Template and gauges

Objectives : At the end of this lesson you shall be able to
- **define template with its uses and advantages**
- **define gauges their necessity and types.**

Templates: Templates are used to check the contour of the profile of a workpiece for conformance to shape or form templates are made from steel sheet. They are also called profile gauge.

Benefits of templates

1 To avoid repetitive measuring and marking the same dimension, and where many identical parts are required.

2 To avoid unnecessary wastage of material and from information given on drawing, it is almost impossible to anticipate exactly where to begin in order that the complete layout can be economically accommodated.

3 To act as a guide for cutting processes.

4 As a simple means of checking bend angles and contours.

Information given on templates

Written on templates may be as follows:

1 Job or contract number

2 Size and thickness of plate

3 Quantity required

4 Bending or folding instructions

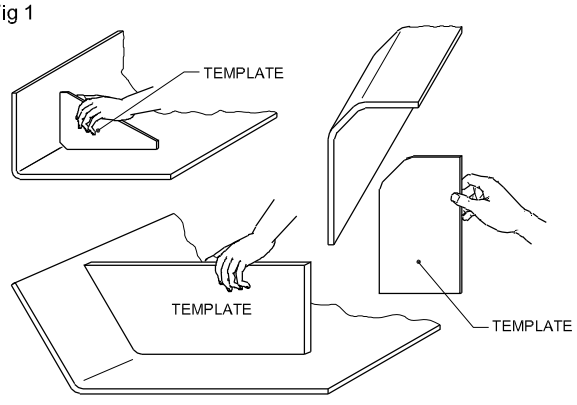
5 Drilling requirement

6 Cutting instructions

7 Assembly reference mark.

Templates as a means of checking is shown in Fig 1 to 6

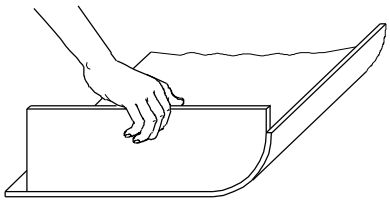
Fig 1



CHECKING ANGLES WITH A TEMPLATE

FIN3112511

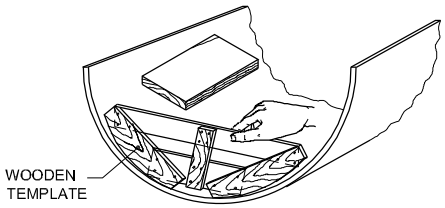
Fig 2



CHECKING THE CONTOUR OF A RADIUSED CORNER

FIN3112512

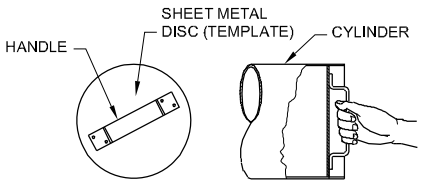
Fig 3



CHECKING THE CONTOUR OF A ROLLED PLATE

FIN3112513

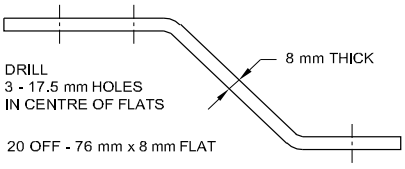
Fig 4



TEMPLATE USED FOR CHECKING CONTOUR OF CYLINDRICAL WORK SUCH AS DUCTWORK.

FIN3112514

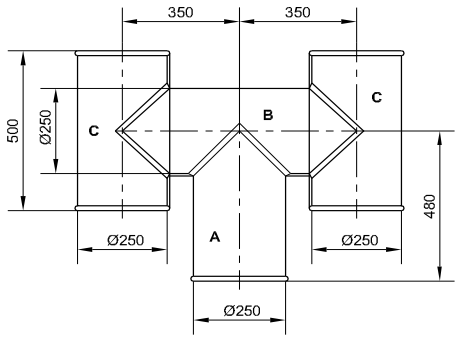
Fig 5



THE USE OF TEMPLATES AS A MEANS OF CHECKING

FIN3112515

Fig 6



CHIMNEY SMOKE COWL

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Templates for setting out sheet metal fabrications: For economy reasons, many patterns are made for marking out the sheet metal prior to cutting and forming operations. Fig 7,8 show a smoke cowl. Here a template is required to check and to mark out the contours of the intersection joint lines for the parts A,B & C whose developed sizes are marked out in the flat with the appripriate datum lines.

Fig 7

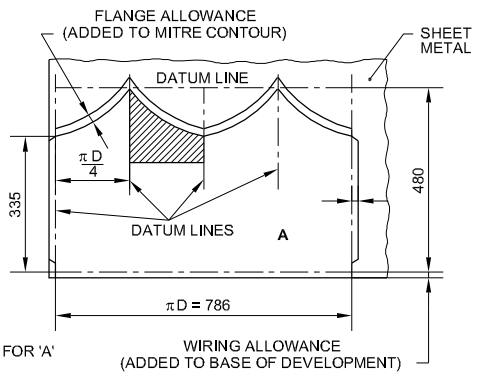
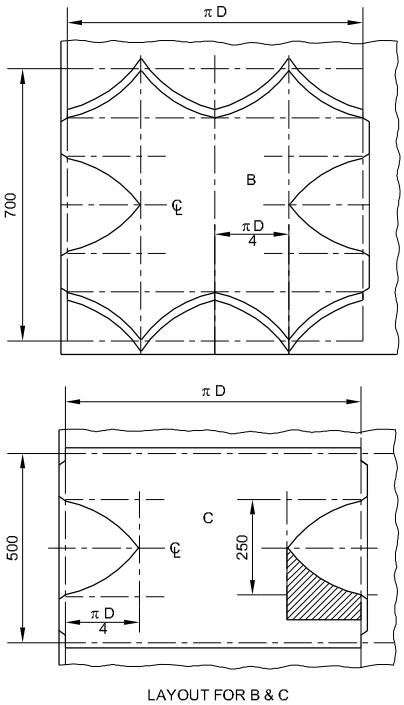


