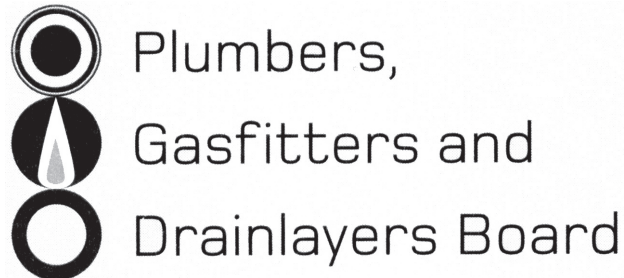


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No. 9195



CRAFTSMAN EXAMINATION, JUNE 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 the blank pages at the back of this booklet. Clearly write the question number 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

- (a) State FIVE functions of the Plumbers, Gasfitters, and Drainlayers Board as prescribed in the Plumbers, Gasfitters, and Drainlayers Act 1976.

1 _____

2 _____

3 _____

4 _____

5 _____

(5 marks)

- (b) State the course of action that is available to a plumber if he or she is dissatisfied with the decision of the Plumbers, Gasfitters and Drainlayers Board following a disciplinary hearing.

(2 marks)

- (c) List TWO plumbing related functions that could lead to a building being classed as insanitary under the terms of the Building Act.

1 _____
2 _____

(2 marks)

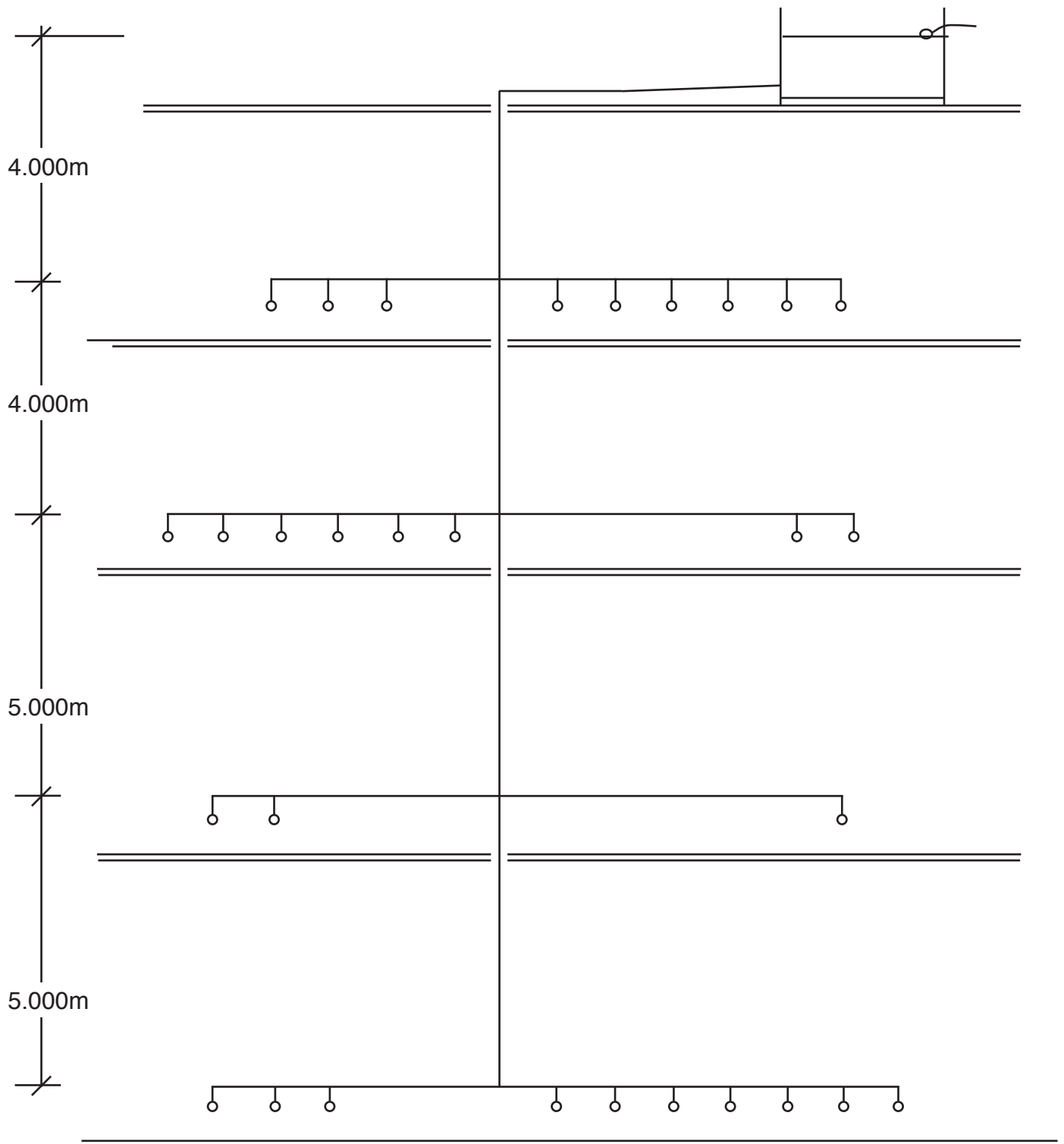
- (d) State the point from when the requirements of the New Zealand Building Code Clause B2 Durability take effect.

