CONTENTS

Introduction 2
  Occupational Health & Safety 2
  Review questions 3
  To pass 3
  Pre-requisites 3
  Suggested references 3

Module Organiser 4

Module Sections
  Section 1: Tools and equipment 5
    Review questions 19
  Section 2: Planning 23
    Review questions 45
  Section 3: Marking out 48
    Exercise 1 - Marking Out - 2D 53
    Exercise 2 - Marking Out - 2D 55
    Optional exercise 1 - Marking Out - 2D 58
    Exercise 3 - Marking Out - 3D 60
    Optional exercise 2 - Marking Out - 3D 63
    Optional exercise 3 - Marking Out - 3D 65
  Section 4: Templates 68
    Exercise 4 - Template construction 71

Answers to review questions 74

Terms and Definitions 76
MODULE SECTIONS

Section 1: Tools and equipment

<table>
<thead>
<tr>
<th>PURPOSE</th>
</tr>
</thead>
<tbody>
<tr>
<td>In this section you will be introduced to the various tools used in marking out, their uses, how to store and handle them safely. You will also become familiar with the reasons for marking out.</td>
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</tbody>
</table>

**Objectives**

At the end of this section you will be able to:

- Name marking out tools and equipment.
- State the purpose of marking out tools and equipment.
- State the safety procedures and precautions for handling, using and storing marking out tools and equipment.

**To pass**

For details, refer to the Student Assessment information, issued by your college.

**Safety**

In the workshop, always wear safety glasses, safety boots, hair protection and suitable clothing. Avoid back injuries – lift the correct way. Know where the first aid station is. Don’t run or play in the workshop. Use ear muffs or plugs to protect your hearing.

**Special rules for this section**

Take care when handling sharp tools.
TECHNICAL INFORMATION

Marking out

Marking out is the process of scribing or marking lines and positions on a work piece to indicate the shape of the work piece, the amount of metal to be removed and the position of holes to be drilled. The accuracy of the finished product can depend greatly upon the accuracy of the marking out. The efficiency in which the metal is removed can be enhanced by good marking out, as excess material may be machined off quickly without having to measure the workpiece constantly, simply by machining close to the marked out lines.

Accurate marking out is often used on large or irregular shaped work pieces as the basis for setting up on a machine prior to machining and is therefore an important skill required of a person working in an engineering environment.

Purpose of marking out

Marking out is resorted to for a number of reasons.
- To discover defects before the work occupies a machine
- To arrange the best distribution of machining allowance
- To save machine time in setting up
- To serve as an approximate guide for machining

Type of work requiring marking out

Large or intricate castings and forgings need to be marked out, especially if more than one operation is to be performed on the piece. In small shops the marking out is done either by a fitter or by the machinist, but in large shops a specialist known as a "marker out" does this class of work, and since becomes quick and an expert. Errors are reduced and machines are not idle while their operators are marking out.

Marking mediums

Marking mediums are used to ensure that the lines are sharp and easy to see. The medium used depends upon the surface condition of the work to be marked out. The most common mediums are:

1. **Marking blue** which is a spirit based metal marking die suitable for machined surfaces. The dye is blue in colour and is mixed with methylated spirits to make it dry quickly.

2. **White wash** is mixed using whiting and water and is most suitable on rough surfaces like castings and black stock. It is water resistant and will not wash off during the machining process. A mixture of whiting, shellac and methylated spirits is often used on large work as it dries rapidly and the shellac binds the whiting to the surface.
3. **White paint** such as flat white is commonly used on both machined and unmachined surfaces.

4. **Chalk** is used where only a small amount of marking out is required on rough or un-machined surfaces. It is not used where coolant will come in contact with the job as the chalk will wash off.

5. **Copper sulphate** is used only for precision marking out on ground or bright steel or iron surfaces. It will not wash off and must be ground or polished off the surface when the job is complete. The copper sulphate is made up into a saturated solution to which 1 (one) drop of nitric acid is added for every 30mls of solution.

6. **Bright steel surfaces** such as are used in die and jig work are often oxidised to a blue colour by heating over an open flame. Fine scribed lines show clearly on such a surface.

**Tools and equipment needed**

A large range of tools and equipment may be required for marking out including:
- Surface plate or marking off table
- Coating mediums
- Surface gauge or scribing block
- Rules
- Squares
- Bevels
- Depth gauges
- Straight edges
- Calipers
- Dividers
- Scribes
- Centre punches
- Prick punches
- Spirit levels
- Centre squares
- Feeler gauges
- Angle plates
- Vee blocks
- Parallel blocks or packing
- Small screw jacks
- Wedges
- Small slips of sheet metal
- In addition for large work:
  - Pinch bar
  - Chalk line
  - Measuring stick

**The marking off table**

The marking off table provides the base from which the various lines can be projected on to the work. It may be a small bench plate; a large plate mounted on legs which are often provided with adjusting screws to permit levelling the table; a larger tee-slotted plate set level with the floor; or sometimes the bed or fixed table of a machine is used, the article being bolted ready for machining.

The top of the table is planed flat and is scored with parallel lines at equal distances apart, these lines are crossed by another series cut at right angles to the first and often assist in setting the work and taking measurements. The edges of the plate are usually machined square to the top surface and to one another so that setting can be obtained from them if required.
Top of marking off table
Some practical hints on marking-off equipment

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•
•Dressing the table
Some tables are made from granite however, most marking-off tables are made from good quality cast iron. The surface must be kept in good condition to provide a true reference plane and to facilitate the sliding of scribing blocks and other equipment. Here is how to “dress” a marking-off table (usually necessary at least once a week or more often in damp weather).

1. Examine the surface for burrs or damage. Remove by light scraping or oilstone.
2. Examine the surface for paint, oil, rust spots, etc. Remove by scrubbing with a sheet of fine emery cloth wrapped around a flat wooden block.
3. Using waste or cloth dampened in turps, “wash” the table all over.
4. Whilst still wet, sprinkle the table liberally with powdered graphite. (Use a tin or bottle with a perforated lid as a shaker).
5. As you see the turps evaporate, rub the graphite in vigorously with a piece of dry waste.
6. After a short time the table can be finally rubbed up where use is to be made of it. Leave the graphite “skin” on the rest of the surface.

Note
The surface resulting from the above method is extremely slippery. If it is necessary to walk on the tables on large work, exercise great care.