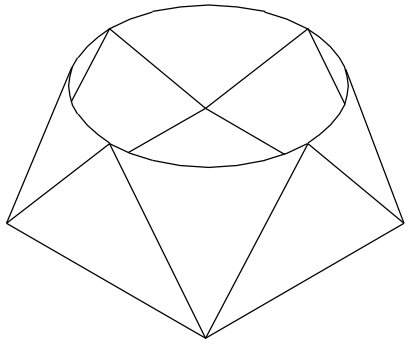
Fig 8



AN EXAMPLE OF THE USE OF TEMPLATES

Fig 9 shows a square to round transformer is an isometric view of the sheet metal trans forming piece which is used to connect a circular duct to a square duct of equal area of cross section. In this example the dia of the round duct is 860 mm and length of one side of the square duct is 762 mm and the distance between the two ducts is 458 mm and sheet thickness is 1.2 mm.

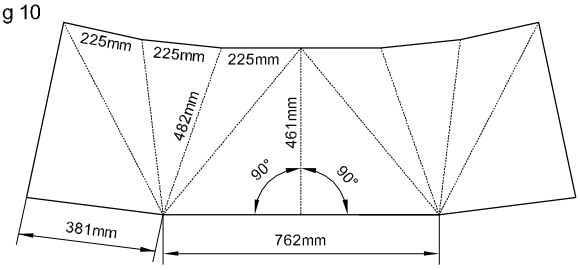
Fig 9



THE COMPLETE TRANSFORMER

Fig 10 shows a scale development pattern on which are marked the full size dimensions. This type of drawings are supplied by the drawing office for marking out purposes. Allowances for the seams and the joints must be added to the layout.

Fig 10



PATTERN OR HALF-TEMPLATE WITHOUT JOINT ALLOWANCES
SQUARE TO ROUND TRANSFORMER

Screw pitch gauge

Objectives : At the end of this lesson you shall be able to
- **state the purpose of a screw pitch gauge**
- **state the features of a screw pitch gauge.**

Purpose

A screw pitch gauge is used to determine the pitch of a thread.

It is also used to compare the profile of threads.

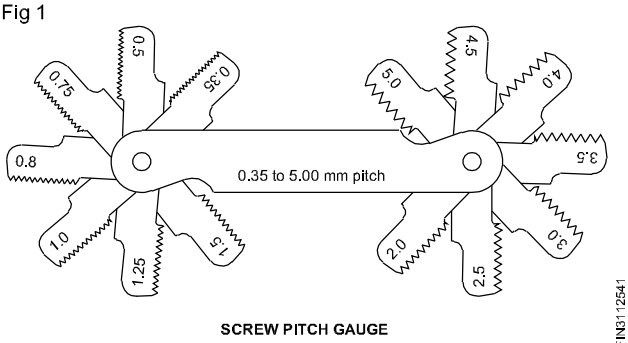
Constructional features

Pitch gauges are available with a number of blades assembled as a set. Each blade is meant for checking a particular standard thread pitch. The blades are made of thin spring steel sheets, and are hardened.

Some screw pitch gauge sets will have blades provided for checking British Standards threads (BSW, BSF etc.) at one end and the metric standard at the other end.

The thread profile on each blade is cut for about 25 mm to 30 mm. The pitch of the blade is stamped on each blade. The standard and range of the pitches are marked on the case. (Fig 1)

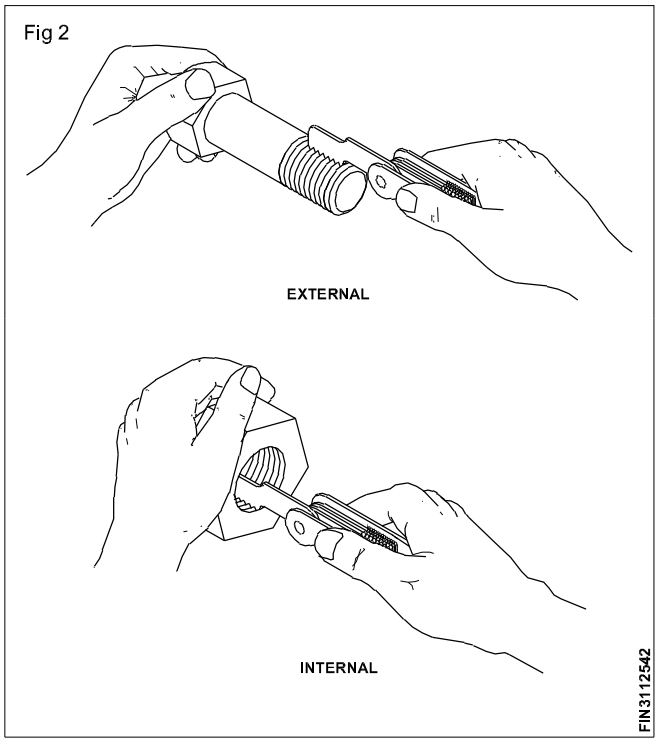
Fig 1



SCREW PITCH GAUGE

For obtaining accurate results while using the screw pitch gauge, the full length of the blade should be placed on the threads. (Fig 2)

Fig 2



Simple and standard workshop gauges

Objectives : At the end of this lesson you shall be able to

- **state what is radius and fillet gauge**
- **mention the sizes and uses of feeler gauge**
- **brief the drill gauge and drill grinding gauge**
- **state the function centre gauge**
- **state the uses of acme threading tool grinding gauge & tool setting gauge**
- **describe the construction and uses of wire gauge.**

Radius and fillet gauges: Components are machined to have curved formation on the edges or at the junction of two steps. Accordingly they are called radius and fillets. The size of the radius and radius is normally provided on a drawing. The gauges used to check the radius formed on the edges of diameters are fillet and the gauges used to check the fillets are called fillets gauges.