(1 mark)

Total 10 marks

QUESTION 2

The schematic drawing below shows the layout of flushing valves (meters) supplied from a break tank in a four-storey building.



Legend:

○ Flushing Valves

QUESTION 2 (cont'd)

- (a) Using the table below from AS/NZS 3500 Part 1: Water services, size the pipework feeding the flushing valves (meters). Show the minimum pipe sizes required, and write your answers on the schematic drawing opposite.

SERVICE PIPE SIZES – BREAK TANKS TO FLUSH VALVES (Meters)		
Available head of water at highest flush valve (meter) (m)	Maximum number of flush valves (meters) served downstream on the same floor and at lower levels	Nominal size of service pipes DN
>3 <6	1 to 2	40
	3 to 15	50
	16 to 50	65
	51 to 150	80
>6 <9	1 to 3	40
	4 to 30	50
	31 to 150	65
	151 to 200	80
>9 <12	1 to 4	40
	5 to 50	50
	51 to 200	65
>12	1 to 6	40
	7 to 100	50
	101 to 250	65

(8 marks)

- (b) The minimum water storage required for each flush valve is 45 litres.

Calculate the volume of water that the break tank must contain to service the total number of flushing valves.

(1 mark)

Total 9 marks

QUESTION 3

A 40mm diameter hot water ring main is to be installed in a motel block. Each motel unit is to be connected to the ring main by a single 18mm diameter pipe.

Calculate how many motel units the ring main can supply.

Formula:

$$N = \sqrt{\left(\frac{D}{d}\right)^5}$$

where

N = Number of laterals (branches)

D = Diameter of the ring main

d = Diameter of the laterals

Total 3 marks

QUESTION 4

- (a) A centrifugal water pump is to be selected to provide a high pressure water supply to a two-storey residence.

The residence contains the following plumbing fittings and fixtures:

Basin – 4 off
Bath – 1 off
Dishwasher – 1 off
Hose tap – 3 off
Laundry tub – 1 off
Mains pressure water heater – 1 off
Shower – 2 off
Sink – 1 off
Washing machine – 1 off
WC cistern – 3 off

Complete the table below to calculate the total loading units required by the fittings and fixtures installed in the residence.

LOADING UNITS			
Fitting or fixture	Loading units	Number of fixtures	Extension
WC cistern	2		
Bath	8		
Basin	1		
Shower	2		
Sink	3		
Laundry tub	3		
Washing machine/dishwasher	3		
Mains pressure water heater	8		
Hose tap	4		
TOTAL LOADING UNITS			

(5 marks)

QUESTION 4 (cont'd)

- (b) Using the table below, establish the probable simultaneous flow rate (PSFR) in litres per minute for the residence in (a).

TABLE 3.3
PROBABLE SIMULTANEOUS FLOW RATES (PSFR)

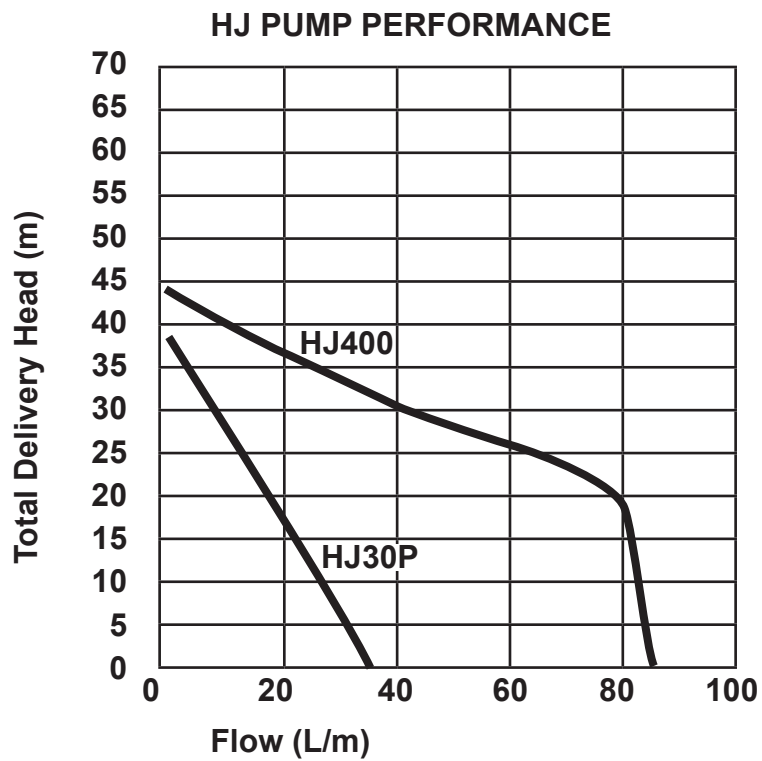
Loading units	PSFR L/s	Loading units	PSFR L/s	Loading units	PSFR L/s
1	0.08	21	0.39	41	0.55
2	0.12	22	0.40	42	0.56
3	0.14	23	0.41	43	0.57
4	0.16	24	0.42	44	0.58
5	0.18	25	0.43	45	0.58
6	0.20	26	0.43	46	0.59
7	0.22	27	0.44	47	0.60
8	0.24	28	0.45	48	0.60
9	0.25	29	0.46	49	0.61
10	0.26	30	0.47	50	0.62
11	0.28	31	0.48	51	0.62
12	0.29	32	0.49	52	0.63
13	0.30	33	0.49	53	0.64
14	0.31	34	0.50	54	0.64
15	0.33	35	0.51	55	0.65
16	0.34	36	0.52	56	0.65
17	0.35	37	0.52	57	0.66
18	0.36	38	0.53	58	0.67
19	0.37	39	0.54	59	0.67
20	0.38	40	0.55	60	0.68

