

# **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:

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

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

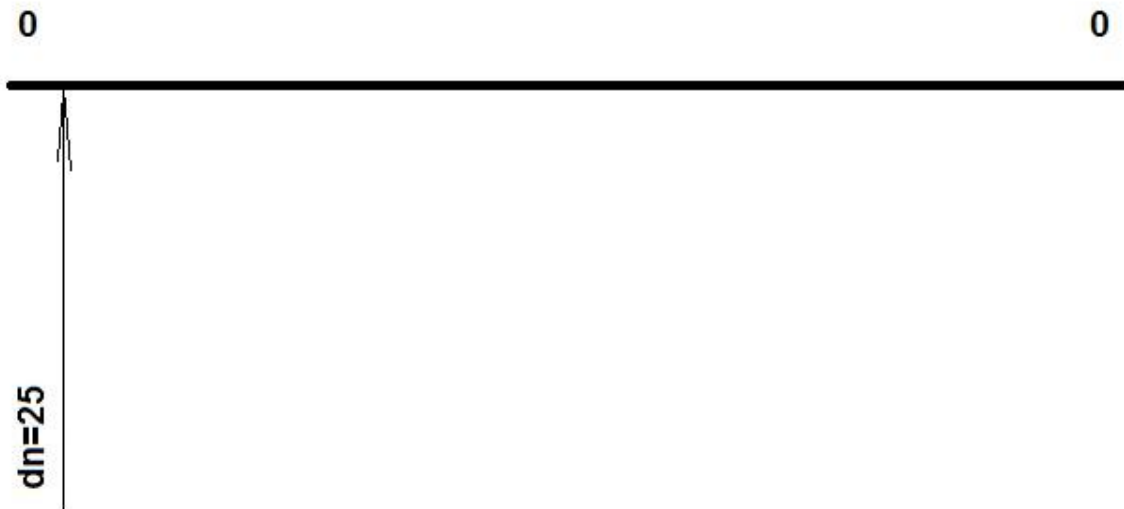
$$d_{\min} = 25.005 \text{ mm}$$

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

