

Seminar 2:

How to draw the tolerance zones of transition fit



Standardization and measurement
assurance of engineering production

Step 1: Example

We have two joint parts (details):

 shaft $\varnothing 25^{+0.015}_{+0.005}$

 bush $\varnothing 25^{+0.025}$

(we have empty place for lower deviation because it is = 0)

Step 2:

Calculation of shaft dimensions

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: Calculation of bush dimensions

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:

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

$$D_{\max} = 25.025 \text{ mm}$$

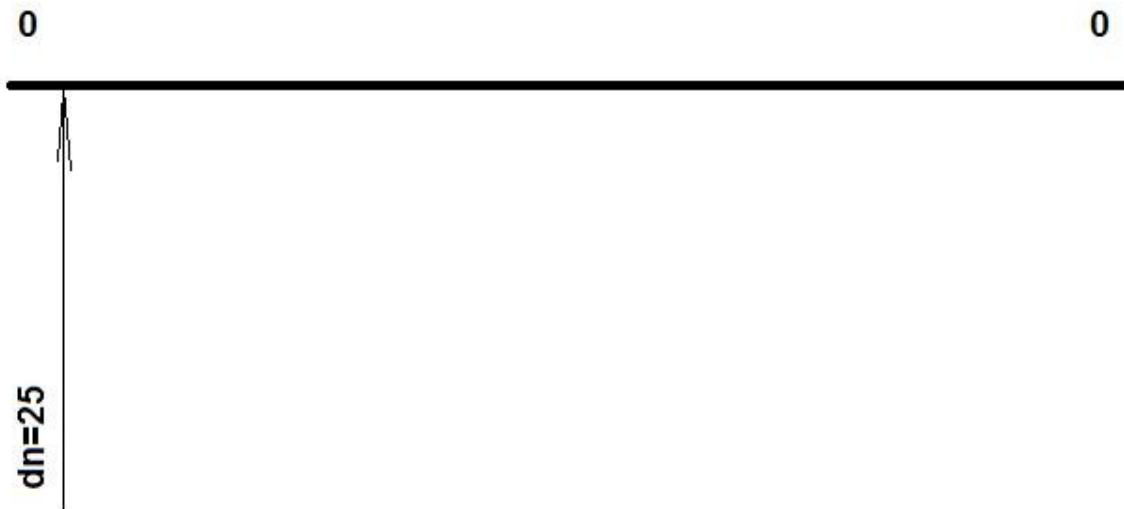
$$D_{\min} = 25.000 \text{ mm}$$

$$\text{So } ES = 25.025 - 25.000 = 0.025 \text{ mm} = 25 \mu\text{m}$$

$$EI = 25.000 - 25.000 = 0 \text{ mm} = 0 \mu\text{m}$$

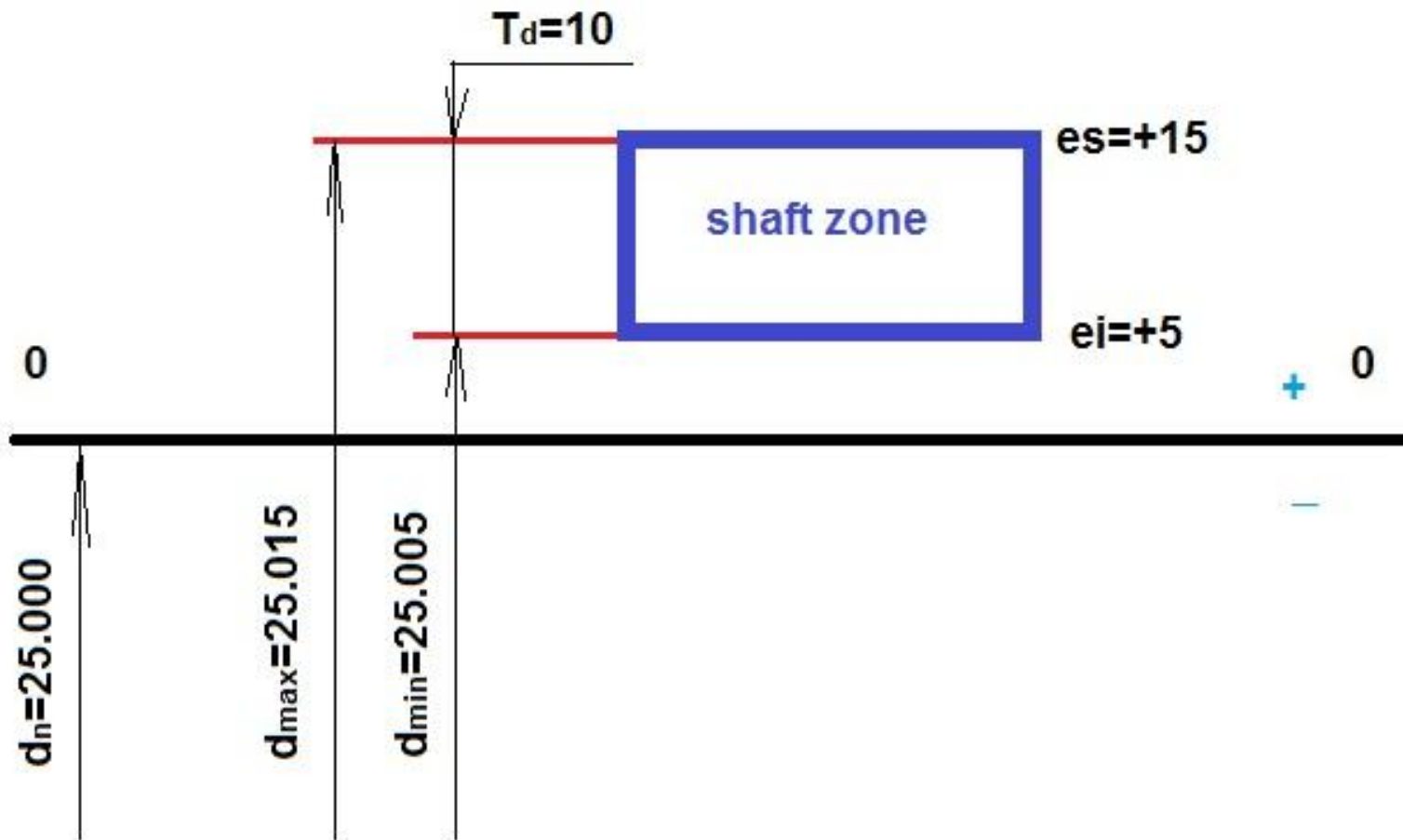
Step 4: Drawing zero line

draw the zero line -
level of a nominal diameter



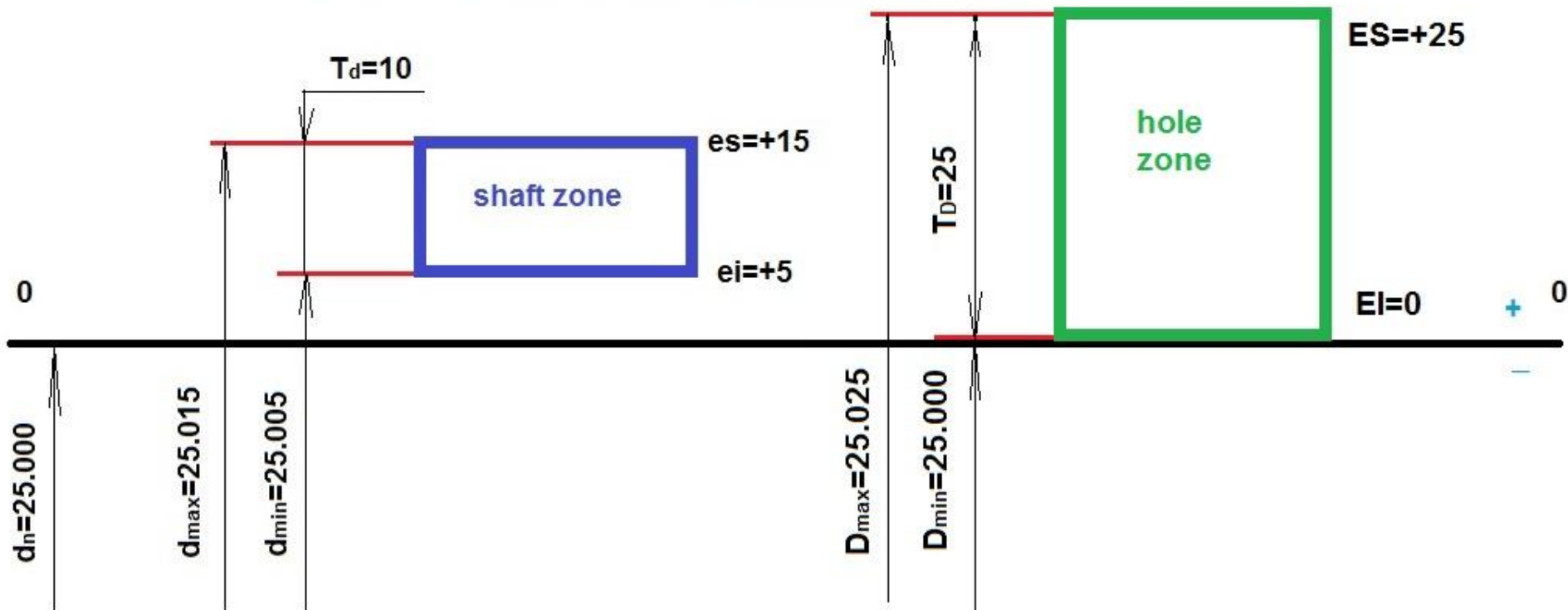
Step 5: Drawing the shaft tolerance zone

