higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

T1670**(E)**(M29)T

NATIONAL CERTIFICATE: MULTI-DISCIPLINARY DRAWING OFFICE PRACTICE

STRUCTURAL STEEL DETAILING N5

(8090225)

29 March 2018 (X-Paper)
09:00–13:00

CLOSED-BOOK EXAMINATION

REQUIREMENTS: A3 drawing sheets

Drawing instruments and computers may be used.

This question paper consists of 5 pages, 2 diagram sheets and 2 information sheets.

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DEPARTMENT OF HIGHER EDUCATION AND TRAINING
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NATIONAL CERTIFICATE: MULTI-DISCIPLINARY DRAWING OFFICE PRACTICE
STRUCTURAL STEEL DETAILING N5
TIME: 4 HOURS
MARKS: 100

INSTRUCTIONS AND INFORMATION

1. Answer ALL the questions.
2. Read ALL the questions carefully.
3. Number the answers according to the numbering system used in this question paper.
4. Use both sides of the DRAWING SHEETS.
5. A balanced layout is very important and candidates will be penalised for bad planning.
6. A 15 mm border must be drawn around the DRAWING SHEETS (both sides).
7. The question numbers must be clearly indicated.
8. ALL drawing work, including candidate information, must be done in pencil.
9. ALL drawing work must comply with the SABS 10111-1990.
10. Write neatly and legibly.

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QUESTION 1: INTRODUCTION

Indicate whether the following statements are TRUE or FALSE. Choose the answer and write only 'true' or 'false' next to the question number (1.1–1.10) in the ANSWER BOOK.

1.1 Steel is not a human-made metal derived from iron.

1.2 The term *structural steel* refers to the various products of a steel mill such as sections, plates and bars.

1.3 Hot-rolled sections are not produced by passing a heated billet between successive pairs of rolls that squeeze the steel, stage by stage, into the final shape.

1.4 Cold-formed sections are made by passing a thin steel strip (not preheated) through sets of rolls that form the strip into the desired section by a bending process.

1.5 Structural steel is produced in a number of different strength grades.

1.6 The different forms in which steel is used are I-sections, H-sections, channels, angles, flats, bars, plates, sheets, cold-formed sections and hollow sections.

1.7 There are two main classes of sections, namely hot-rolled sections and cold-formed sections.

1.8 The symbol used to indicate the H-profile section (column) shape is the letter I.

1.9 The symbol used to indicate the I-profile section (beam) shape is the letter H.

1.10 Channels may be compared to an I-beam that has been trimmed on one side to give a flat back web.

(10 × 1) **[10]**

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QUESTION 2: BEAMS

FIGURE 1, DIAGRAM SHEET 1 (attached), shows a view of a steel structure.

Make, to scale 1 : 10, fully detailed drawings of the beams marked B1 and B3. Supply enough information for the manufacturing of the beams in a structural steel workshop. ALL plates are 10 mm thick and ALL bolts are M20.

Show the following information:

2.1 Column centres

2.2 Lengths and sizes of beams

2.3 Dimensions of the beams over end plates

2.4 Dimensions for the drilling of the bolt holes

2.5 View with dimensions of end plates

2.6 Item marks, number of beams required and diameter of bolt holes

2.7 Top of beams

Use your own discretion for information not given. **[25]**

QUESTION 3: COLUMNS

Refer to FIGURE 1, DIAGRAM SHEET 1 (attached), and make, to scale 1 : 10, fully detailed drawings of the columns marked C1 and C2. Supply enough information for the manufacturing of the columns in a workshop. ALL plates are 10 mm thick and ALL bolts are M20.

Show the following information:

3.1 Lengths and sizes of columns

3.2 Dimensions of the columns over cap and base plates

3.3 Dimensions for the drilling of the bolt holes

3.4 View with dimensions of cap and base plates **[25]**

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QUESTION 4: LATTICED GIRDERS

FIGURE 2, DIAGRAM SHEET 2 (attached), shows a line diagram of a typical welded latticed girder.

Draw, to scale 1 : 5, typical details of the following:

4.1 Detail A

4.2 Detail B

4.3 Detail C

Specifications:

- Top and bottom booms: 120 × 120 × 10 rolled steel angle profiles
- ALL internal members: 90 × 90 × 8 rolled steel angle profiles
- ALL gusset plates: 10 mm thick

Do not insert any dimensions. Gusset plate sizes, as well as information not given, are left to your own discretion. Print a suitable title and scale centred below the details. **[15]**

QUESTION 5: TRUSSES

5.1 Refer to FIGURE 1, DIAGRAM SHEET 1 (attached), and draw, to scale 1 : 20, a line diagram of the bolted steel roof truss. (6)

5.2 Draw, to scale 1 : 5, typical bolted details at A and B. (14)

Use the following specifications:

- Top and bottom boom: 90 × 90 × 10 hot-rolled steel angle profiles
- ALL internal members: 70 × 70 × 10 hot-rolled steel angle profiles
- Gusset plates: 10 mm thick
- Bolt hole centres: 100 mm
- Edge distances: 35 mm
- Bolt holes: drilled on the centre lines of the angles
- ALL bolts: M16