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

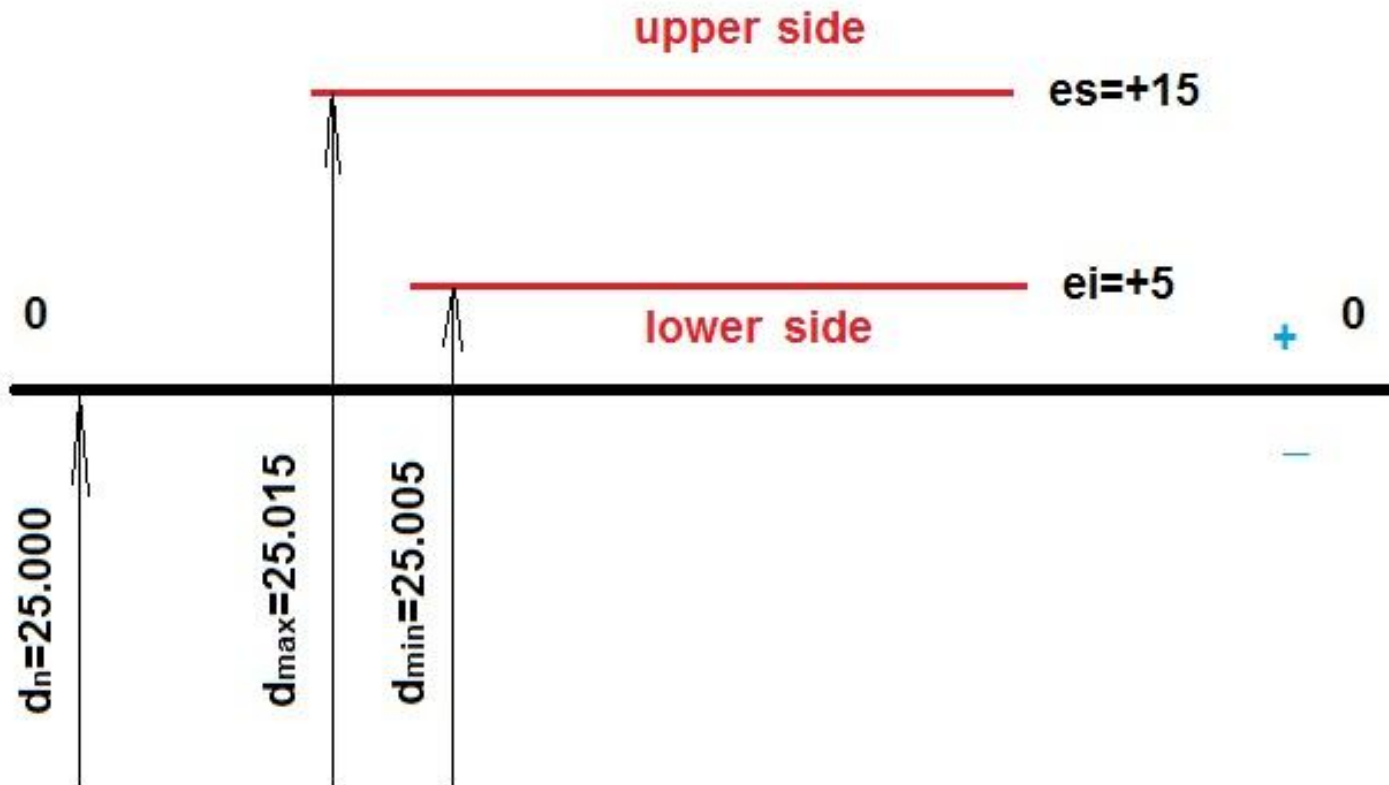
# Step 3: Drawing zero line

draw the zero line -  
level of a nominal diameter



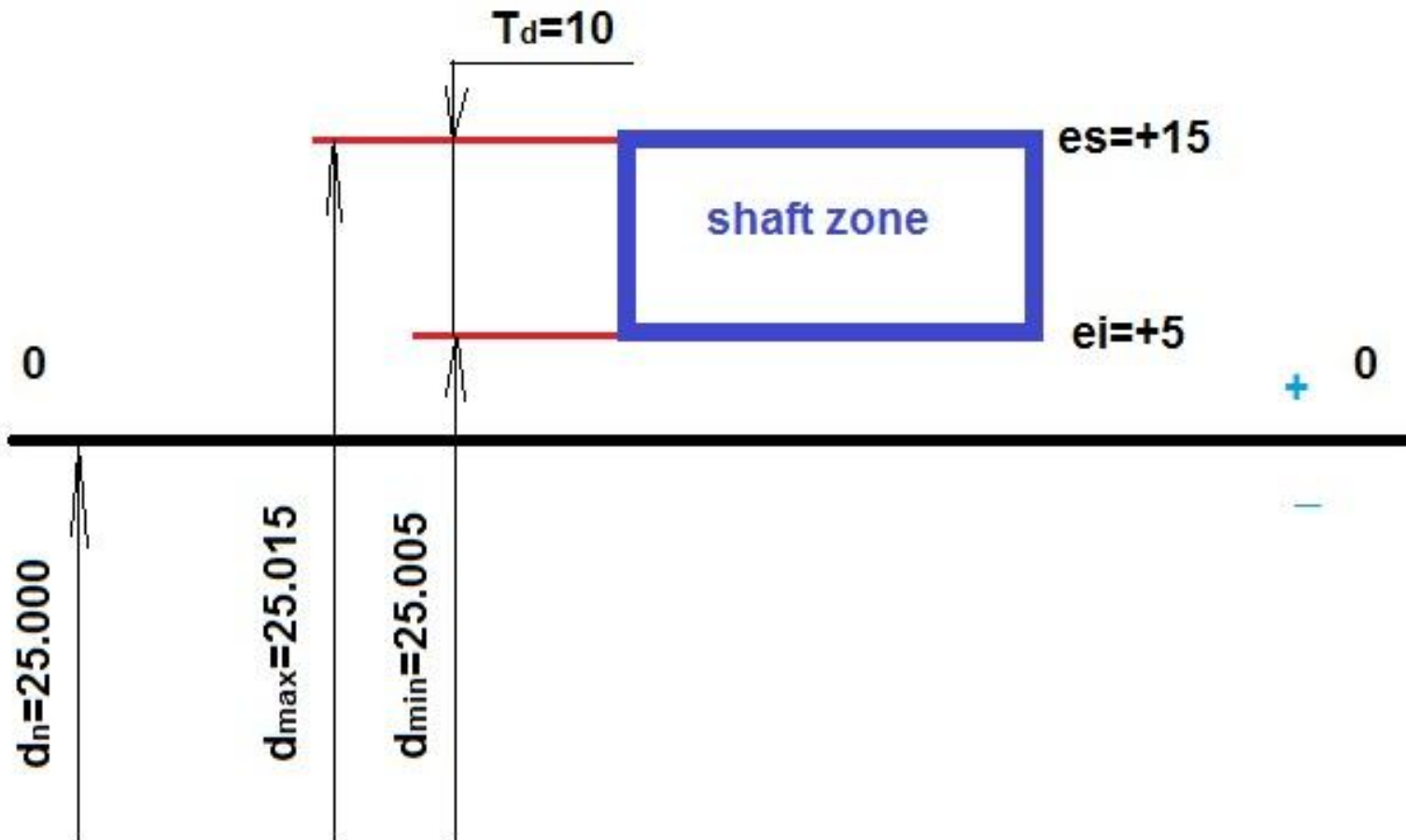
# Step 4: Drawing the boundaries of tolerance zone