the height of rectangular - is the value of tolerance



Step 6: Drawing the hole tolerance zone

zones of transition fits are intersected by vertical direction



Step 7: Clearances and interferences of transition fit

For transition fits we have both clearances and interferences but they go to zero

So

$$S_{\min}=0 \text{ and } N_{\min}=0$$

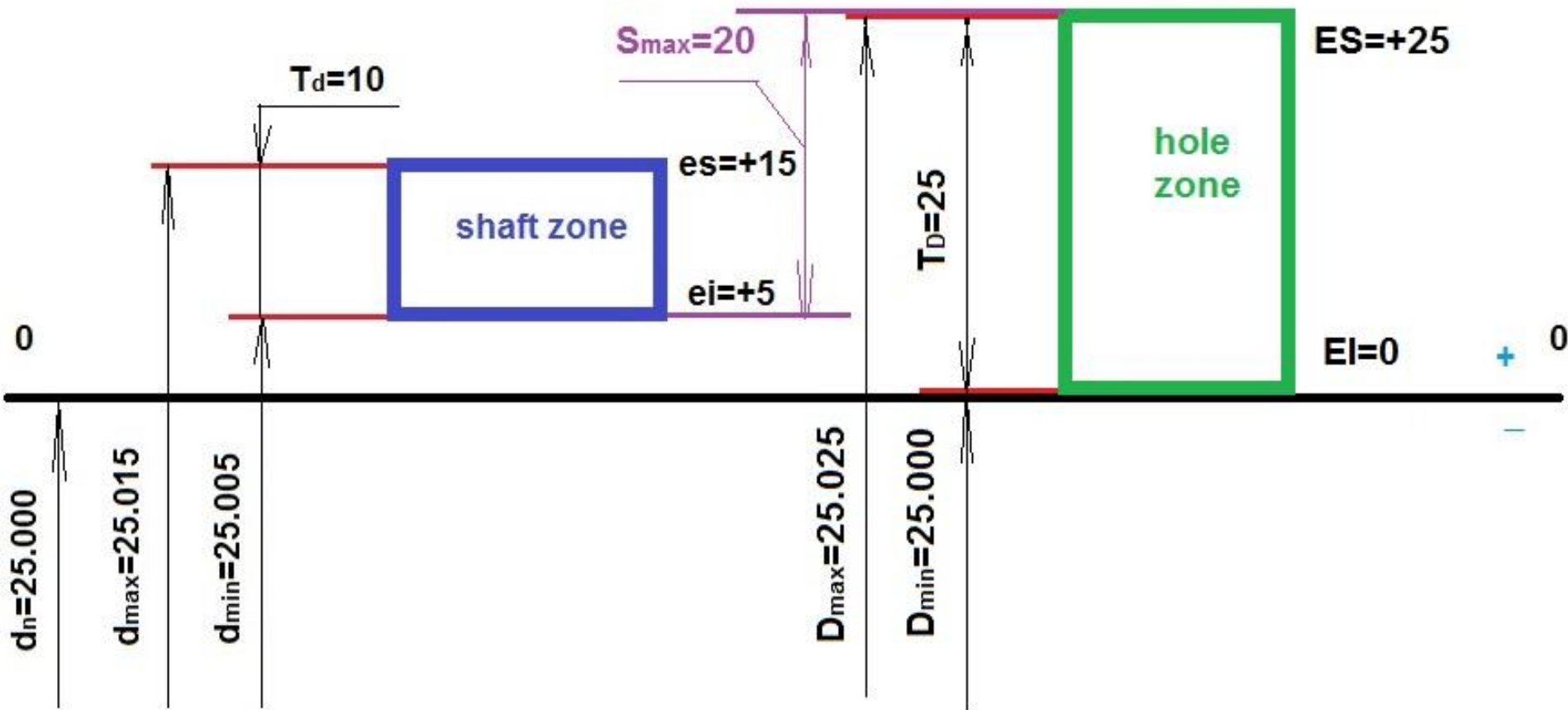
And

$$S_{\max}=D_{\max}-d_{\min}$$

$$N_{\max}=d_{\max}-D_{\min}$$

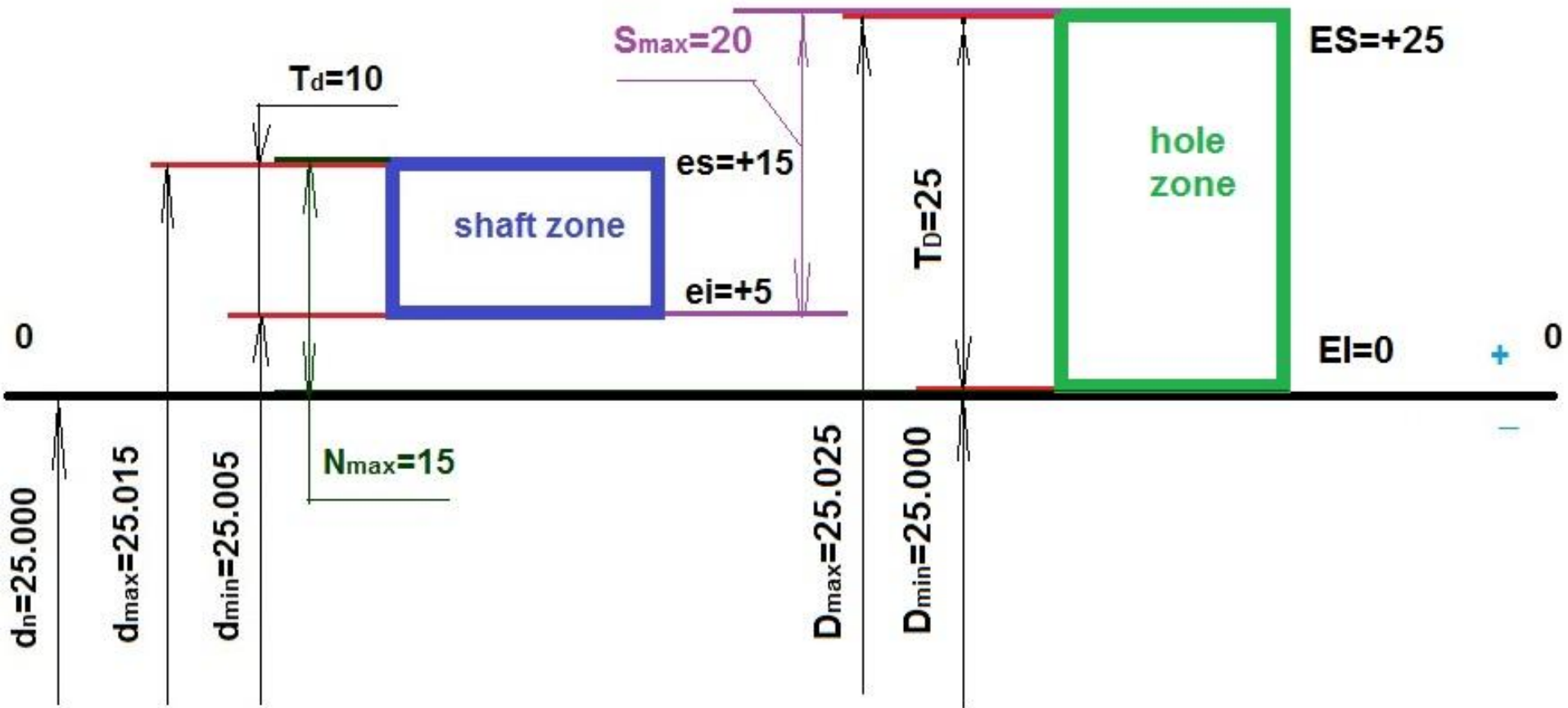
Step 8: Calculation of S_{max}

maximum clearance is between upper side of hole zone and lower side of shaft zone



Step 9: Calculation of N_{max}

maximum interference is between upper side of shaft zone and lower side of hole zone



Step 10: Calculation of fit tolerance

The fit tolerance for transition fit is equal to sum of maximum clearance and maximum interference & also equal to sum of two details tolerances:

$$T_t = S_{\max} + N_{\max} = T_d + T_D = 20 + 15 = 35 \text{ mcm}$$