

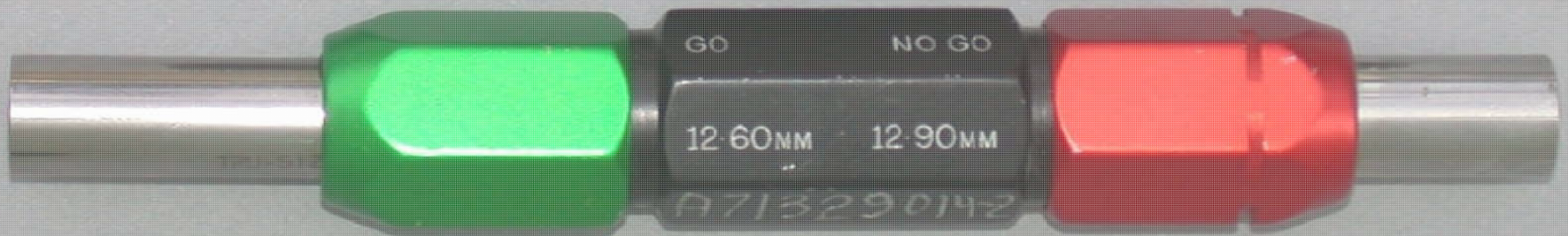
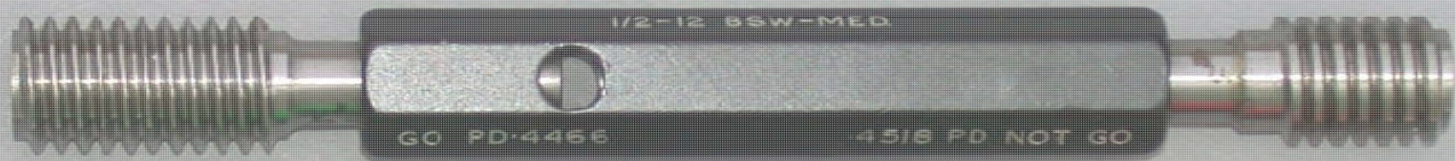
IPE 381

Gauges and Gauge Design

ref : P C Sharma



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Outline

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- Basics of Gauges
- Classification of Gauges
- Gauge Design
- Screw Gauges
- Pros & Cons of Limit Gauges
- Gauge Design problem



Gauges

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- Gauges are inspection tool of rigid design, without a scale, which serves to check the dimensions of manufacturing parts.
- Gauge do not indicate the actual value of the inspected part of the component. They are just used to determine whether the part is made within the specified limit.



Classification of Plain Gauge

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- Plain gauges are used for checking plain (unthreaded) holes and shafts. Gauges are classified:
- According to their type :
 - Standard gauges- made as an exact copy of opposed(mating) part
 - Limit gauges- made to the limits of the dimensions
- According to their purposes :
 - Workshop Gauge: To Check Dimension after manufacture
 - Inspection Gauge: To check part before final acceptance
 - Purchase Inspection Gauge: To check part of other factory
 - Reference or master gauges: To check the dimension of Gauge



Classification of Plain Gauge

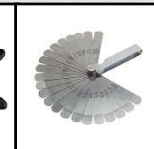
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- According to the form of the tested surface :

a) Plug gauges for checking holes



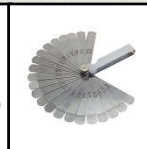
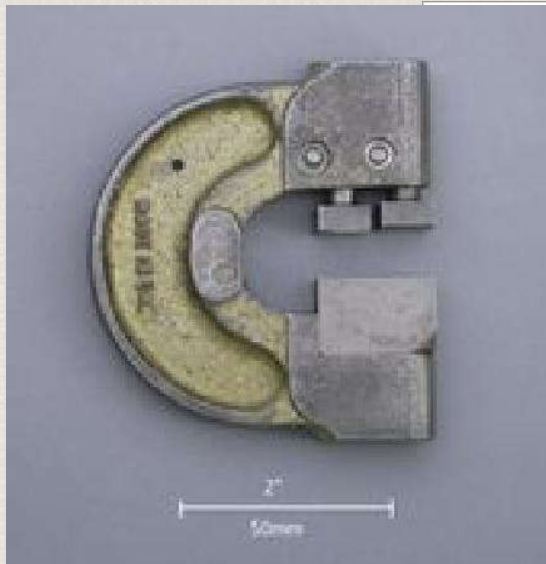
b) Snap and ring gauges for checking shafts