(2 marks)

QUESTION 4 (cont'd)

- (c) For the residence in (a), the static delivery head of the system is 24m and the friction head in the system is 7m.

Using the pump performance graph below, select the appropriate pump for the water supply.



(2 marks)

Total 9 marks

QUESTION 5

The following table lists plumbing fixtures, fittings and installations requiring backflow protection.

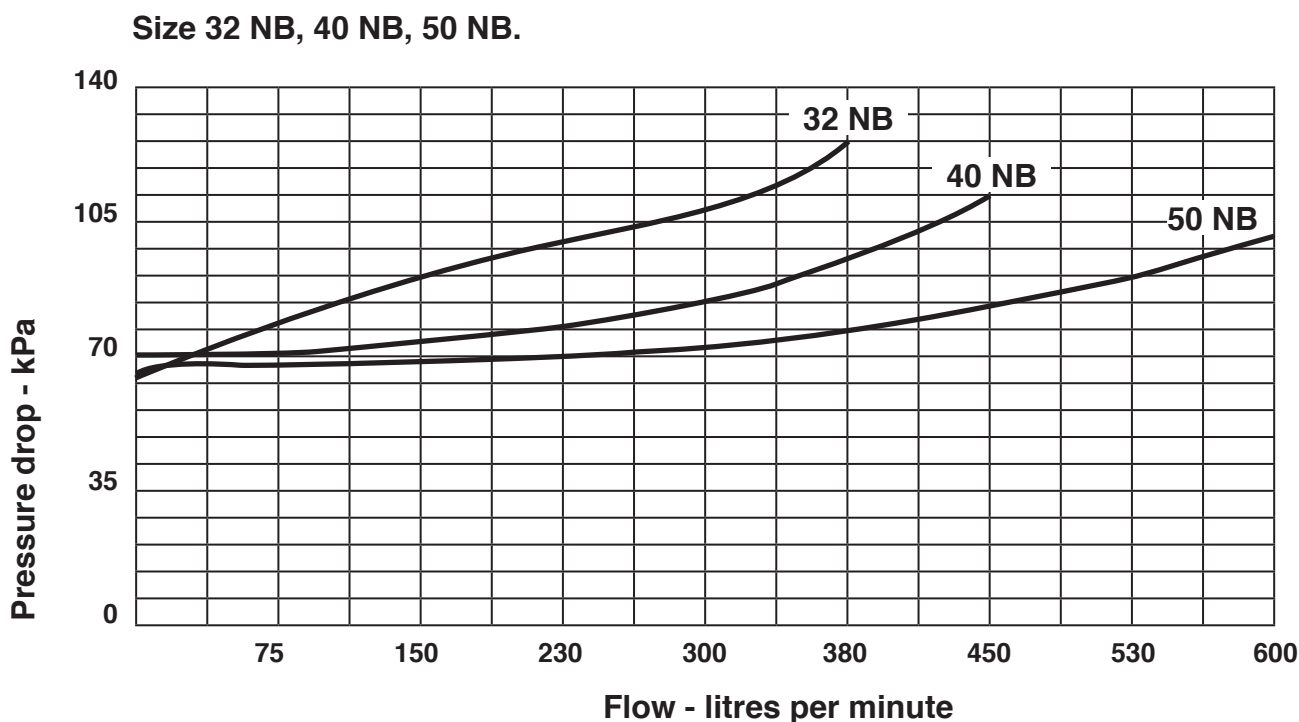
Using your knowledge of the New Zealand Building Code Clause G12/AS1, complete the table by ticking the appropriate boxes to show the cross connection hazard rating of each.