They are made of hardened sheet metal each to a precise radius. They are used to check the radii by comparing the radius on a part with the radius of the gauges.

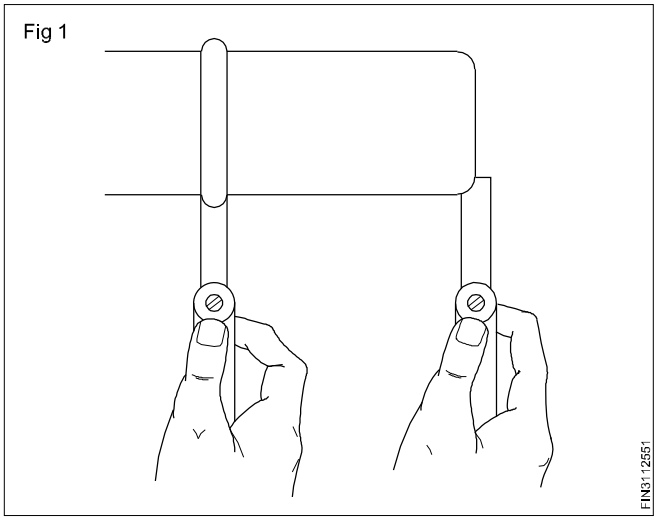
Fig 1 shows the application of radius gauge to check the radius formed externally. Fig 2 shows the application of a fillet gauge to check the fillet formed on a turned component. The other typical applications are:

– Checking the corner radius of a part being filed to shape. (Fig 3)

– Checking a radius formed by a milling cutter. (Fig 4)

The radius and fillet gauges are available in sets of several blades which fold into a holder when not in use. (Fig 5)

Fig 1



Some sets have provisions to check the radius and fillet on each blade. (Fig 6)

And some sets have separate sets of blades to check the radius and fillet. (Fig 7)

Fig 2

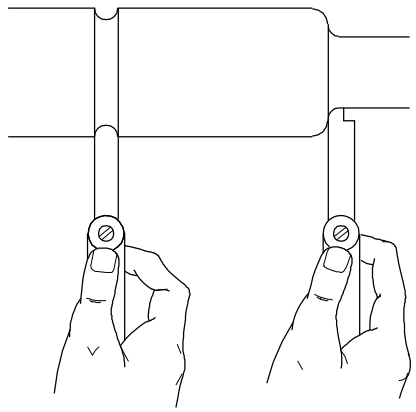


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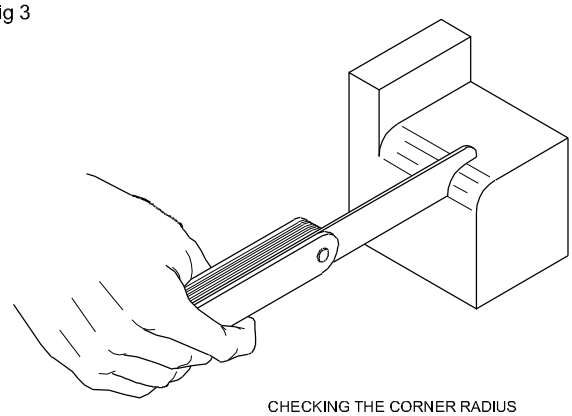
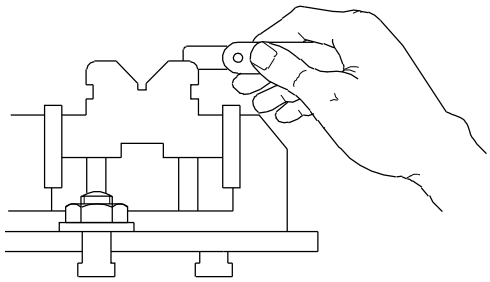
Fig 3



CHECKING THE CORNER RADIUS
OF A PART BEING FILED TO SHAPE

FIN3112553

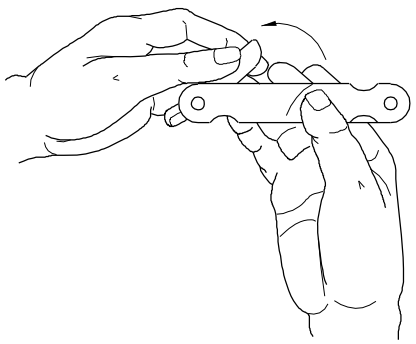
Fig 4



CHECKING A RADIUS FORMED
BY A MILLING CUTTER

FIN3112554

Fig 5



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Each blade can be swung out of the holder separately, and has its size engraved on it. (Fig 8)

Fillet gauges are available in sets to check the radii and fillets from:

Fig 6

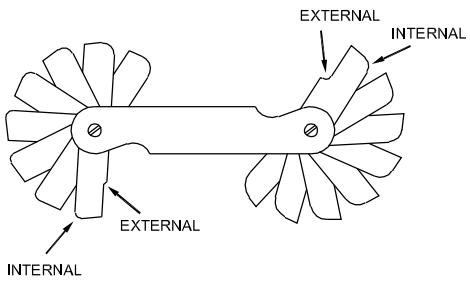

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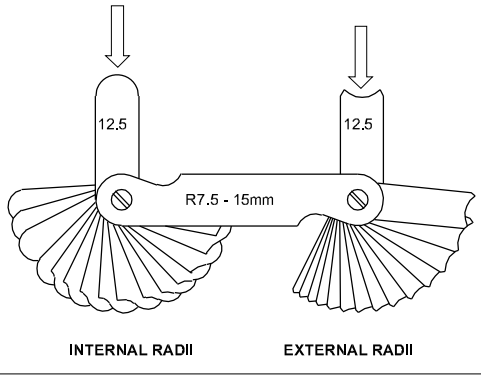
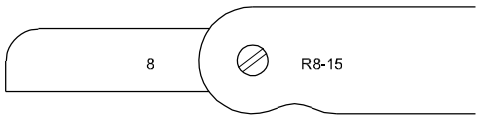
Fig 7



