

Seminar 1:

How to draw the tolerance zone by nominal and limited dimensions



Standardization and measurement
assurance of engineering production

Step 1: Example

we have shaft with:

- Nominal diameter = 25 mm
- Max limited dimension = 25.015 mm
- Min limited dimension = 25.005 mm

It is necessary to:

- 1) calculate limited deviations
- 2) draw the tolerance zone of the dimension

Step 2: Calculation

We know two limited deviations:

- Upper deviation: $es = d_{max} - d_n$
- Lower deviation: $ei = d_{min} - d_n$

d_n , d_{max} & d_{min} are given:

$$d_n = 25 \text{ mm}$$

$$d_{max} = 25.015 \text{ mm}$$

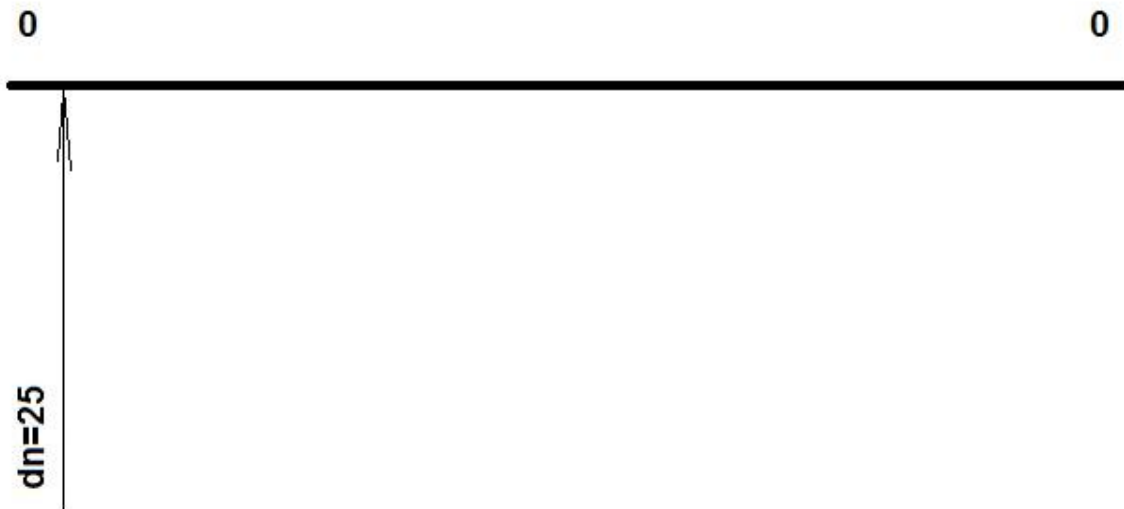
$$d_{min} = 25.005 \text{ mm}$$

So $es = 25.015 - 25.000 = 0.015 \text{ mm} = 15 \mu\text{m}$ (micrometers)

