higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

NATIONAL CERTIFICATE
MULTIDISCIPLINARY DRAWING OFFICE PRACTICE

STRUCTURAL STEEL DETAILING

(8090225)

7 April 2021 (X-paper)
9:00–13:00

REQUIREMENTS: A2, A3 and A4 drawing sheets

Calculators, computer software and drawing instruments may be used.

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

072Q1A2107

Copyright reserved

DEPARTMENT OF HIGHER EDUCATION AND TRAINING
REPUBLIC OF SOUTH AFRICA

NATIONAL CERTIFICATE:
MULTIDISCIPLINARY 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. Answer each drawing question on a separate A3 or A4 drawing sheet when using the computer.
5. Retrieve a border from the symbols directory and display it on the screen before you commence any drawing work.
6. Plot the answers on ONE side of the drawing paper only.
7. Plot all candidate information in the title block.
8. Candidates are responsible, under suitable supervision, for the plotting of their own answers.
9. All the standard structural steel symbols may be obtained from the symbols directory.
10. Work neatly.

Copyright reserved

QUESTION 1: INTRODUCTION

Indicate whether the following statements are TRUE or FALSE by writing only 'True' or 'False' next to the question number (1.1–1.10) on the DRAWING SHEET.

1.1 The gusset plate transfers loads between members.

1.2 Setting-out points (SOPs) or node points are set out on the centre line of the steel member.

1.3 Latticed trusses and girders are not extremely efficient in material usage for spanning long distances.

1.4 The internal joints of a truss may be made using a gusset plate, or the members may be welded directly together.

1.5 The top chord of the lattice girder is made up of rolled steel angles back-to-back.

1.6 There are three methods of fastening steel structures together: bolting, welding and riveting.

1.7 A shop weld is carried out in the fabrication workshop.

1.8 A site weld is carried out on the site where the steel structures are erected.

1.9 A structural steel detailer must always wear safety equipment when in the fabrication workshop.

1.10 Metals do not expand when heated and contract when cooled.

(10 × 1) **[10]**

QUESTION 2: BEAMS

DIAGRAM SHEET 1 (attached) shows a view of a steel structure. As a structural steel detailer, make fully detailed drawings (scale 1:10) of the beams marked B1 and B2 and supply enough information for the manufacturing of the beams in a fabrication steel workshop. All plates are 10 mm thick and all bolts are M20.

Show the following information:

2.1 The 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

Information not given is left to your own discretion. **[25]**

QUESTION 3: COLUMNS

Refer to DIAGRAM SHEET 1 (attached). As a structural steel detailer, make fully detailed drawings (scale 1:10) of the columns marked C1 and C2 and supply enough information for the manufacturing of the columns in a workshop. All plates are 10 mm thick and 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]

Copyright reserved

QUESTION 4: LATTICED GIRDERS

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 × 8
- All gusset plates are 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 centrally below the details.

[15]

QUESTION 5: TRUSSES

5.1 Refer to DIAGRAM SHEET 1 (attached) and draw to scale 1:20 a line diagram of the BOLTED steel roof truss. (5)

5.2 Draw to scale 1:5 typical bolted details at A and B. (20)

Use the following specifications:

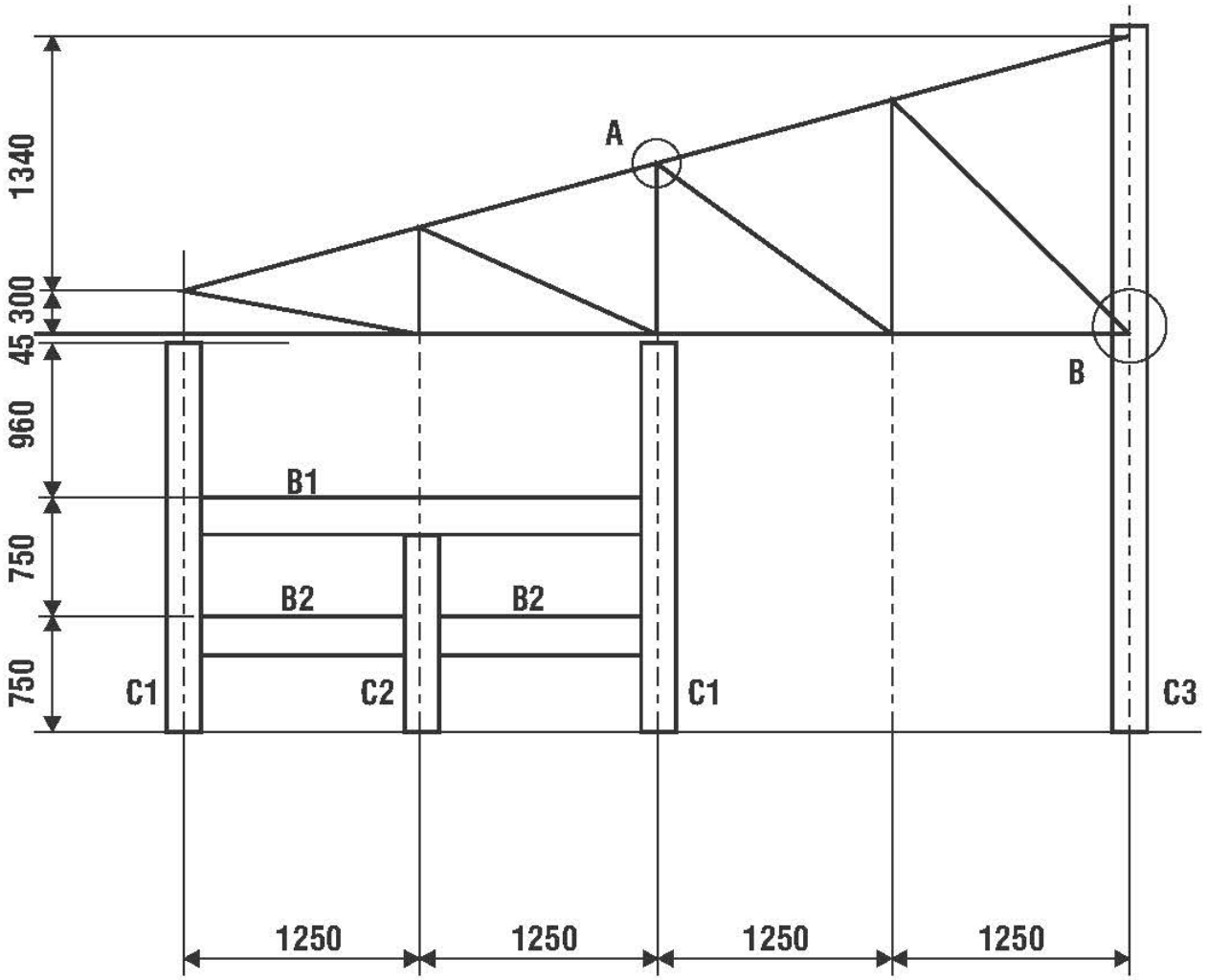
- Top and bottom boom: 90 × 90 × 10 hot rolled steel angle profiles
- All internal members: 70 × 70 × 10 hot rolled steel angle profiles
- Gusset plates: 10 mm thick
- Use your discretion for bolt-hole centres and edge distances.
- All bolt holes are drilled on the centre lines of the angles and all bolts are M16.
- Insert suitable dimensions

[25]

