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No. 9195



Plumbers,
Gasfitters and
Drainlayers Board

CRAFTSMAN EXAMINATION, NOVEMBER 2009

PLUMBING

QUESTION AND ANSWER BOOKLET

Time allowed **THREE** hours

INSTRUCTIONS

Check that the Candidate Code Number on your admission slip is the same as the number on the label at the top of this page.

Do not start writing until you are told to do so by the Supervisor.

Total marks for this examination: 100.

The pass mark for this examination is 60 marks.

Write your answers and draw your sketches in this booklet. If you need more paper, use pages 21–25 at the back of this booklet. Clearly write the question number(s) if any of these pages are used.

All working in calculations must be shown.

Candidates are permitted to use the following in this examination:

Drawing instruments, approved calculators

The following are NOT permitted in the examination room:

Any publications, Acts, Regulations, Codes of Practice, or Standards

Check that this booklet has all of 25 pages in the correct order and that none of these pages is blank.

YOU MUST HAND THIS BOOKLET TO THE SUPERVISOR AT THE END OF THE EXAMINATION

QUESTION 1

Give TWO reasons why plumbers need to have knowledge of NZS 3604: Timber Framed Buildings when designing plumbing systems.

- 1 _____

- 2 _____

Total 2 marks

QUESTION 2

(a) AS/NZS 3500 Part 1: Water services requires that supply tanks be fitted with an overflow.

State THREE requirements of the standard that must be met in relation to the discharge point of the overflow.

1 _____

2 _____

3 _____

(3 marks)

QUESTION 2 (cont'd)

(b) A storage tank is to be installed to supply wash-down water to a dairy shed complex.

The volume of the tank is 25 000 litres.

The inflow pressure is 500 kPa.

The tank must fill from empty in 1.25 hours.

With the aid of the following table, determine the diameter of the float-valve inlet orifice. Show the calculation required.

Rate of inflow to storage tanks	
Diameter of float valve inlet orifice (mm)	Inflow at 500 kPa (L/s)
6	0.54
8	0.95
10	1.49
15	3.40
20	6.00
25	9.30
32	15.30
40	23.80

(3 marks)

Total 6 marks

QUESTION 3

- (a) In a multi-storey building, water for sanitary fittings and fixtures is supplied from a header tank on the roof.

Pressure ratio valves can be installed at various levels to lower the supply pressure to the rated working pressure of the fittings and fixtures. In order to comply with AS/NZS 3500 Part 1: Water services, the installation of these valves must meet specific installation requirements.

Give these requirements.

1 _____

2 _____

3 _____

4 _____

5 _____

(5 marks)

QUESTION 3 (cont'd)

(b) A supply tank and pipework tank have been installed to supply drinking (potable) water.

Following are the specifications for the installation.

- Tank A, 3500mm in diameter, with the overflow level 2500mm above the base.
- Tank B, 2800mm in diameter, with the overflow level 2200mm above the base, on a 300mm high stand.
- The tanks are manifolded together by 2.5m of 80mm NB pipe.
- There is a total length of 24m of 50mm NB pipe from the tanks to the outlet.

The supply tank and pipework must be chlorinated before being put into service. 400ml of 12.5% sodium hypochlorite solution must be used for each 1000 litres of water capacity in the installation.

Calculate the amount of sodium hypochlorite solution required to chlorinate the complete installation. Give your answer in litres.

(4 marks)

QUESTION 3 (cont'd)

- (c) A water reticulation system is to be installed. The pipes and fittings must be selected to ensure compliance with AS/NZS 3500 Part 1: Water Services.

Give FOUR factors to be taken into account when selecting the material for the pipes and fittings.

1 _____

2 _____

3 _____

4 _____

(4 marks)

Total 13 marks

QUESTION 4

(a) Give THREE aspects of the way in which a craftsman plumber must provide DIRECTION as determined by the Plumbers, Gasfitters and Drainlayers Board.

1 _____

2 _____

3 _____

(3 marks)

(b) Give THREE aspects of the way in which a craftsman or registered plumber must provide SUPERVISION as determined by the Plumbers, Gasfitters and Drainlayers Board.

