

**SULIT**



**KEMENTERIAN PENDIDIKAN TINGGI  
JABATAN PENDIDIKAN POLITEKNIK DAN KOLEJ KOMUNITI**

**BAHAGIAN PEPERIKSAAN DAN PENILAIAN  
JABATAN PENDIDIKAN POLITEKNIK DAN KOLEJ KOMUNITI  
KEMENTERIAN PENDIDIKAN TINGGI**

**JABATAN KEJURUTERAAN AWAM**

**PEPERIKSAAN AKHIR**

**SESI I : 2025/2026**

**DCB20302 : PLUMBING SERVICES**

**TARIKH : 28 NOVEMBER 2025**

**MASA : 8.30 PAGI – 10.30 PAGI (2 JAM)**

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Kertas ini mengandungi **ENAM BELAS (16)** halaman bercetak.

Struktur (4 soalan)

Dokumen sokongan yang disertakan : Tiada

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**JANGAN BUKA KERTAS SOALAN INI SEHINGGA DIARAHKAN**

(CLO yang tertera hanya sebagai rujukan)

**SULIT**

**INSTRUCTION:**

This section consists of **FOUR (4)** subjective questions. Answer **ALL** questions.

**ARAHAN:**

*Bahagian ini mengandungi **EMPAT (4)** soalan subjektif. Jawab **SEMUA** soalan.*

**QUESTION 1****SOALAN 1**

- CLO1 (a) Describe **TWO (2)** advantages and **TWO (2)** disadvantages of a direct cold water supply system in the building.

*Huraikan **DUA (2)** kelebihan dan **DUA (2)** kekurangan sistem bekalan air sejuk terus dalam bangunan.*

[6 marks]

[6 markah]

- CLO1 (b) A gas water heater is a tank that heats water from a gas-fired burner located at the bottom of the tank. Hot water starts at the bottom and rises upward, where it is drawn off the top by a discharge tube. Sketch and label the components of a gas water heater type.

*Pemanas air gas ialah tangki yang memanaskan air daripada penunu api gas yang terletak di bahagian bawah tangki. Air panas bermula di bahagian bawah dan naik ke atas, di mana ia ditarik keluar dari bahagian atas oleh tiub nyahcas. Lakarkan dan labelkan komponen pemanas air jenis gas.*

[9 marks]

[9 markah]

CLO1

- (c) In a drainage system, water seal traps are essential in preventing foul gases from entering a building. The Figure 1c below shows a water trap system in a bathroom sink. Based on the diagram, explain the following **TWO (2)** factors that cause the loss of the water seal in sanitary appliances: -

*Dalam sistem saluran, perangkat air berfungsi untuk menghalang gas berbua busuk daripada memasuki bangunan. Gambar Rajah 1c di bawah menunjukkan sistem perangkat air dalam sinki bilik mandi. Berdasarkan gambarajah tersebut, terangkan **DUA (2)** faktor berikut yang menyebabkan kehilangan kedap air dalam peralatan kebersihan:-*

- i. Self-siphonage / *Persifonan Kendiri*
- ii. Capillary Attraction / *Tindakan Kapilari*



Figure 1c / *Rajah 1c*

[10 marks]

[10 markah]

**QUESTION 2****SOALAN 2**

CLO1

- (a) Identify **THREE (3)** sanitary appliance design requirements.

*Kenal pasti **TIGA (3)** keperluan reka bentuk perkakas kebersihan.*

[6 marks]

[6 markah]

CLO1

- (b) In a city that frequently experiences flash floods, the local authorities have taken steps to improve the drainage system by implementing a separate drainage system. This system channels wastewater and rainwater through separate pipelines to prevent pollution and overflow issues. Based on the situation above, explain the separated drainage system with the aid of a diagram.

*Di sebuah bandar yang sering mengalami masalah banjir kilat, pihak berkuasa tempatan telah mengambil langkah untuk menambah baik sistem saliran dengan membina sistem saliran berasingan. Dalam sistem ini, air kumbahan dan air hujan dialirkan melalui saluran yang berbeza bagi mengelakkan pencemaran dan masalah limpahan air. Berdasarkan situasi di atas, terangkan dengan bantuan gambarajah sistem saliran berasingan.*

[9 marks]

[9 markah]

- CLO1 (c) An indirect hot water supply system is the most common type in modern houses. The rising main feeds a storage tank located at a high point in the building, from which the water is distributed to all the other taps using gravity. With the aid of a diagram, explain an indirect hot water supply system for a domestic building.

