

# ***Study Guide***

## ***Installation and maintenance of sanitary appliances and fixtures***

30553 (Version 1, Level 4, Credits 8) | 30555 (Version 1, Level 4, Credits 5)

Trainee Name \_\_\_\_\_

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**skills.**

# Unit Standards

## Unit standard 30553

People credited with this unit standard are able to:

- demonstrate knowledge of regulatory requirements and selection of methods and materials as applied to the installation and maintenance of sanitary appliances and fixtures
- describe the selection of appropriate sanitary appliances and fixtures
- describe the selection of appropriate sanitary appliances and fixtures
- describe the positioning of sanitary appliances and fixtures
- describe the installation, connection, and commissioning of sanitary appliances and fixtures
- describe the maintenance of sanitary appliances and fixtures

## Unit standard 30555

People credited with this unit standard are able to:

- identify components used in water supply systems
- record dimensions, mark, cut, join, and test water supply pipework
- identify components used in sanitary plumbing systems and their correct positioning
- record dimensions, mark, cut, join, and test pipework for foul water
- install sanitary fixtures in accordance with job requirements

This study guide can also be used for unit standard 30554; Select, position, install, connect, commission, and maintain sanitary appliances and fixtures.

The best way to use this Study Guide is:

1. Read through the following information step by step.
2. Where other resources are mentioned (such as websites), find and read them as well.
3. Complete the practice exercises, then check your answers.

# Contents

Unit Standards .....	1
Sanitary appliances and maintenance .....	1
Range of installations.....	2
Types of systems .....	2
Selection of appliances and fixtures.....	3
Sanitary fixtures.....	3
Water closet pans (WC).....	4
Bidet.....	4
Basin.....	4
Bath — with or without a shower over .....	5
Activity 1 .....	5
Means of compliance .....	6
Building Code Requirements .....	7
Building consents and exempt work .....	10
Working safely.....	11
Activity 2 .....	11
Position of sanitary appliances.....	12
Attachment of appliances/fixtures .....	12
Install sanitary appliances and fixtures .....	13
Drainage designed systems .....	13
Equipotential bonding .....	19
Activity 3 .....	20
Maintain sanitary appliances and fixtures, fix faults .....	21
Informing customers .....	21
Activity 4 .....	22
Specialist sanitary fixtures .....	23
Ablution Trough .....	23
Autopsy table .....	23
Bain Marie.....	24
Bar sink (commercial) .....	24
Bedpan Steriliser .....	24
Bedpan washer.....	25
Dental Unit.....	25
Drinking fountain.....	26
Glass washing machine (commercial) .....	26
Potato peeler .....	26

Laboratory sink .....	26
Job completion checklist .....	27
Activity 5 .....	28
Installation requirements .....	29
Activity 6 .....	29
Taps, mixers and valves .....	30
Activity 7 .....	34
Regulations for specialist fixtures/appliances.....	35
Activity 8 .....	36
Maintain specialist sanitary appliances and fixtures.....	37
Activity 9 .....	37
Activity answers .....	38

# Sanitary appliances and maintenance

Sanitary plumbing includes installing fixtures that provide washing and toilet facilities, piping water to them and piping their discharge to a drain.

Sanitary plumbing must comply with clause G13 of the New Zealand Building Code (NZBC). AS/NZS 3500.2 BS 5572 are acceptable solutions.

## Readings

As well as this Guide you should also read and be familiar with the following information sources:

- New Zealand Building Code Clause G1 Personal Hygiene
- New Zealand Building Code Clause G2 Laundering
- New Zealand Building Code Clause G3 Food Preparation and Prevention of Contamination
- New Zealand Building Code Clause G12 Water Supplies
- New Zealand Building Code Clause G13 Foul Water
- AS/NZS 3500.0 Glossary of terms & AS/NZS3500.1 Plumbing and Drainage — Water Services. This is the main reference guide to the national Standards which are the agreed specifications for installation of water services.
- AS/NZS 3500.2 Sanitary Plumbing and Drainage. This is the main reference guide to the national Standards which are the agreed specifications for installation of sanitary plumbing and drainage.

Note: All building code documents are free to download and print. AS/NZ standards can be accessed for free through MySkills on our website [www.skills.org.nz](http://www.skills.org.nz). These can be downloaded for free but are view only and cannot be printed.

Web resources and searches — do further research online wherever possible and use New Zealand web sites first. A good place to start is [www.level.org.nz/](http://www.level.org.nz/)

# Range of installations

## Types of systems

The Unit Standard requires you to understand how to install the following appliances/fixtures:

- basin
- bidet
- cleaner's sink
- dishwashing machine
- washing machine
- waste disposal unit
- laundry tub
- shower
- bath
- sink
- urinal
- water closet pan
- valves
- mixers and taps

AS/NZS 3500 Part 0 defines an appliance as “a piece of equipment....” designed to perform a task. The definition of fixture includes a “receptacle” designed for a specific purpose, with discharge into a sanitary plumbing/drainage installation.

Generally, an appliance will not need to have its own individual trap; rather, it can connect to the trap of an adjacent sanitary fixture. For example, a dishwasher (sanitary appliance) can discharge to the trap of a sink (a sanitary fixture).

Most installations will use very similar techniques; for example, connections to water supplies and discharge pipes may be the same or similar. You need to be prepared to provide evidence of your installation knowledge for all the above in your assessment.

For this reason, you should (if you haven't already) be keeping a detailed record of any of the above installations that you do in your job. This could either be electronic like an eportfolio, or hard copy e.g. photos etc.

# Selection of appliances and fixtures

Fittings will often be specified in a contract or they may be chosen by yourself or the client for example for bathroom fixtures that will have a significant influence on appearance.

## Sanitary fixtures

Depending on the situation and type of fixture, different Regulations may apply and the relevant codes and standards must be used to determine the required discharge pipe size and grade.

The New Zealand Building Code and in particular NZBC Clause G13 need to be considered when installing sanitary fixtures and appliances.

Some of the Codes that may be relevant include but are not limited to:

- G13 Personal Hygiene, G1 Personal Hygiene, G12 Water Supplies
- B2 Durability, B1 Structure, E3 Internal Moisture
- G2 Laundering, G3 Food Preparation and Prevention of Contamination, G4 Ventilation

Here is a quick summary of different fixtures and appliances:

- A **soil fixture** is a sanitary fixture designed to receive human waste. For example, WC pans, urinals, bedpan disposal units, slop sinks, and water-flushed sanitary towel disposal units. These are fixed permanently to the wall or floor.
- A **waste water fixture** is a sanitary fixture or sanitary appliance, such as a bath or basin, used to receive waste, and which is not a soil fixture.
- A **sanitary appliance** is connected to the water and waste system usually via a flexible hose, such as a dishwasher or washing machine.

### What is a discharge unit?

The NZ Building Code states a 'discharge unit' is the unit of measure for the discharge (hydraulic load) in the plumbing system. It is based on the rate, duration and frequency (how much, how long and how often) of discharge from a sanitary fixture or appliance.

Some typical discharge units and pipe diameters are listed below. You can view a more detailed list in G13 and AS/NZS 3500.2.