1 _____

2 _____

3 _____

(3 marks)

(c) A non-apprentice working at plumbing has held a limited certificate for less than two years.

Give the supervision requirements for this class of worker.

(2 marks)

Total 8 marks

QUESTION 5

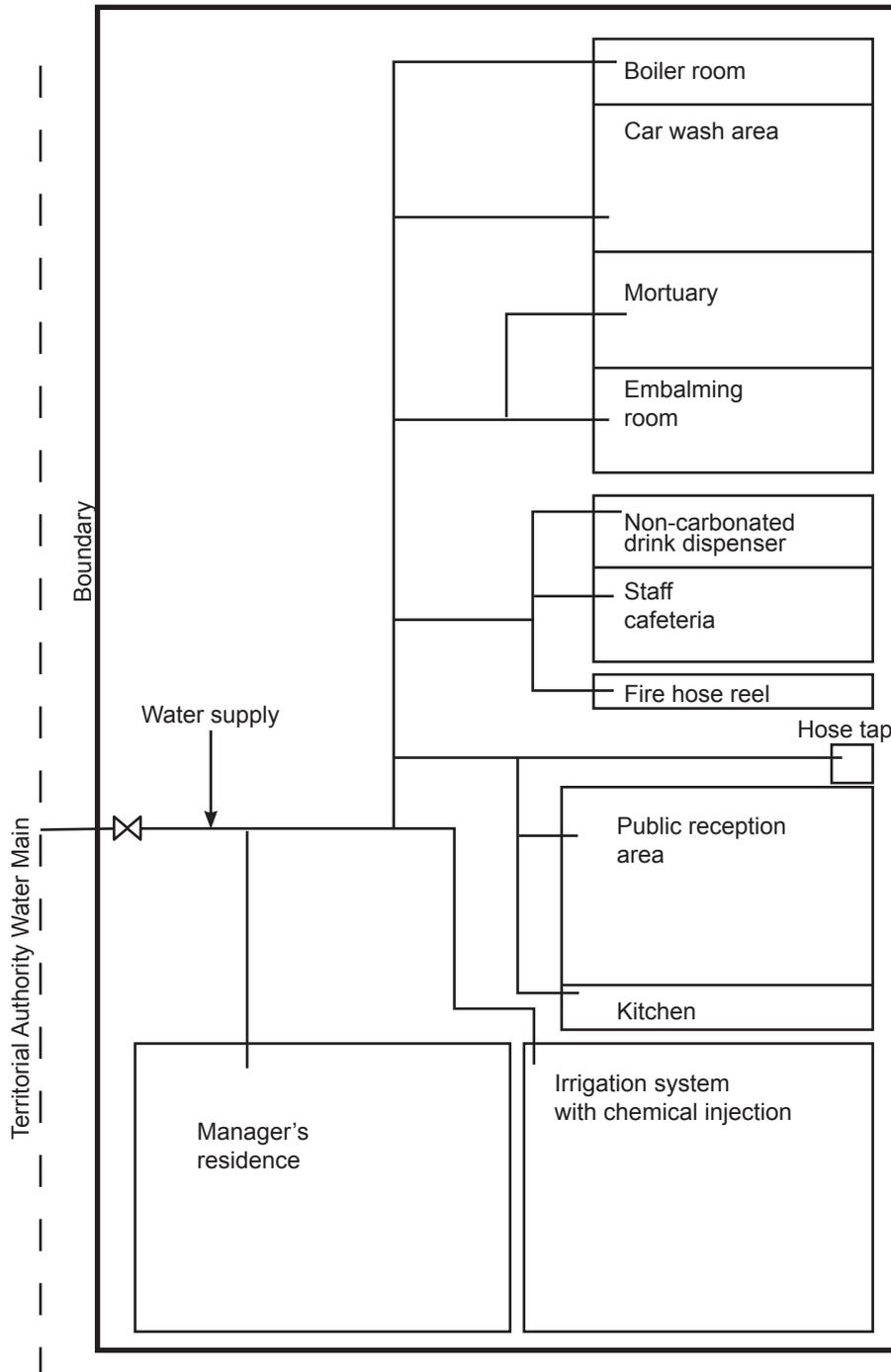
The drawing opposite is a schematic plan of an undertaker's premises. The water pipe layout and the usage of the various areas are shown.