*Sistem bekalan air panas tidak langsung adalah jenis yang paling biasa ditemui di rumah moden. Paip utama menaik membekalkan air ke tangki simpanan yang terletak di titik tinggi dalam bangunan, dari situ air diagihkan ke semua pili lain menggunakan graviti. Dengan bantuan gambar rajah, terangkan sistem bekalan air panas secara tidak langsung untuk sebuah bangunan kediaman.*

[10 marks]

[10 markah]

**QUESTION 3****SOALAN 3**

CLO2

- (a) Figure 3a shows Manhole 1 (MH1), which has dimensions of 750 mm x 600 mm with a depth of 750 mm. The size of the pipe (sewer) used is 150 mm. Estimate the depth and determine the dimensions of Manhole 2 (MH2) by referring to Tables 6 and 7.

*Rajah 3a menunjukkan Manhole 1 (MH1), yang mempunyai dimensi 750 mm x 600 mm dengan kedalaman 750 mm. Saiz paip (pembetung) yang digunakan ialah 150 mm. Anggarkan kedalaman dan tentukan dimensi Manhole 2 (MH2) dengan merujuk kepada Jadual 6 dan 7.*

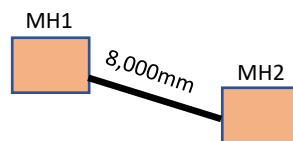


Figure 3a / Rajah 3a

[6 marks]

[6 markah]

CLO2

- (b) A commercial building uses a copper piping system to distribute cold water to various sections. One of the main pipes in this system has an actual length of 15 meters and passes through several bends before reaching its destination. The building engineer needs to ensure that the energy loss in this pipe remains within an acceptable range to maintain efficient water flow. Based on this situation, calculate the loss of head per meter run of the pipe when a copper cold water distributing pipe with an actual length of 15 m and 6 elbows is used to discharge water at a rate of 2.5 liters/s under a constant head of 6 m. Assume the pipe diameter is 32 mm.

*Sebuah bangunan komersial menggunakan sistem paip kuprum untuk mengagihkan air sejuk ke pelbagai bahagian. Salah satu paip utama dalam sistem ini mempunyai panjang sebenar 15-meter dan melalui beberapa selekoh sebelum sampai ke destinasi. Jurutera bangunan perlu memastikan bahawa kehilangan tenaga dalam paip ini adalah dalam julat yang boleh diterima bagi memastikan aliran air yang efisien. Berdasarkan situasi ini, hitung kehilangan tenaga per meter panjang paip apabila paip kuprum dengan panjang sebenar 15 m dan mempunyai 6 siku digunakan untuk mengalirkan air pada kadar 2.5 liter/s di bawah ketinggian air tetap 6 m. Anggap diameter paip adalah 32 mm.*

[9 marks]

[9 markah]

CLO2

- (c) The purpose of the sanitary system is to remove effluent discharged from plumbing fixtures and other equipment to an approved disposal point. Referring to Figure 3c, calculate the total number of discharge units on levels 2 and 3 based on the capacity in Table 3c below.

*Tujuan sistem kebersihan adalah untuk mengalihkan efluen yang dibuang dari lekapan paip dan peralatan lain ke tempat pelupusan yang diluluskan. Merujuk Rajah 3c, kirakan jumlah unit luahan pada Aras 2 dan 3 berdasarkan kapasiti yang diberikan dalam Jadual 3c di bawah.*