$$ei = 25.005 - 25.000 = 0.005 \text{ mm} = 5 \mu\text{m}$$

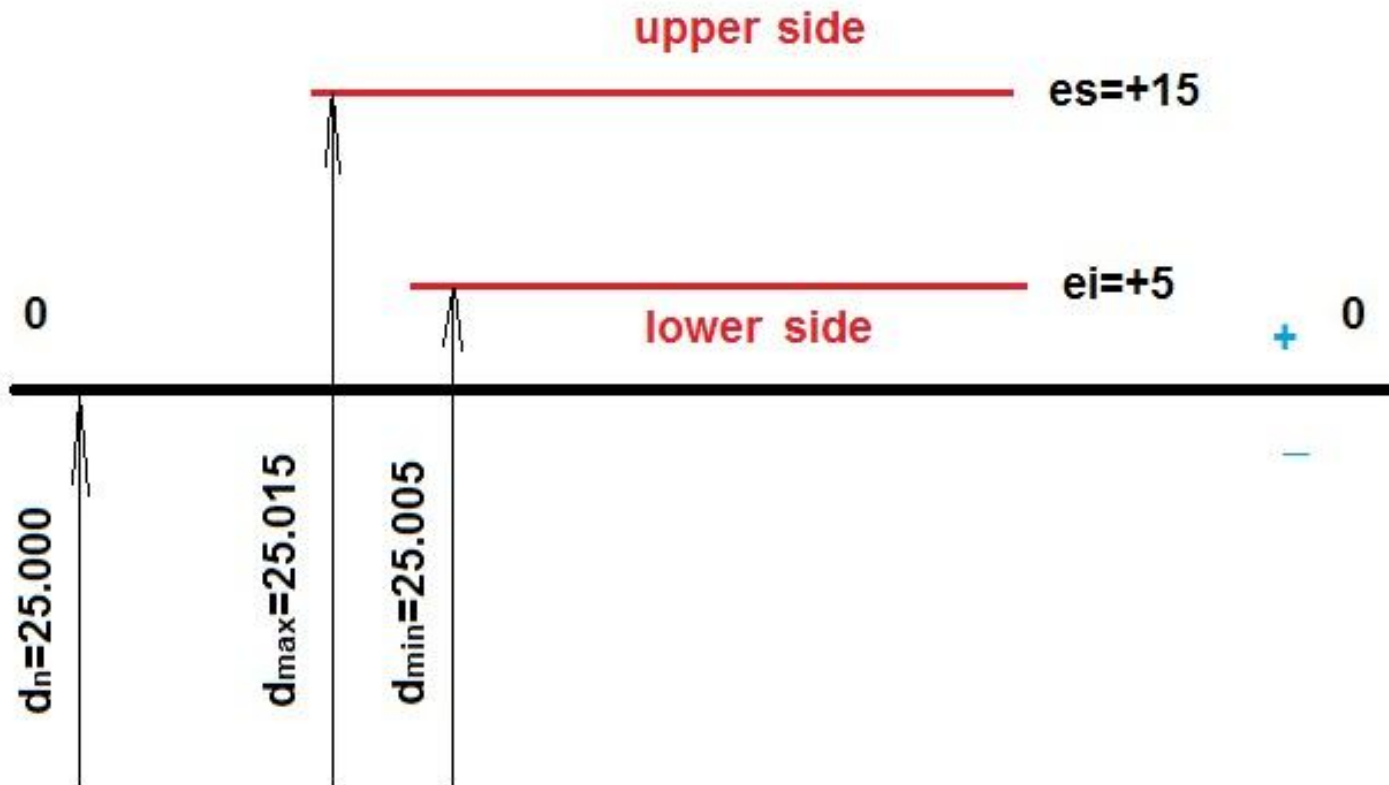
Step 3: Drawing zero line

