Subject: Maths

Class: Applied Mathematics

Topic: Using Limits to Calculate the Tolerance

Levels: Basic, Intermediate, Advanced

Level: Basic

1. Define 'Tolerance' in the context of manufacturing limits. ?

2. If a metal rod has a nominal length of 50mm and a tolerance of ±0.05mm, find the upper limit.

3. A worker measures a bolt at 12.02mm. If the limits are 12.00mm to 12.05mm, is it acceptable? (Yes/No)

4. Calculate the total tolerance if the upper limit is 25.10mm and the lower limit is 24.90mm.

5. The 'Nominal Size' of a pipe is 100mm. If the tolerance is +0.02 and -0.01, write the lower limit. ?

6. Arjun produces a gear with a diameter of 40.00mm ± 0.10mm. What is the maximum possible diameter?

7. Represent the limit 15.00mm +0.05/-0.05 using the ± symbol: _____

8. If a component costs ?500 to make but is rejected due to size limits, how much money is lost? ?

9. True or False: A larger tolerance value makes the manufacturing process easier and cheaper.

10. Calculate the difference: Upper Limit 10.5mm - Lower Limit 10.2mm = _____ ?

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Level: Intermediate

1. An engineer at a Chennai factory sets a limit of 200mm +0.08/-0.04. Calculate the 'Mean Size'.

2. Calculate the total tolerance for a shaft where the limits are 45.075mm and 45.025mm. ?

3. If a square plate has a side ? = 10cm ? 0.02cm, what is the maximum possible area?

4. A machine in Bengaluru produces parts at ?150 each. If 2% fall outside the ?0.01mm limit, calculate loss in 1000 parts.

5. Find the Upper Limit of a hole if the basic size is 25.00mm and the fundamental deviation is +0.007mm.

6. A piston must fit a cylinder. If the cylinder limit is 80.05mm and piston is 79.95mm, what is the 'Clearance'? ?

7. A wire has a radius r = 5mm ? 0.01mm. Use ? ? 3.14 to find the limit of the circumference. ?

8. If a length is given as L = 120 ± 0.5%, calculate the absolute tolerance value in mm.

9. A metal sheet expands by 0.02mm for every 1?C. If the limit is ?0.1mm, what is the max temperature change allowed? ?

10. Identify the type of fit if the shaft is always smaller than the hole: [?] Clearance | [?] Interference

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1. Using the limit formula, if $Y = X^2$, and $X = 10 \pm 0.1$, find the tolerance in Y using the ² symbol. ²

2. In a high-precision lab in Pune, a laser measures a gap as 0.005mm ? 0.0002mm. Express this in micrometers (?m).

3. Calculate the 'Allowance' between a hole of 30.00 +0.02/0.00 and a shaft of 30.00 -0.02/-0.05.

4. A batch of 5000 valves costs ?10,00,000. If the tolerance is tightened, costs rise by 15%. New cost? ?

5. Derive the maximum interference if a hole is 40.00 +0.02/0.00 and the shaft is 40.05 +0.03/+0.01.

6. A spherical bearing has a volume V = (4/3)?r?. If r = 3cm ? 0.05cm, find the tolerance in volume. ?

7. Explain why a bilateral tolerance (e.g., ?0.05) might be preferred over a unilateral tolerance (+0.10/0.00). ?

8. A CNC machine has a precision limit of 10?? mm. If a part requires 0.0005mm tolerance, can this machine make it? ?

9. Solve for x: The upper limit of (2x + 5) is 15.1 when the tolerance is ±0.1. What is the nominal value of x?

10. An assembly has three parts stacked: A(10?0.1), B(20?0.2), C(15?0.1). Find the worst-case total tolerance. ?