Classification of Plain Gauge

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- According to their design :
 - a) Single limit and double limit gauges
 - b) Single ended and double ended gauges
 - c) Fixed and adjustable gauges



Other Gauges

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- **Taper gauges are shown in Figs. 17.16 and 17.17. Taper gauges are not dimensional gauges but rather a means of checking in terms of degrees. Their use is a matter more of fitting rather than measuring.**

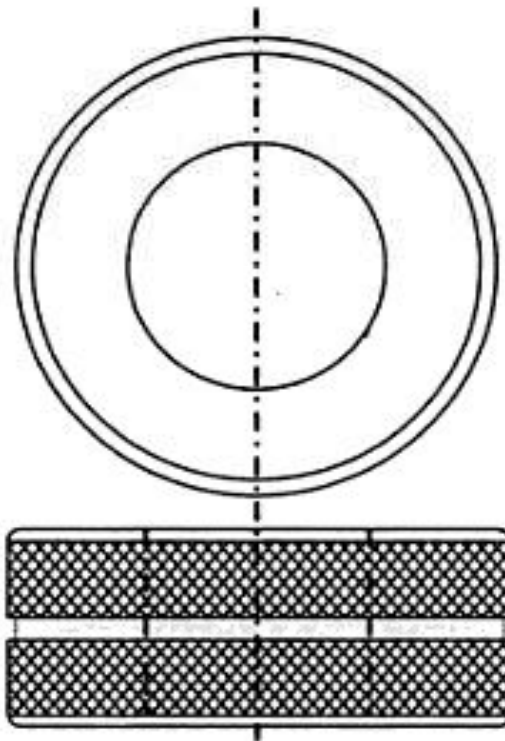


Fig. 17.15. Ring gauge.

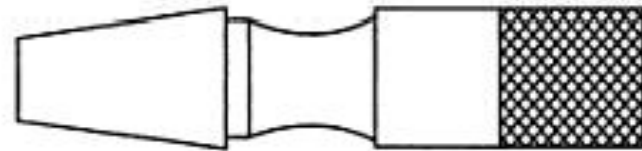


Fig. 17.16. Taper gauge for shafts.



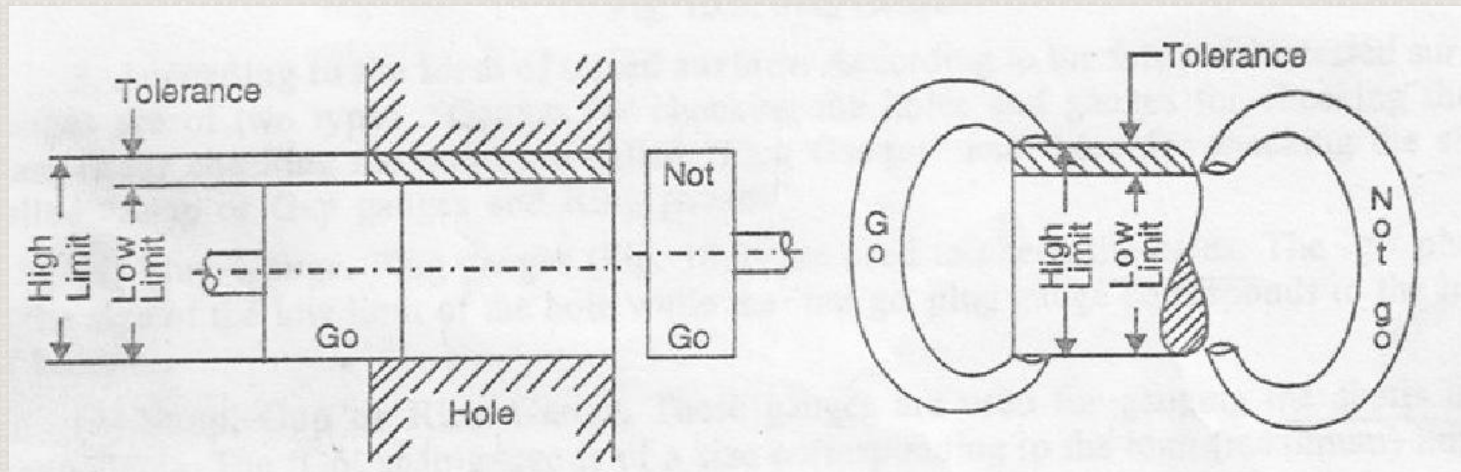
Fig. 17.17. Taper gauge for holes.



