

Machine Shop Practical

Using a Lathe to Create a Stepped Bar

Session 2

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Session Aims:

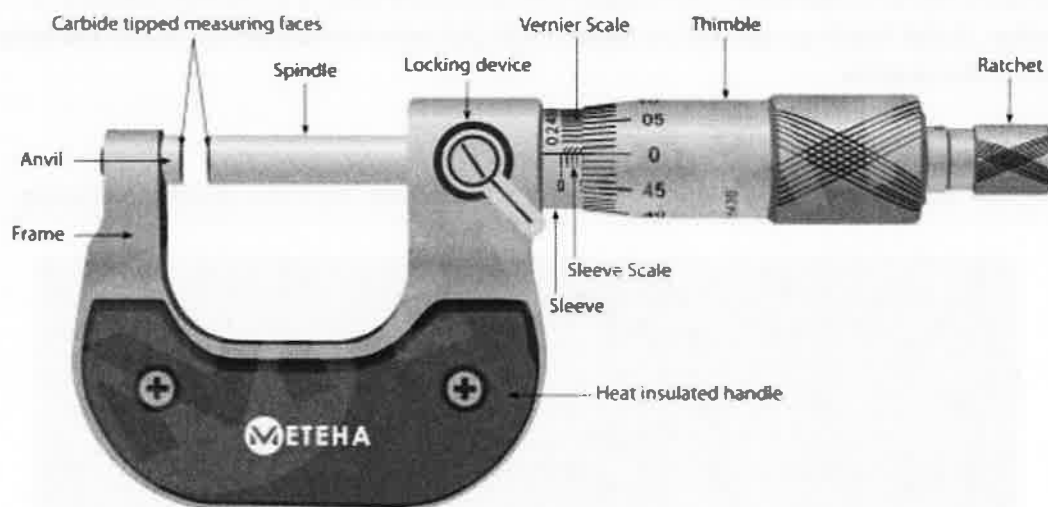
- Demonstration of accurate measurements
- Issue technical drawing
- Begin first steps of task

Health and Safety

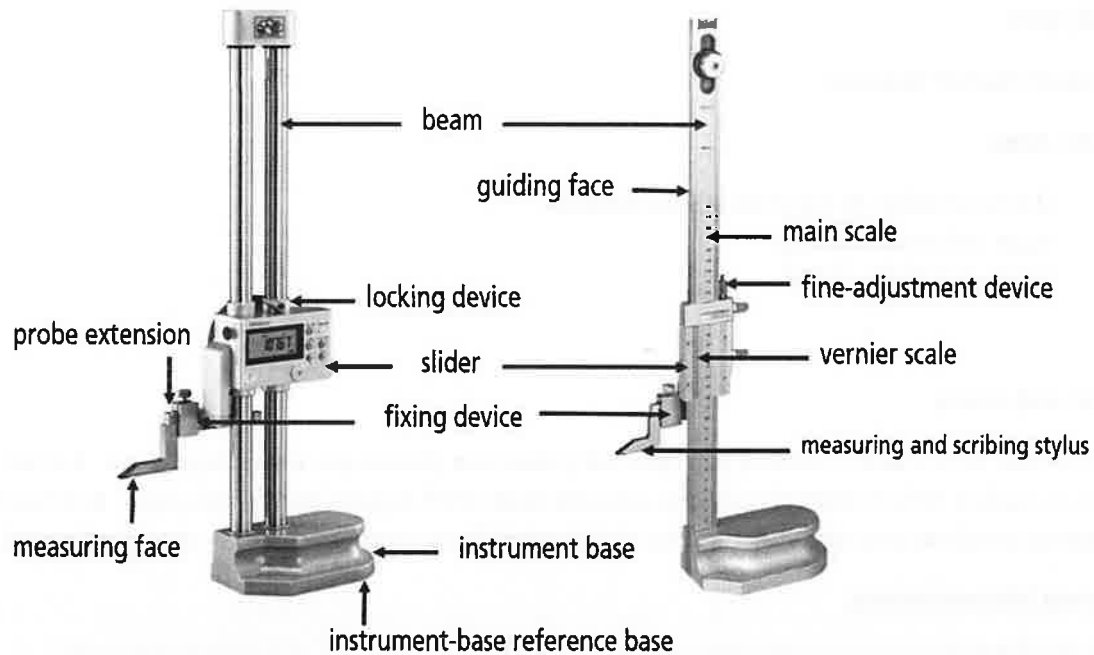
Steel toe cap boots, work trousers, lab coat and protective glasses are worn throughout. Barrier cream is applied before work commences and a session brief is given by the instructor. Key health and safety concerns are raised such as the risk of injury from swarf and the risk of entanglement.

Accurate Measurements

The assigned task requires highly accurate measurements to be made. A height gauge and micrometer are the main two apparatus to be used. Using a micrometer correctly is crucial to reaching the tight tolerances set. Incorrect dimensions are achieved when measurements are not made correctly. It is also possible for a micrometer scale to be misread so checking dimensions and readings regularly is important.



Height gauges should be on a perfectly flat and level surface, calibrated to zero whilst the measuring face is touching the surface and then raised and lowered at least once to ensure calibration is correct before any measurement is made. The digital output reduces the risk of misreading measurements. It is still very important to measure frequently throughout the process to minimise mistakes.