## Water closet pans (WC)

<b>G13/AS1 discharge units</b>	4	
AS/NZS 3500 Fixture unit rating	4	If cistern flushed
	6	If flushed by a flushing valve

- The minimum diameter discharge pipe from a WC pan is 80 mm. 100 mm is the generally accepted rule with 80 mm having special design considerations.
- WC pans can be floor-mounted or wall-mounted and must have a flushing system that will clear the contents of the pan. Pans are made of impervious materials (vitreous china or stainless steel) for easy cleaning. Pans must also be able to hold a full flush if they become blocked.

## Bidet

<b>G13/AS1 discharge units</b>	1	Min. trap / discharge pipe	32 mm
AS/NZS 3500 Fixture unit rating	1	Min. trap / discharge pipe	32 mm

A bidet is a personal washing pan with a water spray device delivering hot or cold water which may be above or below the fixture rim.

AS/NZS 3500.1 classifies a bidet as a high hazard cross connection rating.

## Basin

<b>G13/AS1 discharge units</b>	1	Min. trap / discharge pipe	32 mm
AS/NZS 3500 Fixture unit rating	1	Min. trap	32 mm
		Min. discharge pipe	40 mm

There are a wide range of basins available and they can be installed as a fixture pair.

A basin is required in a space containing a soil fixture or in an immediately adjacent space. The basin must be located in the same space as the soil fixture if the door opens into a household kitchen area.

Basins can be wall-mounted, floor-mounted standing on a pedestal, top-mounted in a vanity unit or wall-mounted in a corner.



## Bath — with or without a shower over

<b>G13/AS1 discharge units</b>	4	Min. trap / discharge pipe	40 mm
AS/NZS 3500 Fixture unit rating	4	Min. trap / discharge pipe	40 mm

A fixture containing water for washing and bathing.

### Taps, mixers and valves

As part of installing fixtures and appliances you will also be installing taps, mixers and valves. There will usually be at least one valve, mixer or tap associated with each installation.

Often taps and mixers come with their own installation instructions. It is important to take the time to read the instructions before starting the job. You may need to contact the supplier or manufacturer for more information on product specifications.

## Activity 1

1. A **soil fixture** is a sanitary fixture designed to receive \_\_\_\_\_ waste. For example \_\_\_\_\_, \_\_\_\_\_, \_\_\_\_\_, slop sinks, and water-flushed sanitary towel disposal units. These are fixed permanently to the wall or floor.
2. A basin is a sanitary appliance. True or False
3. What is the minimum discharge pipe size for a basin as per AS/NZS3500?

4. WC pans must have a minimum trap seal of \_\_\_\_mm and be large enough to hold a \_\_\_\_\_ if they become blocked.

***Check your answers at the back of the study guide.***

# Means of compliance

The Building Code is made up of a number of clauses. Each clause sets out the **objective** of the clause, the **function** or how well it must work and the **performance** or what the minimum standard is that must be achieved. One example is G13. This clause includes compliance documents for the supply of sanitary plumbing and includes two Acceptable Solutions, that is G13 AS1 and G13 AS3 (AS/NZS 3500.2).

Installations completed according to G13 will be compliant with the Building Code.

G13 also refers to other Clauses, Regulations and Standards that may or must be used as an alternative to prove compliance, for example the AS/NZS 3500 series.

Getting to know the Regulations and working with your local building consent authority to meet them is a big part of your job.

## Acceptable Solutions

Building Code Compliance Documents are acceptable solutions – Pre-approved ways of completing work to comply with the New Zealand Building Code and therefore the Building Act.

## Alternative Solutions

In situations where it is impractical to complete the work to the specifications included in the New Zealand Building Code clauses, it is possible to design a different way to complete an installation to meet the objectives of the code. This is referred to as an 'alternative solution.'

An alternative solution must be approved by the local regional council or territorial authority.

If you intend to use an alternative solution you will need to supply information proving how the solution meets the objectives to the building consent authority (council) before construction has started.

## Verification Methods

Verification methods are included within the New Zealand Building Code clauses.

They are test procedures or calculations that can be used to prove an installation design will comply with the code.

## Other legislation, standards and codes

Other regulatory requirements include the:

- Plumbers, Gasfitters and Drainlayers Act 2006
- The Health and Safety at Work Act 2015
- The Building Act 2004
- The Health (Drinking Water) Amendment Act 2007
- AS/NZS 3500.1
- AS/NZS 3500.2

Make sure that you are familiar with these requirements and how they affect your work.

## Building Code Requirements

To obtain a Building Consent for a water heating installation, the installation must comply with the relevant sections of the Building Code. Relevant clauses for water heating systems are:

B1 Structure, B2 Durability, E2 External Moisture, G12 Water Supplies, and H1 Energy Efficiency.

Some of the Codes that may be relevant when installing sanitary fixtures and appliances are detailed in the next pages.

### B1 Structure

The structural integrity of the building must be considered when:

- notching or boring through structural parts of the building
- locating water flushing tanks in ceilings
- relying on framework to support sanitary fixtures

### B2 Durability

All components of the sanitary plumbing system must be durable as they are subject to constant use over the life of the building.

The durability requirements are:

- 50 years for plumbing difficult to access, such as pipework cast in concrete or under slabs
- 15 years for plumbing moderately difficult to access, such as plumbing behind wall linings
- 5 years for surface mounted plumbing such as fixtures and appliances

### G1 Personal Hygiene

Functional requirement — Buildings shall be provided with appropriate spaces and facilities for personal hygiene.

Important considerations under G1 are:

- the number of sanitary fixtures required in a building
- accessible facilities required for people with disabilities
- privacy — line of sight into sanitary rooms
- protection from unpleasant odours and offensive matter
- installation to provide ease of cleaning
- location and dimensions for sanitary rooms, including required layout and dimensions of accessible toilets and shower rooms

### **G13 Foulwater**

Requirements are:

- to convey foulwater from a building to a drainage system
- to prevent foul air entering a building
- to avoid the likelihood of blockages

### **G12 Water Supplies**

Functional Requirement — Buildings provided with water outlets, sanitary fixtures or sanitary appliances must have safe and adequate water supplies.

Important considerations under G12 are:

- safe hot water temperatures at fixtures
- cross connection hazards
- backflow prevention requirements for sanitary fixtures and appliances
- fixtures and appliances for utensil and personal washing to be provided with hot water in houses, retirement homes and early childhood centres
- acceptable water supply flow rates to sanitary fixtures

### **E3 Internal Moisture**

Objective of E3:

- to safeguard people against illness, injury and loss of amenity (a feature which provides comfort or convenience) resulting from the accumulation of internal moisture
- to protect other household units in the same building from overflow or spillage

When installing sanitary fixtures the following must be considered:

- adequate ventilation to remove moisture
- overflow provisions (floor drains)
- impervious (waterproof) and easily cleaned floor and wall surfaces
- impervious and easily cleaned fixture surfaces
- fixtures sealed in position to prevent water becoming trapped or penetrating into concealed spaces

It is therefore important to ensure that:

- fixtures such as toilet pans are well secured and sealed to the floor or wall.
- concealed spaces such as behind basins, urinals, showers and around baths must also be well sealed

### **G2 Laundering**

This covers the requirements for providing laundry facilities in buildings.

## **G3 Food Preparation and Prevention of Contamination**

Requirements for hygienic space and facilities for storage, preparation and cooking of food in domestic, commercial and industrial facilities.

## **G4 Ventilation**

This code ensures that buildings have adequate fresh air.