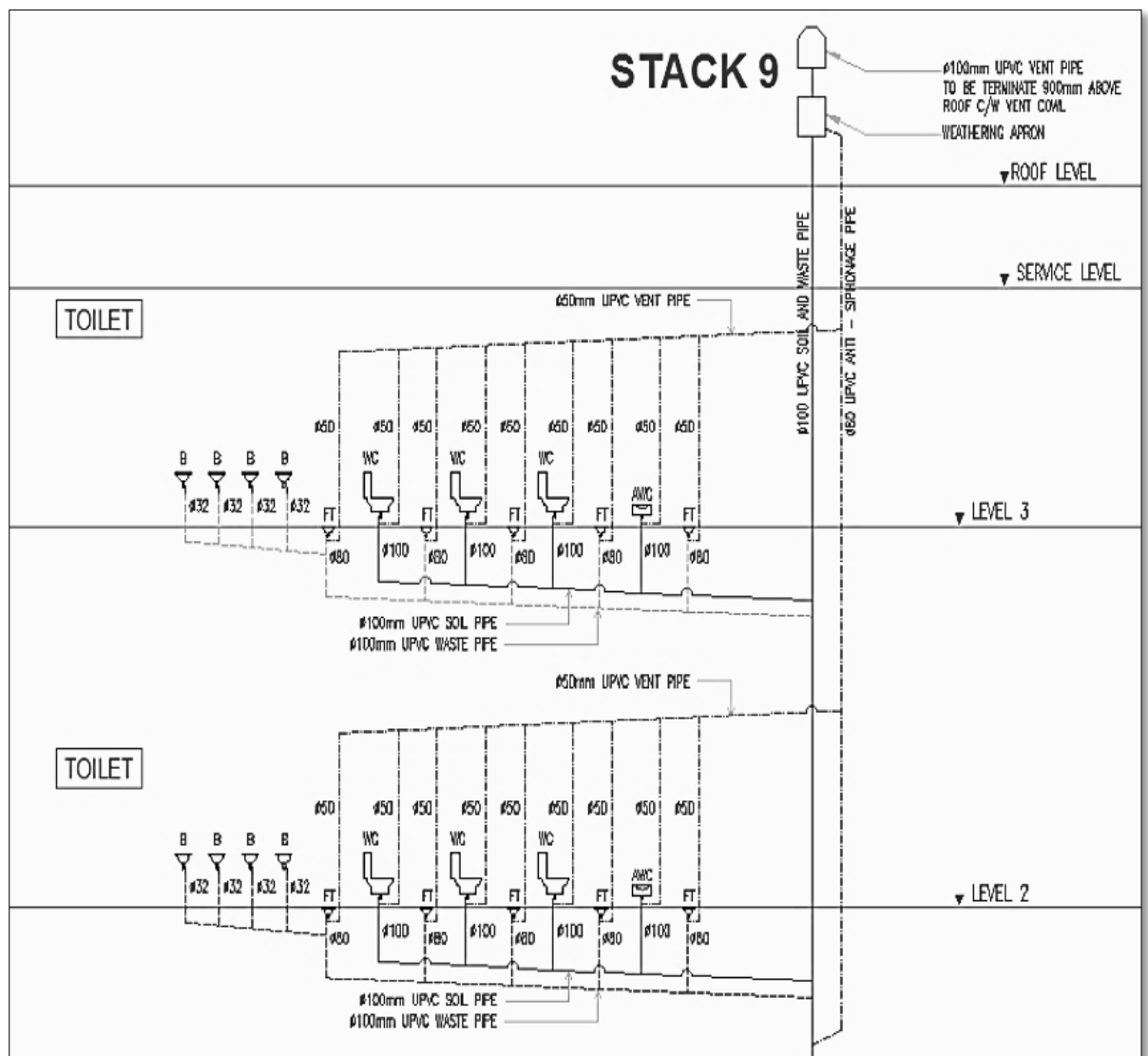


Figure 3c / Rajah 3c

Table 3c / *Jadual 3c*

| Sanitary appliances        | Capacity              | Discharge data                 |                      |
|----------------------------|-----------------------|--------------------------------|----------------------|
|                            |                       | Maximum flow rate<br>$1s^{-1}$ | Duration<br>(t)<br>S |
| Washdown Water Closet (WC) | 9                     | 2.3                            | 5                    |
| Urinal (per person unit)   | 2.5                   | 0.15                           | 30                   |
| Wash Basin (32 mm branch)  | 6                     | 0.6                            | 10                   |
| Sink (40 mm branch)        | 23                    | 0.9                            | 25                   |
| Long Bath (40 mm branch)   | 80                    | 1.1                            | 75                   |
| Automatic washing machine  | 4 kg to 5 kg dry load | 0.6                            | 30                   |
| Shower                     | -                     | 0.1                            | -                    |
| Spray tap basin            | -                     | 0.06                           | -                    |

[10 marks]

[10 markah]

**QUESTION 4****SOALAN 4**

CLO2

- (a) Estimate the diameter for the discharge stack and ventilating pipe if the total (DU) is 2000 DUs.

