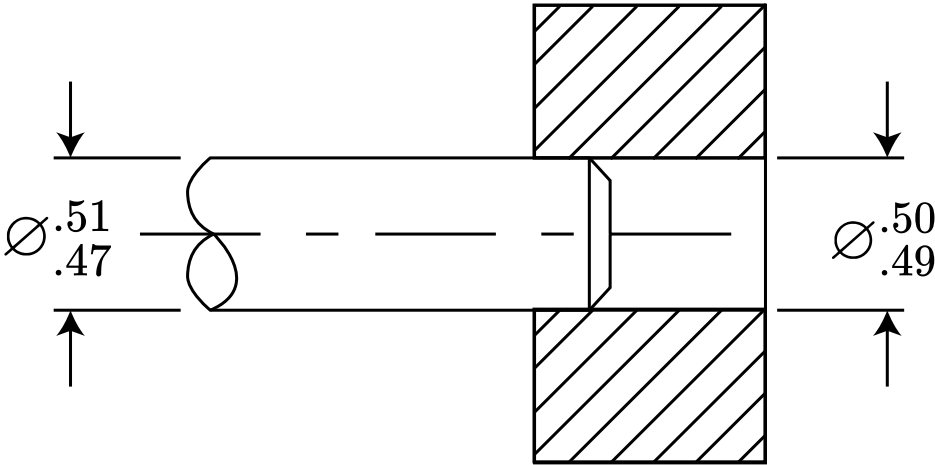


Given the following shaft and hole cross section. Complete the following table assuming metric tolerancing.



	Shaft	Hole
Limits		
Basic Size		
Tolerance		
MMC		
LMC		
Max Clearance		
Min Clearance		
Type of Fit		

Definitions:

Limits: The limits are the maximum and minimum size that the part can be.

Tolerance Δ_D Δ_d : The total amount that a specific dimension is permitted to vary. It is the difference between the maximum and the minimum limits for the dimension.

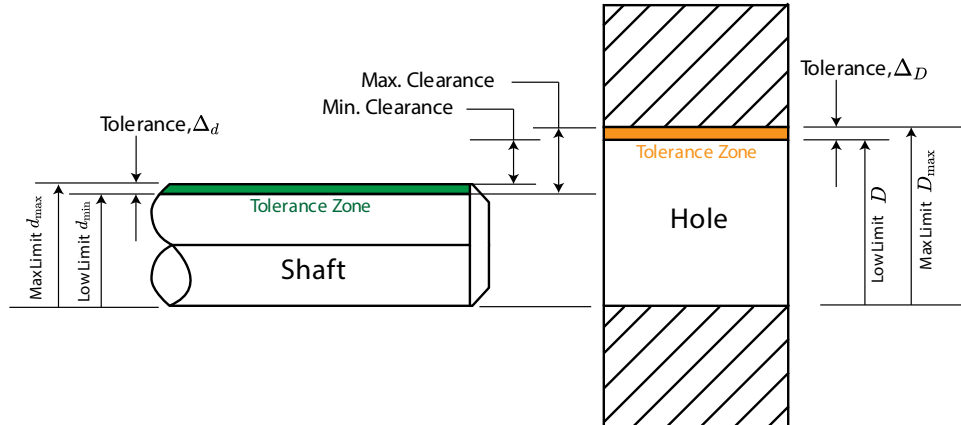
Basic Size: The basic size is the size from which the limits are calculated. Basic sizes, usually diameters, should be selected from a table of preferred sizes. It is the same for both components.

Deviation: is the difference between the basic size and the hole or shaft size.

Upper Deviation δ_u : is the difference between the basic size and the permitted maximum size of the part.

Lower Deviation δ_l : is the difference between the basic size and the minimum permitted size of the part.

Fundamental Deviation δ_f : is the upper or lower deviation, the deviation closest to the basic size.



For a hole:

$$D_{max} = D + \Delta_D$$
$$D_{min} = D$$

For a shaft with clearance fits $d, g, h, c, \text{ or } f$

$$d_{max} = d + \delta_F$$
$$d_{min} = d_{max} - \Delta_d$$

For a shaft with transition or interference fits $k, p, s, u, \text{ or } n$

$$d_{min} = d + \delta_F$$
$$d_{max} = d_{min} + \Delta_d$$

Where,

D	=	basic size of hole
d	=	basic size of shaft
δ_u	=	upper deviation
δ_l	=	lower deviation
δ_F	=	fundamental deviation
Δ_D	=	tolerance grade for hole
Δ_d	=	tolerance grade for shaft

MMC and LMC

For shafts:

- Maximum Material condition (MMC) refers to the largest shaft (upper limit of size). The most amount of material or weighs the most
- Least Material Condition (LMC) refers to the smallest shaft (Lower limit of size). The least amount of material or weighs the least.