TOTAL: 100

Copyright reserved

DIAGRAM SHEET 1

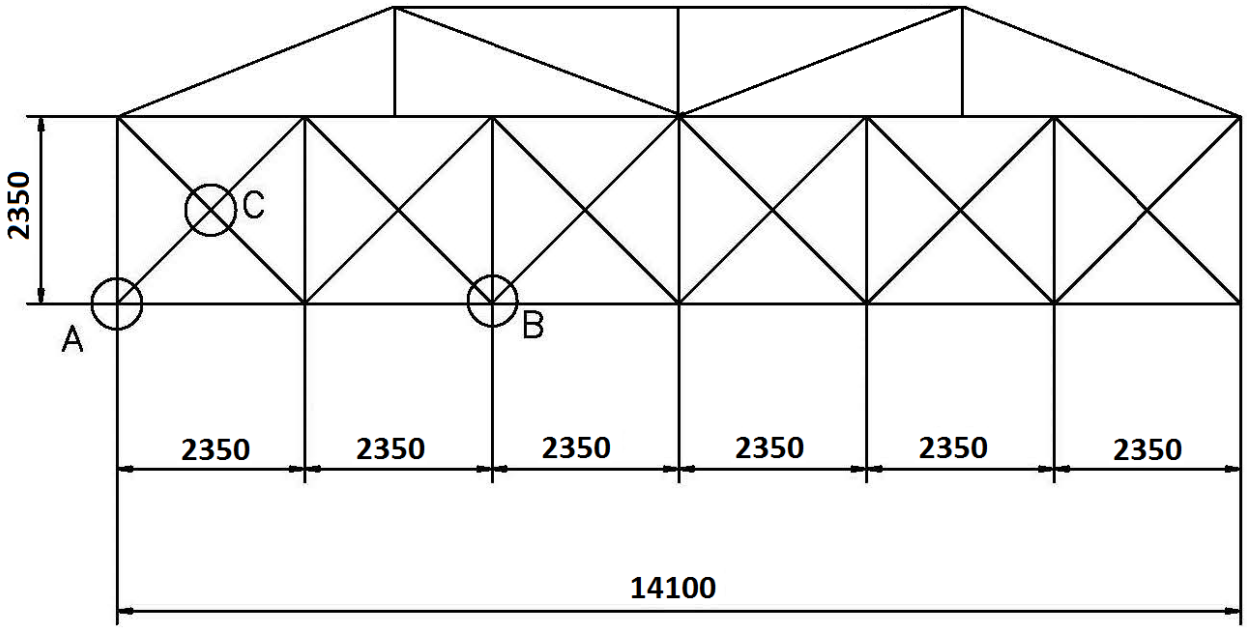


B1	**UB 254 x 146 × 31 kg/m**	**C1**	**UC 203 × 203 × 46 kg/m**
B2	**UB 254 x 146 × 31 kg/m**	**C2**	**UC 203 × 203 × 46 kg/m**
		C3	**UC 203 × 203 × 46 kg/m**

END PLATES	**10 mm WITH 4 × M20 BOLTS**
BASE PLATES	**20 mm WITH 2 × M20 BOLTS**
ENDPLATE	**10 mm MET 4 × M20 BOUTE**
VOETPLATE	**20 mm MET 2 × M20 BOUTE**

Copyright reserved

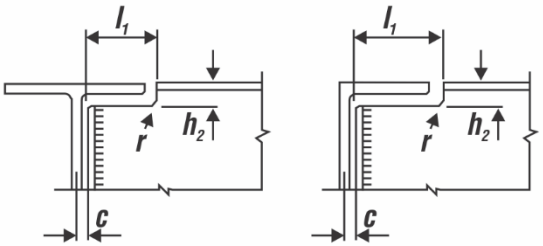
DIAGRAM SHEET 2



Copyright reserved

INFORMATION SHEET 1

Dimensions of Beam Notches



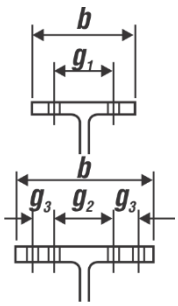
Dimension c is to face of end plate or angle cleat.
r = 10mm minimum
Dimensions are in mm.

	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

Copyright reserved

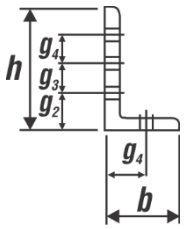
INFORMATION SHEET 2

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



b (mm)	Gauge (mm)			Ø max. (mm)
	g_1	g_2	g_3	
64	32	120	60	12
73-82	40	140	75	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)
				g_1	g_2	g_3	g_4	
25	15	8	90	50	45	45		24
30	17	10	100	50				24
35	20		120	60				24
40	22		120					16
45	25		125	65				24

Copyright reserved