*Kenalpasti diameter paip tumpu dan paip pengudaraan jika jumlah (DU) adalah 2000 DU.*

[6 marks]

[6 markah]

CLO2

- (b) Figure 4b shows Manhole 1 (MH1), which has dimensions of 750 mm x 600 mm and its depth is 900 mm. The size of the pipe (sewer) used is 225 mm. Interpret the depth and determine the size of manholes 2,3 and 4 by referring to Figure 4b, Tables 6 and 7.

*Rajah 4b menunjukkan Manhole 1 (MH1), yang mempunyai dimensi 750 mm x 600 mm dan kedalamannya ialah 900 mm. Saiz paip (pembetung) yang digunakan ialah 225 mm. Tafsirkan kedalaman dan tentukan saiz Manhole 2, 3 dan 4 dengan merujuk kepada Rajah 4b, Jadual 6 dan 7.*

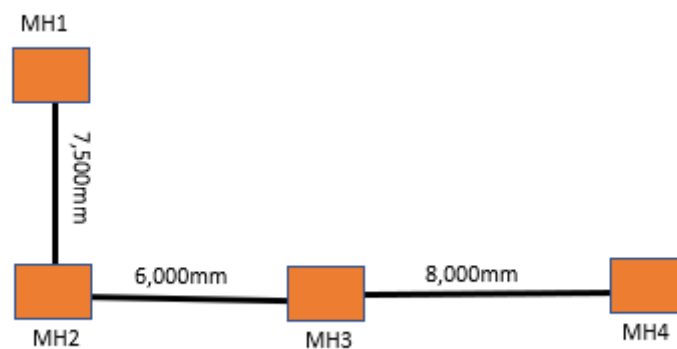


Figure 4b / Rajah 4b

[9 marks]

[9 markah]

CLO2

- (c) A drainage system in a residential area requires proper planning to ensure efficient wastewater flow and maintenance access. Manholes are installed at key points in the drainage network to allow for inspection, cleaning, and repairs. The depth and size of these manholes must be determined based on standard guidelines to ensure compliance with safety and functionality requirements. Based on Figure 4c, calculate the depth and determine the size of manholes (MH1, MH2, MH3, MH4, and MH5) by referring to Tables 6 and 7 given.

*Sistem saliran di kawasan perumahan memerlukan perancangan yang teliti untuk memastikan aliran air sisa yang efisien serta akses penyelenggaraan yang baik. Lurang dipasang di lokasi utama dalam rangkaian saliran bagi membolehkan pemeriksaan, pembersihan, dan pembaikan dilakukan. Kedalaman dan saiz lurang perlu ditentukan berdasarkan garis panduan standard bagi memastikan pematuhan terhadap keperluan keselamatan dan fungsi. Berdasarkan Rajah 4c di bawah, kirakan saiz lurang (MH1, MH2, MH3, MH4 dan MH5) dengan merujuk Jadual 6 dan 7 yang diberi dalam lampiran.*

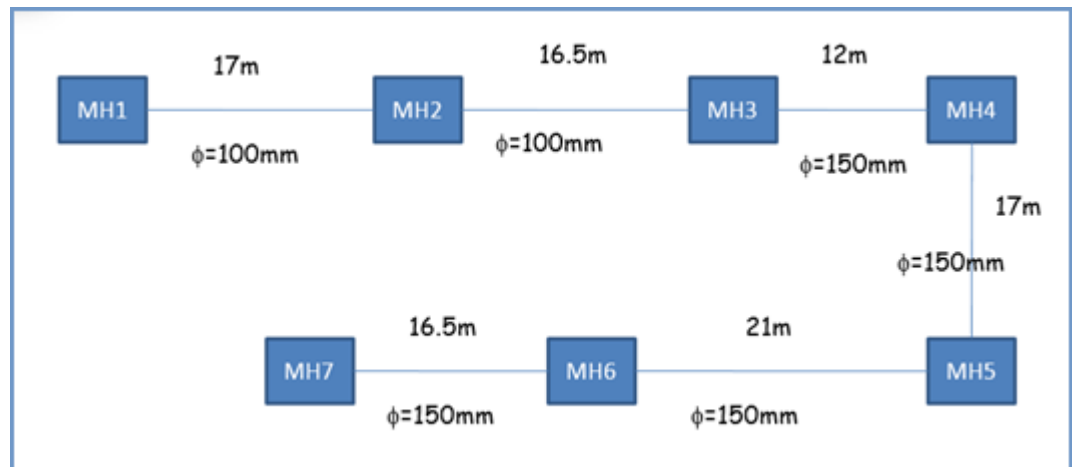


Figure 4c / Rajah 4c

[10 marks]

