FACULTY OF ENGINEERING

DESIGN AND PRODUCTION ENGINEERING DEPARTMENT

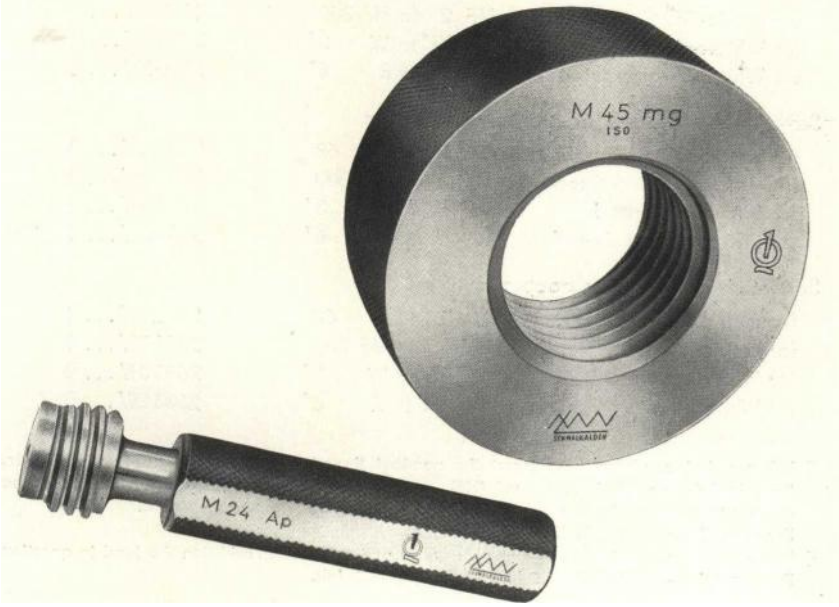
Credit Hour System

Metrology Lab 1 – MDP 240

Report On:

(1)

Fixed gauges



Metrology laboratory

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Class No:	Signature
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Fixed Gauges

Introduction:

Fixed gauges are measuring tools without a scale being used. It is used to check dimensions, forms (geometrical conditions) and relative positions of surfaces of parts. The actual size of a part can not be obtained with the aid of fixed gauges; their purpose is to determine whether the size lies within the specified limits or not.

Requirements in the fixed gauges:

1- Accuracy of manufacture
2- High rigidity and low weight
3- High wear resistance
4- Size stability
5- Rust resistance

Classification of fixed gauges:

Depending on the kind of part to be checked, fixed gauges may be classified as follows:

1- Mating gauges
2- Limit gauges.

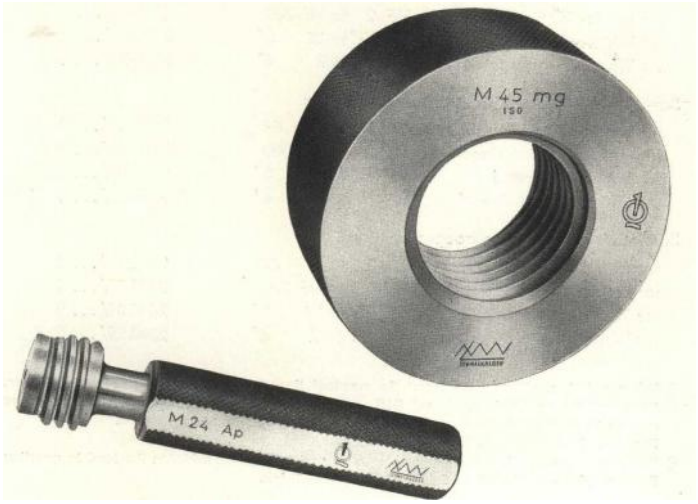
Mating gauges

Limit gauges.

Mating gauges: these are fixed gauges to which a part is fitted closely and tested for tight mating by feel, by sighting or by pigment transfer method. The correspondence of the gauge and part sizes is thereby ensured. The estimation of the mating quality depends on the skill of the inspector or operator, and is, therefore, subjective. Feeler gauges and feeling pins can be considered as two types of the mating gauges.

Limited gauges: these are fixed gauges made according to one of the size limits of the part being checked. Inspection by means of limit gauges is done by determining whether or not they enter the parts being checked.

Here, two limit gauges are used: one corresponds to the high limit of size and the other to the low limit of size. Limit gauges are divided into Go gauges, which should enter good parts, and NOT Go gauges which shouldn't. Consequently, a part is accepted if the GO gauge entered and the NOT GO gauge didn't.



Depending on the construction, fixed gauges may be classified as:

- Non-adjustable, or fixed gauge for checking a size only
- Adjustable, allowing wear compensation and setting up to different dimensions; single limit gauge having one limit member, and two-limit gauges having both GO and NOT GO limit members.