FIN3112557

Fig 8



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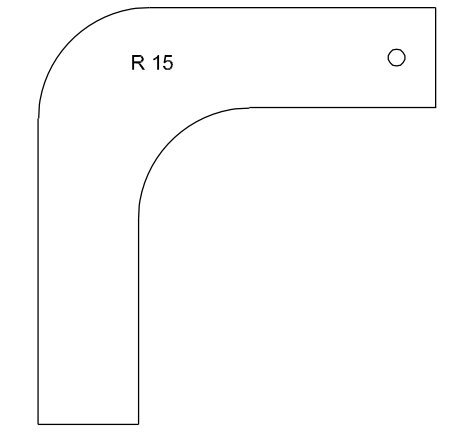
1 to 7 mm in steps of 0.5 mm

7.5 to 15 mm in steps of 0.5 mm

15.5 to 25 mm in steps 0.5 mm.

Individual gauges are also available. They usually have internal and external radii on each gauge and are made in sizes from 1 to 100 mm in steps of 1 mm. (Fig 9)

Fig 9



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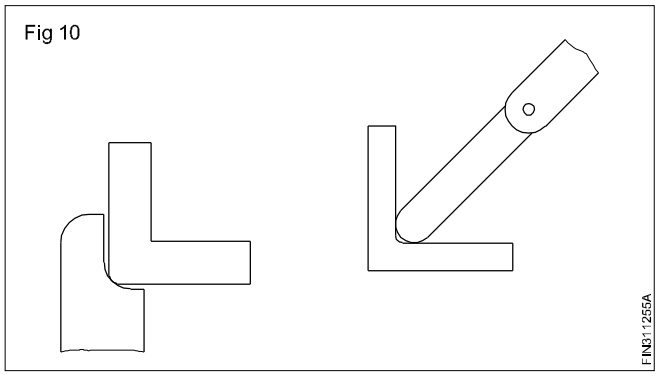
Before using the radius gauge, check that it is clean and undamaged.

Remove burrs from the workpiece.

Select the leaf of the gauge from the set corresponding to the radius to be checked.

Fig 10 shows that the radius of the fillet and that of the external radius are smaller than the gauge.

Fig 10

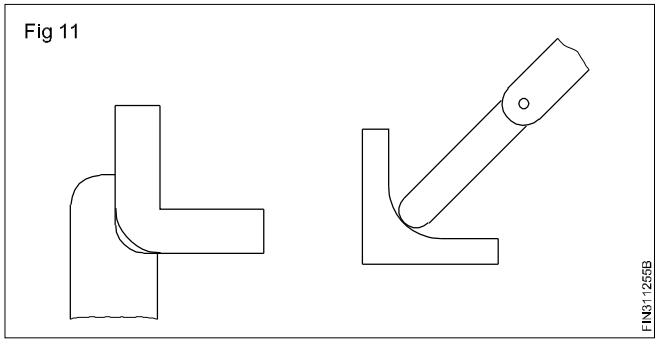


Try a smaller gauge to determine the radius dimension.

File or machine the workpiece if it has to be of the radius of the gauge.

Figure 11 shows that the radius of the fillet and that of the external radius are larger than the gauge.

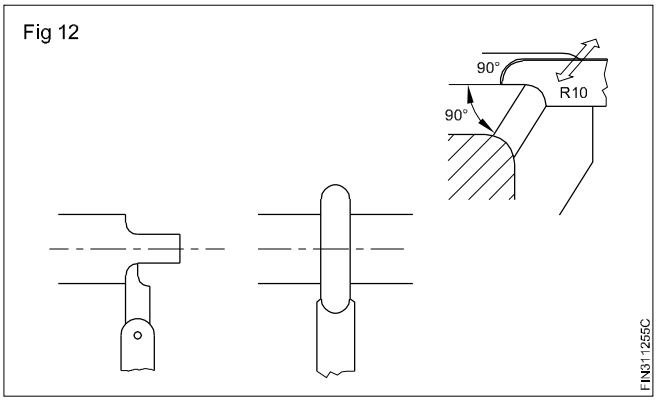
Fig 11



Try a larger gauge if you need to find the radius dimension.

Fig 12 shows the workpiece having the same radius as that of the gauge that is being used for checking.

Fig 12

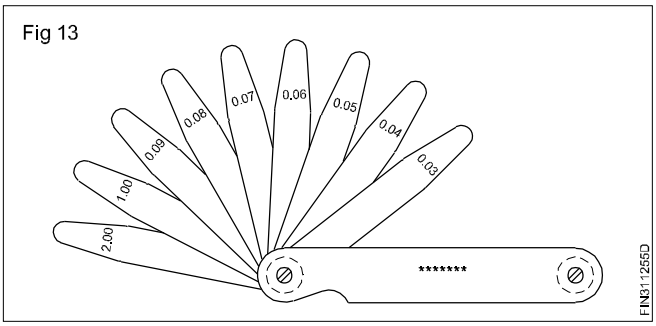


Feeler gauge and uses

Features: A feeler gauge consists of a number of hardened and tempered steel blades of various thicknesses mounted in a steel case. (Fig 13)

The thickness of individual leaves is marked on it. (Fig 13)

Fig 13



B.I.S. Set: The Indian Standard establishes four sets of feeler gauges Nos.1,2,3 and 4 which differ by the number of blades in each and by the range of thickness (minimum is 0.03 mm to 1 mm in steps of 0.01 mm). The length of the blade is usually 100 mm.