[10 markah]

**SOALAN TAMAT**

## LAMPIRAN

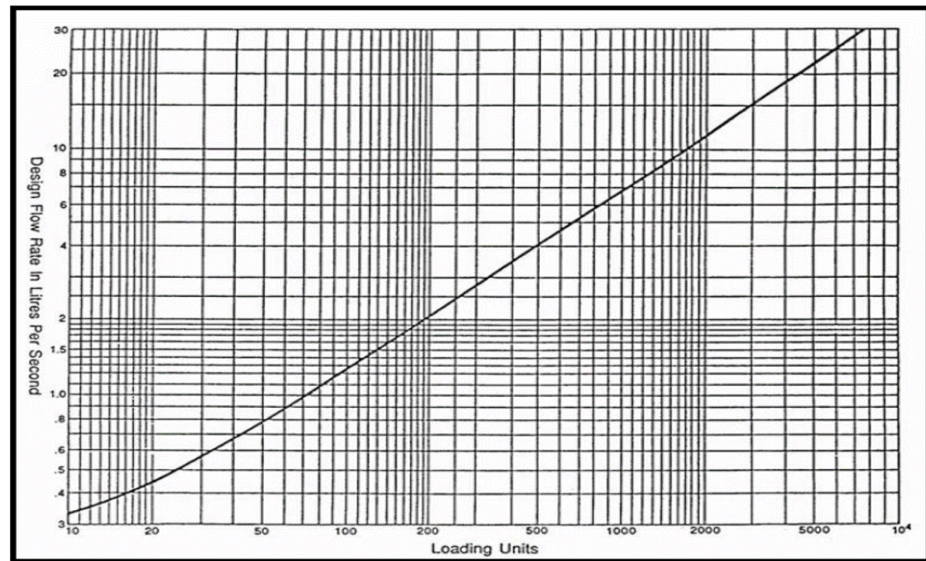


Table 1.1 gives the 'loading unit' rating for various appliances.

Table 1.1

|   | Loading unit rating |
|---|---------------------|
| <b>Dwellings and flats</b>              |                     |
| W.C. flushing cistern                   | 2                   |
| Wash basin                              | 1½                  |
| Bath                                    | 10                  |
| Sink                                    | 3—5                 |
| <b>Offices</b>                          |                     |
| W.C. flushing cistern                   | 2                   |
| Wash basin (distributed use)            | 1½                  |
| Wash basin (concentrated use)           | 3                   |
| <b>Schools and industrial buildings</b> |                     |
| W.C. flushing cistern                   | 2                   |
| Wash basin                              | 3                   |
| Shower (with nozzle)                    | 3                   |
| Public bath                             | 22                  |

*Note:* Certain sanitary appliances require a continuous flow of water throughout the whole of the time that they are being used. These include: ablution appliances fitted with spray taps, umbrella sprays, shower nozzles or similar fittings.

In buildings where high peak demands occur, a loading unit rating for such appliances is not applicable and 100 per cent of the flow rate for these appliances is required as shown in Table 1.2. The same applies to automatic flushing cisterns and for urinals.

Table 1.2 Recommended minimum rate of flow at various appliances

| Type of appliance          | Rate of flow (litre/s) |
|----------------------------|------------------------|
| W.C. flushing cistern      | 0.12                   |
| Wash basin                 | 0.15                   |
| Wash basin with spray taps | 0.04                   |
| Bath (private)             | 0.30                   |
| Bath (public)              | 0.60                   |
| Shower (with nozzle)       | 0.12                   |
| Sink with 13 mm taps       | 0.20                   |
| Sink with 19 mm taps       | 0.30                   |
| Sink with 25 mm taps       | 0.60                   |

