higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

T1670**(E)**(J30)T

NATIONAL CERTIFICATE:
MULTIDISCIPLINARY DRAWING OFFICE PRACTICE

STRUCTURAL STEEL DETAILING

(8090225)

30 July 2019 (X-Paper)
09:00–13:00

CLOSED-BOOK EXAMINATION

REQUIREMENTS: A3 drawing sheet

Drawing instruments or 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:
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. 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. 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 profiles, plates and bars.

1.3 A butt joint is a weld joint formed when two joint members are lapped over each other.

1.4 A lap joint is a weld joint formed when two joint members located in approximately the same plane are positioned edge to edge.

1.5 Precision bolts (grade 8.8) have a much higher strength grading and are manufactured to a closer dimensional tolerance than ordinary bolts.

1.6 A weld toe is the intersection of the base metal and the weld face.

1.7 The shaft of a bolt is called the tail.

1.8 Plate girders are constructed by welding steel plates together to form an I-section.

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

1.10 Column cap plates are fixed to the bottom of the column section.

(10 × 1) **[10]**

QUESTION 2: BEAMS

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

Make fully detailed drawings, to scale 1:10, 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 the end plates

2.4 Dimensions for the drilling of the bolt holes

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2.5 View with dimensions of the 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 discretion.

(15 × 2) **[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 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 the 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]**

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 × 12
- 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.

(3 × 5) **[15]**

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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:

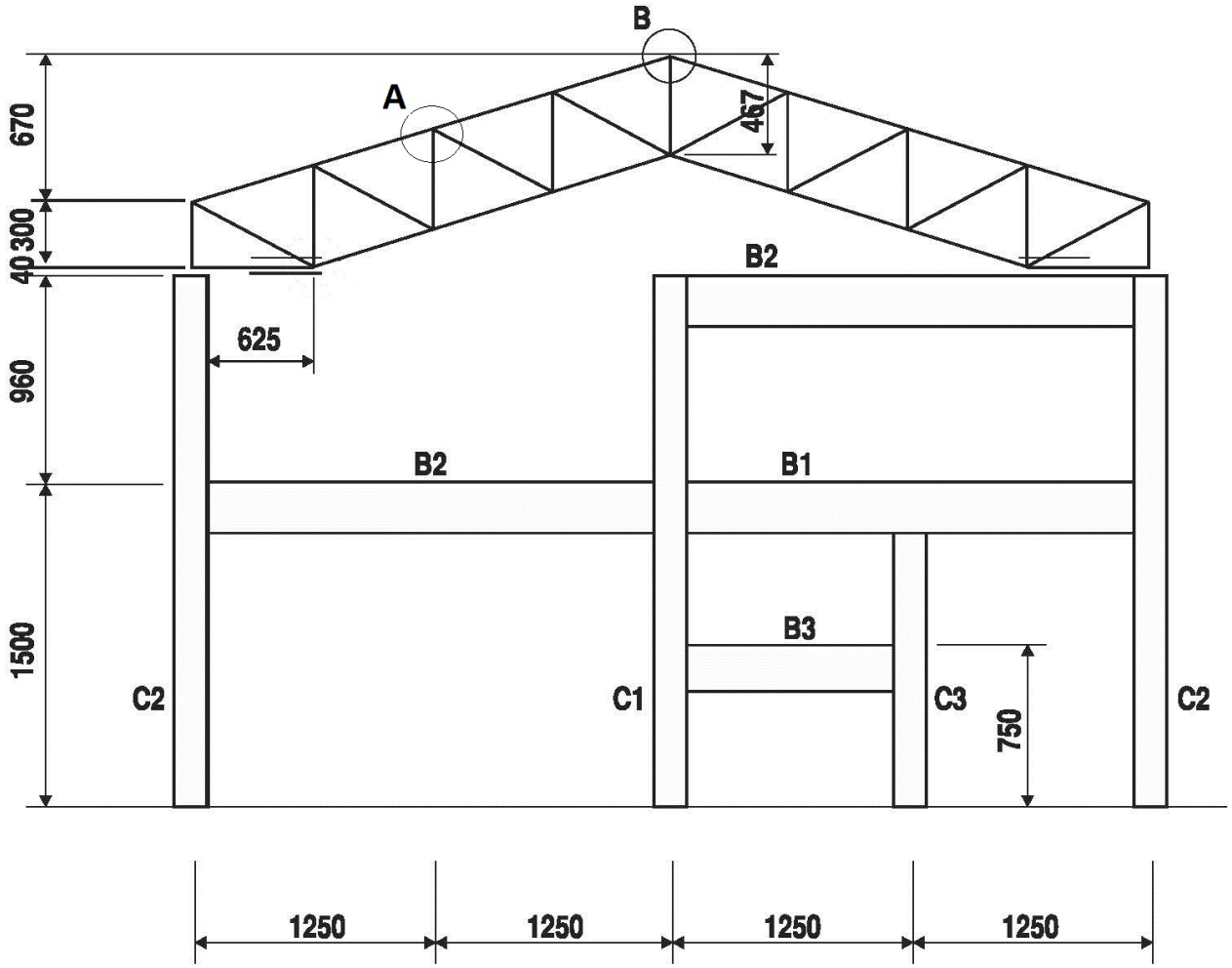
- Top and bottom boom: 100 × 100 × 10 hot rolled steel angle profiles
- ALL internal members: 80 × 80 × 10 hot rolled steel angle profiles
- Gusset plates: 10 mm thick
- Bolt-hole centres: 100 mm
- Edge distances: 35 mm

