**-SQA- SCOTTISH QUALIFICATIONS AUTHORITY**

**NATIONAL CERTIFICATE MODULE: UNIT SPECIFICATION**

**GENERAL INFORMATION**

**-Module Number-** **2270424** **-Session-1994-95**

**-Superclass-** **XF**

**-Title-** **MARKING OUT PROCEDURES ($x^1/_2$)**

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**-DESCRIPTION-**

**GENERAL COMPETENCE FOR UNIT:** Using procedures, equipment and standard tables to mark out 3-dimensional shapes taking into account all necessary allowances. Understanding the methods used for marking out specialised materials, shapes and sizes.

**OUTCOMES**

1. explain and calculate allowances;

2. determine the true lengths and true angles in a 3-dimensional structure;

3. demonstrate the use of marking out procedures, equipment and standard tables;

4. describe the methods of marking out on specialised materials, shapes and sizes.

**CREDIT VALUE:** 0.5 NC Credit

**ACCESS STATEMENT:** Access is at the discretion of the centre. However, it would be beneficial if the candidate had experience in the fabrication sector of the engineering industry and had a knowledge of basic trigonometry and pythagorus. Possession of relevant Units, eg: 2270414 Introduction to Marking Out Procedures and Engineering Graphical Skills would also be satisfactory evidence.

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For further information contact: Committee and Administration Unit, SQA, Hanover House, 24 Douglas Street, Glasgow G2 7NQ.

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**NATIONAL CERTIFICATE MODULE: UNIT SPECIFICATION**

**STATEMENT OF STANDARDS**

**UNIT NUMBER:** 2270424

**UNIT TITLE:** MARKING OUT PROCEDURES

Acceptable performance in this unit will be the satisfactory achievement of the standards set out in this part of the specification. All sections of the statement of standards are mandatory and cannot be altered without reference to SQA.

**OUTCOME**

**1.** EXPLAIN AND CALCULATE ALLOWANCES

**PERFORMANCE CRITERIA**

(a) Explanation of the necessity for allowances is correct.
(b) Calculation of allowances is within accepted tolerances.

**RANGE STATEMENT**

Allowances for: material thickness; joint processes; section growth; bend allowances.

**EVIDENCE REQUIREMENTS**

Written and/or pictorial evidence that the candidate clearly understands the necessity for allowances if accuracy in marking out is to be obtained.

Written and/or pictorial evidence of the candidate's ability to calculate allowances to within accepted tolerances as identified in the range.

**OUTCOME**

**2.** DETERMINE THE TRUE LENGTHS AND TRUE ANGLES IN A 3-DIMENSIONAL STRUCTURE

**PERFORMANCE CRITERIA**

(a) Recognition of views which are 'not true' on an orthographic drawing from a 3-dimensional shape is correct.
(b) Determination of the 'true' lengths and 'true' angles of the shape is correct to within accepted tolerances.

**RANGE STATEMENT**

Drawings: sections; pipework; platework; sheet.

Views: 'true'; 'not true'.

Tolerances: British Standards; Euro-Norm.

**EVIDENCE REQUIREMENTS**

Written and/or oral evidence that the candidate has the ability to identify 'true' and 'not true' views.

Written and/or graphical evidence that the candidate can produce the results to within accepted tolerances.

**OUTCOME**

**3.** DEMONSTRATE THE USE OF MARKING OUT PROCEDURES, EQUIPMENT AND STANDARD TABLES

**PERFORMANCE CRITERIA**

(a) Production of datums, at least 1m long, on a horizontal and a vertical surface is correct.
(b) Production of a marked out "shape" is correct.

**RANGE STATEMENT**

Horizontal procedures: straight edge and square; 3, 4, 5 principle; chalk line and trammels.

Vertical procedures: spirit levels, plumbline and chalk.

Equipment: steel tape; back-mark gauge; level gauge/stick; protractor; callipers.

**EVIDENCE REQUIREMENTS**

Performance evidence that the candidate has the ability to fulfil the outcome by using all the range.

Supplementary oral evidence to ensure that the candidate can cover all the critical classes in the range.