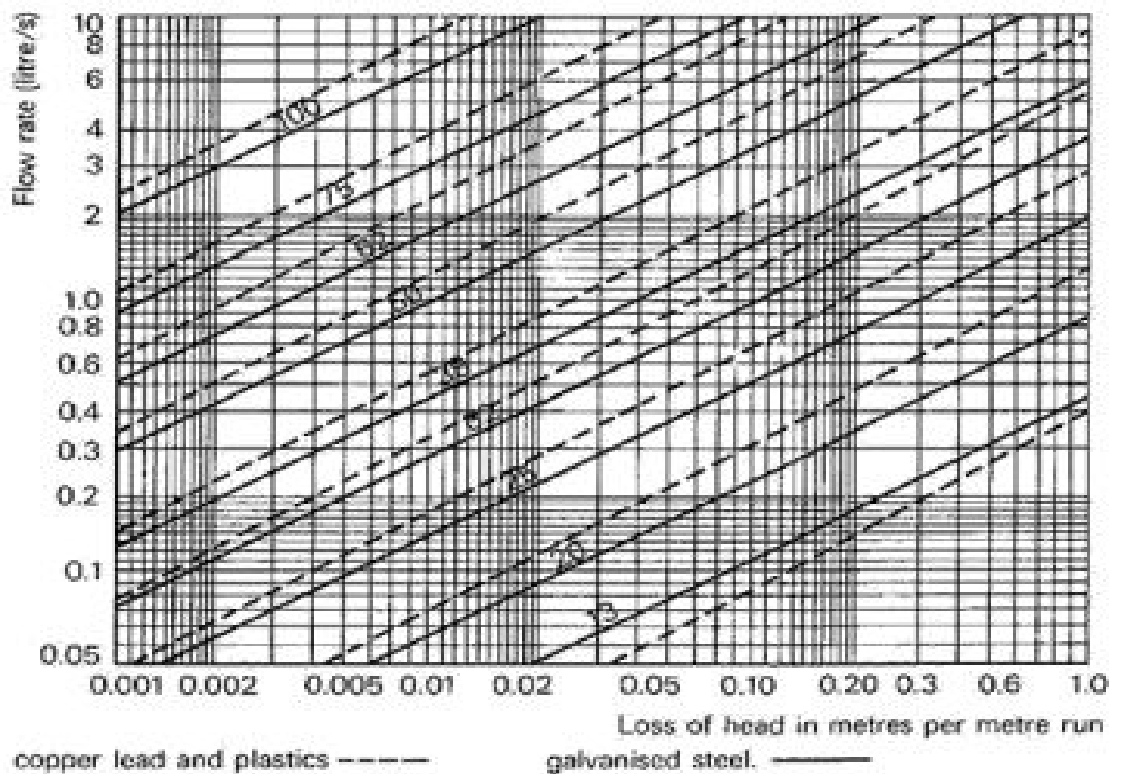
**Table 1.3** Frictional resistances of fittings expressed in equivalent pipe lengths

| Copper                        |                   |     | Galvanised steel              |                   |      |     |
|-------------------------------|-------------------|-----|-------------------------------|-------------------|------|-----|
| Nominal outside diameter (mm) | Metre run of pipe |     | Nominal outside diameter (mm) | Metre run of pipe |      |     |
|                               | Elbow             | Tee |                               | Elbow             | Bend | Tee |
| 15                            | 0.5               | 0.6 | 15                            | 0.5               | 0.4  | 1.2 |
| 22                            | 0.8               | 1.0 | 20                            | 0.6               | 0.5  | 1.4 |
| 28                            | 1.0               | 1.5 | 25                            | 0.7               | 0.6  | 1.8 |
| 35                            | 1.4               | 2.0 | 32                            | 1.0               | 0.7  | 2.3 |
| 42                            | 1.7               | 2.5 | 40                            | 1.2               | 1.0  | 2.7 |
| 54                            | 2.3               | 3.5 | 50                            | 1.4               | 1.2  | 3.4 |
| 62                            | 3.0               | 4.5 | 65                            | 1.7               | 1.3  | 4.2 |
| 76                            | 3.4               | 5.8 | 80                            | 2.0               | 1.6  | 5.3 |
| 108                           | 4.5               | 8.0 | 100                           | 2.7               | 2.0  | 6.8 |

In calculating the diameter of a pipe to supply individual fittings, the loss of head through the draw-off tap should also be taken into account. Table 1.4 gives the allowances for draw-off taps expressed in equivalent pipe lengths.