draw the zero line -
level of a nominal diameter



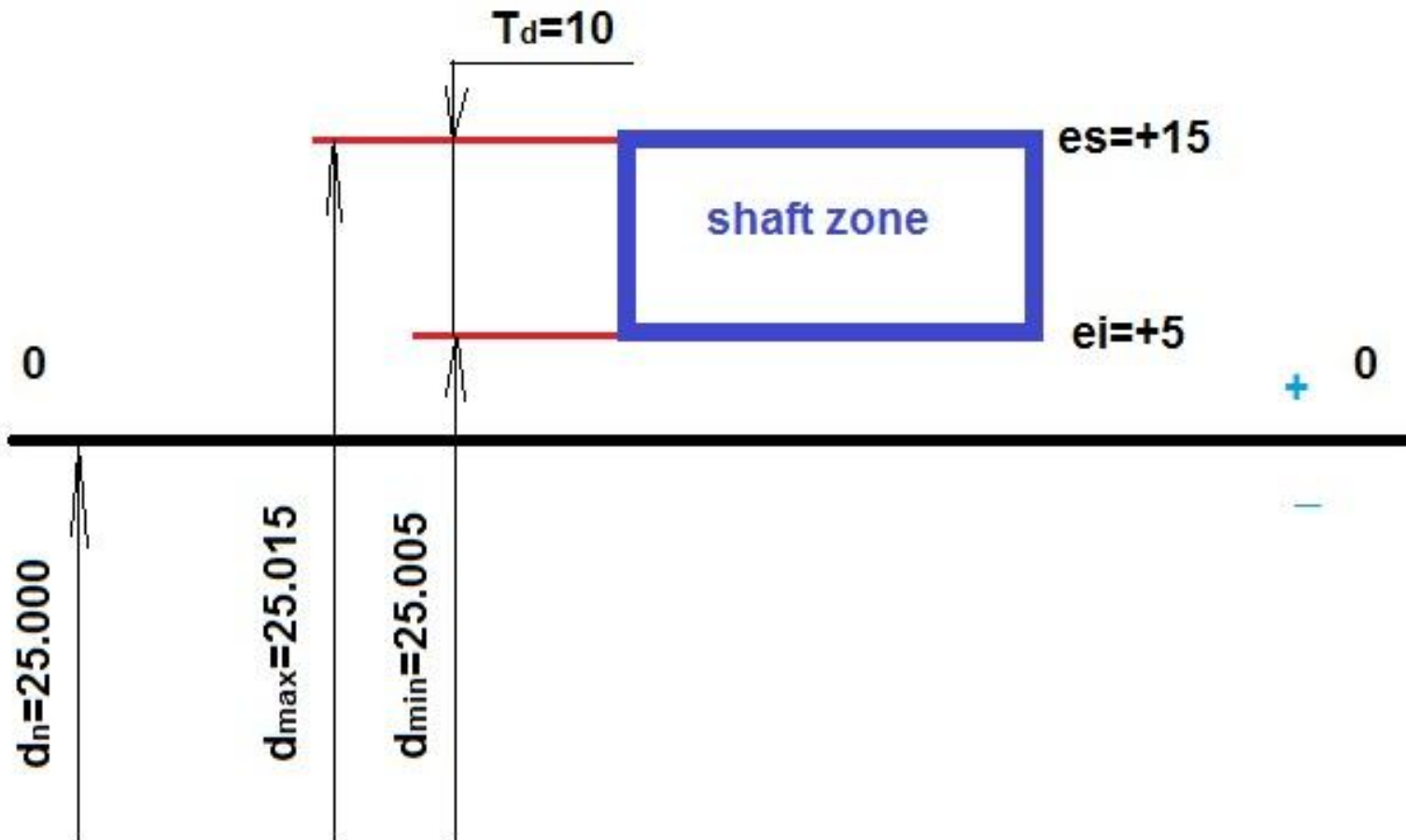
Step 4: Drawing the boundaries of tolerance zone