Limit Gauge

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- Limit gauges are made to the limits of the dimensions of the part to be tested. There are two limit of dimensions, so we need two limit gauge.



- 'Go gauge' should pass through or over a part while 'Not Go gauge' should not pass through or over the part.



Design of Limit Gauge

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- Allocation of Tolerance
 - Manufacturing Tolerance
 - Wear Allowance
- Taylor's Principle of gauge Design
- Materials
- Hardness and Surface finish
- Rigidity
- Alignment of Gauge facesetc.

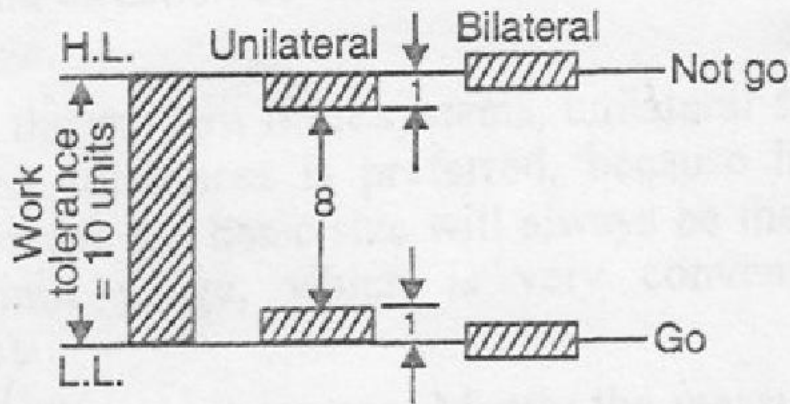


Gauge Makers Tolerance

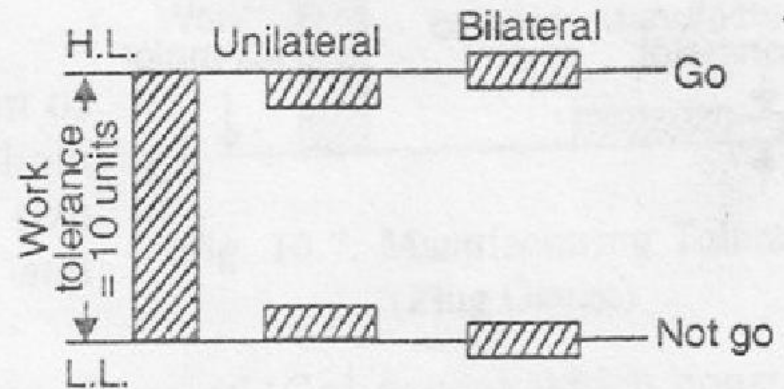
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- **Manufacturing /gauge makers Tolerance**

- It is economically impractical to attempt to make “Go” and “Not Go” gauges exactly to the two limits of work tolerance.
- Limit gauges are made 10 times more accurate than the tolerances they are going to control.



(a) Hole (Plug gauge)