It requires that cooking fumes and odours, moisture from laundering, washing and bathing, and odours from sanitary rooms are vented outside the building. This can be achieved by natural ventilation (opening windows or trickle ventilators) or mechanical ventilation.

## **F2 Hazardous Building Materials**

Safety glazing is required in sanitary rooms to fixtures such as shower doors. Windows must be outside a 'fall zone' (where people will cut themselves if they come into contact with glass). This may be by using safety glass or some type of barrier.

## **F8 Signs**

Signs shall be provided to identify accessible routes and the availability of facilities for disabled people.

## **D1 Access Routes**

Siting of accessible sanitary fixtures must take into account access to allow people with disabilities to be able to use the facilities.

## **C1, C2, C3, C4 Fire Safety (The C Docs)**

These codes are relevant when pipework serving sanitary fixtures penetrates a fire separation. Collars or fire wraps must be used as required by the fire protection engineer to ensure the integrity of the fire wall.

## **G14 Industrial Liquid Waste and G15 Solid Waste**

These codes are particularly relevant in commercial and industrial installations.

## **F7 Warning systems**

To achieve Code of Compliance for all household building work, smoke alarms must be located to wake sleeping occupants. They must be positioned within three metres of a bedroom door.

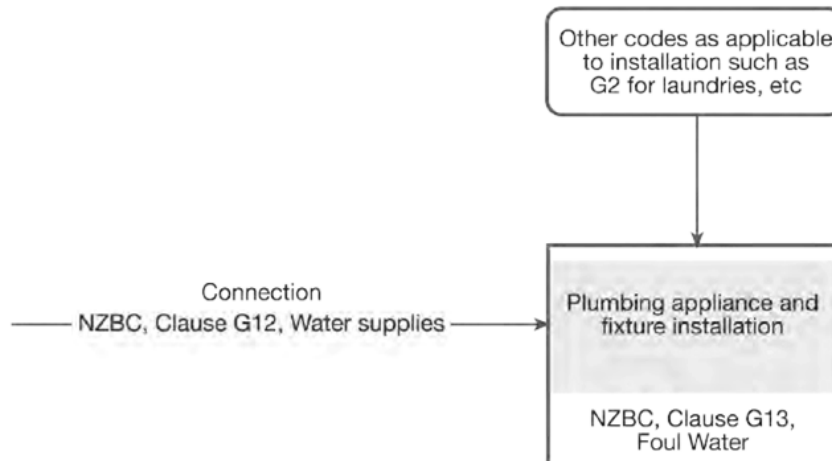
## **H1 — Energy efficiency**

This clause covers all aspects of a building structure in terms of energy efficiency. For water heating systems, it sets out the requirements for insulation of hot water storage vessels and pipes. Larger systems and the associated piping and controls are not controlled by the NZBC. Clause H1 includes a means of minimising pipe runs to conserve water and energy.

## Schedule 1 of the New Zealand Building Code

This schedule identifies building work (including plumbing work) for which a building consent is not required. However even when a Building Consent is not required (is exempt), the NZ Building Act 2004 requires that plumbing work must still be carried out as if a consent had been obtained and be undertaken by a suitably qualified tradesman.

The diagram below shows how different Clauses and their requirements combine when installing a laundry appliance or fixture.



*Influence of the NZBC Clauses on appliance and fixture installation*

## Schedule 2 of the New Zealand Building Code

This schedule lists buildings which require facilities for disabled persons, which usually means any building to which the public are admitted.

## Building consents and exempt work

As discussed sometimes building consent is not required when undertaking plumbing and drainage work, however plumbing work must still be undertaken by a suitably qualified tradesman, and a certifying plumber is required to supervise work carried out by licensed plumbers and limited certificate holders (apprentices). It must still comply with the NZBC (New Zealand Building Code).

The Plumbers, Gasfitters and Drainlayers Act 2006 is designed to give the public assurance that the person who is carrying out the plumbing or gasfitting work at their building is well-trained and competent.

**Note:** A building consent is not required for a range of repairs and maintenance jobs – but these jobs must be carried out by authorised plumbers and drainlayers.

This exemption enables a range of work relating to the repair, maintenance and replacement of sanitary plumbing or drainage to be done without a building consent (if it is carried out by an authorised person).

For repairs and maintenance, comparable materials must be used. For replacement work, comparable components or assemblies can be used providing the replacement is in the same position.

Some examples are:

- replacing an existing sanitary fixture with another comparable fixture in the same position (e.g. replacing a vanity with a vanity, or replacing a toilet pan and cistern with a close-coupled toilet suite).
- a section of glazed earthenware foul water drain is damaged in an earthquake and requires replacement. The drainlayer proposes to replace the damaged section with uPVC. This is considered to be a comparable component.

Check the website <https://www.building.govt.nz/> for more information on building consents and exempt work.

## Working safely

When working with sanitary plumbing fixtures and appliances, the main safety issues will be to do with lifting moderately heavy objects of an awkward size and shape. These objects may have sharp edges, and so gloves should be worn. When replacing fixtures, especially those made of vitreous enamel, special care must be taken with broken items.

As you do the installation work your assessor will be checking that you are following all of the workplace safety and health requirements — in accordance with the Health and Safety at Work Act 2015 (HSWA), including requirements around lifting.

Refresh your health and safety knowledge by going back over your resources and notes.

The WorkSafe website also has information on health and safety requirements, and you can search by topic and industry.

## Activity 2

1. What is a design which includes a different way to meet the objectives of the building code?

2. What do you call a calculation that can be used to prove an installation design will comply with the code?

***Check your answers at the back of the study guide.***

# Position of sanitary appliances

There are two separate requirements when positioning sanitary appliances and fixtures:

1. Positioning according to the NZBC requirements (regulatory).
2. Positioning according to the plans or owner requirements.

Compliance with NZBC is usually covered by Clause G13 or AS/NZS 3500.2. There are exceptions such as installations which also must be compliant with Clause G2.

AS/NZS 3500.2 provides extra information and dimensions that may be helpful.

Before finalising positions of fixtures (and especially before drilling any holes), you should check it is within your plan and in accordance with Clause G13 or AS/NZS 3500. This is to make sure that the connections match the interface with the plumbing system, for example vent positions/trap positions and connections to a stack.

A structural element position like a wall, joist etc. may prevent you from making a connection to an appliance such as a WC that is within Clause G13. If the fixture position is critical, building elements may need to be altered by a builder.

**Note:** *The structural integrity of the building must not be compromised.*

Remember, refer to NZBC B1 to check that you have complied with the requirements.

At the time you measure and mark positions, you must check that floors and walls are level, plumb and can safely hold or secure the fixture or appliance you are about to fit.

## Attachment of appliances/fixtures

When appliance/fixtures are fastened in position you need to remember to:

- follow the manufacturer's installation instructions
- make sure that you don't compromise the structural strength of the building when drilling and cutting holes
- appropriately support and fasten the appliance/fixture, e.g. use washers and fasteners that are secure and strong enough
- consider access for maintenance
- install equipotential bonding for sanitary fixtures if required (see G12/AS1 section 9)



# Install sanitary appliances and fixtures

Building Code clause G1 personal hygiene covers the installation of sanitary fixtures, including:

- the number and type of sanitary fixtures required, depending on the type/use of building
- fixture construction and installation for fixtures such as WC pans, urinals and showers
- location of sanitary fixtures
- access and number of facilities for people with disabilities
- privacy requirements

When you install sanitary appliances your waste connections usually go to floor drains, floor waste gullies, soil stacks or waste pipes terminating over a gully. These are effectively the disposal service termination points.

