higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

T1670**(E)**(A1)T

NATIONAL CERTIFICATE: MULTI-DISCIPLINARY DRAWING OFFICE PRACTICE

STRUCTURAL STEEL DETAILING

(8090225)

1 April 2019 (X-Paper)
09:00–13:00

CLOSED-BOOK EXAMINATION

REQUIREMENTS: A3 drawing sheet

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
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 SHEET.
5. Draw a 15 mm border around the DRAWING SHEET (both sides).
6. Do ALL drawing work, including candidate information, in pencil.
7. ALL drawing work must comply with the SABS 10111-1990.
8. A balanced layout is very important and candidates will be penalised for bad planning.
9. Work neatly.

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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 A transfer force is involved in all bolted connections.

1.2 The spacing between bolts in the longitudinal direction of a member is called the pitch.

1.3 Steel-framed buildings consist of a skeletal framework which carries loads to which the building is subjected.

1.4 When connecting a beam to a beam, the flange of the one beam may have to be notched to allow for the flanges of the beams to be flush.

1.5 The main use of beams is to support floors.

1.6 Beams are horizontal and resist gravity loads.

1.7 A crane beam consists of a universal beam and channel.

1.8 Detailing beams, purlins and sheeting rails is largely concerned with showing the length, end joints, welding and drilling required.

1.9 Plate girders are constructed by welding steel plates together to form I-sections.

1.10 Columns are vertical members supporting floors, roofs and cranes in buildings.

(10 × 1) **[10]**

QUESTION 2: BEAMS

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

Make fully detailed drawings, to scale 1:10, of the beams marked B2 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 the end plates

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2.4 Dimensions for the drilling of the bolt holes

2.5 View with dimensions of the end plates

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

2.7 Top of beams

Information NOT given is left to your discretion. **[30]**

QUESTION 3: COLUMNS

Refer to FIGURE 1, DIAGRAM SHEET 1 (attached), and make fully detailed drawings, to scale 1:10, of the columns marked C1 and C3. 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 the cap and base plates

3.3 Dimensions for the drilling of the bolt holes

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

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: rolled steel angle profiles 120 × 120 × 10
- ALL internal members: rolled steel angle profiles 90 × 90 × 10
- ALL gusset plates: 10 mm thick
- Do NOT insert any dimensions.
- Gusset plate sizes, as well as information NOT given, are left to your discretion.
- Print a suitable title and scale centred beneath the details. **[15]**

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QUESTION 5: TRUSSES

5.1 Refer to FIGURE 1, DIAGRAM SHEET 1, 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)

Specifications:

- Top and bottom boom: 100 × 100 × 10 hot-rolled steel angle profiles
- ALL internal members: 80 × 80 × 10 hot-rolled steel angle profiles
- Gusset plates: 10 mm thick
- Bolt-hole centres: 100 mm
- Edge distances: 35 mm
- ALL bolt holes are drilled on the centre lines of the angles and ALL bolts are M20.
- Insert suitable dimensions. **[20]**