Insert suitable dimensions. **[20]**

QUESTION 6: MATERIAL LIST

Make a typical material list, 180 mm × 70 mm, that can be used to itemise the materials of a detail drawing. Insert suitable headings. **[5]**

TOTAL: 100

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DIAGRAM SHEET 1

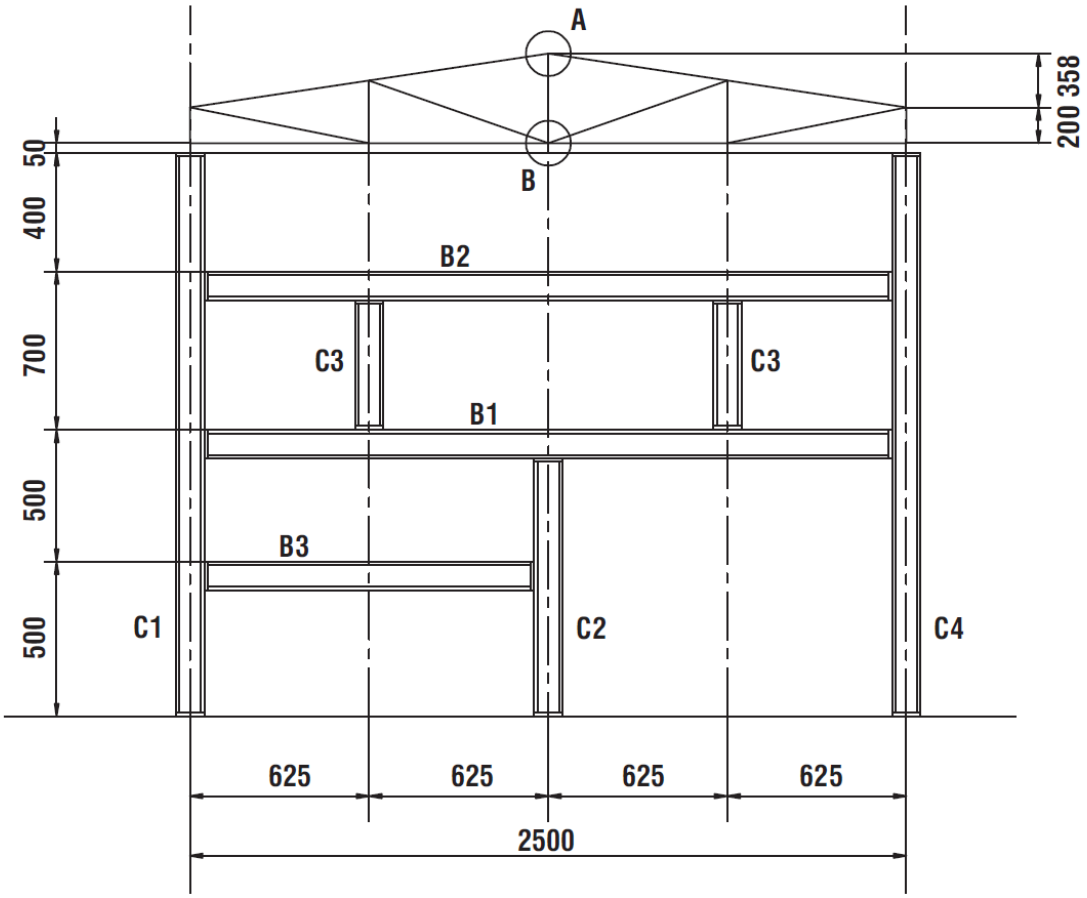


FIGURE 1

Beams	B1 – UB 254 × 146 × 31 kg/m	B2 – UB 203 × 133 × 25 kg/m
Columns	C1, C2, C4 – UB 203 × 203 × 46 kg/m	C4 – UB 152 × 152 × 23 kg/m
End plates	10 mm with 4 × M20 bolts	
Base plates	20 mm with 2 × M20 bolts	

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DIAGRAM SHEET 2

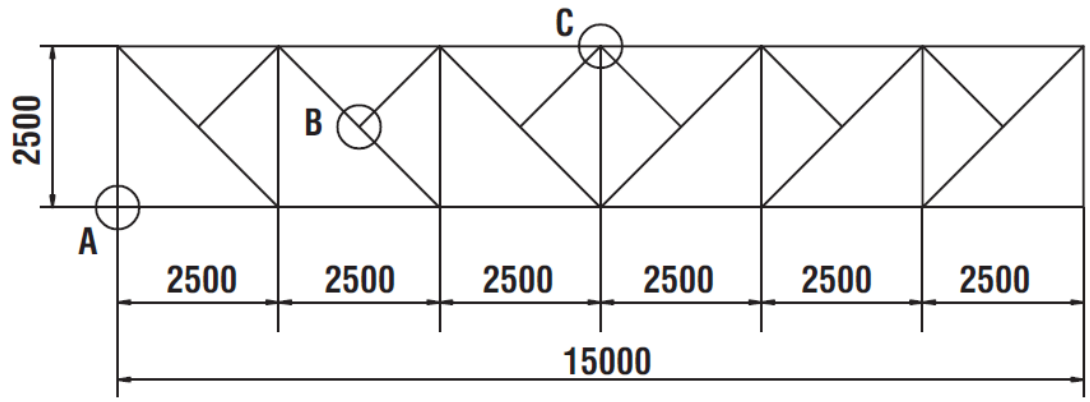
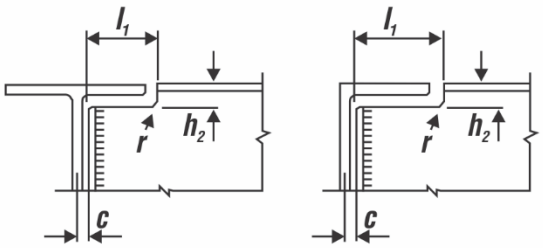