In New Zealand we use the design systems outlined in NZBC Clause G13 and AS/NZS3500.2 as a means of compliance.

Foul water systems will be discussed more in depth in study guide 30542.

## Drainage designed systems

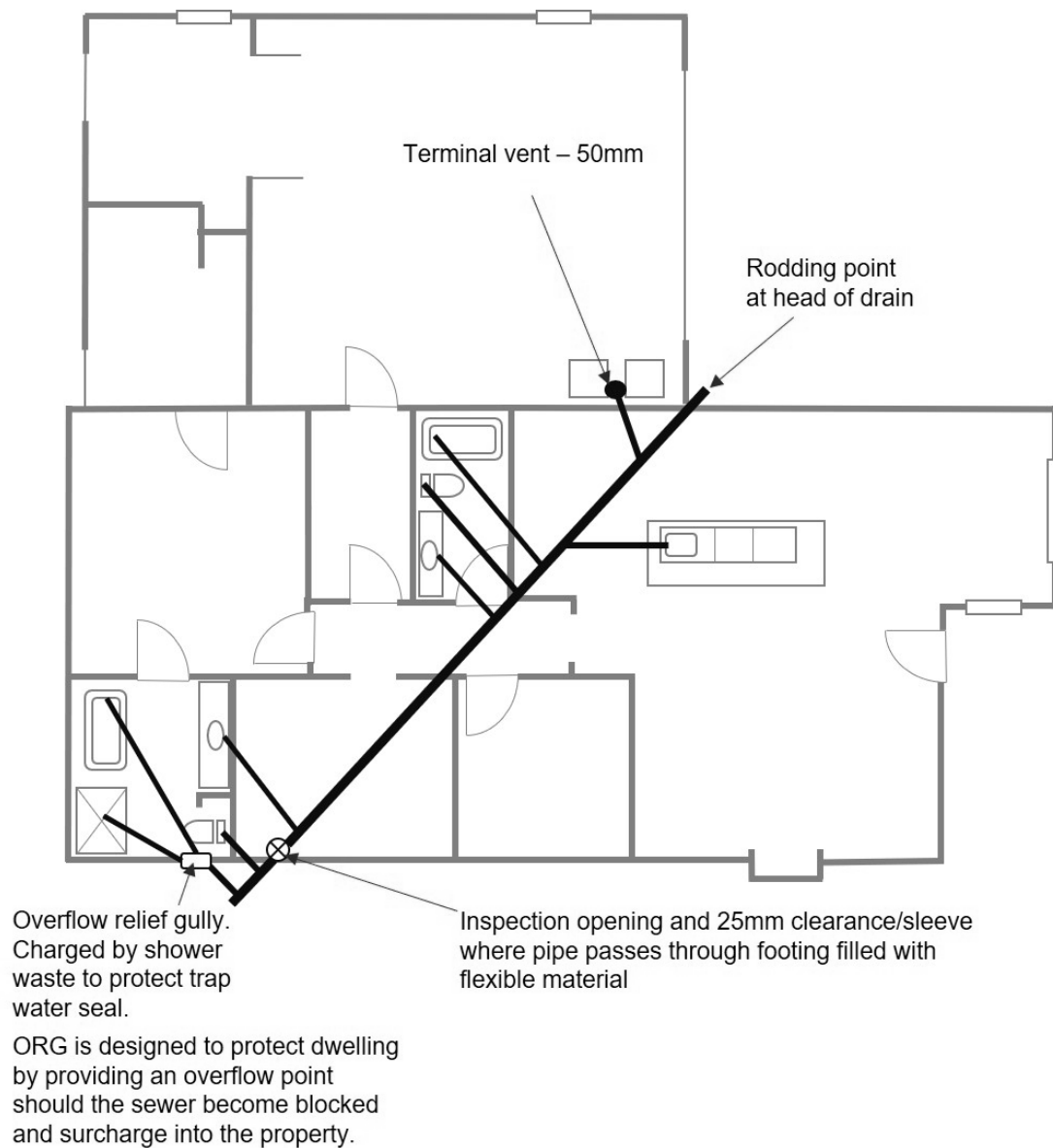
### **Under floor systems**

Under NZBC, Clause G13/AS2:

- a waste and soil pipe system can be installed under a concrete slab or under floor using single discharge pipes
- waste pipes connect to gully traps — below the gully trap grating, but above the water seal
- soil pipes connect directly to the foul drain
- the dwelling must be protected should the council sewer surcharge. One gully trap must be sited at least 150 mm below the overflow level of the lowest fixture so that any surcharge will not flow inside the building. This measurement can vary according to Network Utility Operator rules
- the main drain (foul drain) is vented by a terminal vent

## Installations using drainage principles

Pictured below is a typical one-pipe ground floor (under floor or under slab) sanitary plumbing layout using AS/NZS 3500.2 requirements which can be used to comply with NZBC Clause G13. G13/AS3 states that many parts of AS/NZS 3500.2 are an Acceptable Solution for plumbing and drainage.



### Typical underfloor design

**Note:** This is only one way of installing the sanitary plumbing system in this dwelling. AS/NZS 3500 allows a range of options when installing an under floor or under slab system.

The main drain is run in 100 mm to the WC in the main bathroom with the terminal vent taken off as the second to last fitting. The bathroom fixtures can drain to floor waste gullies if desired.

## Above ground pipework

Pipework above ground level can be installed using the same principles that are used for below ground drainage. A pipework system using drainage principles is another above ground sanitary plumbing system which is permitted under G13/AS3 — using guidelines in AS/NZS 3500.2.

Design of stacks using drainage principles is based on the same requirements as under slab or below ground drainage systems, including pipe gradients and fixture unit loadings.

The advantages of this system are:

- unvented branches can be longer — up to 10 m from the weir of the trap to the main drain
- the horizontal branch drains can be combined before connecting to the stack, but not exceed 10 m from the most distant fixture to the main drain

## Maximum fixture unit loading requirement for unvented branch drains

65 mm	5 fixture units or 10 fixture units from a single floor waste gully.
80 mm	12 fixture units. One toilet pan may be fitted.
100 mm	30 fixture units. A maximum of two toilet pans can be fitted. If three or more toilet pans are installed on a branch drain, a 50 mm vent is required.

It is important to remember that all branch connections to a system using drainage principles must be made to the horizontal section of the pipework system.

The discharge pipe must not have a vertical drop from the crown of the trap to the invert of the branch drain of more than:

- 2 m for a WC with an 80 mm discharge pipe
- 1.5 m for basins and bidets with an S trap
- 2.5 m for all other fixtures

Where the fixture discharge pipe is the same size as the unvented branch drain, the drain from the trap can have a maximum of two vertical drops (maximum of 2 m). There must be at least 300 mm of graded pipe between drops.

This applies to the first four floors only, in a multi-storey building. However, the exception is the top floor branch drain which may connect to the vertical section of the stack. Above the fourth floor the vertical pipework is treated as a stack when connections are made to it.

## Floor drains

Floor drains are often installed to protect the surrounding area or areas on floors below from accidental spillage or overflow. The NZ Building Code requires separate dwelling units in the same building to be protected from accidental overflow or spillage in rooms containing sanitary fixtures.