Example

Set No.4 of Indian Standard consist of 13 blades of different thicknesses.

0.03, 0.04, 0.05, 0.06, 0.07, 0.08, 0.09, 0.10, 0.15, 0.20, 0.30, 0.40, 0.50.

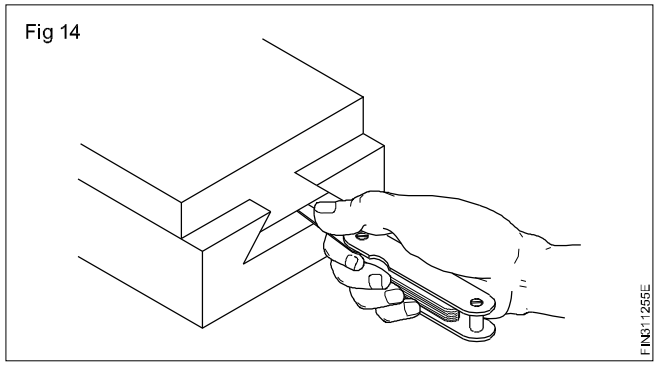
The sizes of the feeler gauges in a set are carefully chosen in order that a maximum number of dimensions can be formed by building up from a minimum number of leaves.

The dimension being tested is judged to be equal to the thickness of the leaves used, when a slight pull is felt while withdrawing them. Accuracy in using these gauge requires a good sense of feel.

Feeler gauges are used:

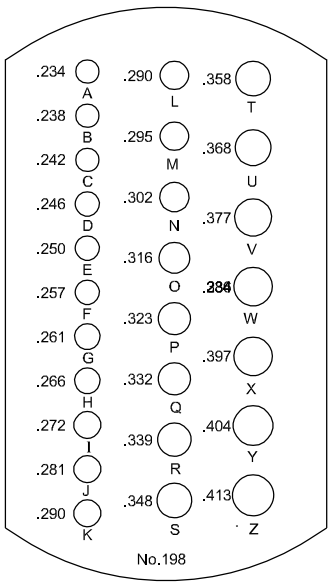
– To check the gap between the mating parts
– To check and set the spark plug gaps
– To set the clearance between the fixture (setting block) and the cutter/tool for machining the jobs
– To check and measure the bearing clearance, and for many other purposes where a specified clearance must be maintained. (Fig 14)

Fig 14



Drill gauge: A drill gauge is a rectangular or square shaped metal piece containing a number of different diameter holes. The size of the hole is stamped against each hole. (Fig 15)

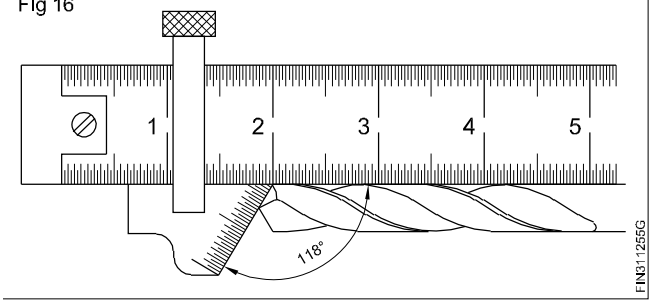
Fig 15



In the number drill and letter drill series, the diameter of the drill is gauged with the help of the respective drill gauge.

Drill point grinding gauge: Drill point grinding gauge having an angle 118°. In the 118° angle/side/0.5 graduations are marked to check the length of the cutting edge. In inches version this tool is calibrated with 1/32 parts of an inch. (Fig 16)

Fig 16

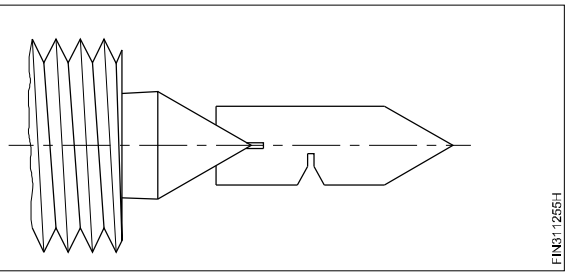


It consists of a sliding head mounted on a steel rule. The head may be positioned on the rule and clamped by a knurled nut.

This gauge is used to check the correctness of the cutting angle 118°, of the twist drill after re-sharpening by hand.

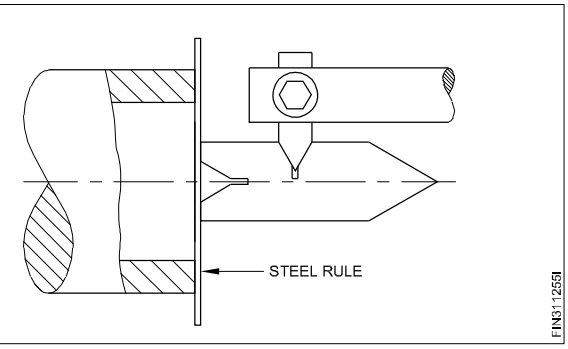
Centre gauge: A centre gauge is made up of spring steel hardened and tempered and is used mainly for grinding and setting single point thread cutting tool. These gauges have graduation for checking the number of threads per inch. Some gauges have a table giving the double depth of various threads and also used to check the included angle 60° of ground lathe centres. (Fig 17)

Fig 17



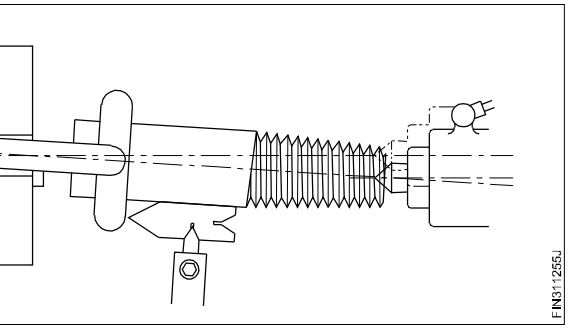
For internal threading, the cutting tool is set to square with the help of centre gauge and steel rule. (Fig 18)