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

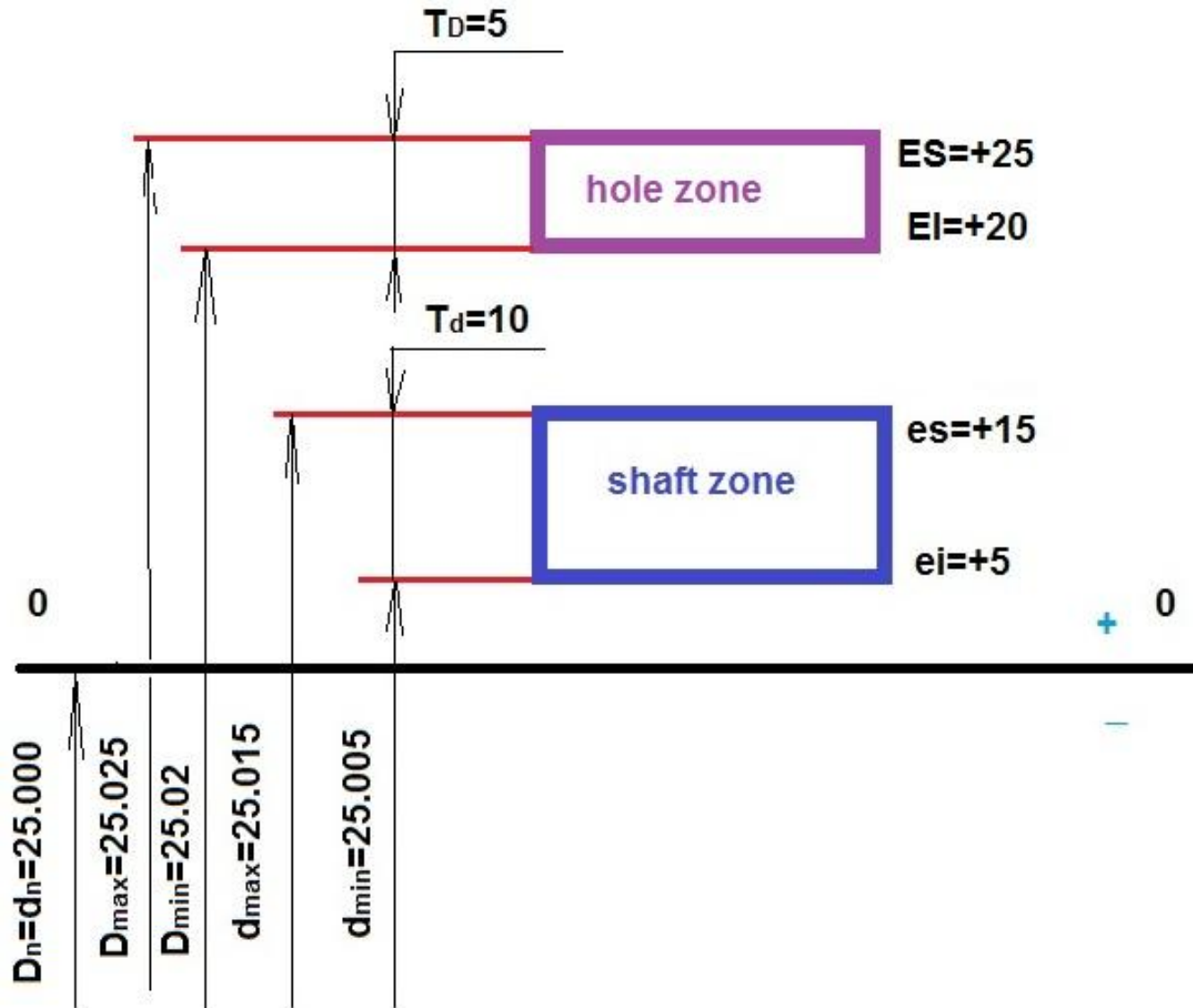


## Step 6: Tolerance zones for joint

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





