Cold Differential
Test Pressure

Objectives of this Presentation. Knowledge to learn.

The aim of this presentation is to explain
the Cold Differential Test Pressure (CDTP)
and to learn how to estimate it.

Reason Why?.

The safety valve in the plant shall open during operation at a certain pressure. This pressure is called **Set Pressure**.

The **Cold Differential Test Pressure (CDTP)** shall assure the right Set Pressure in the plant during operation.

The CDTP considers the **influence of Temperature and Back Pressure** for settings on a test bench.

Codes and Standards. Definition of Cold Differential Test Pressure (CDTP).

CDTP is used if **correction of set pressure of safety valves** according to **deviation of service conditions** is necessary.

ASME PTC 25, 2001, 2.7 OC of PRD

The inlet static pressure at which a pressure relief valve is adjusted to open on the test stand. This test pressure includes corrections for service conditions of superimposed back pressure and/or temperature.

API 20, 2000, Part I, 1.2.3.3 b.

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

ISO 4126-1, 2004, 3.2.5

The inlet static pressure at which a safety valve is set to commence to open on the test bench. NOTE: This test pressure includes corrections for service conditions, e.g. back pressure and/or temperature.

Influence of Temperature.

The relevant part of the safety valve influenced by the temperature is **the spring**.

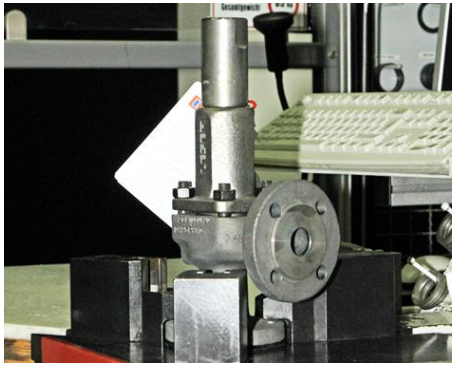
➔**The higher the temperature** at the spring **the lower the spring rate.**

Influence of Temperature. Estimation of CDTP in Theory.

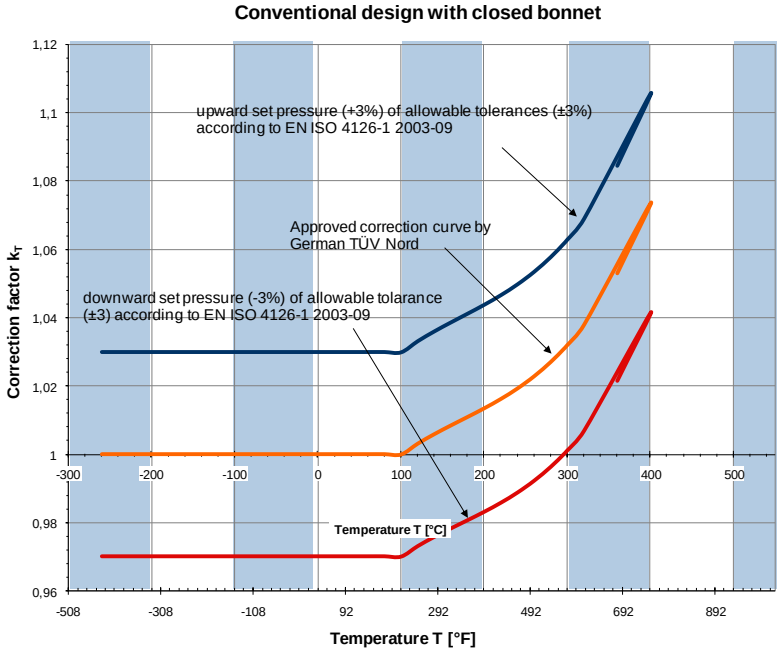
Example of CDTP estimation (theoretical)

	Set Pressure	**10**	**bar**
Operation	Required spring force	2.000	N
	Medium temperature	300	° C
	Spring rate at 300° C medium temperature	95	N / mm
	Spring preloaded	21	mm

	CDTP (acc. LDeS 1001.69 → + 0,5 bar temperature correction)	**10,5**	**bar**
Test bench	Spring preloaded	21	mm
	Spring rate at 20° C temperature at test lab	100	N / mm
	Spring force	2.100	N



Example of CDTP estimation (in practice)



Influence of Temperature. Findings.

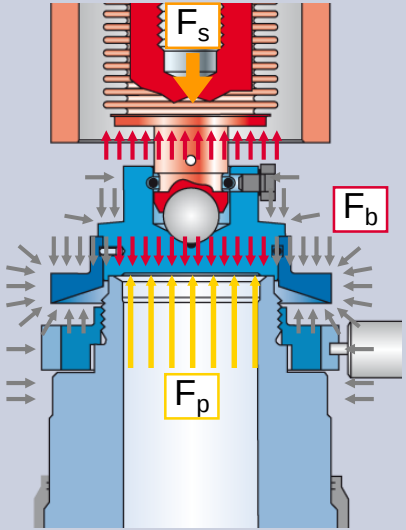
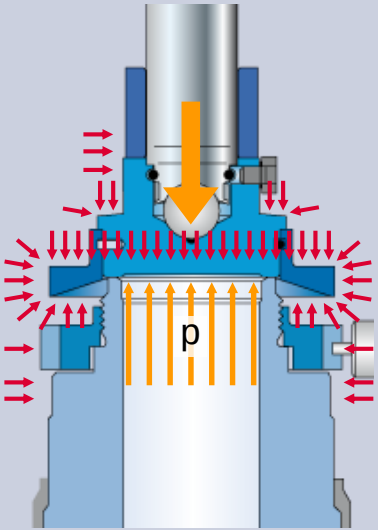
Set pressure too high

- Safety valve didn’t reach the operation temperature
  - Corrective action:
    Wait until operation temperature is reached.
    This can be checked by a thermometer
- Set pressure definition “initial audible discharge”
  is difficult to hear in the plant

Influence of Back Pressure.