**OUTCOME**

**4.** DESCRIBE THE METHODS OF MARKING OUT ON SPECIALISED MATERIALS, SHAPES AND SIZES

**PERFORMANCE CRITERIA**

(a) Description of methods adopted when marking out on specialised materials is correct in terms of the material.
(b) Description of empirical methods used for marking out double curvature surfaces is clear and precise.
(c) Description of the methods of marking out on specialised sizes is correct.

**RANGE STATEMENT**

Specialised material: polished surfaces; metal coated; non-metal coated; perforated metal; expanded metal.

Double curvature: hemisphere; spherical-corner.

Specialised size methods; dumpy level; quick set; theodolite; clinometer; laser.

**EVIDENCE REQUIREMENTS**

Written, oral and/or pictorial evidence that the candidate has the ability to describe the range of methods for marking out on the range of specialisms identified.

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**ASSESSMENT RECORDS**

In order to achieve this unit, candidates are required to present sufficient evidence that they have met all the performance criteria for each outcome within the range specified. Details of these requirements are given for each outcome. The assessment instruments used should follow the general guidance offered by the SQA assessment model and an integrative approach to assessment is encouraged. (See references at the end of support notes).

Accurate records should be made of assessment instruments used showing how evidence is generated for each outcome and giving marking schemes and/or checklists, etc. Records of candidates' achievements should be kept. These records will be available for external verification.

**SPECIAL NEEDS**

In certain cases, modified outcomes and range statements can be proposed for certification. See references at end of Support Notes.

## NATIONAL CERTIFICATE MODULE: UNIT SPECIFICATION

## SUPPORT NOTES

**UNIT NUMBER:** 2270424

**UNIT TITLE:** MARKING OUT PROCEDURES

**SUPPORT NOTES:** This part of the unit specification is offered as guidance. None of the sections of the support notes is mandatory.

**NOTIONAL DESIGN LENGTH:** SQA allocates a notional design length to a unit on the basis of time estimated for achievement of the stated standards by a candidate whose starting point is as described in the access statement. The notional design length for this unit is 20 hours. The use of notional design length for programme design and timetabling is advisory only.

**PURPOSE** SQA publishes summaries of units for easy reference, publicity purposes, centre handbooks, etc. The summary statement for this unit is as follows:

On completion of this unit, the candidate will be able to use marking out procedures, adding allowances where required; can find 'true' length/angles in 3-dimensional shapes and can describe marking out on specialised materials, shapes and sizes.

**CONTENT/CONTEXT** The candidate should achieve the level of competence of someone who is required to mark out various components on sheet/plate as part of his or her normal work and be competent in adding the correct allowances as required. Additionally he or she should be competent, by inspecting and examining an engineering drawing, to arrive at true sizes and angles for three-dimensional structures prior to using them in marking out. Use of correct procedures and the use of the correct tables will be integral with all aspects of marking out.

Corresponding to Outcomes 1-4:

1. Could be carried out predominantly by exercises to obtain:

   (i) the correct 'bare' size;
   (ii) the correct 'allowances';
   (iii) the correct overall shape and size.

If time permits, 'hands-on' projects, ie simple brackets, pipe hanger brackets, etc can be made to prove the case. 'Hands-on' examination of structural sections which have been rolled at the extremes of tolerance together with a gusset node plate showing the clearance between the strut ends should be undertaken by the candidates. Support sheets showing the various joint configurations and the position of the 'neutral line' should also be used.

An elementary knowledge of the concept of the 'neutral line' (restricted to sheet/plate and assume it is on the centreline sheet/plate) to enable the sizes of cylindrical shapes and allowances for simple bends to be calculated. Allowances for grooved seam and knocked-up joints and for wire edges in thin sheet material. Minimum lap allowances for soldered, riveted, spot-welded and adhesive joints. Clearance allowances for sectional 'growth' on frameworks such as node point gusset plates and clearance hole sizes.

Calculation, by any means, (ie mensuration, calculator, use of tables, circumferences rules, etc) of cylinder sizes to a given inside/outside diameter and material thickness and of simple straight bends in sheet or plate.

Tolerances: British; Euro-norm.

2. A selection of orthographic drawings, and/or overhead projection 'skins', are essential if the candidates are to recognise 'true length' lines on a drawing from lines which are 'not true length'. This is possibly the most difficult part of the module for a candidate to grasp and the use of three-dimensional wire models may be a help.