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



B1 - UB 254 x 146 x 31 kg/m
B2 - UB 254 x 146 x 31 kg/m
B3 - UB 203 x 133 x 25 kg/m

C1 - UC 203 x 203 x 46 kg/m
C2 - UC 203 x 203 x 46 kg/m
C3 - UC 203 x 203 x 46 kg/m

END PLATES - 10mm with 4 x M20 Bolts
BASE PLATES - 20mm with 2 x M20 Bolts

FIGURE 1

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DIAGRAM SHEET 2

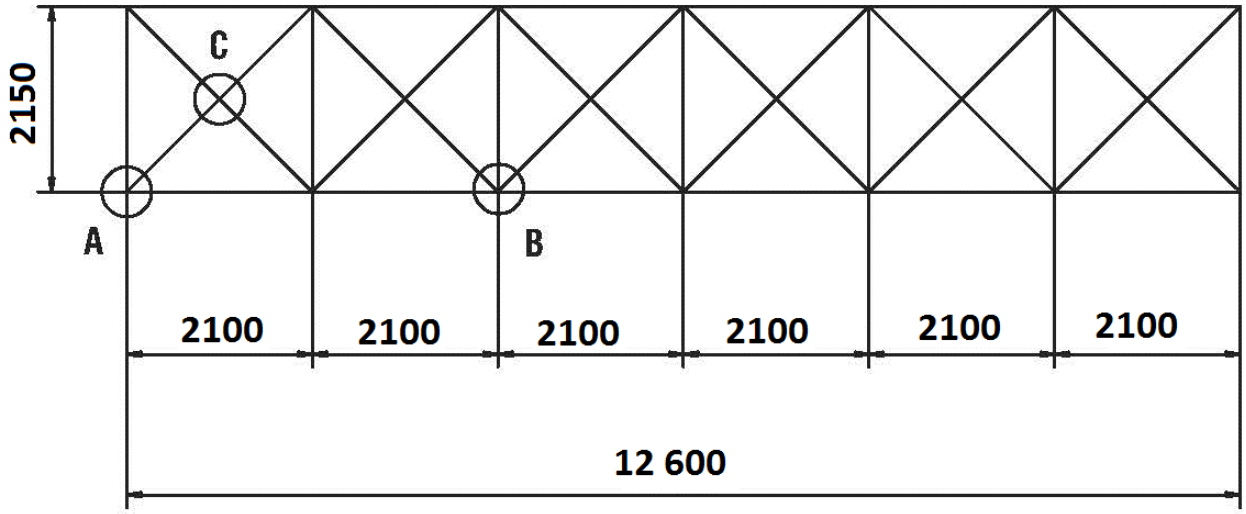
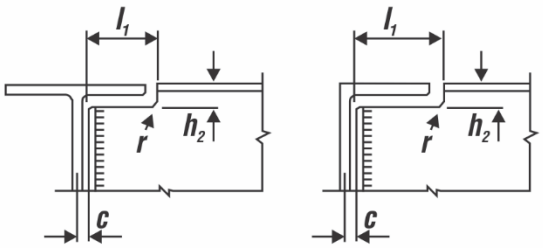


FIGURE 2

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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.

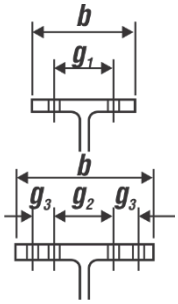
	Section	c	Notch			Section	c	Notch	
			l_1	h_1				l_1	h_1
I - Sections (parallel flange)	100 x 55 x 8	4	33	15	I - Sections (parallel flange)	533 x 210 x 82	4	33	15
	120 x 64 x 19	4	37	15		93	4	37	15
	140 x 73 x 13	4	42	20		101	4	42	20
	160 x 82 x 16	5	47	20		109	5	47	20
	180 x 91 x 19	5	51	20		122	5	51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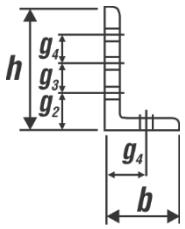
INFORMATION SHEET 2

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



b (mm)	Gauge (mm)			Ø max. (mm)
	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

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