The relevant part of the safety valve which is **influenced by the back pressure is the disc.**

➔**The higher the back pressure the lower the CDTP must be** (conventional design)**.**

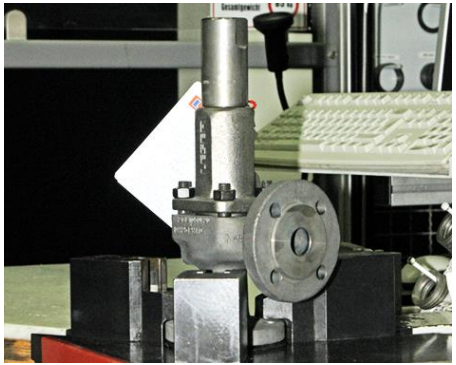
Balanced Bellows Design	Conventional Design
	

Influence of Back Pressure. Estimation of CDTP.

Example of CDTP estimation (theoretical)

	Set Pressure	10	bar
Operation	Constant back pressure	2	bar

	CDTP	8	bar
Test bench (Conventional design)	Set pressure	10	bar
	Constant back pressure	2	bar
	CDTP	**10**	**bar**
Test bench (Balanced bellows design)	Set pressure	10	bar
	Constant back pressure*	2	bar



LESER
The-Safety-Valve.com

Influence of Back Pressure. Findings.

Set pressure too low

- Back pressure is not as high as specified
  - Corrective action:
    - Check the plant conditions
    - Gauge the pressure at the outlet of the safety valve
    - Adjust the safety valve to actual service conditions

Set pressure too high

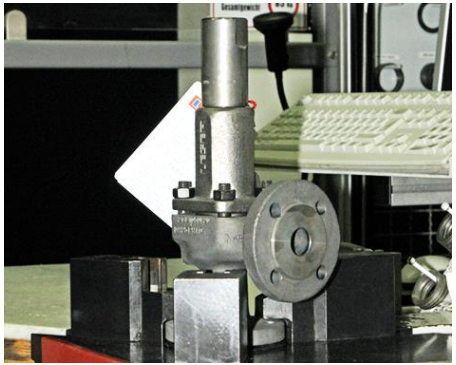
- Back pressure is higher as specified
  - Corrective action:
    - Check the plant conditions
    - Gauge the pressure at the outlet of the safety valve
    - Adjust the safety valve to actual service conditions

Conclusion. Estimation of CDTP in case of temperature and back pressure.

Example of CDTP estimation (theoretical)

	Set Pressure	10	bar
Operation	Required spring force	1.600	N
	Constant back pressure	2	bar
	Medium temperature	300	° C
	Spring rate at 300° C medium emperature	95	N / mm
	Spring preloaded	21	mm

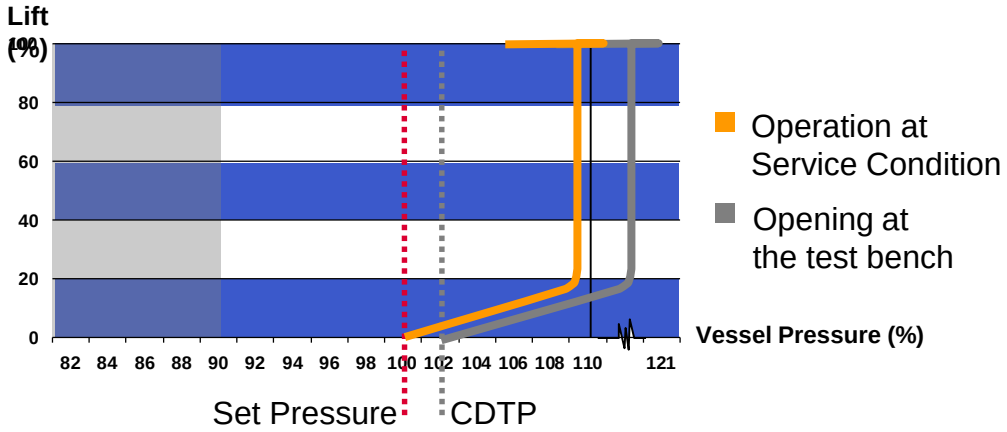
	CDTP	8,5	bar
Test bench (Conventional design)	Temperature correction	+0,5	bar
	Back pressure correction	-2	bar
	Spring preload at 200° C	16,8	mm
	Spring rate at 20° C temperature at test lab	100	N / mm
	Spring force	1.684	N



Conclusion. Estimation of CDTP in case of temperature and back pressure.

The **cold differential test pressure (CDTP)** can secure that the safety valve opens at the required set pressure in the plant during operation.

Caution:
The specified service conditions must fit the actual operation conditions.



Cold Differential

Thank you for your attention.