Floor drains must:

- be designed for the removal of accidental overflow or spillage
- have a grating which is removable, and finish flush with the floor so it will not be a hazard
- must not be used for human waste
- be a minimum of 40 mm in diameter

A floor drain may be installed without a trap providing the following conditions are met:

- the floor drain must discharge to the open air above ground in a safe place within the property
- the floor drain cannot be directly connected to any drain
- the floor drain must be fitted with a means to prevent entry of birds and vermin

A floor drain may be installed with a trap providing the following conditions are met:

- the floor drain discharges 50 mm above the grating of a gully trap
- the floor drain must be vented — see figure 3 G13/AS1
- the trap water seal must be charged (may be lost through evaporation). This can be achieved by a tap, cold water cylinder relief drain or a mechanical trap priming device
- an 'air gap' (normally achieved by using a tundish) or some form of backflow prevention must be maintained between the floor drain water seal and the charge water
- floor drains may be combined to form a floor waste stack which must be vented

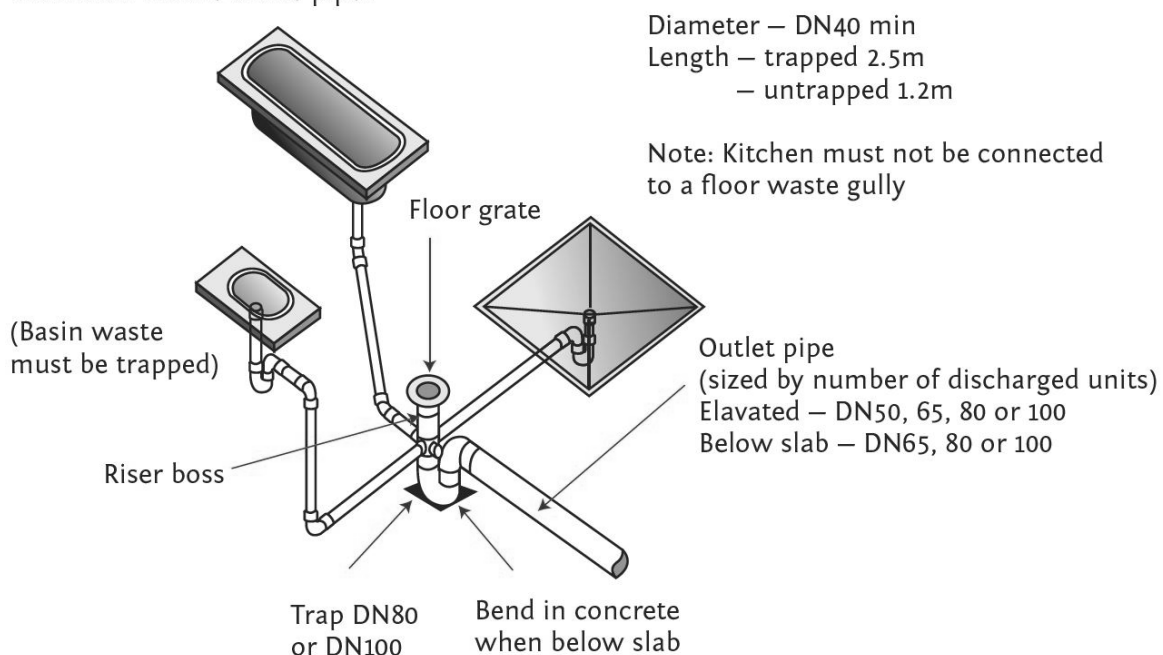
## Floor waste gullies (FWG)

AS/NZS 3500 allows the use of floor waste gullies to drain wet areas such as bathrooms and can also be used to receive the discharges from some waste water sanitary fixtures.

There are strict requirements for the installation of floor waste gullies and section 4.6.7 of AS/NZS 3500 should be read thoroughly to ensure those requirements are met.

- shower wastes can be used as floor waste gullies
- care must be taken, particularly in upper floors that there is enough space available to fit a FWG and the required riser to the floor level
- the water seal in a FWG must be charged in the same way as a floor drain if it is likely to be lost through infrequent use
- fixtures likely to cause foaming, such as washing machines should not be connected through a FWG
- only fixtures in the same room can be connected to a FWG, apart from tundish drains from water heaters, condensate drains, and so on. Tundish drains cannot be more than 10 m in length
- all waste pipes connected to a floor waste gully must have a grade of 2.5% or 1:40
- a waste pipe connected to a FWG must not exceed 1.2 m if it is untrapped, and 2.5 m if it is trapped. Table 4.4 in AS/NZS 3500 lists the fixtures that can be connected to a FWG
- basins and drinking fountains must be trapped when connected to a FWG
- many fixtures are not permitted to be connected to a floor waste gully, such as sinks and urinals
- only one bath can be connected to a FWG
- soil fixtures cannot discharge to floor waste gullies

Individual fixture waste pipes



Floor waste gully

The pipe lengths cannot be increased. Ventilation pipes cannot be connected to waste pipes discharging to a floor waste gully.

The riser to the floor grate into which the wastes are connected must be either 80 mm or 100 mm in diameter. This can be reduced to 50 mm if the FWG is only used for spillage or wash down water.

The height of the riser from the water seal to the floor level is governed by the riser size and the angle at which the waste pipes enter.

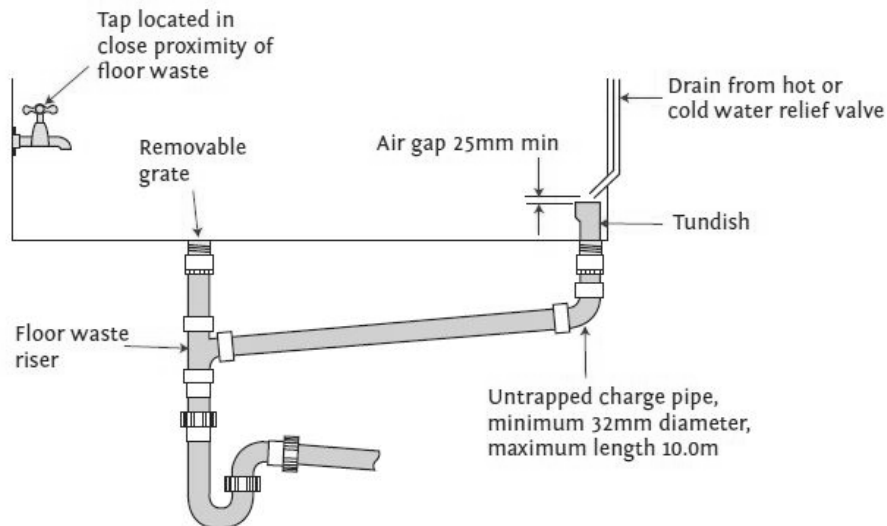
Height of floor gully riser		
Riser size	Minimum height	Minimum height
	88.5° waste pipe entry	45° waste pipe entry
80 mm	200 mm	150 mm
100 mm	150 mm	100 mm

Some fixtures can be connected to a submerged inlet FWG. In this case the waste pipe becomes part of the FWG water seal as it drains into the FWG below the level of the water seal. Only certain fixtures are allowed to connect in this manner — see table 4.4 and figure 4.2A in AS/NZS 3500.