FITTING, FIXTURE OR INSTALLATION	HIGH	MEDIUM	LOW
Carbonated drink dispenser			
Hair dressers' sinks and beauty salons			
Swimming pools and spas			
Auxiliary water supplies			
Dental equipment			
Livestock water supplies with added chemicals			
Boiler, chiller and cooling tower make-up water			
Pest control equipment			
Car and factory washing facilities			
Non-carbonated drink dispenser			
Fire sprinkler systems using toxic additives			
Untreated water storage tanks			

Total 6 marks

QUESTION 6

The following graph shows the pressure drop that will occur across a reduced pressure zone backflow prevention device installed in a potable (drinking) water supply.



- (a) The system must deliver 340 litres of water per minute.

From the graph above establish the pressure drop across:

- (i) a 32 NB valve. _____
- (ii) a 40 NB valve. _____
- (iii) a 50 NB valve. _____

(3 marks)

- (b) The flow rate is to be 230 litres of water per minute and the pressure drop must not exceed 85kPa.

From the graph above give the minimum diameter of the backflow device required.

(1 mark)

Total 4 marks

QUESTION 7

- (a) A reduced pressure zone backflow prevention device must be tested annually. During this test, THREE checks are carried out on the device.

State the purpose of each check and give any minimum pressure requirements that must be met.

1 _____

2 _____

3 _____

(3 marks)

- (b) A flushing valve (meter) for a slop hopper is to be connected directly to a potable (drinking) water supply.

State what must be incorporated into the valve to comply with AS/NZS 3500 Part 1: Water services.

(1 mark)

Total 4 marks

QUESTION 8

A commercial customer wishes to convert from a gas fired continuous flow hot water system to an electrically heated hot water storage system. One storage water heater is required to serve each of the two separate areas of the premises.

- The area 1 water heater element will operate for 4.5 hours each day.
- The area 1 water heater has an energy input of 4.8 kWh each hour.
- The area 2 water heater element will operate for 6.25 hours each day.
- The area 2 water heater has an energy input of 9.6 kWh each hour.
- The premises are in operation for 304 days per annum.
- The GST inclusive cost of electricity is 21.47c per kWh.
- The GST inclusive Electricity Commission Levy Charge is 0.16c per kWh.
- The GST inclusive line charge is 65.8c per day per annum.

Calculate the total GST exclusive cost of electrical energy and line charges per annum for the supply of hot water for the premises.

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Total 7 marks

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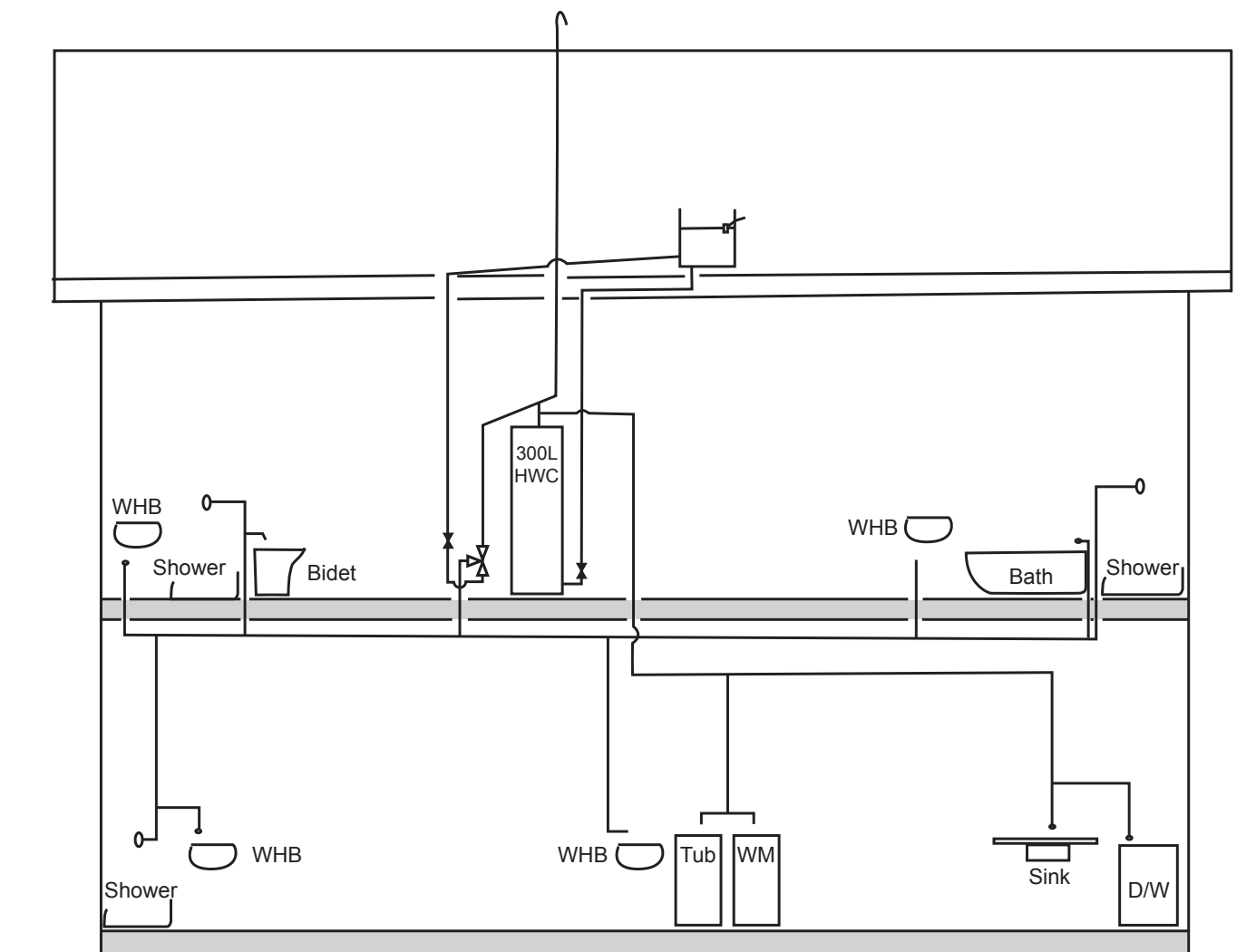
QUESTION 9