Backflow protection is to be provided to comply with the minimum requirements of the New Zealand Building Code Clause G12 Water Supplies.

Mechanical backflow prevention devices are to be used for all containment, zone and individual backflow prevention.

- (a) For each area where an actual or potential cross-connection hazard exists, label on the plan the hazard rating.
- (b) On the plan, show the position of each mechanical backflow prevention device required.
- (c) Label each backflow prevention device to show whether it is for individual, zone or containment purposes.
- (d) Label each pipeline either drinking (potable) water or non-drinking (non-potable) water.

QUESTION 5 (cont'd)

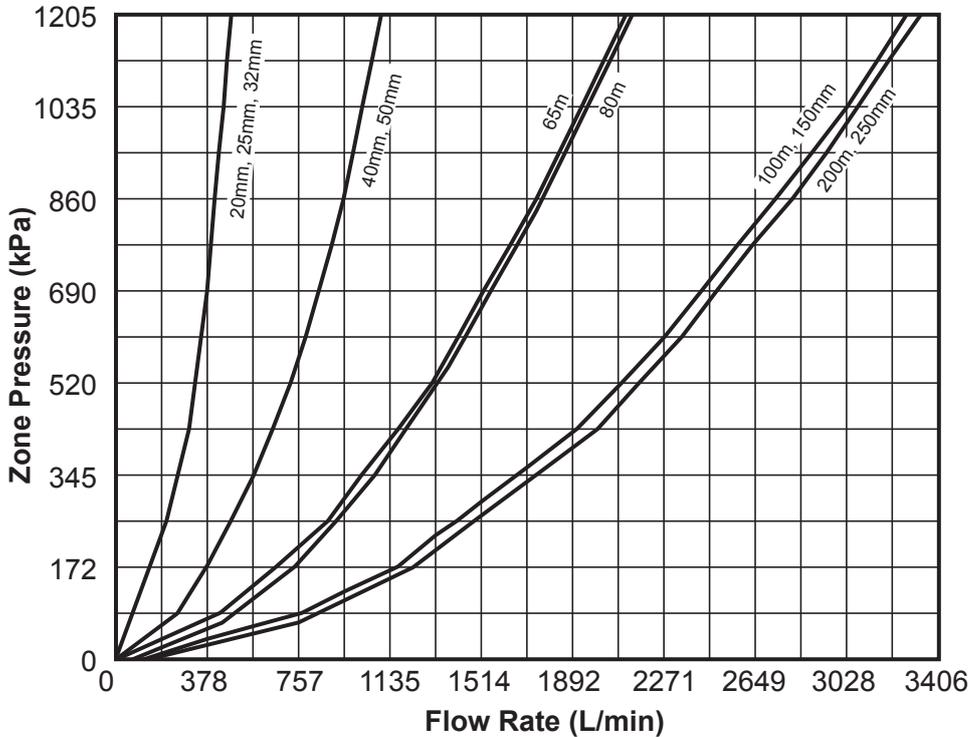


Total 11 marks

QUESTION 6

The graph below relates to the discharge rates for the relief valves of reduced pressure zone backflow prevention devices.

RELIEF VALVE DISCHARGE RATES
for Reduced Pressure Zone Devices



**Typical flow rates
for floor drains**

50mm	208L/min
80mm	423L/min
100mm	643L/min
125mm	964L/min
150mm	1703L/min
200mm	2876L/min

From the graph, establish the rate of discharge and the size of the drain required for the following diameter backflow prevention device installations.

(a) A DN 25mm device operating at 1035kPa.

(i) The discharge rate.

(ii) The diameter of the drain.

(1 mark)

QUESTION 6 (cont'd)

(b) A DN 20mm device operating at 690kPa.

(i) The discharge rate.

(ii) The diameter of the drain.

(1 mark)

(c) A DN 80mm device operating at 520kPa.

(i) The discharge rate.

(ii) The diameter of the drain.

