

Experiment No. 6

Title:- Measurements machine parts using optical profile projector.

Specific Outcomes:- Students will able to

- 1) To appreciate the importance of precision measurement.
- 2) To know the working principle of profile projector.
- 3) To know the field of application of this instrument.

Instruments/ Equipment with Specifications:-

- 1) Optical profile projector:-

Make:-

Height x Width x Depth:-

Lamp:- 230 Volt x Watt (Pre-focused Base Projection)

Screen Diameter:- mm.

Magnification:- X

Co-Ordinate Table Movement:- X-Axis: mm, L.C. = 0.01 mm.

Y-Axis: mm, L.C. = 0.01 mm.

- 2) Master Tracing

- 3) Work piece

Working Principle:-

All Projectors require a parallel beam of light as illuminating source hence light source is normally a near point source placed at principal focus of the condensing lens which collimates i.e. makes outgoing rays parallel. The projection lens which is a combination of lenses. Light from lamp source passes through a condensing lens and then through a projection lens. The component / object is supported on the work table between these two lenses, interrupts the light and produce an inverted magnified real image of an object on screen placed on the other end. If the screen is opaque image can be seen from the same side of projector or it could be translucent when it can be viewed from opposite side of the screen

Description:-

Optical profile projector is incorporated with a coordinate table and micrometers for accurate measurement of coordinates. A rotating table with locking arrangement is mounted on the slide which facilitates easy alignment of the workpiece.

A profile projector, with illumination adjusted to obtain an even intensity on the screen for the inspection of diascopic as well as episcopic projections of either sharp edge shadows or surface illuminated images of the parts under inspection. It eliminates eye strain and makes it easy to check the parameters of even tiniest objects.

With an enlarged shadow it is possible to compare work piece with magnified master drawing. It is handy for checking a large variety of components like watch parts, jewels, diamonds, wire mesh and netting, tool edges and angles, rubber parts, integrated circuits, printed circuit boards, metallurgical structures, thread forms, etc.



Fig. 6.1 Profile Projector

Image Source: https://www.solidswiki.com/images/0/08/Profile_Projector1.jpg



Fig. 6.2 Optical Profile Projector

Image Source:

<https://www.master-abrasives.co.uk/machinery-and-equipment/measuring-equipment/optical-metrology.aspx>

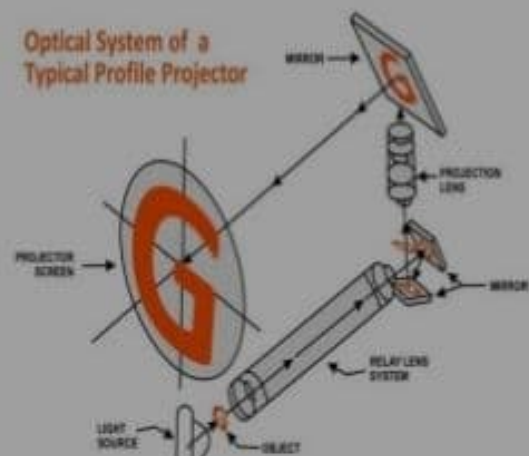


Fig. 6.3 Optical Profile Projector

Image Source:

<https://sipconinstrument.com/2019/06/14/profile-projectors-all-you-need-to-know/>

Experiment no. 6Title :-

Measurement of machine parts using optical profile projector.

Instruments/Equipments with specification.

1] Optical profile projector :-

Make

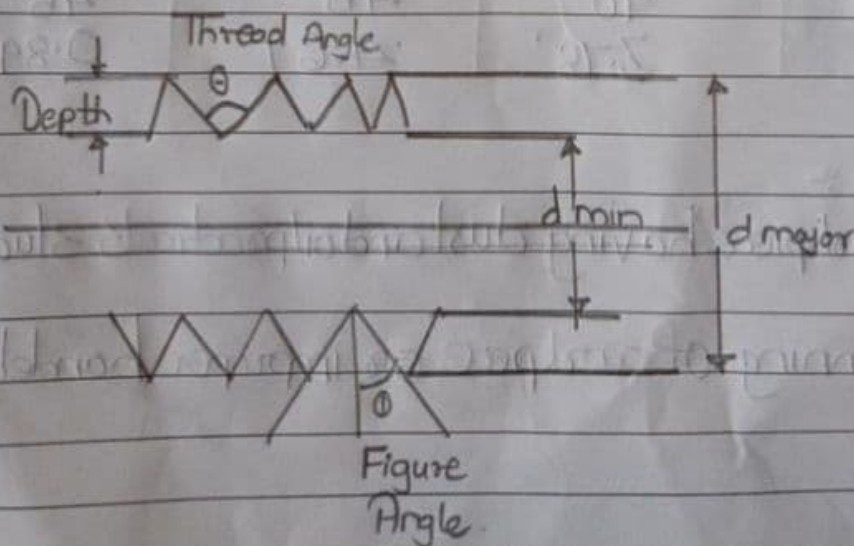
Height x width x Depth :- 988 x 563 x 1224 mmLamp :- 234 volts x 150 watts (Prefocused base projection)

Magnification,

Co-ordinate table movement = x axis = 150 mm LC = 0.01 mm
y axis = 100 mm LC = 0.01 mm

2] Master Tracing

3] Work piece



Observation Table							
Work piece 2				Work piece 2			
Parameter to be Measure	Initial Reading (R1 Unit)	Final Reading (R2 Unit)	Dimension of Parameter (Unit)	Parameter to be Measure	Initial Reading (R1 Unit)	Final Reading (R2 Unit)	Dimension of Parameter (Unit)