   Isometric or graph paper or drawing paper may be used, as appropriate, by each candidate to sketch true views from given orthographic drawings.

   Depending upon the candidate's background and ability the true lengths and angles required may be found by scale drawings or by calculation.

3. This is entirely hands-on and each candidate should, where he or she is working in pairs, take the lead with the other candidate being the assistant. The PC's lend themselves to working from drawings and operation sheets to establish a procedure for marking out. Support sheets giving tabulated information, and illustrating the correct use of the various marking out tools are essential.

4. The use of surveying instruments on large structures could be carried out by visual aids, ie film strips, videos', etc. in order that the candidate knows 'what' he or she can do, not 'how he or she can do it'. It is not intended that the candidates attain any proficiency in the use of surveying equipment, simply that they know their use for marking out specialised sizes.

   'Hands-on' examination, followed by a discussion of the special materials should, if possible, be undertaken by the candidates and possible solutions arrived at by them.

The problem of shrinking and stretching of metal when formed into a double curvature surface may be illustrated by sectioning a double curvature shape, ie a simple hemispherical dome, and allowing the metal thickness to be measured. Approximate methods of marking out to accommodate this 'metal movement', including empirical methods, should be shown to the candidates.

A 'hands-on' exercise should be given to each candidate to produce, in a suitable material, eg template paper, an approximate pattern for a selected double curvature surface.

**APPROACHES TO GENERATING EVIDENCE** The delivery of the unit could be organised in such a way that all four outcomes integrate together, for example Outcome 1 and Outcome 3 could be combined as could Outcome 2 and Outcome 4. Support sheets could be used extensively throughout all four outcomes with 'hands-on' candidate activity wherever possible. It should be the tutor/trainer's aim to constantly apply the outcomes to workplace situations in order that the candidates instinctively apply the correct procedures when marking out at work. Any cognitive assessments required in the unit could best be managed by including restricted response questions within the context of support sheets and/or worksheets.

**ASSESSMENT PROCEDURES** Centres may use the Instruments of Assessment which are considered by tutors/trainers to be the most appropriate. The assessment of this unit could also be approached in an integrated way with worksheets covering Outcomes 1-4 developed as a complete project rather than as four separate outcomes. Examples of Instruments of Assessment which could be used are as follows:

Outcome 1 Restricted response and/or pictorial questions to cover Performance Criterion (a) and part of (b). The remainder of (b) to be covered by any means of calculation. The suggested number of questions to cover PC(a) is a minimum of two. Performance Criterion (b) would require at least five questions to adequately cover cylinder and bend sizes; grooved and knocked-up joints; wired edges; sectional 'growth' clearance; soldered, riveted, spot-welded and adhesive joints.

Outcome 2 Performance Criterion (a) could be carried out by means of a checklist where the candidate correctly recognised seven from nine drawings which are a mixture of 'true' and 'not true' views/parts. Performance Criterion (b) could use one of the correctly recognised drawings in (a) and, depending upon the candidate's background, may be completed entirely as a drawing exercise or by a sketch and calculation. One scale drawing with 'scaled
up' sizes or a dimensioned sketch with the relevant calculations is required from each candidate.

Outcome 3 Performance Criteria (a), (b) could best be carried out with the aid of an observation checklist. Drawings used to obtain the 'shape' in Performance Criterion (b) should also be kept for validation. The "shape" should be applicable to the candidate's background.

Outcome 4 Restricted response and/or pictorial questions would cover Performance Criteria (a), (c) and part of (b). A minimum of four questions for (a), (c) and part of (b) would be adequate. In addition Performance Criterion (b) would require each candidate to submit one approximate pattern (in a suitable material) for a selected double curvature surface.

Satisfactory achievement of the unit is based on all the performance criteria in all of the outcomes being met.

**RECOGNITION** Many SQA units are recognised for entry/recruitment purposes. For up-to-date information see the SQA guide 'Recognised and Recommended Groupings'.

**REFERENCES**

1. Guide to unit writing.
2. For a fuller discussion on assessment issues, please refer to SQA's Guide to Assessment.
3. Procedures for special needs statements are set out in SQA's guide 'Students with Special Needs'.
4. Information for centres on SQA's operating procedures is contained in SQA's Guide to Procedures.
5. For details of other SQA publications, please consult SQA's publications list.