As regards the number of dimensions or conditions being checked, there are fixed gauges with surface contact (e.g. a plug gauge), line contact (a snap gauge), and point contact (a bore gauge).

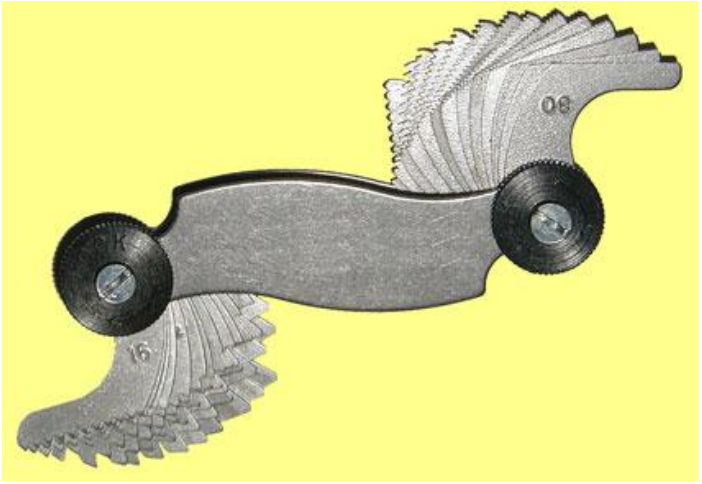
Other applications of fixed gauges:

Outer threads: An adjustable GO- NOT GO gauge for threads is similar to that of diameter checking (shown in the figure). It has the advantage of being easy to use while the workpiece is still being machined. The sensors having the threaded shape could be removed and replaced by others having different dimensions.

Inner threads (nuts): A bolt-like gauge is used for inspection of inner threads. Simply, if the thread under test is of a wrong diameter or pitch, the gauge will not fit in it.

Pitch gauge: This is used to measure the pitch of the thread. It has got two sides; one is a metric thread and the other is Whitworth. It should be noticed that while using this type of gauges, it is

preferred to measure one tooth only of the thread. This facilitates the observation while measuring.



2. Feeler Gauges

Feeler (or thickness) gauges may be also regarded as fixed length gauges. These contain a series of metal strips with parallel surfaces. They are used to check the clearance between surfaces.

Dimensions: The strips come with the thickness from 0.02 to 1 mm and length of 50, 100 and 200 mm

The following table shows a list of the sizes of feeler gauges.

Code # of feeler gauge	Normal thickness of gauge strips	number of strips in gauge
1	0.02, 0.03, 0.04, 0.05, 0.06, 0.07, 0.08, 0.09, 0.1	9
2	0.02, 0.03, 0.04, 0.05, 0.06, 0.07, 0.08, 0.09, 0.1, 0.15, 0.2, 0.25, 0.3, 0.35, 0.4, 0.45, 0.5	17
3	0.55, 0.6, 0.65, 0., 0.75, 0.8, 0.85, 0.9, 0.95, 1	10
4	0.1, 0.2, 0.3, 0.4, 0.5, 0.6, 0.7, 0.8, 0.9, 1	10

Therefore, both; separate strips and combinations, can be used to check the required size. Feeler gauges are also available in inches. The sides of the feeler blades may be parallel or tapered.

Only “plus” deviations from the nominal thickness of feeler gauge strips are permitted: +5 to +15 μm and +8 to +25 μm (depending on the nominal size) for feeler gauges of accuracy grades 1 and 2, respectively. These tolerances cover three-quarters of the strip length taken from the free ends of strips. The strips are verified at not fewer than six points with the aids of a Mikrokator on a gauge stand.

How to use a thickness ('feeler') gauge

Sometimes you need to set a gap between two components in your car, for instance when checking your spark plugs, doing a valve adjustment, or setting the distributor. When you need an exact gap, thickness or 'feeler' gauges are the perfect help.

Find out the gap of what you're trying to adjust from a manual, help guide or the ever helpful internet. Each of the blades of the thickness gauge has a different measurement on it, e.g. .025, .0015 (very thin), etc. Separate the one you want and fold the rest away. Some gauges have a knob where they all hinge which you can tighten to keep the blade you want locked in place.

Slide the measuring blade in to the gap you want to set, then move the machinery you're adjusting in to it's just touching the gauge, the move it out just slightly. What you're after here is to not quite grip the measuring blade - it should be able to just slide in and out. Don't use the machinery to clamp it in, as that will actually be too small a gap and also you'll dent the soft metal of the blade.

Once you have the gap set so you can just get the blade out, tighten up the machinery a bit, but not to full tightness. Now double check you can get the blade in but it doesn't rattle, and you can't get the next size blade up in the gap. If it's still right, tighten up the machinery the rest of the way.

Don't forget to fold away the blade before putting the thickness gauge in your toolbox, as they're easily bent.