(1 mark)

(d) A DN 40mm device operating at 860kPa.

(i) The discharge rate.

(ii) The diameter of the drain.

(1 mark)

Total 4 marks

QUESTION 7

A residential apartment is to be supplied with hot water from a storage hot water heater. The heater has a capacity of 200 litres and a 3.5kW electric element.

The water is to be heated to 70°C.

The temperature of the water entering the storage hot water heater is 7°C.

The apartment has:

- one shower
- one handbasin
- one kitchen sink
- one dishwasher
- one clothes washer.

- (a) Complete the table below to calculate the possible maximum simultaneous hot water demand for the apartment.

Typical flow rates of hot water demand at the outlet of fittings		
Fitting	Flow rate	
Shower	0.1 L/s	
Handbasin	0.1 L/s	
Kitchen sink	0.2 L/s	
Clothes washer	0.2 L/s	
Dishwasher	0.2 L/s	
TOTAL		

(2 marks)

- (b) When the shower, sink and dishwasher are operating simultaneously, the delivery flow rate of mixed water is 0.9 litres/s.

Calculate the delivery temperature of the water in this situation.

Formula:

Litres hot water × temp. rise cold to hot = litres mixed water × temp. rise cold to mixed

(3 marks)

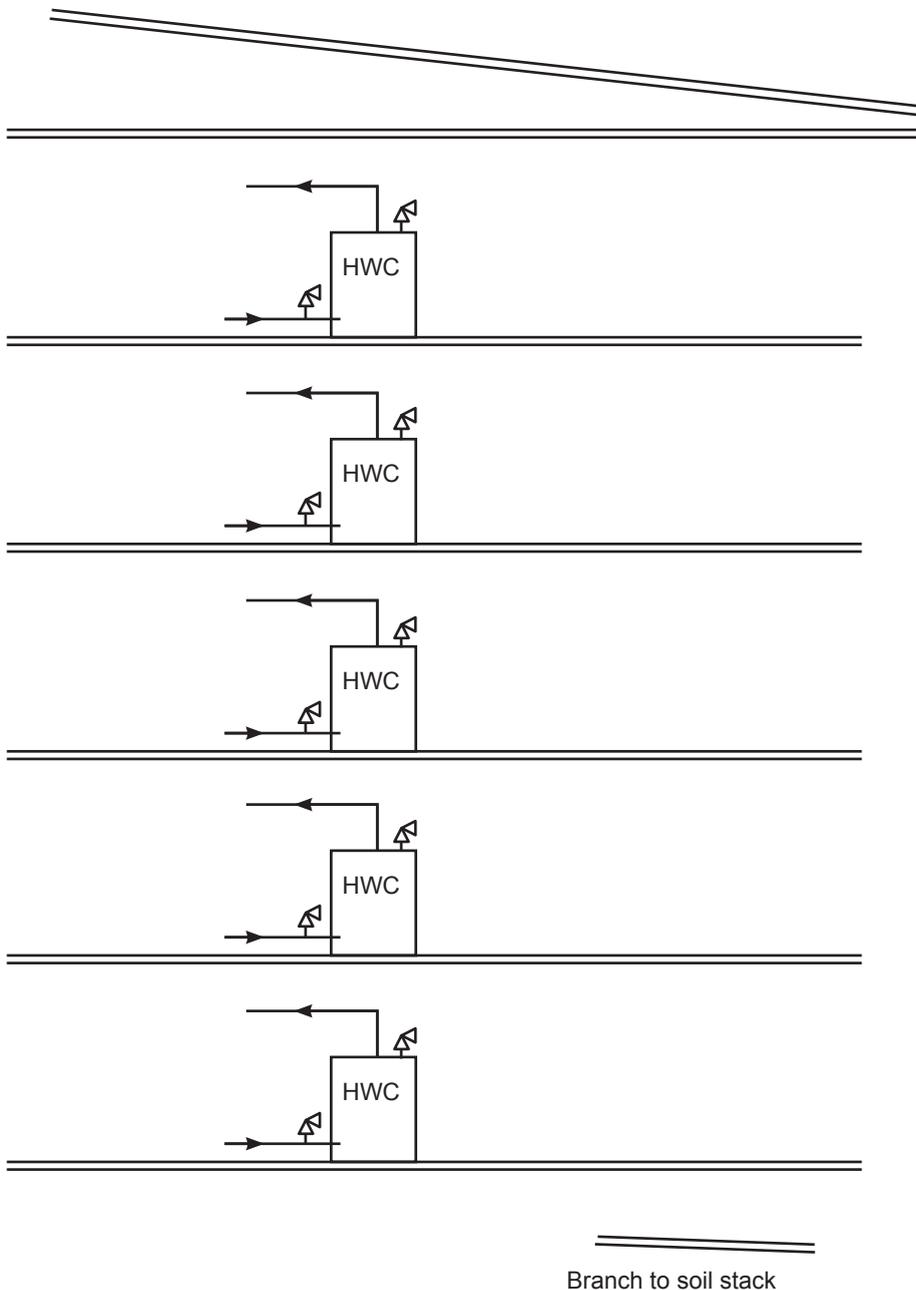
QUESTION 8

The drawing below shows individual valve vented storage hot water heaters installed above each other in an apartment building.

All valves discharge to a common stack, which then discharges into the branch to the soil stack.