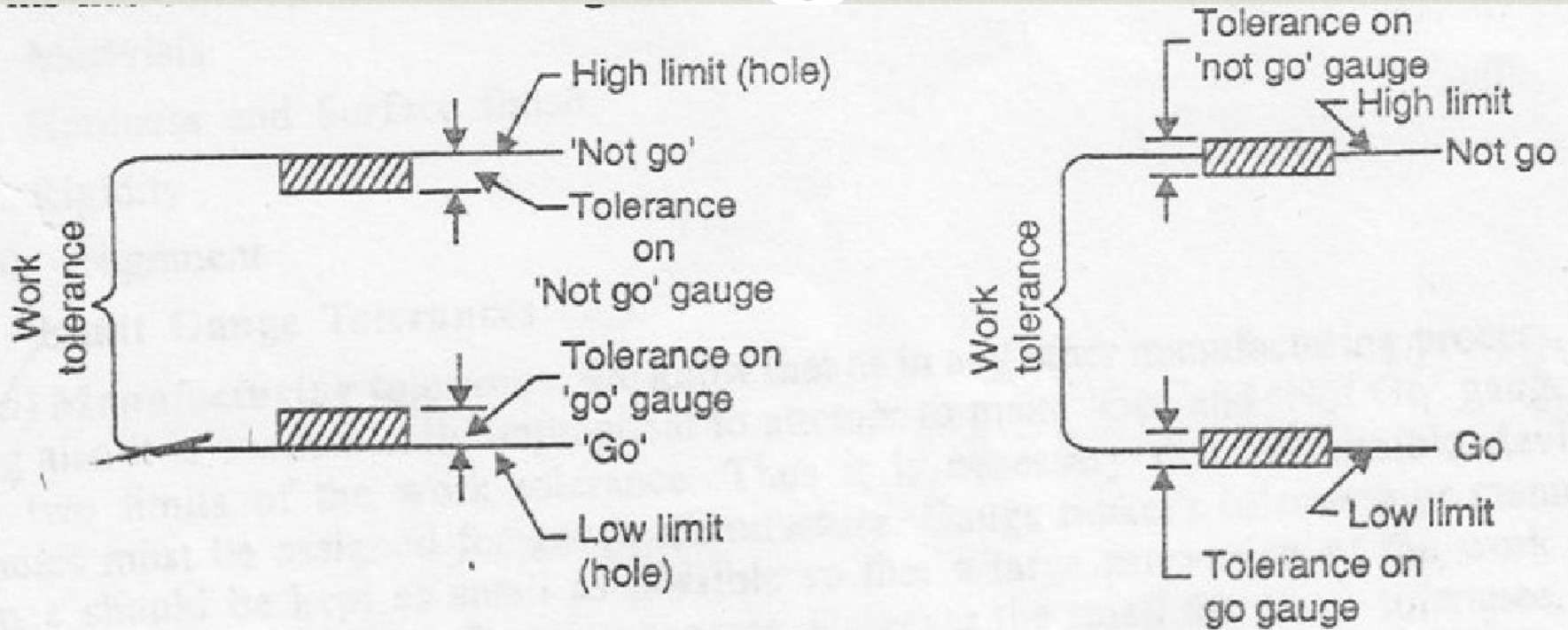


(a) Shaft (Snap gauge)



Gauge Makers Tolerance

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(a) Single Limit

(b) Double limit

Fig. 10.5. Single Limit and Double Limit Gauge.



Gauge Makers Tolerance

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For example, let the size of the hole to be tested be 25 ± 0.02 mm
Therefore,

High limit of hole = 25.02 mm

Low limit of hole = 24.98 mm

Work tolerance = 0.04 mm

Gauge makers tolerance = 10% of tolerance = 0.004 mm

- Dimension of 'Go' Plug/gauge

$$= 24.98 \text{ mm} + 0.004$$

- 0.000

- Dimension of 'Not Go' Plug/gauge

$$= 25.02 \text{ mm} + 0.000$$

- 0.004



Wear allowance

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Wear Allowance

- The surface of “Go” gauge is constantly rub against the surface of the part in inspection and loose their initial size
- The size of plug gauge is reduced but size of snap gauge is increased
- 5% wear allowance is provided if working tolerance is greater than 0.09 mm
- Practice math for more clarification



Taylor's Principle

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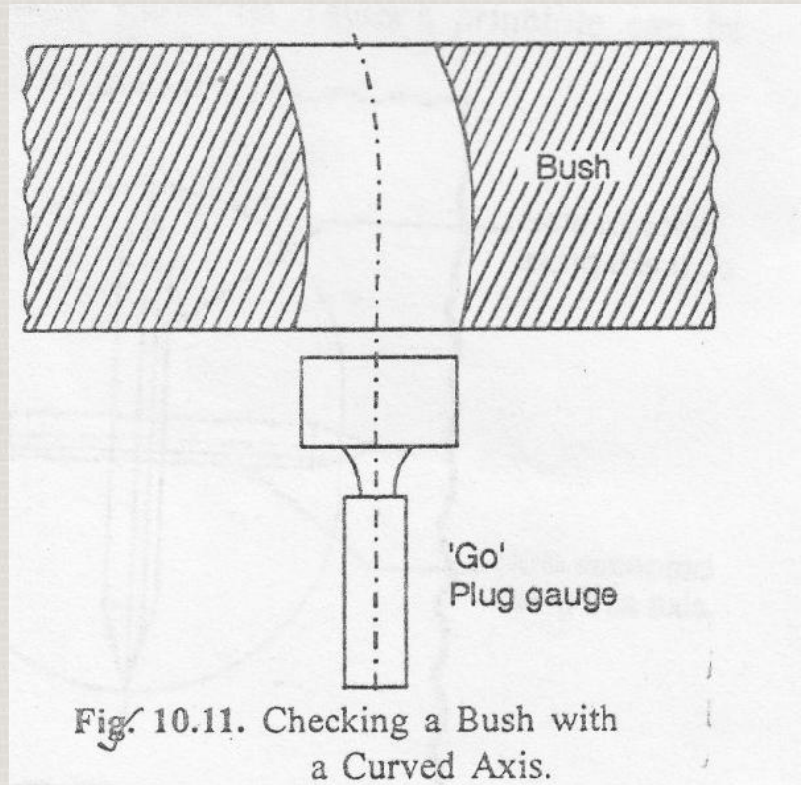
- **Go Gauge should always be so designed** that it will cover the Maximum Metal Condition(MMC) of as many dimensions as possible in the same limit gauge.
- **Not Go gauge to cover the** minimum metal condition of one dimension only.