Fig 18



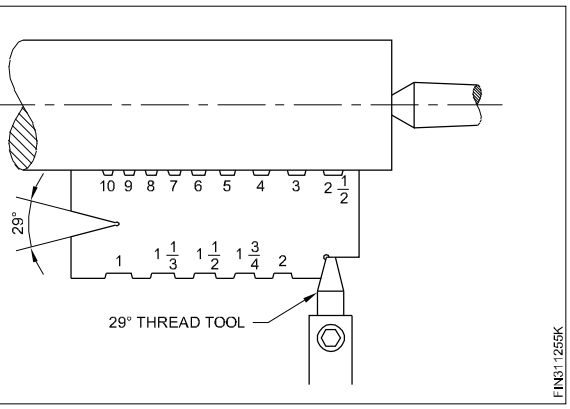
When cutting tapered threads the centre gauge is used to set the cutting tool square with the axis of the workpiece. (Fig 19)

Fig 19



Acme thread gauge: An Acme thread gauge is used when grinding thread cutting tool and also for setting the tool square with the work. (Fig 20)

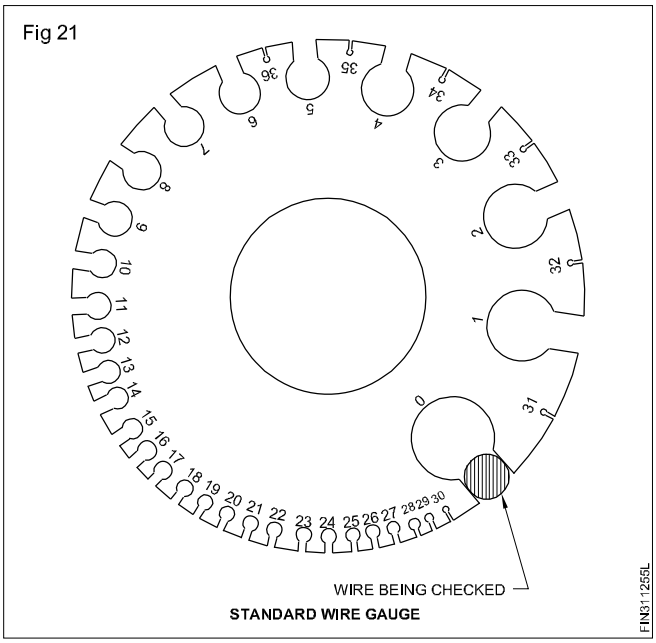
Fig 20



The notches on the edge of the gauge are for checking the correct width of point of the tool according to the number of threads per inch specified for acme thread. It is made of spring steel and hardened. Similarly, a metric thread gauge is also available.

Standard Wire Gauge (SWG): It is used to measure the size of a wire and thickness of sheet shown in Fig.21

Fig 21



The standard wire gauge is a circular metal disc with varying hole and slot size on its circumference. Each slot size corresponds to a gauge number which is written just below the hole.

The gauge numbers specify the size of a round wire in terms of its diameter.

As the gauge number increase from 0 to 36, the dia size decrease.

The thickness of sheet metal and the diameter of wires confirm to various gauging numbers and the following Table 1 give the decimal equivalents of the different gauge numbers for the diameter of wires, and the thickness of sheets.

Table 1

Standard wire gauge number and equivalent value in mm as per IS 5049-1969

Wire No. according to SWG	Wire Dia according to IS:280-1962 in mm
0	8.00
2	7.10
3	6.30
4	6.00
5	5.60
6	5.00
7	4.50
8	4.00
9	3.55
10	3.15
11	2.80
12	2.50
13	2.24
14	2.00
15	1.80
16	1.60
17	1.40
18	1.25
-	1.12

Wire No. according to SWG	Wire Dia according to IS:280-1962 in mm
19	1.00
20	0.90
21	0.80
22	0.710
23	0.630
24	0.560
25	0.500
26	0.450
27	0.400
29	0.355
30	0.315
32	0.280
33	0.250
34	0.224
36	0.200
37	0.180
38	0.160
39	0.140
40	0.125

Gauges and types of gauges

Objectives : At the end of this lesson you shall be able to
- **define template with its uses and advantages**
- **define gauges their necessity and types.**

Gauge

Gauge is an inspection tool used to check product dimension with reference to its maximum and minimum acceptable limits. It is, generally, used to segregate acceptable and non-acceptable products in mass production, without the exact dimensions. It is made of tool steel and is heat treated.

Advantages of gauging

Faster checking of the product is within the specified limits.

Less dependence on operator skill and getting affected by operator judgement.

Gauges are economical when compared to measuring instruments.

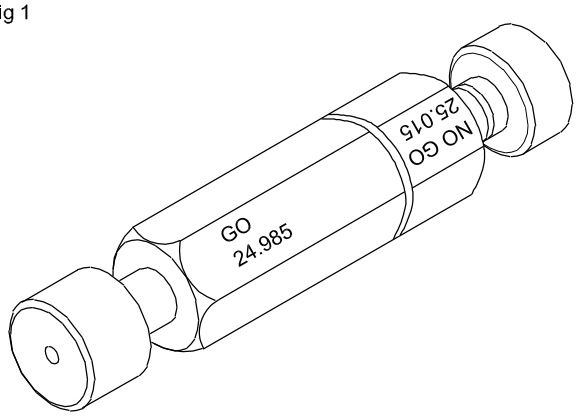
Instrument used for gauging

1 Snap and ring gauge
2 Combined gauge
3 Plug gauge
4 Screw pitch gauge
5 Template and form gauge
6 Taper gauge

Types of cylindrical plug gauges

Double-ended plug gauge (Fig 1 and 2)