Complete the drawing to show the following so that the system complies with AS/NZS 3500 Part 4: Heated water services.

- (a) the method of discharge from the individual valves
- (b) the common stack
- (c) the method of discharge to the soil stack.



Total 4 marks

QUESTION 9

(a) A hot water supply reticulation system is to be designed.

Give the FIVE design requirements that must be met for the piping system to comply with AS/NZS 3500 Part 4: Heated water services.

- 1 _____
- 2 _____
- 3 _____
- 4 _____
- 5 _____

(5 marks)

(b) Give THREE advantages of multiple valve vented storage heaters being installed in parallel.

- 1 _____
- 2 _____
- 3 _____

(3 marks)

(c) Give THREE disadvantages of multiple valve vented storage heaters being installed in series.

- 1 _____
- 2 _____
- 3 _____

(3 marks)

Total 11 marks

QUESTION 10

The drawing opposite shows a cross-sectional view of a residential building. The drawing is not to scale.

Sanitary fixtures and the drain below the floor slab are shown.

The grade of the drain is 1.65%. The foul water pipework is to be installed to comply with the minimum requirements of AS/NZS 3500 Part 2: Sanitary plumbing and drainage.

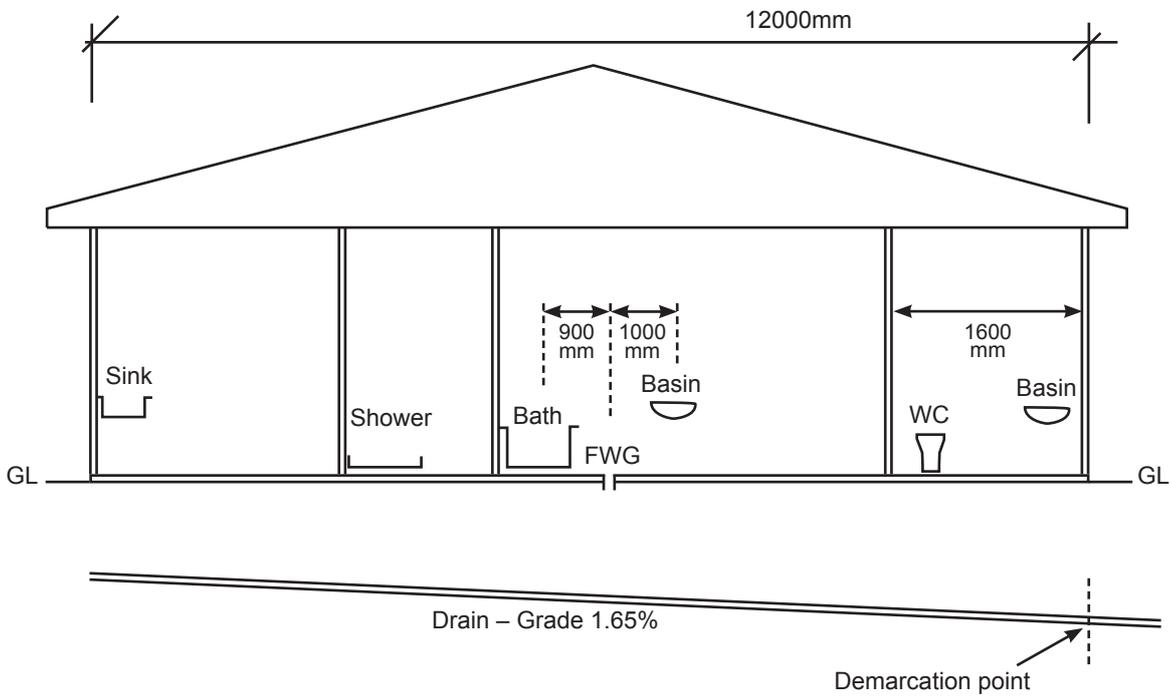
- (a) Using the tables below, complete the drawing to show:
- (i) connections to the drain
 - (ii) venting requirements
 - (iii) overflow relief
 - (iv) diameters of foul water pipes and vent(s)
 - (v) traps.