The elevation opposite is a cross sectional view of a two-storey house with a low pressure hot water service. The pipework, supply tank and 300 litre electric hot water storage cylinder are shown. No pipe runs exceed 20m in length.

Using the table below from the New Zealand Building Code Clause G12/AS1, determine the tempering valve diameter and nominal pipe diameters for the system to comply with this acceptable solution. Write your answers on the diagram opposite.

Table 4	Tempering Valve and Nominal Pipe Diameters Paragraphs 5.3.1 and 6.12.1		
	Low pressure (i.e. header tank supply or low pressure)	Low and medium pressure unvented (valve vented) and open vented	Mains pressure
Pressure of water at tempering valve (kPa)	20 – 30	30 – 120	over 300
Metres head (m)	2 – 3	>3 – 12	over 30
Minimum tempering valve size	25mm	20mm	15mm
Pipes to tempering valve	25mm (see Note 3)	20mm	20mm (15mm optional see Note 1)
Pipes to shower	20mm	20mm (See Note 4)	20mm (See Note 5 15mm optional see Note 1)
Pipes to sinks/laundry (see Note 2)	20mm	20mm	15mm
Pipes to bath (see Note 2)	20mm	20mm	15mm
Pipes to basin (see Note 2)	15mm	15mm	10mm
Notes: 1. If supplied by separate pipe from storage water heater to a single outlet 2. This table is based on maximum pipe lengths 20 metres. 3. 2m maximum length from water heater outlet to tempering valve. 4. 15mm if dedicated line to shower. 5. 10mm if dedicated line to shower. 6. Table 3 pipe sizes have been calculated to deliver water simultaneously to the kitchen sink and one other fixture.			

QUESTION 9 (cont'd)



Total 10 marks

QUESTION 10

The schematic diagram opposite shows a single stack system in a commercial building with four floors.