Fig 1



DOUBLE ENDED PLUG GAUGE

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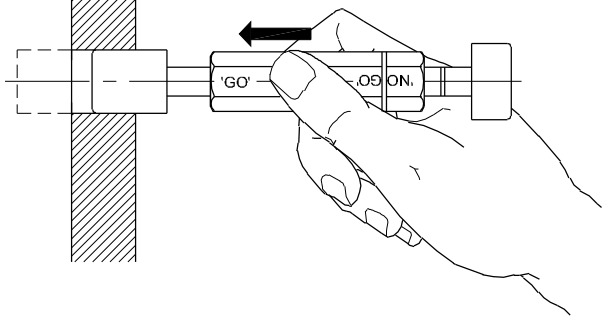
Fig 2



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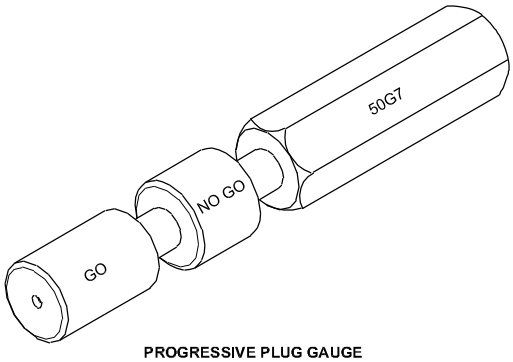
Progressive plug gauge (Fig 3)

Plain cylindrical gauges are used for checking the inside diameter of a straight hole. The ‘Go’ gauge checks the lower limit of the hole and the ‘No- Go’ gauge checks the upper limit. The plugs are ground and lapped. (Fig 3)

Fig 3



PROGRESSIVE PLUG GAUGE

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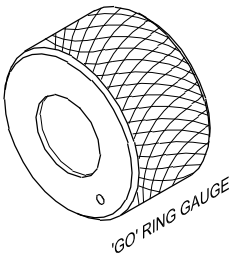
Plain ring gauge (Fig 4)

Fig 4



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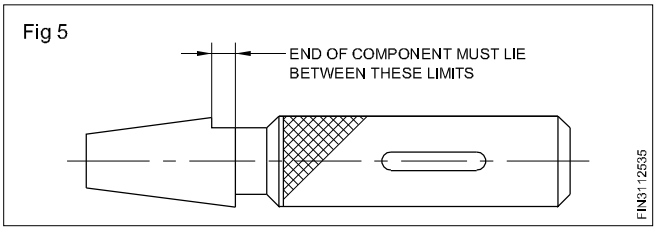
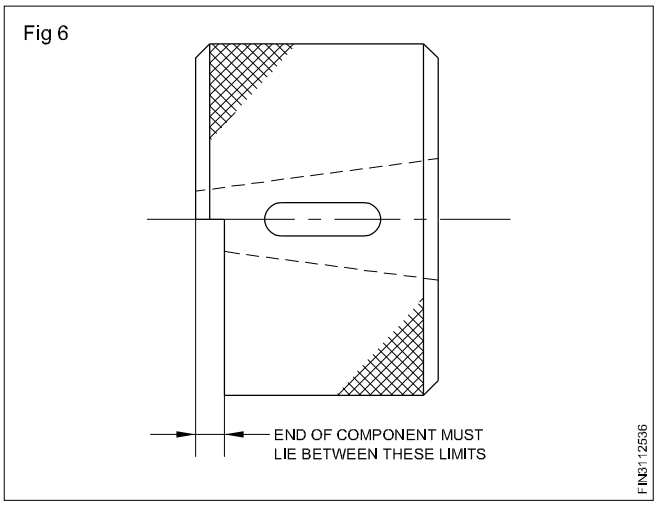
Plain ring gauges are used to check the outside diameter of pieces. Separate gauges are used for checking ‘Go’ and ‘No- Go’ sizes. A `No-Go’ gauge is identified by an annular groove on the knurled surface.

Taper plug gauges (Fig 5)



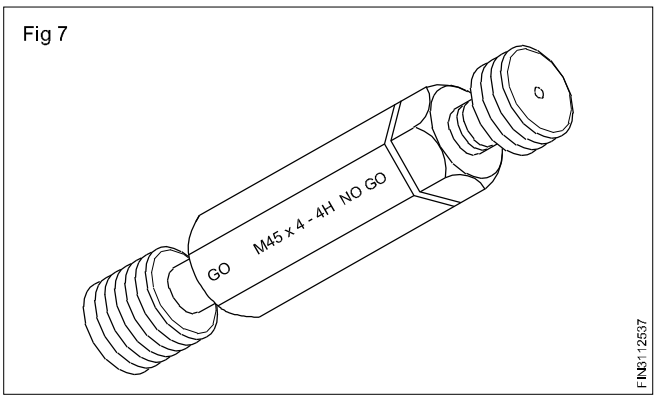
These gauges made with standard or special tapers are used to check the size of the hole and the accuracy of the taper. The gauge must slide into the hole for a prescribed depth and fit perfectly. An incorrect taper is evidenced by a wobble between the plug gauge and the hole.