Fixture unit ratings		
Fixture	Min. discharge pipe size	Fixture unit rating
Basin	40	1
Bath	40	4
Sink	50	3
Shower	40	2
Water closet pan with flush valve	100	6

Maximum Fixture Unit Loading For Vented Drains			
	Nominal size of drain, DN		
Grade %	65	80	100
2.50	25	100	255
2.00		76	205
1.65		61	165
1.45		50	140
1.25		42	120

Size of vents		
Size of vent pipe	Fixture units discharging to drain	
40	>1	< 10
50	>10	<30
65	>30	< 175
80	>175	< 400
100	> 400	

QUESTION 10 (cont'd)



(10 marks)

- (b) The drain below the floor slab is laid with a grade of 1.65%. The distance from the top of the pipe at the head of the drain to the floor level is 450mm.

Calculate the level of the drain invert below the floor at the demarcation point with the drainage contractor.

(2 marks)

Total 12 marks

QUESTION 11

The diagram opposite shows a foul water installation consisting of four discharge stacks.

All the stacks are to have relief vents fitted. All the relief vents are to discharge through a header vent.

The header vent is to discharge to the stack vent from the 100mm foul water stack.

The developed length of each relief vent is 16 metres.

The system is to comply with the minimum requirements of AS/NZS 3500 Part 2: Sanitary plumbing and drainage.

(a) Complete the drawing to show the relief vents, header vents and stack vent.

(4 marks)