3. Radius Gauges

Radius gauges consist of a series of steel strips with the outer ends shaped as arcs of circles; either internal or external radii. The radius gauges are used to check the radii from 0.75mm to 13mm (1/32″ to 33/64″), which are listed in the following table:

No. of pieces	From	To	Step
18	1/32″	17/64″	1/64″
16	9/32″	33/64″	1/64″
18	0.75mm	5.0mm	0.25mm
16	5.50mm	13.0mm	0.50mm

The corresponding gauge strip is laid against the product radius for checking the latter by seeing if any light is visible between them.

5. Angle Slip Gauges

Introduction:

Angle slip gauges are angle-measuring standards. They are made of hardened steel following the same principle of the length slip gauge blocks.

Shape and dimensions:

Those blocks found in our lab are of triangular shape; isosceles triangle. Blocks could also be found in trapezoidal shapes.

They are available in sets in which each part has two lapped surfaces including a certain angle. Some sets contain 13 blocks with 12 different angles so that all angles from 0º to 90º can be built-up in steps of 13″.

5 blocks	1º 3º 9º 27º 41º
4 blocks	1´ 3´ 9´ 27´
3 blocks	6″ 18″ 30″

An additional block having an angle of 9º is also available so that 90º angle can be built-up.

Grades of angle slip gauges:

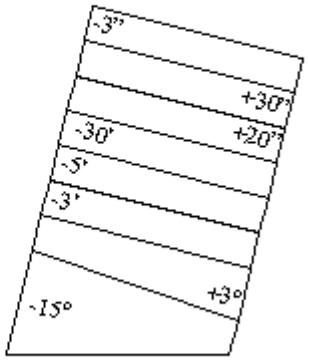
Two different grades A and B are available. Grade B contains the above mentioned blocks with an accuracy of 0.1´ (6″) can be achieved. Grade A set contains an additional block with an angle of 0.05´(3″) so that higher accuracy can be achieved. For the visual inspection of angles, each set of angle slip gauges is provided with a starting-edge having parallel faces. The limited number of 13 pieces of angle blocks is due to the possibility of combining them in an adding as well as in a *subtracting* manner.

Building a combination

The selection of angular gauge blocks is similar to the selection of linear gauge blocks, except that subtraction may also be required. (When the blocks are stacked, then angles are simply reversed.

For the angle 12°37'13", find the angular gauge block stack using the 16 piece set.

12°37'13"
-3"
12°37'10"
+30"
12°37'40"
+20"
12°38'
-30'
12°8'
-5'
12°3'
-3'
12°
+3°
15°
-15°
0



Numerical examples:

Here is an example illustrating the addition and subtraction of angles. The two blocks of 20º and 21º are used twice. Once, they are added, the other, they are subtracted.

The procedure used for making various angles is as follows:

Example: build up an angle of 57º 34´24″

First build up the seconds as,

$$24'' = 30'' - 6''$$

Next, build up the minutes as,

$$34' = 27' + 9' + 1' - 3'$$

Finally, build up the degrees as,

$$57^\circ = 41^\circ + 27^\circ + 1^\circ - 3^\circ - 9^\circ$$

Another example, building up 46º 50´30″

First build up the seconds using 10º 30″, therefore

46º 50´30″

-10º 30″

36º 50´

Next, build up the minutes using 15º 50´, therefore

36º 50´

-15º 50´

21º

Finally, build up the degrees using 21º, therefore

21º

-21º

0

Thus, the blocks used are all added. We use, 10º 30″, 15º 50´, 21º

Other shapes of angle slip gauges are used for inspection of right angles. The block is either of perfect right angle, or with small deviation to measure the tolerance of the measured part.

A holder is usually used to hold a combination of blocks together while measuring.

The two common sets of angular gauge blocks for the measurement of angles are,

16 piece set		
	degrees	45°, 30°, 15°, 5°, 3°, 1°
	minutes	30', 20', 5', 3', 1'
	second	30", 20", 5", 3", 1"
13 piece set		
	degrees	1°, 3°, 9°, 27°, 41°, 90°
	minutes	1', 3', 9', 27', 0.1', 0.3', 0.5'

tool room accuracy ±1 second
laboratory accuracy ± 0.25 seconds

The Experiment

Main Objective

To study the different types of fixed gauges, specification and fields of applications.

Apparatus

Limit gauges for plain shafts and holes

Non adjustable type

Adjustable type

Standard rings

Feeler gauges

Radius gauges

Feeling pins

Angle gauge blocks

Requirements

1 Study the different types of the fixed gauges given to you then draw neat sketch for each and state the specifications and field of application for each of them.

2 Check the dimension of the given product using the available gauges given to you.

3 Indicate the minimum number of the angle gauges required to obtain the following angles:

24^{o} $3^{/}$ $6^{//}$

32^{o} $50^{/}$ $54^{//}$

49^{o} $44^{/}$ $12^{//}$

Results & discussion