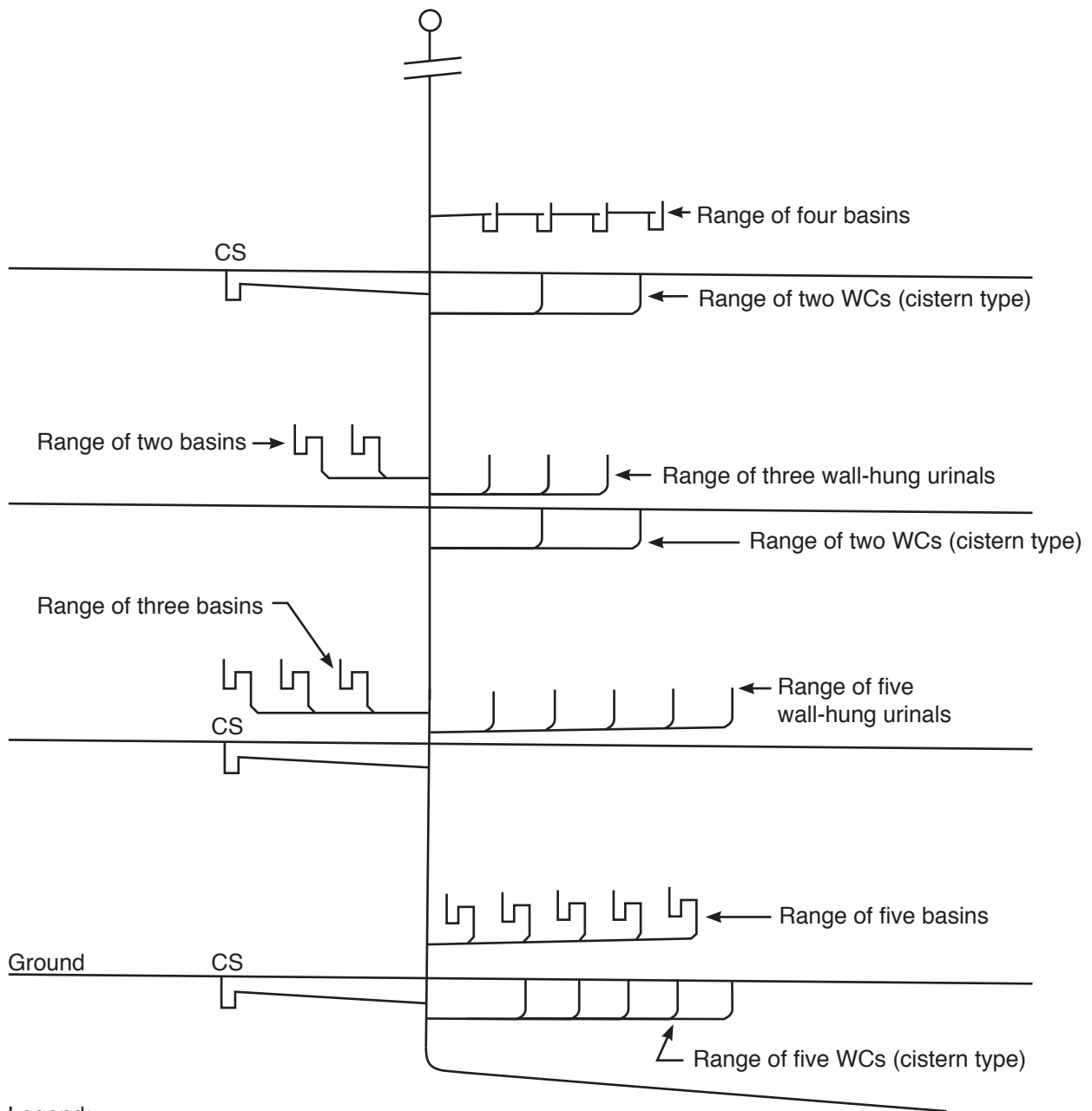
Using the tables below, size the foul water pipework and vent to comply with the minimum diameters required by AS/NZS 3500 Part 2: Sanitary plumbing and drainage. Write your answers on the diagram opposite.

FIXTURE UNIT RATINGS		
FIXTURE	MINIMUM SIZE OF FIXTURE DISCHARGE PIPE	FIXTURE UNIT RATING
Basin	40	1
Cleaner's sink	50	1
Water closet (cistern type)	80	4
Urinal (wall hung type)	40	1

SINGLE STACK SYSTEMS – COMMERCIAL OR INDUSTRIAL BUILDINGS		
SIZE OF STACK (DN)	MAXIMUM FIXTURE UNIT LOADING	MAXIMUM NUMBER OF CONSECUTIVE FLOOR LEVELS
100	60	4
125	100	6
150	200	8

MAXIMUM FIXTURE LOADINGS FOR GRADED DISCHARGE PIPES					
GRADE (%)	NOMINAL SIZE OF PIPE (DN)				
	40	50	65	80	100
2.5	4	8	21	27	182

QUESTION 10 (cont'd)



Legend:

WC = water closet

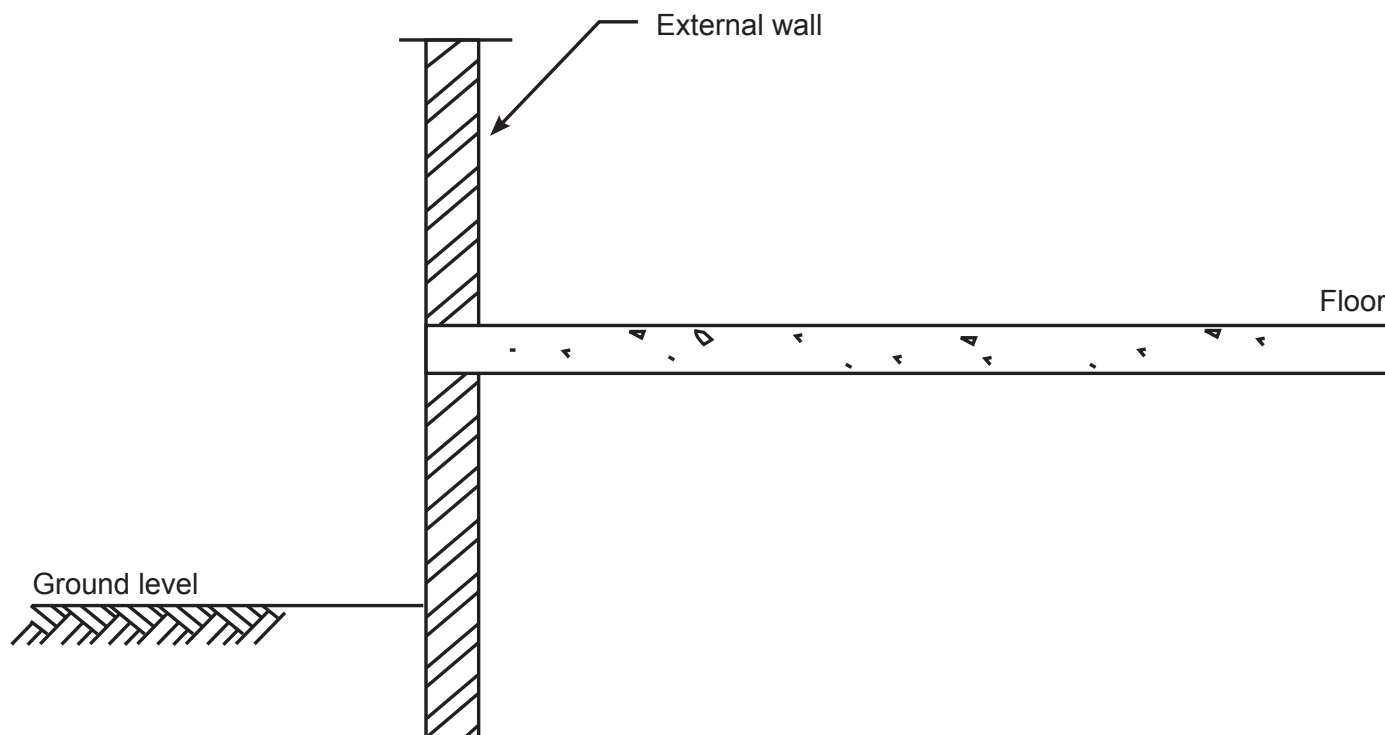
CS = cleaner's sink

Total 10 marks

QUESTION 11

An overflow relief gully is to be installed in the ground floor inside a building. The gully is to be charged by a single wash-hand basin.

The diagram below shows the floor and external wall of the building and the ground level. On the diagram, sketch the installation so that it complies with AS/NZS 3500 Part 2: Sanitary plumbing and drainage. Label all components and show all relevant minimum measurements.



Total 5 marks

QUESTION 12

State FOUR methods of charging a floor waste gully trap where the position of the floor waste is such that it does not receive water from a discharge pipe (waste pipe).

1 _____

2 _____

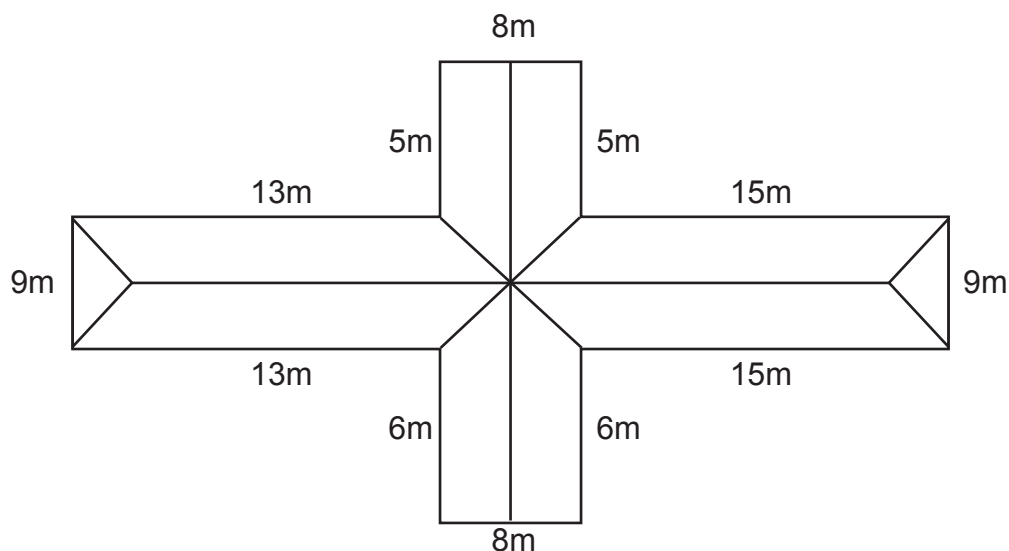
3 _____

4 _____

Total 4 marks

QUESTION 13

The following drawing shows a plan view of a dwelling roof.



- (a) Calculate the plan area of the roof.

(2 marks)

- (b) The roof pitch is 30° . Using table 5 below, calculate the number of 74mm circular downpipes required for the dwelling.