if we have positive deviations - tolerance zone is upper zero line



Step 5: Drawing the zone & calculate the tolerance

the height of rectangular - is the value of tolerance

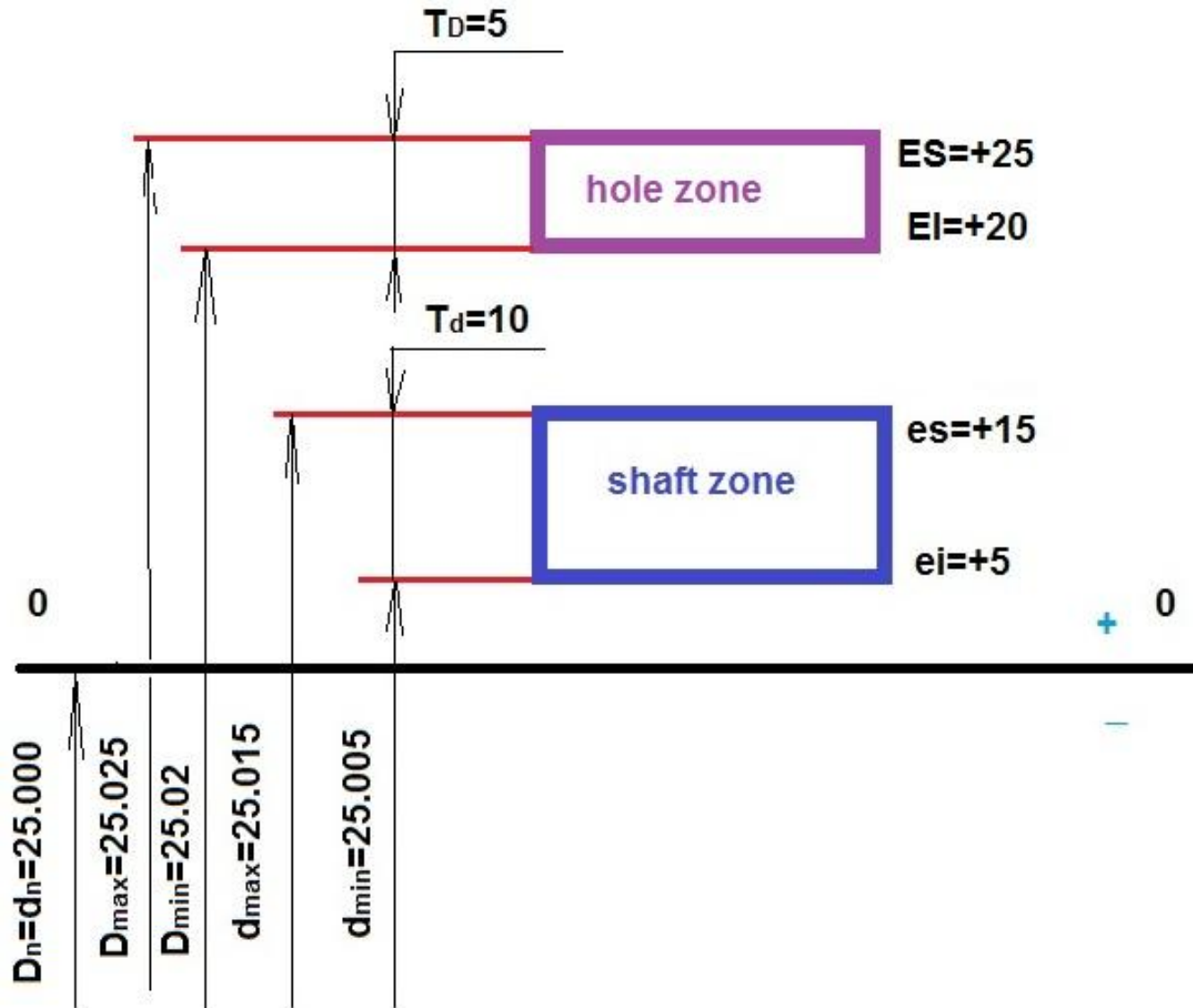


Step 6: Tolerance zones for joint

For example we have two joint parts (details):

- shaft $\varnothing 25 \begin{matrix} +0.015 \\ +0.005 \end{matrix}$
- bush $\varnothing 25 \begin{matrix} +0.025 \\ +0.02 \end{matrix}$