**Table 1.4** Frictional resistances of draw-off taps expressed as equivalent pipe lengths

| Fitting (BS 1010)                    | Discharge rate tap fully open (litre/s) | Equivalent length of pipe of same diameter as tap (m) |                  |
|--------------------------------------|---|---|------------------|
|                                      |   | Copper  | Galvanised steel |
| 15 mm diameter bib-tap or pillar tap | 0.20                                    | 2.70  | 4.00             |
| 20 mm diameter bib-tap or pillar tap | 0.30                                    | 8.50  | 5.75             |
| 25 mm diameter bib-tap or pillar tap | 0.60                                    | 20.00   | 13.00            |



**Fig.1.2** Pipe-sizing chart

**Table 1: Discharge unit values**

| <b>Appliance</b>              | <b>Application</b> | <b>Discharge unit value</b> |
|-------------------------------|--------------------|-----------------------------|
| WC                            | Domestic           | 7                           |
|                               | Commercial         | 14                          |
|                               | Congested/public   | 28                          |
| Basin                         | Domestic           | 1                           |
|                               | Commercial         | 3                           |
|                               | Congested/public   | 6                           |
| Bath                          | Domestic           | 7                           |
|                               | Commercial         | 18                          |
| Sink                          | Domestic           | 6                           |
|                               | Commercial         | 14                          |
|                               | Congested/public   | 27                          |
| Shower                        | Domestic           | 1                           |
|                               | Commercial         | 2                           |
| Urinal                        | -                  | 0.3                         |
| Washing machine               | -                  | 4                           |
| 1 group of WC, bath and basin | -                  | 14                          |

***Table 2: Discharge unit and stack diameter***

| <b>Nominal bore (mm)</b> | <b>Approximate no. of DUs.</b> |
|--------------------------|--------------------------------|
| 50                       | 10                             |
| 65                       | 60                             |
| 75                       | 200                            |
| 100                      | 750                            |
| 125                      | 2500                           |
| 150                      | 5500                           |

**Table 3: Discharge unit and branch discharge pipe**

| Nominal<br>bore<br>(mm) | Approximate no. of DUs.      |                               |                               |
|-------------------------|------------------------------|-------------------------------|-------------------------------|
|                         | Gradient                     |                               |                               |
|                         | 1//2 <sup>0</sup><br>(9mm/m) | 11/4 <sup>0</sup><br>(22mm/m) | 21/2 <sup>0</sup><br>(45mm/m) |
| 32                      | -                            | 1                             | 1                             |
| 40                      | -                            | 2                             | 8                             |
| 50                      | -                            | 10                            | 26                            |
| 65                      | -                            | 35                            | 95                            |
| 75                      | -                            | 100                           | 230                           |
| 90                      | 120                          | 230                           | 460                           |
| 100                     | 230                          | 430                           | 1050                          |
| 125                     | 780                          | 1500                          | 3000                          |
| 150                     | 2000                         | 3500                          | 7500                          |

**Table 4 : General guide for sizes of ventilating pipes**

| Branch or stack<br>diameter (D) | Ventilating pipe min.<br>diameter |
|---------------------------------|-----------------------------------|
| Up to 75 mm bore                | 2/3 D (min. 25mm)                 |
| Over 75 mm bore                 | ½ D                               |

**Table 5 : Discharge Flow Rate**

| Fitment           | Capacity<br>(l) | Discharge<br>flow rate<br>(l/s) |
|-------------------|-----------------|---------------------------------|
| Basin             | 6               | 0.6                             |
| Basin – spray tap | -               | 0.06                            |
| Bath              | 80              | 1.1                             |
| Shower            | -               | 0.1                             |
| Sink              | 23              | 0.9                             |
| Urinal            | 4.5             | 0.15                            |

|                 |     |     |
|-----------------|-----|-----|
| Washing machine | 180 | 0.7 |
| Water closet    | 6   | 2.3 |

| Saiz Paip | Nisbah Kecerunan |
|-----------|------------------|
| 100 mm    | 1:40             |
| 150 mm    | 1:60             |
| 225 mm    | 1:90             |
| 300 mm    | 1:100            |

Table 6: Pipe gradient ratio

*Jadual 6: Nisbah kecerunan paip*

| Kedalaman Lurang (mm) | Saiz Lurang (mm) |       |
|-----------------------|------------------|-------|
|                       | Panjang          | Lebar |
| Tidak melebihi 600    | 600              | 450   |
| 600-900               | 750              | 600   |
| 900-1500              | 750              | 750   |
| 1500-2400             | 900              | 1125  |

Table 7 :Manhole size

*Jadual 7: Saiz lurang*