)/(1,4-1)}} = 2,7$$

Values for factor C can also be obtained from Table 3.

Compressibility factor, Z, may be estimated from published data.

The calculation involved is as follows:

Reduced pressure, $P_r = \frac{p_o}{p_c}$

where

p_c is the critical pressure = 33,94 bar (abs.) = 3,394 MPa abs (from a thermodynamics handbook).

Reduced temperature, $T_r = \frac{T_o}{T_c}$

where

T_c is the critical temperature = 126,05 K (from a thermodynamics handbook);

$$p_r = 12/33,94 = 0,35;$$

$$T_r = 293/126,05 = 2,32;$$

$$Z = 1,000 \text{ (from Figure 1).}$$

$$A = \frac{18\,000}{12 \times 2,7 \times 0,87 \times \sqrt{\frac{28,02}{1,00 \times 293}}} = 2\,065 \text{ mm}^2$$

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