FIGURE 2

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INFORMATION SHEET 1



Dimension c is to face of end plate or angle cleat.
r = 10mm minimum
Dimensions are in mm.

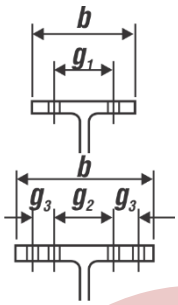
	Section	c	Notch			Section	c	Notch	
			l_1	h_1				l_1	h_1
I - Sections (parallel flange)	100 x 55 x 8	4	33	15	I - Sections (parallel flange)	533 x 210 x 82	4	33	15
	120 x 64 x 19	4	37	15		93	4	37	15
	140 x 73 x 13	4	42	20		101	4	42	20
	160 x 82 x 16	5	47	20		109	5	47	20
	180 x 91 x 19	5	51	20		122	5	51	20
	200 x 100 x 22	5	56	25		610 x 229 x 101	5	56	25
	203 x 133 x 25	5	74	20		113	5	74	20
	30	5	74	20		125	5	74	20
	254 x 146 x 31	5	81	20		140	5	81	20
	37	5	81	25	I - Sections (taper flange)	127 x 76 x 13	5	81	25
	43	6	81	25		152 x 89 x 17	6	81	25
	305 x 102 x 25	5	57	25		178 x 102 x 22	5	57	25
	29	5	57	20		203 x 102 x 25	5	57	20
	33	5	57	20		52	5	57	20
	41	5	91	25		254 x 152 x 59	5	91	25
	46	5	91	25		305 x 152 x 66	5	91	25
	54	6	91	25	Channels	100 x 50 x 11	6	91	25
	356 x 171 x 45	5	94	25		120 x 55 x 13	5	94	25
	51	5	94	25		140 x 60 x 16	5	94	25
	57	6	94	30		160x 65 x 19	6	94	30
	67	7	94	30		180 x 70 x 22	7	94	30
	104 x 140 x 39	5	78	25		200 x 75 x 25	5	78	25
	46	5	78	25		220 x 80 x 29	5	78	25
	54	6	97	25		240 x 85 x 32	6	97	25
	60	6	97	30		260 x 90 x 38	6	97	30
	67	6	97	30		280 x 95 x 42	6	97	30
	457 x 191 x 67	6	103	25		300 x 100 x 46	6	103	25
	75	7	103	30		76 x 38 x 7	7	103	30
	82	7	103	30		127 x 64 x 15	7	103	30
	90	7	103	30		152 x 75 x 18	7	103	30
	98	8	103	35		178 x 54 x 15	8	103	35
H - Sections	152 x 152 x 23	5	84	20		381 x 102 x 55	5	84	20
	30	5	84	20	H - Sections	254 x 254 x 107	5	84	20
	37	6	84	20		132	6	84	20
	203 x 203 x 45	6	111	25		167	6	111	25
	52	6	111	25		305 x 305 x 97	6	111	25
	60	7	111	30		118	7	111	30
	72	7	111	30		137	7	111	30
	86	8	111	35		158	8	111	35
	254 x 254 x 73	6	138	30		198	6	138	30
	89	7	138	35		240	7	138	35

Dimensions of beam notches

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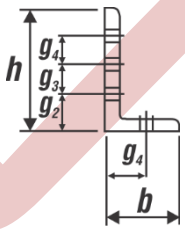
INFORMATION SHEET 2

Recommended gauges and back marks for I- and H-sections



b (mm)	Gauge (mm)			Ø max. (mm)
	g1	g2	g3	
64	32	120 140	60 75	12
73-82	40			12
89-91	50			12
102	54			16
133-146	70			20
152	90			20
165-191	90			24
203-254	140			24
305	140			24
368-406	140			24

Recommended gauges and back marks for angles



h or *b* (mm)	Back mark g_1 (mm)	Ø max. (mm)	*h* or *b* (mm)	Back mark (mm)				*h* or *b* (mm)
				g1	g2	g3	g4	
25	15	8	90		45	45		24
30	17	10	100	50				24
35	20		120	50				24
40	22		120	60				16
45	25		125	65				24

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