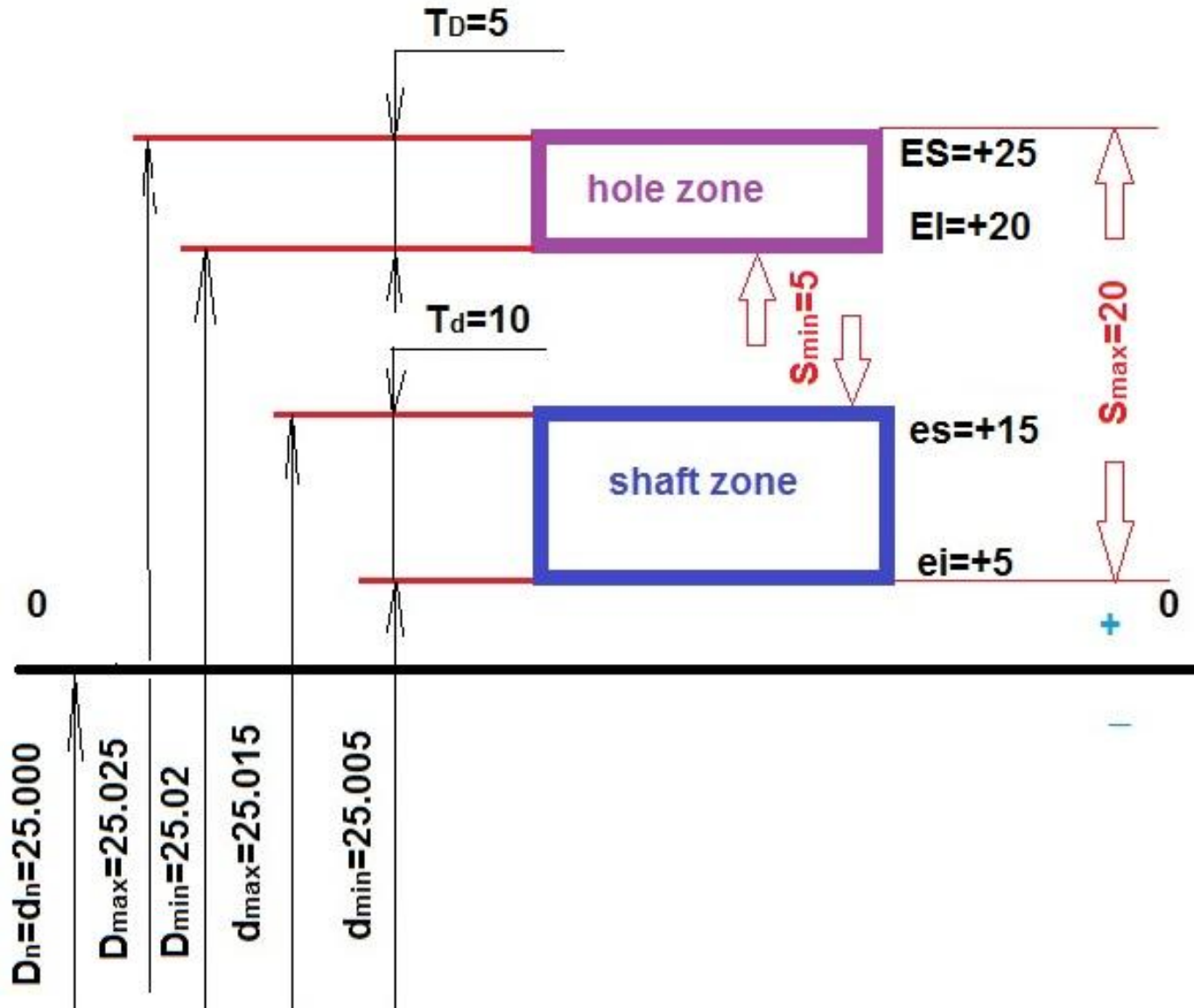
# Step 8: Defining of the fit type

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:

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