Procedure:-

- 1) Switch on the projection lamp for diascopic image and obtain evenly distributed green light on the screen.
- 2) Keep the Work piece under inspection on the co-ordinate table.
- 3) Insert the required magnification in the focusing system. It can be easily removed to replace with another higher magnification objective by unscrewing.
- 4) With the help of co-ordinate table, bring the Work piece exactly in the field of view of objective
- 5) Focus the object properly to obtain sharp shadow image on the screen, with the focus adjustment.
- 6) Compare the image with the help of Mastered Tracing and/or measure linear dimensions & angles on the screen directly.
- 7) Switch on the transformer for obtaining episcopic image with surface illuminator

Sources of error:-

Precautions:-

- 1) Do not disturb the setting of the instrument by playing unnecessary with any screw.
- 2) Avoid extreme conditions with respect to dust, vibrations and shocks.
- 3) Use voltage stabilizer in case voltage fluctuations.
- 4) While the instrument is in use, take care of removing the leather cover provided totally so as to ensure natural ventilation for the projection lamp.
- 5) Do not remove the projection lamp unless fused. The fused projection lamp can be easily replaced

Observation Table :-Workpiece no. 1.

Parameters to be Measured	Initial Reading (R ₁)	Final Reading (R ₂)	Dimension of Projector
Major Diameter	6.25	20.15	13.9 mm
Minor Diameter	4.48	10.35	5.87 mm
Pitch	8.5	10.5	2 mm
Thread Angle	90°	45°	45°
Depth	7.35	8.45	1.1 mm

Workpiece no. 2.

Parameters to be Measured	Initial Reading (R ₁)	Final Reading (R ₂)	Dimension of Projector
Major Diameter	7.49	21.49	14 mm
Minor Diameter	6.48	10.35	3.87 mm
Pitch	4.5	6.15	1.65 mm
Thread Angle	90°	45°	45°
Depth	3.78	4.67	0.89 mm

Source of Error :-

1. Uncleaned workpiece having dust and oil/practicals stuck in it.
2. Improper planning of workpiece or improper handling.

since it is provided with bayonet any type base (like ordinary house lamp).

- 6) Avoid movement of instrument when the lamp is on and/or in hot state. Always ensure complete cooling of the bulb.
 - 7) Oil the micrometer slides periodically to ensure smooth working and to avoid corrosion.
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Assignment:-

- 1) How optical profile projectors are classified?
- 2) What are the different models available in the market?
- 3) Explain the illumination system of profile projector?
- 4) What are the latest developments for the screen of optical profile projector?
- 5) How we can check profile of gear tooth with the help of optical profile projector?

References

Title of Article	Web Link
Profile Projector	https://www.youtube.com/watch?v=Ads0y7mg2wg
Thread Measurement Using Profile Projector	https://www.youtube.com/watch?v=OL80Kg_pmyc
Optical Profile Projectors	https://www.youtube.com/watch?v=kMFZfH-8DeQ
Profile projector - part 1 linear measurement	https://www.youtube.com/watch?v=T7gE8n9yqFY
Profile projector part 2	https://www.youtube.com/watch?v=YFxxg_0pTkQ

Assignment

1. How optical profile are classified?

Answer: Depending upon the application and light path profile projection are classified as vertical profile projector and horizontal profile projector. Based on types of optics it is classified as coaxial profile projector.

2. What are different Models available in market?

Answer: Models from Batty International are :- Batty R14, Batty R400, Batty R600, Batty M20.
Other Models :- JTI 2A 500 Digital measuring projector (dmp).
JTB A/B \varnothing 800 Horizontal projector JTB 36 \varnothing 600 Vertical projector.
JTB 35 A/B/E \varnothing 1500 Horizontal projection.

3. Express the Illumination system of profile projector?

Answer: Illumination = Method to observe any components by bottom light or transmitted light and used mainly to measure the contour of components.

Process = There is a light source present under the base can which be tungsten or mercury lamp when switch on the light travel from base to base while travelling base to head light through the transparent which given for replacing the workpiece on it. And as light passes through carries its shadow image to lense this lens magnified the light source image fall on prism then that image is travel from prism the mirror opposite to it and at last the image is travel from mirror to the screen.

4. What is the latest development of screen of optical profile projector?

Answer: The size of screen is increased for the better measurement as screen size increase it gives better view of shadow of image. Newly develop developed screen mounted edge sensor allows of data point to be taken quickly and construct standard geometric feature or to overlay into an important CAD File for best file profile dimension making standard Crosby unnecessary. Also screen is provided with dip to draw the image workpiece on the paper.

5. How can we check our profile of gear tooth with the help of profile projector?

Answer: We can use optical profile projection to measure tooth thickness and pitch to diameter to measure the thickness of tooth switch on very first keep gear on work-piece table. Switch on light and adjust needed proper magnification put x-y cross hair on the top of tooth gear (Figure 1) then the next cross hair is shown in (Figure 2).

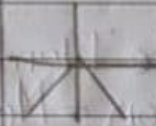


Figure 1.

After setting the cross hair move the cross hair in horizontal direction until it touches that side more $y=0$ at that

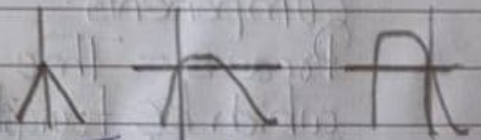


Figure 2.

part then move in horizontal direction till touches another then you get volume (y) which will give you tooth thickness of gear.