For holes;

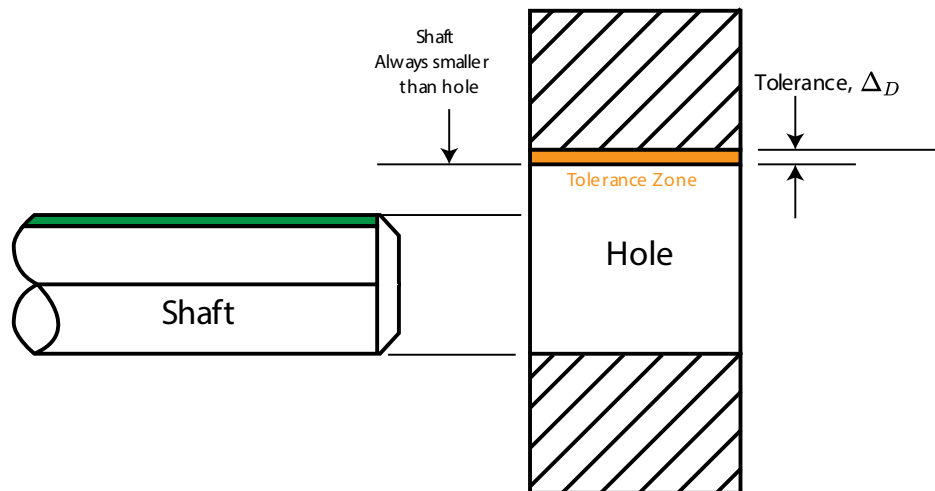
- Maximum Material condition (MMC) refers to the smallest hole (lower limit of size). The most amount of material or weighs the most
- Least Material Condition (LMC) refers to the largest hole (upper limit of size). The least amount of material or weighs the least.

Some Preferred Fits

Clearance Fit

Where movement is required between mating parts a clearance fit is necessary. With a clearance fit the upper and lower limits of size for each component are set so that a clearance always exists between the two components (the upper limit of the shaft is equal to or less than the lower limit of the bearing).

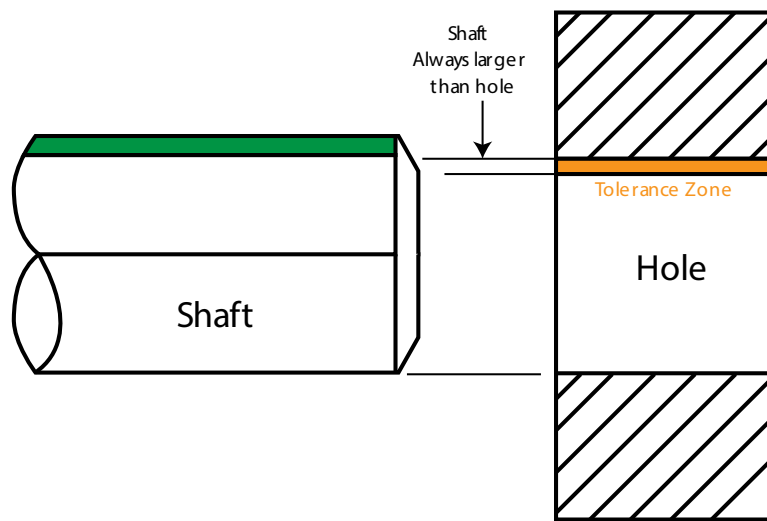
Min. Clearance > 0



Interference Fit

An Interference fit is required where movement between mating components is not permitted due to the function of the components e.g. a gear mounted on a shaft. With an Interference fit the upper and lower limits of both component are set so that Interference always occurs.

$$\text{Max. Clearance} \leq 0$$



Transition Fit

A Transition fit is required when two mating components are not required to rotate or slide but may need to be dismantled easily for example a pulley mounted on a shaft. With a transition fit the upper and lower limits of size for each component are set so that either a small clearance or a small interference could occur.

Max. Clearance > 0

Min. Clearance < 0