Step 7: Drawing the second zone



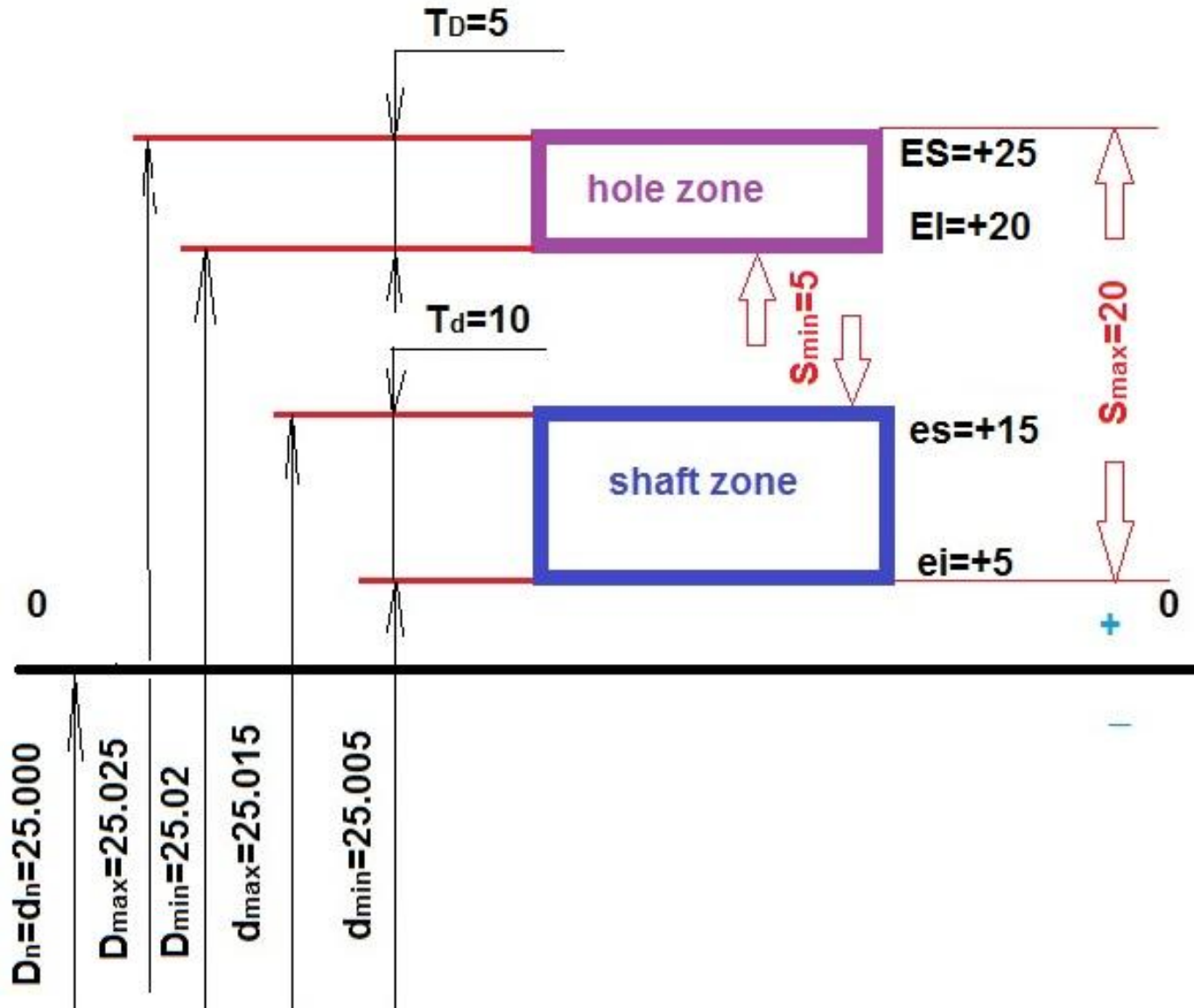
Step 8: Defining of the fit type

Some rules:

- if hole zone upper than shaft zone – it is clearance
- if shaft zone upper than hole zone – it is interference
- if zones are partially or fully intersected – it is transition fit

Step 9: Calculate limited clearances (interferences)

we have clearance fit



Step 10: Calculation of fit tolerance

The fit tolerance equal to difference between maximum & minimum clearances (interferences) & also equal to sum of two details tolerances:

$$T_S = S_{\max} - S_{\min} = 20 - 5 = 15 = T_D + T_d$$