## Tundishes

A tundish is basically a funnel — they are installed to provide an air gap in drain lines from water heater relief valves, air conditioning units, condensate lines, and so on. Tundishes are often used to provide a small flow of water to maintain the water seal in a trap which is not often used, for example, a trapped floor drain.

G13/AS1 requires any charge pipe maintaining the water seal in a floor waste to have some form of backflow prevention. A tundish can be used for this purpose as it provides an air gap.



### *Tundish*

As previously stated, water supply connections are covered by Clause G12 — Water supplies. Waste disposal is covered by Clause G13 Foul water and in AS/NZS3500.2 Sanitary Plumbing & Drainage.

Note that G12 Section 3.1 covers prevention of backflow and also has provision for the installation of backflow prevention devices.

3.1.1 Water drawn from the water main shall be prevented from returning to that system avoiding cross connections or backflow.

## Equipotential bonding

Bonding must be carried out on metal sanitary fixtures in certain situations. The bonding requirements are covered in Section 9 of G12/AS1. It was also covered off in study guide 30605. Read through this and then test your knowledge on the following activity.

## Activity 3

1. What are the conditions that are likely to require equipotential bonding?

Find the following regulatory installation information in AS/NZS 3500.2 Section 13 Fixtures and Appliances and G13.

Then answer these questions.

2. What is the general installation requirement for securing a fixture in terms of support?

3. Refer to AS/NZS 3500.2 Section 6 6.4 Trapping of fixtures and appliances on page 72. Which fixture may be connected in pairs to a single trap?

4. Refer to G13 to find special requirements for the trapping of a pair of kitchen sinks. What must all waste water discharge pipes incorporate that is connected directly to the fixture?

5. If water traps are not removable, what must they be fitted with?

***Check your answers at the back of the study guide.***



# Maintain sanitary appliances and fixtures, fix faults

Maintenance will be required on sanitary plumbing fixtures and appliances and their associated tapware as they are subject to the effects of heat, chemical make-up of water supply, nature of wastewater and the wearing out of moving parts. Maintenance of supply pipework and outlet connections is necessary for similar reasons.

Manufacturer's instructions often include maintenance requirements, e.g. suitable cleaning requirements.

Make it easier to maintain fixtures and appliances by installing openings in pipework, e.g. inspection openings, and fitting isolation valves to the inlet water supply.

Typical maintenance problems include:

- water traps leaking
- tap washers worn out by heat, debris or excessive operator force
- worn out/stiff mixers
- incorrectly tightened water supply connections
- WC connections leaking
- WC adjustments — water level in cisterns
- leaking connections — either on inlet side or outlet — can be very problematic if hidden in walls
- effects of water hammer on water supply connections
- blocked water traps
- incorrect installation leading to blockage — i.e. fall of discharge/venting etc
- incorrect discharge pipe size
- incorrect connection positions

What are your own maintenance nightmares? Have you come across any of these problems on jobs where you have had to troubleshoot?

Following on from this, remember back to an appliance or fixture that you have been involved with installing. This will help you to complete the activity on the following page.

## Informing customers

If there are any changes to the work you have been scheduled for, it is important to let the customer know so that they can make an informed decision.

For example, if there is a work change that was not planned and accounted for, you should go over the options and explain the cost and time involved to the customer.

If you are called to do a repair job, give a summary of what the fault was and how you fixed it in non-technical language so that the client can understand.

## Activity 4

1. Review the installation of an appliance or fixture that you have worked on.
  - What was the job specification and specific Standards/Codes used?
  - Compare the connections to the specifications. Are they all in the correct locations (vent, water seal detail, discharge)?
  - What holes were drilled? Was any part of the structure altered?
  - What techniques did you use for fastenings and positioning? How did you decide where to position and which fastenings to use? Did you follow the manufacturer's specifications or did you do something else?
  - What commission tests did you carry out?
  - What faults did you discover if any?

Reviewing installations helps you build your knowledge and experience — helping you become better and better in your trade.

***Check your answers at the back of the study guide.***

# Specialist sanitary fixtures

G13 Foul Water does not cover specialist types of sanitary fixtures and appliances in buildings such as hospitals, laboratories and factories.

Some specialist fixtures and appliances are covered in AS/NZS 3500.2.

Refer to Table 6.1 for fixture rating units and minimum discharge diameters. Many specialist fixtures and appliances are deemed 'high hazard' when considering backflow prevention, to protect the potable water supply.

For specialist fixtures not covered by G13/AS1 or AS/NZS 3500, the contractor should consult with the local Building Consent Authority.

## Ablution Trough

AS/NZS 3500 Fixture unit rating	3	Min. trap / discharge pipe	40 mm
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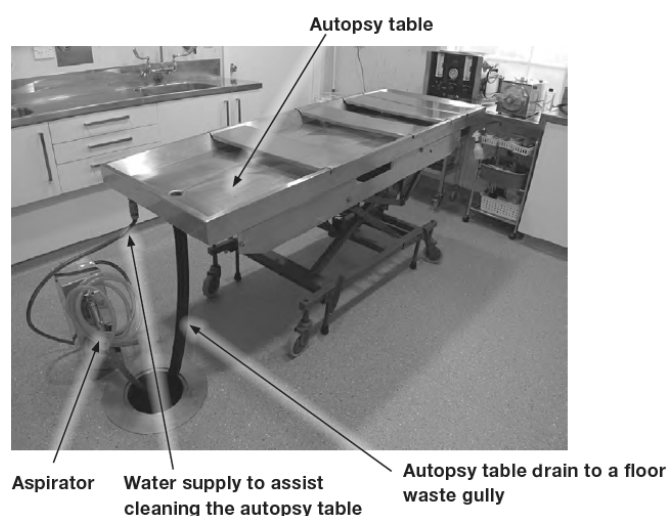
An ablution trough is a fixture for holding water for cleansing purposes which has a number of taps spaced for multiple use. These are most commonly found in factories, schools, public toilets and medical scrub up areas.

AS/NZS 3500 — can discharge to a FWG, a vented drain or a disconnector gully trap (a disconnector gully provides disconnection by means of a water seal from the waste discharges and the sewer system).

## Autopsy table

AS/NZS 3500 Fixture unit rating	3	Min. trap / discharge pipe	50 mm
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The picture below shows an example of an autopsy table. The picture also shows a device known as an aspirator (the aspirator will be discussed in the section on tapware later in this Guide).



An autopsy table is a fixture on which post-mortem examinations are performed and which has provision for drainage to the sanitary plumbing system. The table is usually made of stainless steel with a raised edge to prevent blood and fluids spilling onto the floor and is slanted to a drain point.

It is normally waist height with several mixers and flushing valves fitted to allow easy facilitation of flushing the organic matter and blood away, carried out by the autopsy process.

Some tables come with special features such as:

- medical vacuum and air supply points
- overbody or integral cutting boards / tables
- water spargers for dissecting areas
- lever action mixer taps

Nearly all of this equipment is pre-made by the manufacturer to allow for easy installation by simply adding the supply and discharge connections as per the code.

## Bain Marie

AS/NZS 3500 Fixture unit rating	1	Min. trap / discharge pipe	40 mm
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A bain-marie is a fixture designed to heat or cook food by using heated water to supply heat to the container holding the food. They can be called 'double boilers' and are often used in commercial food production.