Table 5 Downpipe sizes for Given Roof Pitch and Area Paragraphs 4.2.1				
Downpipe size (mm) (minimum internal sizes)	Roof pitch			
	0 – 25°	25 – 35°	35 – 45°	45 – 55°
	Plan area of roof served by the downpipe			
63mm diameter	60	50	40	35
74mm diameter	85	70	60	50
100mm diameter	155	130	110	90
150mm diameter	350	290	250	200

(2 marks)

QUESTION 13 (cont'd)

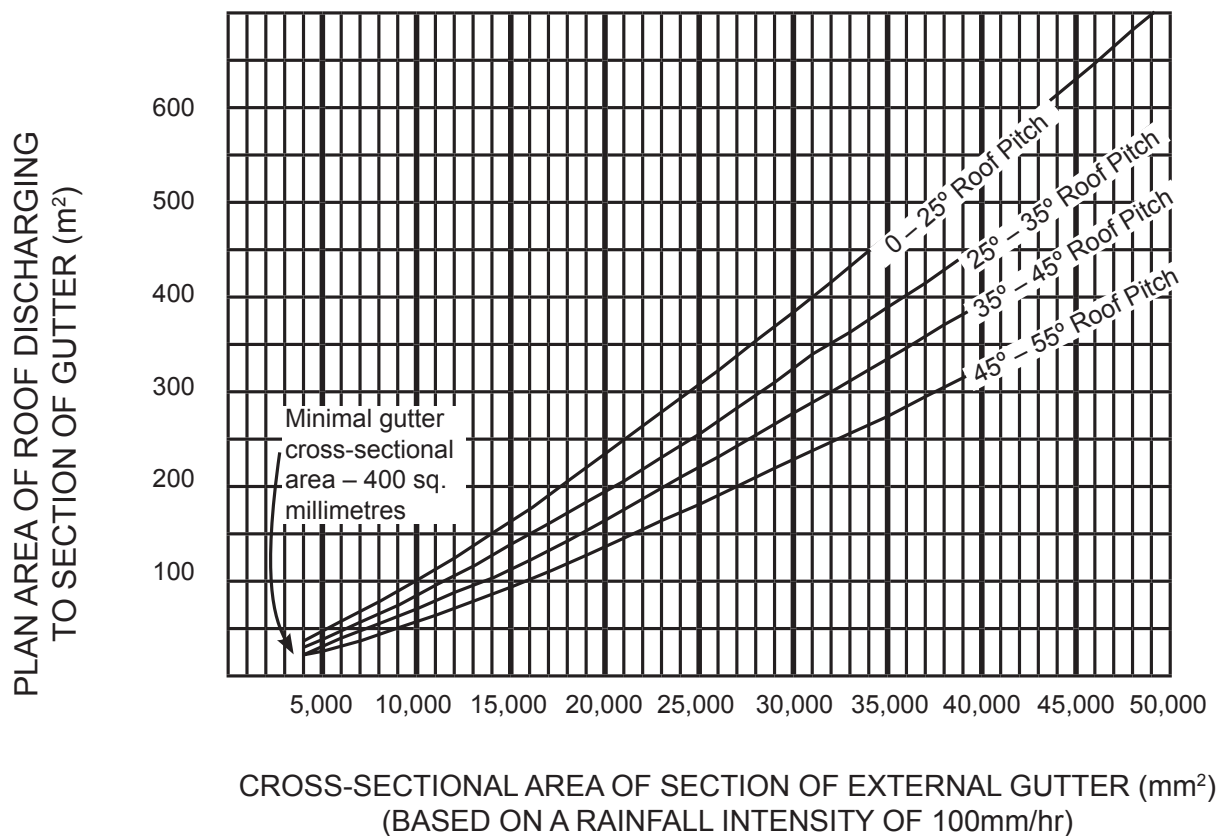
- (c) The area of roof discharging to a downpipe in (a) is 69m^2 .

Using Fig. 15 below, determine the cross sectional area of the external gutter required for the roof.

Figure 15

Cross-sectional Area of External Gutter

Paragraphs 5.1.2 and 5.1.3



(1 mark)

Total 5 marks

QUESTION 14

- (a) A faulty temperature and pressure relief valve on a hot water storage vessel is to be replaced.

Give THREE performance factors that must be considered when selecting the replacement valve.

1 _____

2 _____

3 _____

(3 marks)

- (b) A cold water expansion valve is to be installed on the inlet pipework to a hot water storage vessel.

Give the pressure rating requirements that must be met.

(1 mark)

- (c) A temperature limiting valve is to be installed in a hot water system.

Give TWO factors that will determine its location.

1 _____

2 _____

(2 marks)

Total 6 marks

QUESTION 15

Answer the following questions with regard to the New Zealand Building Code Clause G13/AS1 Foul Water.

- (a) State FOUR situations in which a fixture vent must be fitted to a discharge pipe serving a waste water or soil fixture.

1 _____

2 _____

3 _____

4 _____

(4 marks)

- (b) State how the venting requirements for a discharge stack serving sanitary fixtures on each floor of a two-storey building differ from the venting requirements for a discharge stack serving sanitary fixtures on each floor of a three-storey building.

(1 mark)

- (c) State the TWO purposes of a ventilating pipe that is fitted to a sealed gully.

1 _____

2 _____

(2 marks)

- (d) Explain why the ventilating pipe from a sealed gully must be independent of any other system ventilating pipe.

(1 mark)

Total 8 marks

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