To Check Circular Holes

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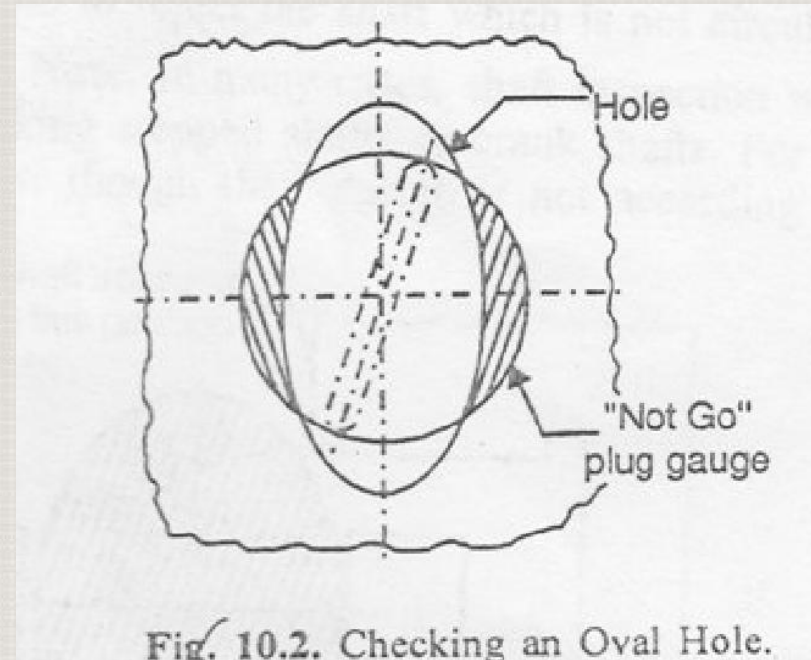
- **Go Plug Gauge should have a full circular Section**
- **Length should be equal to the length of the hole**



To Check Circular Holes

16

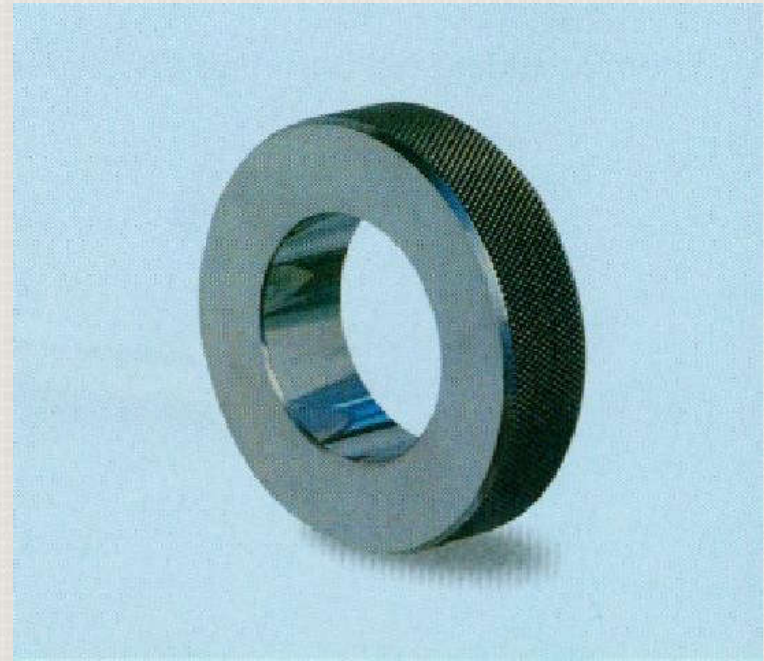
- **Not Go Plug Gauge** should be in the form of pin or bar
- Should check the **upper limit of the hole**