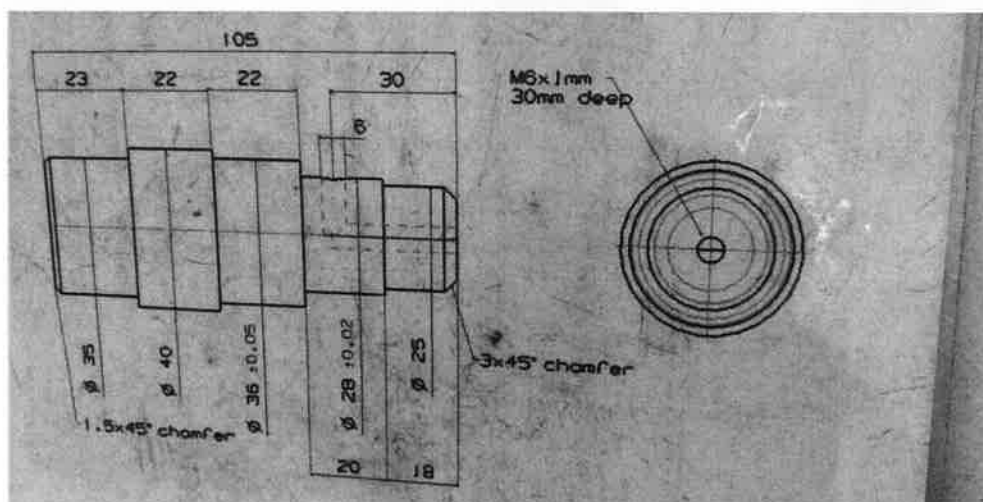


Materials and Equipment

The material used for this task is a solid steel cylinder approximately 110mm in length and approximately 45mm in diameter. The cutting tool used in the lathe is made from carbide. A micrometer, digital height gauge and the Digital Read Out system incorporated within the lathe are also used in this session.

Technical Drawing

The technical drawing and instructions for the task are provided. Note the specific tolerances.



Facing the Piece

The piece should be positioned in the lathe with a short projection from the chuck. This will provide sufficient grip for the lathe to be operated safely. If a long projection is selected there is a risk of the piece working loose and being ejected. The chuck should then be correctly tightened and the guard pulled down into place. A right hand knife edge tool is inserted into the tool post and set to the correct height (The correct spindle speed and feed rate are already set).

The first lathe operation is to remove a small amount of material from the face of the piece. This needs to be done to both sides to ensure both faces are flat for measuring. Move Z axis to touch material. Zero the Z axis on the Digital Readout System (DRO). Set value to 0.500mm, check the value is correct. Move cutting tool along the X axis past the edge of the material. Move Z axis handwheel to 0.000mm. Start Lathe and initiate automatic feed for X axis. Observe facing process to ensure correct operation. Once the cutting tool reaches the centre of the piece disengage the lathe (switch to neutral) and step on the foot brake. Lift guard and remove piece from chuck. Turn piece through 180°. Insert back into chuck and tighten correctly. Repeat the steps from the first operation to achieve smooth surfaces on both faces.

The height gauge can now be used to accurately measure the overall length of the piece. The reading recorded from this is 108.71mm. The desired length to satisfy the technical drawing is 105mm (+/- 0.200mm).

Cutting to Correct Length

The piece should be positioned in the lathe again with a short projection from the chuck. The chuck should then be correctly tightened and the guard pulled down into place. Move Z axis to touch material. Zero the Z axis on the Digital Readout System (DRO). Set value to 108.710mm, check the value is correct. Move cutting tool along the X axis past the edge of the material. Move Z axis handwheel to 108.000mm. Start Lathe and initiate automatic feed for X axis. Observe facing process to ensure correct operation. Once the cutting tool reaches the centre of the piece disengage the lathe (switch to neutral) and step on the foot brake. Lift guard and remove piece from chuck. Measure again with height gauge, 107.01mm. repeat last step setting the value for Z to 107.01mm and cut down to 106.000mm. recheck with height gauge, 105.93mm.

Satisfy the Tolerance

As the length becomes close to the desired value, the increments should decrease from 1.000mm to 0.300mm. Decreasing the increments means a higher accuracy can be achieved and lowers the risk of going outside of the lower limit of the tolerance set, when comparing between the DRO and height gauge.

The next cut gives a result of 105.58mm so the increment is now decreased to 0.200mm. The result of the next cut is 105.35mm. The 0.200mm increment is used for a final time which gives the result of 105.03mm. This final cut brings the overall length within tolerance. 105mm $\pm$ 0.200mm.



Conclusion

The Digital Read Out system built into the lathe has slight discrepancies with the Digital Height Gauge. This can be due to various reasons. There are many moving parts on the lathe and the cutting tool and piece are under significant pressure whilst a cut is being made. There may be a possibility of slight movements whilst in operation. The piece must be made to suit the measurements of the Digital Height Gauge and Micrometer, so it is important to continuously check and adjust the values between the lathe and the height gauge. Failure to continuously update the DRO could result in tolerances being missed.

No health and safety issues were presented in today's session and PPE was worn at all times including safety glasses. The lathe bed was cleared of swarf using a dustpan and brush and the surrounded area was swept to keep the work area safe. Swarf was discarded into a scrap metal bin to be disposed of correctly. All tools were put away in the correct places. And hands were washed thoroughly with restore cream applied once dried.