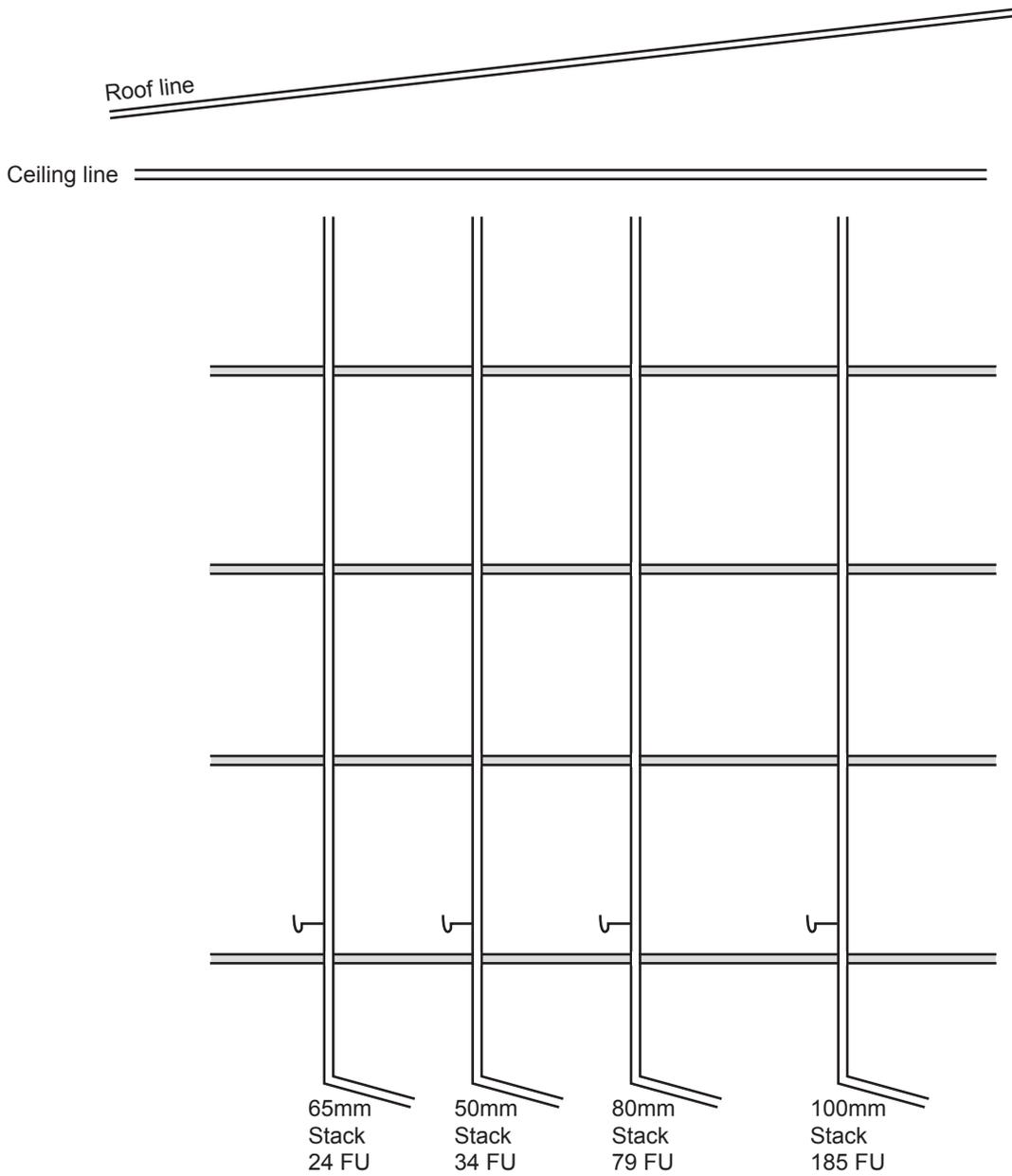
(b) Using the fixture unit ratings and stack diameters shown on the diagram and the tables below, size all the vents. Show your answers on the diagram.

(7 marks)

Size of relief vents and stacks							
		Vent size (DN)					
		32	40	50	65	80	100
Stack size (DN)	Fixture unit load	Length of vent in metres					
40	16	6	15				
50	20	8	15	46			
50	36	6	10	30			
65	20		12	40	110		
65	56		7	24	80	170	
80	20		8	27	70	110	
80	80			12	20		
100	150			9	25	70	280
100	300			8	22	60	216
100	500			6	19	50	197

Size of header vents		
Size of stack vent or relief vent DN	Equivalent number of DN 50 vents	Size of header vent DN
50	1	50
65	2	65
80	3	80
100	6	100

QUESTION 11 (cont'd)



Total 11 marks

QUESTION 12

(a) List FOUR performance outcomes that a building's foul water system must meet to comply with the New Zealand Building Code.

- 1 _____
- 2 _____
- 3 _____
- 4 _____

(2 marks)

(b) List TWO factors used when calculating the size of roof gutters as specified in the New Zealand Building Code Clause E1/AS1 Surface Water.

- 1 _____
- 2 _____

(2 marks)

(c) State when it is necessary to provide overflow outlets to roof gutters in order to comply with the New Zealand Building Code Clause E1/AS1 Surface Water.

- _____
- _____

(1 mark)

(d) Give THREE requirements of the New Zealand Building Code Clause E1/AS1 Surface Water that must be met when overflow outlets are being installed in internal roof gutters.

- 1 _____
- 2 _____
- 3 _____

(3 marks)

Total 8 marks

For Examiner's use only

Question number	Marks	Marks
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		
11		
12		
Total		