## Bar sink (commercial)

<b>G13/AS1 discharge units</b>	3	Min. trap / discharge pipe	50 mm
AS/NZS 3500 Fixture unit rating	3	Min. trap / discharge pipe	50 mm

A sink specifically designed for use in bars and similar situations for rinsing beer, spirits and wine swill from glasses prior to placing them in a glass washer or sterilizer.

## Bedpan Steriliser

AS/NZS 3500 Fixture unit rating	4	Min. trap / discharge pipe	50 mm
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A fixture designed for sterilising bedpans using very high water temperatures and steam. Note the smaller discharge pipe as this fixture is designed to use small amounts of water.

## Bedpan washer

AS/NZS 3500 Fixture unit rating	6 - flush valve	4 - cistern flush	Min. trap / discharge pipe	80 or 100 mm
---------------------------------	-----------------	-------------------	----------------------------	--------------

A fixture into which bedpans and urine bottles are emptied or cleaned. It will incorporate some form of flushing device. Note this fixture has a larger discharge pipe designed to use larger amounts of water to flush waste and soil materials.

Bedpan washer assemblies normally include a pull down spring loaded flexible hand spray with positive shut off, volume control and a pressure vacuum break.

These are normally fed via a flushing cistern and the pan is “washed down” just like a WC, under rim style.

Bedpan washers are most commonly found in hospitals or aged care facilities, and they are sometimes used in conjunction with a slop hopper. (Take a look at AS/NZS3500.0 for a description of a slop hopper or do a web search).

## Dental Unit

AS/NZS 3500 Fixture unit rating	1	Min. trap / discharge pipe	40 mm
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Dental equipment covers a wide range of specialist applications. Primarily they are used for oral health care. Often, suction equipment will be involved, and backflow prevention is an extremely important consideration.

The most common item is the Cuspidor, this unit allows the patient to rinse, mouthwash and spit the remains of the dental procedure into the porcelain bowl.

It also has a vacuum function to help remove saliva, blood and filling debris from the mouth.

Most of these units come as pre-made installations from the manufacturer (supply and discharge connections will need to be installed as per the code).



## Drinking fountain

<b>G13/AS1 discharge units</b>	1	Min. trap / discharge pipe	25 mm
AS/NZS 3500 Fixture unit rating	1	Min. trap / discharge pipe	25 mm

Drinking fountains come in a variety of configurations — they are often installed free-standing. They are usually found in public buildings, schools, workshops, playgrounds and factories.

The water is usually supplied via a push button timer tap, foot operated tap or an ultrasonic sensor tap.

## Glass washing machine (commercial)

AS/NZS 3500 Fixture unit rating	3	Min. trap / discharge pipe	40 mm
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Glass washing machines are used in commercial hospitality venues, cafeterias, clubs and some factory canteens to sterilize glasses and vessels. It is important to refer to the installation specifications for commercial dishwashing machines, as the discharge pipework may have to resist very high temperatures.

This usually means the pipework may be copper or stainless steel.

AS/NZS 3500.2 Fixture unit rating — when connected to a commercial sink, use the sink's rating — for flow rates of .5 litres/second or higher, use Table 6.3.

## Potato peeler

AS/NZS 3500 Fixture unit rating	3	Min. trap / discharge pipe	50 mm
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Commercial potato peelers are heavy-duty devices designed for a range of food peeling and chipping applications. Specialist traps are required to prevent food scraps entering the drainage system.

## Laboratory sink

AS/NZS 3500 Fixture unit rating	1	Min. trap / discharge pipe	50 mm
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Laboratory sinks are normally simple robust sinks designed to resist a wide range of chemicals and toxic substances. Often, specialised discharge pipes are required to suit the particular laboratory functions, using materials such as glass or chemically resistant pipework.

A specialist trap may be required to prevent solids suspended in the wastewater from entering the drainage system.

## Job completion checklist

Read to check you know what each fixture or appliance is, and what it's used for. Make sure you also refer to AS/NZS3500 part 0 and part 2.

On completion of any installation, the tradesman should check to ensure the completed work complies with the NZ Building Code.

Checklist		Tick / Cross
1.	Has the discharge pipework been tested and found to be leak free?	
2.	Is the discharge pipework well supported and correctly graded? Are fire collars or wraps in place, if required?	
3.	Are the structures secured, sealed to surrounding surfaces and functional? Durability requirements met – are the fixtures suitable for the intended use?	
4.	Have the fixtures been tested under normal operation and are traps holding the correct water seal?	
5.	Are wet areas impervious and correctly sealed?	
6.	Is sufficient ventilation available to the sanitary room?	
7.	Check for cross-connection issues. Is backflow prevention in place if required? Is air gap separation maintained between outlets and contained water, for example, flexible shower hoses cannot lie under running water?	
8.	Have required measurements been met, particularly in accessible facilities?	
9.	Is safety glazing in place where required?	
10.	Does the dwelling have smoke alarms in the required locations?	
11.	Has the work area been cleared of waste items?	
12.	Has the 'final' inspection been completed by the Building Consent Authority?	

## Activity 5

Give the definition and the use of each type of fixture or appliance in the table below.

Installation	Definition of specialist sanitary fixtures/appliances and their use
Ablution trough	
Autopsy table	
Bain-marie	
Bar sink	
Bedpan steriliser	

***Check your answers at the back of the study guide.***



# Installation requirements

Many of the installations of specialist sanitary fixtures will use similar techniques — for example connections such as water supplies and discharge may be the same or similar.

For the next activity, you will need to research the installation requirements for various fixture types.

Refer to the following sources:

- AS/NZS3500.2 Section 13 — Fixtures and appliances — which includes general installation requirements for sanitary fixtures and appliances.
- AS/NZS3500.2 Appendix C — Maximum length of fixture discharge pipe without venting. This appendix includes information about trap and waste pipe diameter, maximum length of pipes and suitable outfalls.

## Activity 6

Describe the installation requirements for each fixture listed in the table below.

Installation	Description: Installation of fixtures and appliances
Bedpan washer	
Dental unit	
Drinking fountain	
Glass washing machine	
Potato peeler	
Laboratory sink	

***Check your answers at the back of the study guide.***

## Taps, mixers and valves

As part of installing specialist sanitary fixtures you will also be installing specialist taps, mixers and valves as required. There will usually be at least one valve, mixer or tap associated with each installation.

### Control valves

Control valves are installed within a water system to ensure a safe controlled operation can be maintained. Valves which plumbers use are generally made from brass, plastic or stainless steel and come in different sizes to accommodate differing water demands.

All control valves incorporate working parts which, over time, will require maintaining or replacing. A sound knowledge of each valve is essential, as plumbers are regularly called upon to fix faulty water systems caused by a failing control valve.

### Stop valve

A stop valve is a screw-down tap. When opened, the thrust of water raises the jumper from its seat allowing water to pass through. It is important to install the valve in the correct direction as it will not operate if installed backwards. The correct direction will be indicated with an arrow on the valve.