To Check Circular Shaft

17

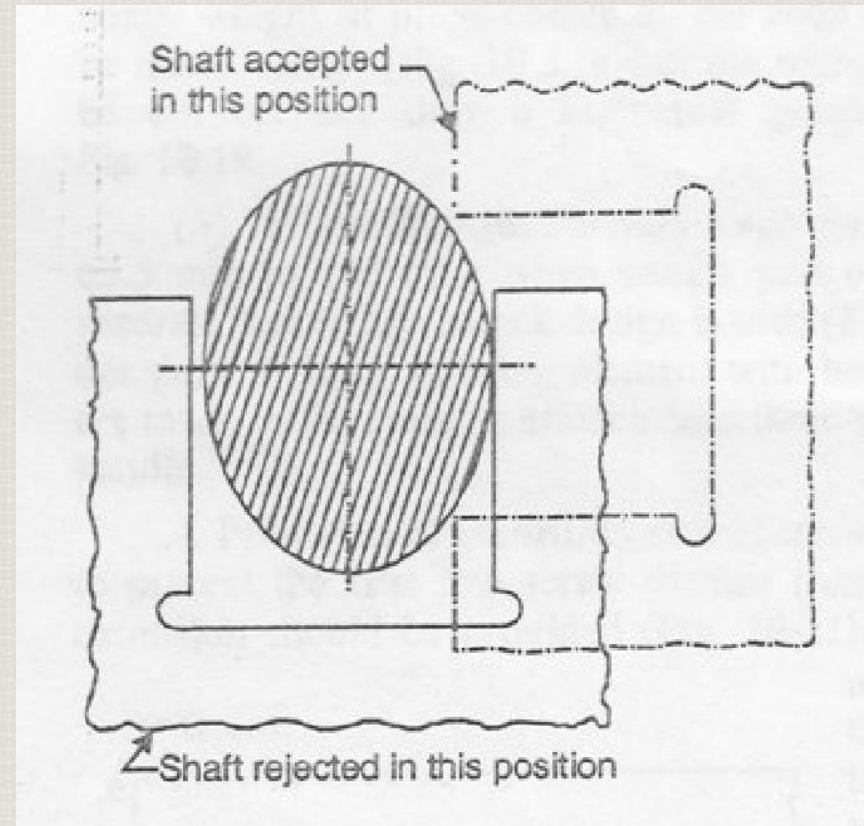
- Ring Gauge should be used as **Go Gauge**
- Length should be equal to the length of the shaft



To Check Circular Shaft

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- Snap Gauge Should be used as **Not Go Gauge** –see fig.
- Should check the **low limit of shaft**
- For non circular shaft, Snap gauge will not pass through



Designing a Gauge

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A 25mm H8-f7 fit is to be checked.

The limit of size for H8 Hole are:

High Limit - 25.033mm

Low Limit - 25.000mm

The limits for the f7 shaft are:

High limit - 24.980mm

Low limit - 24.959mm

Taking the gauge makers tolerance to be 10% of the work tolerance, design plug gauge and gap gauge to check the fit.



Designing a Gauge

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- Find tolerance for hole and shaft
- Find gauge tolerance
- Basic Size for “Go” Plug Gauge is LL of Hole
- Basic Size for “Go” Plug Gauge is HL of Hole
- For plug gauge:
 - High limit of “Go” Plug gauge
 - Low limit of “Go” Plug gauge
 - High limit of “Not Go” Plug gauge
 - Low limit of “Not Go” Plug gauge
- Repeat for Snap gauge
- Draw the Diagram of “Go”, “Not Go” Plug gauge and “Go”, “Not Go” Snap gauge



Self Study

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- Advantage of Limit Gauge
 - Disadvantage of Limit Gauge
 - Care of Gauges
 - Mathematical Problems
-
- Ref : A textbook of production engineering--
by P C Sharma





**THAT IS ALL FOR
TODAY**