Taper ring gauges (Fig 6)

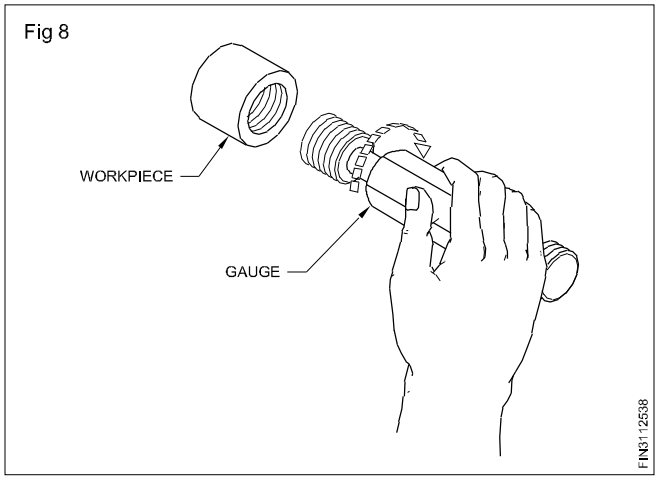


They are used to check both the accuracy and the outside diameter of a taper. Ring gauges often have scribed lines or a step ground on the small end to indicate the 'Go' and 'No-Go' dimensions.

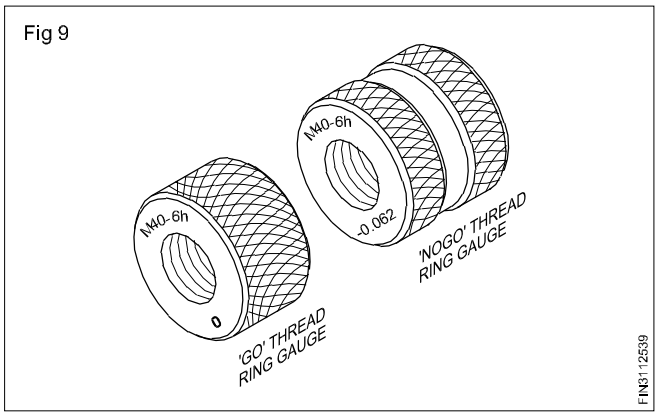
Thread plug gauges (Figs 7 and 8)



Internal threads are checked with thread plug gauges of 'Go' and `No-Go' variety which employ the same principle as cylindrical plug gauges.

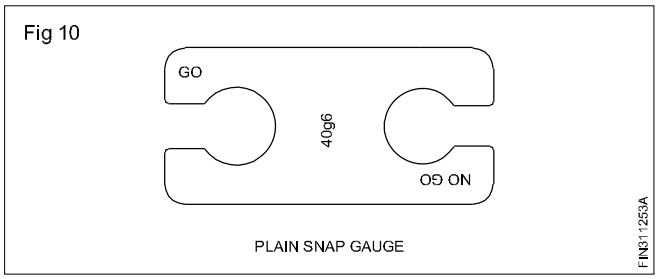


Thread ring gauges (Fig 9)



These gauges are used to check the accuracy of an external thread. They have a threaded hole in the centre with three radial slots and a set screw to permit small adjustments.

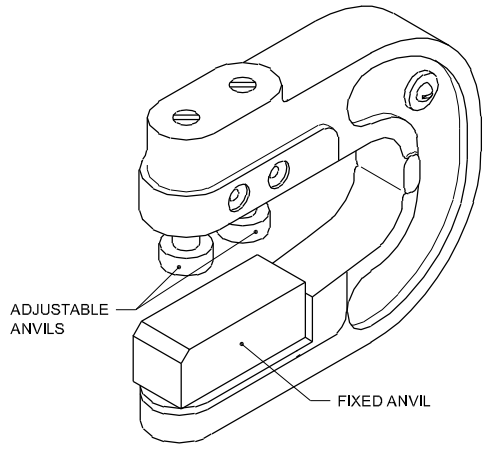
Snap gauges (Figs 10, 11, 12 and 13)



Snap gauges are a quick means of checking diameters and threads to within certain limits by comparing the part's size to the present dimension of the snap gauge.

Snap gauges are generally C-shaped and are adjustable to the maximum and minimum limits of the part being checked. When in use, the work should slide into the 'Go' gauge but not into the 'No-Go' gauging end.

Fig 12



ADJUSTABLE SNAP GAUGE

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Fig 13

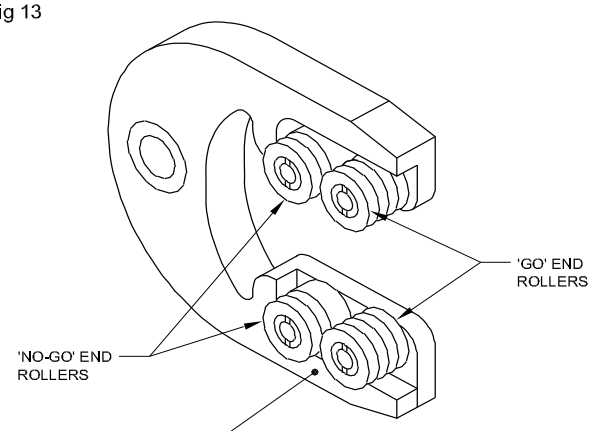

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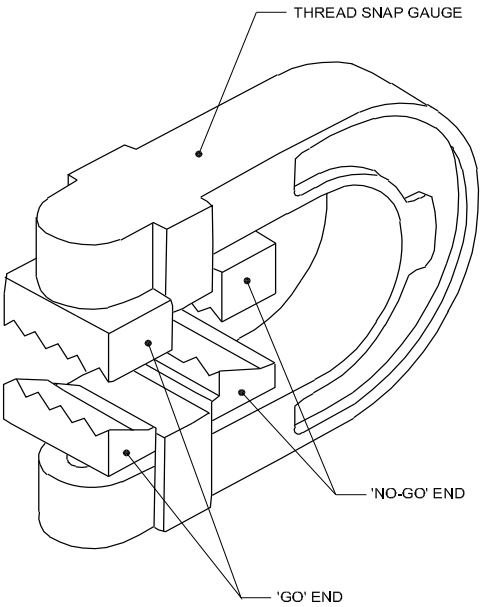
Fig 12



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