TOTAL: 100

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DIAGRAM SHEET 1

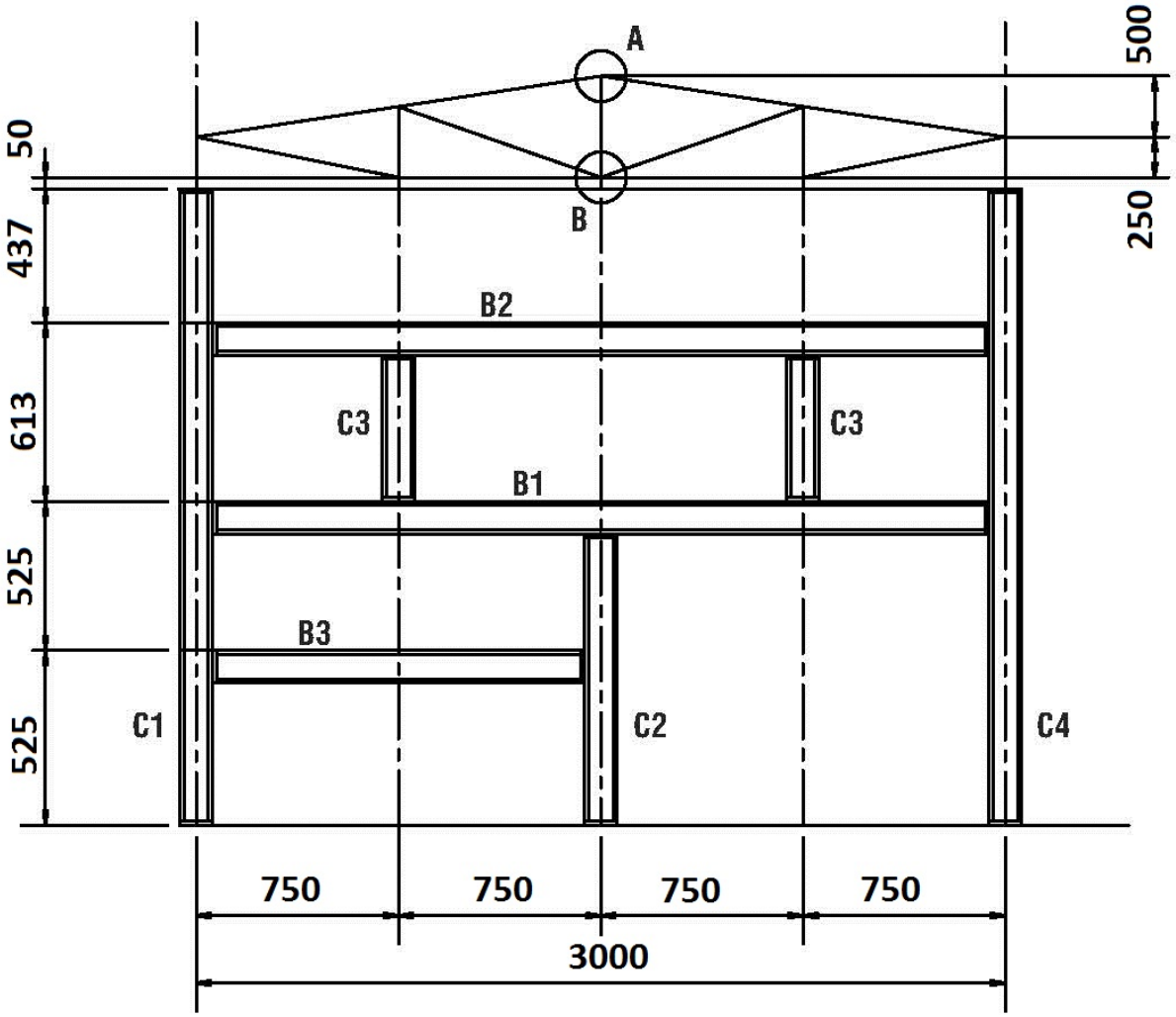


FIGURE 1

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

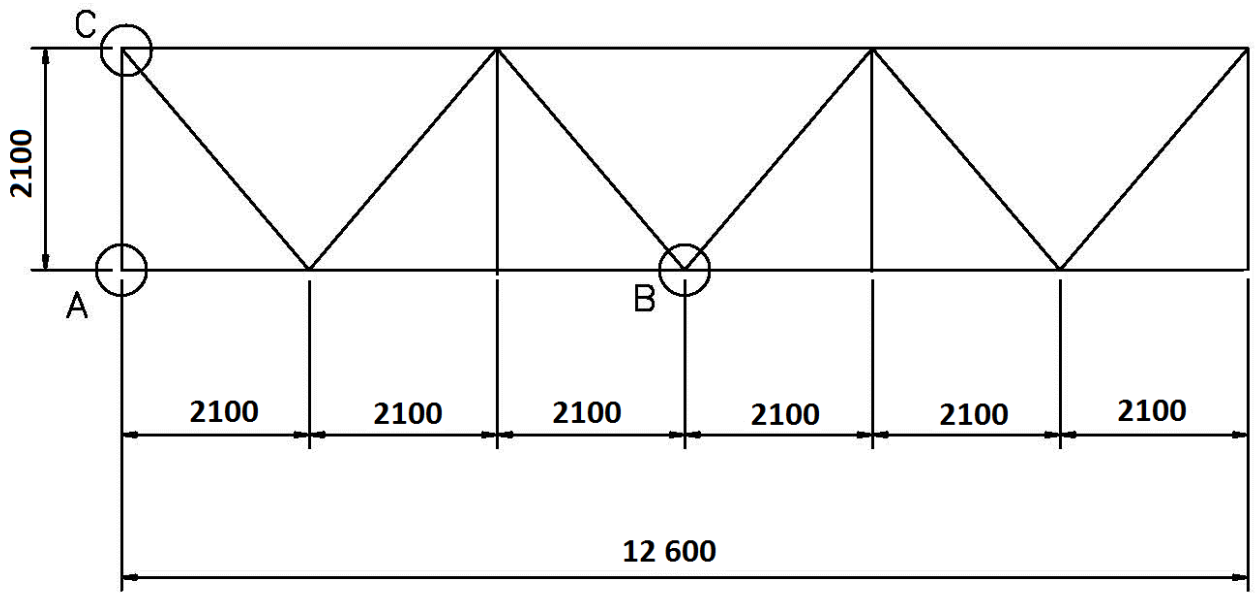
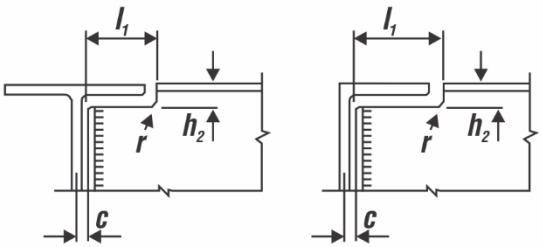


FIGURE 2

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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.

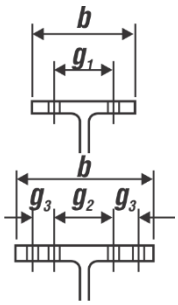
	Section	c	Notch			Section	c	Notch	
			l_1	h_1				l_1	h_1
I - Sections (parallel flange)	100 x 55 x 8	4	33	15	I - Sections (parallel flange)	533 x 210 x 82	4	33	15
	120 x 64 x 19	4	37	15		93	4	37	15
	140 x 73 x 13	4	42	20		101	4	42	20
	160 x 82 x 16	5	47	20		109	5	47	20
	180 x 91 x 19	5	51	20		122	5	51	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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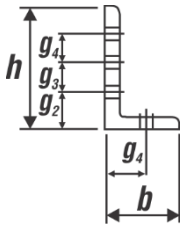
INFORMATION SHEET 2

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
203-254 305 368-406	140 140 140			24 24 24

Recommended gauges and back marks for angles



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

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