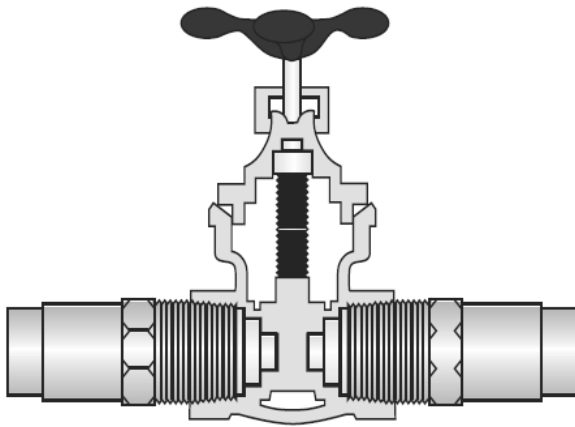
*Stop valve*

Stop taps are generally found in older houses to isolate water at the boundary and prior to water entering a hot water cylinder or a header tank. As the stop tap requires maintenance on its washer, o-ring and a gasket, both ball and gate valves are the preferred option as isolation valves.

## Gate valves

Gate valves can be used in either high or low-pressure systems. The valve has a sliding gate which raises and lowers as the handle and spindle are rotated.

The valve can be installed in either direction and full flow is achieved once the handle has been fully rotated.



*Gate valve*

The gate valve is a simple low maintenance valve, which is why it is commonly used to isolate water at the boundary in residential areas.

## Ball valves

The ball valve is a quarter-turn valve which closes or opens by turning the handle 90 degrees. The valve runs at full flow when the valve handle runs along the direction of the pipework as indicated in the figure below.



*Ball valve*

The ball valve gains its name because there is a hollowed stainless steel ball inside, which in the open position aligns exactly with the waterway, allowing flow through the opening.

Once closed, the ball turns 90 degrees, closing the opening and revealing the full face of the ball isolating the flow of water. Ball valves come with the option of a long handle, short handle or a screw slot.

### **Inline strainer**

An inline strainer is installed at the beginning of a valve train to filter out fine impurities which may inflict damage on downstream valves. These strainers have fine gauze mesh housed on a 45 degree angle to the waterway to collect impurities. They are easily removed for maintenance and must be installed in the correct direction as indicated on the valve with an arrow.

### **Pressure limiting valve**

A pressure limiting valve is installed as close to the boundary as practicable. It is designed to reduce incoming pressure and reduces the fluctuations within a mains pressure system to prevent the hot water cylinder becoming exposed to excessive pressure. It will also protect cold water tapware, shower mixers and water filters that have maximum operating pressures.

Demand for more water is met by the valve opening allowing greater flow while maintaining the pressure. Manufacturers supply these valves with differing preset outlet pressures. They are often supplied as part of a valve set where the pressures of the different valves are synchronised.

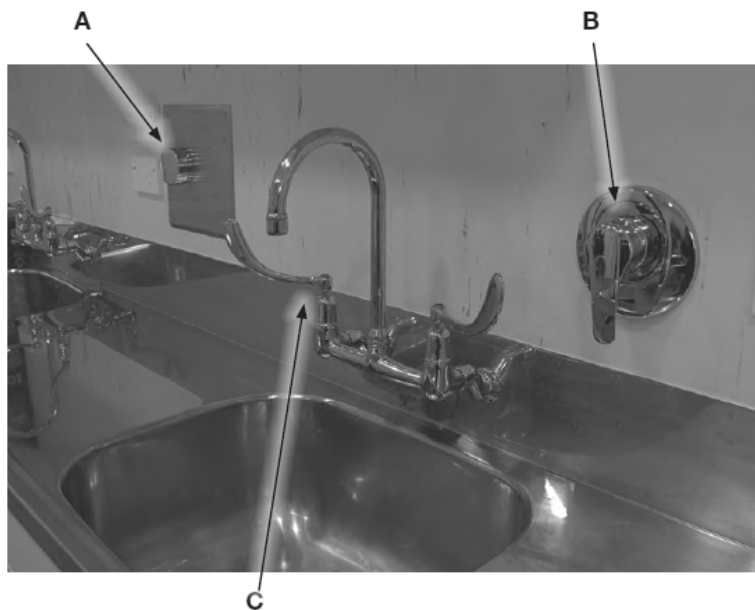
Typical pressure settings are:

- maximum mains pressure = 950 kpa
- pressure limiting valve = 600 kpa
- cold water expansion valve = 1000 kpa
- pressure/temp. relief valve = 1200 kpa.

Typical preset pressure limiting valves may work with pressures of 300 kPa, 500 kPa or 600 kPa. The valve you choose will influence which relief valves must be used for the system to function safely.

Specialist taps and mixers should come with installation instructions. It is important to take the time to read the instructions before you begin the job.

The picture below shows examples of tapware used in a mortuary (a specialist sanitary situation): a flush valve (A), a shower mixer (B) and a wall mounted faucet (C).



The flush valve is a mains pressure device used to flush a floor waste gully. The shower mixer is connected to an overhead shower with a flexible handheld rose (shown below), and the faucet is used for washing hands.



Below is an aspirator used for removing fluid from a body cavity. It usually contains a hollow needle, connected by tubing to a container in which a vacuum is created by a venturi action as mains pressure water flows to waste.



## Activity 7

Which of these tapware examples is most and least likely to allow potential backflow should the water supply be interrupted.

Rank your answers as 1 = highest risk to 3 = lowest risk, then explain your choice.

Note that all these examples require a high hazard backflow prevention device.

Tapware	Backflow Risk ranking (1-3)	Explain your choice of risk level
Flush valve (A)		
Shower mixer (B)		
Wall mounted faucet (C)		

***Check your answers at the back of the study guide.***

# Regulations for specialist fixtures/appliances

Depending on the situation and fixture, different Regulations may apply. The options to prove compliance are compliance with either:

- AS/NZS 3500.2 or
- The NZ Building Code, Clause G13/AS1 or AS/3.

Remember G13 Foul Water does not cover specialist types of sanitary fixtures and appliances in buildings such as hospitals, laboratories and factories. Some specialist fixtures and appliances are covered in AS/NZS 3500.2.

Many specialist fixtures and appliances are deemed 'high hazard' when considering backflow prevention, to protect the potable water supply. For specialist fixtures not covered by G13/AS1 or AS/NZS 3500.2 the contractor should consult with the local Building Consent Authority. NZBC G1 Personal hygiene has the following objectives:

Clause G1—PERSONAL HYGIENE
Provisions
<b>OBJECTIVE</b>
<b>G1.1</b> The objective of this provision is to:
(a) Safeguard people from illness caused by infection or contamination,
(b) Safeguard people from loss of <i>amenity</i> arising from the absence of appropriate personal hygiene facilities, and
(c) Ensure <i>people with disabilities</i> are able to carry out normal activities and processes within <i>buildings</i> .

NZBC G1 AS1 is an Acceptable Solution which includes the installation of specialist sanitary appliances and fixtures, e.g. sanitary napkin disposal units. You can refer to the Section 'Definitions' to find the words or terms used in this Acceptable Solution.

## Activity 8

Access AS.NZS 3500.2 through MySkills or the PGDB website. Read the following Sections and, as you are not allowed to photocopy AS/NZ Standards, write your own notes on the important points in each Section.

1. Section 3, Drainage design — including unit fixture loading.
2. Section 13, Fixtures and appliances.
3. Section 15, Testing of sanitary plumbing and sanitary drainage.

***Check your answers at the back of the study guide.***



# Maintain specialist sanitary appliances and fixtures

Maintenance can include either repair, upgrade, alteration or removal of sanitary appliances and fixtures. When maintaining specialist sanitary appliances and fixtures, and their associated taps, traps and valves, it is very important to follow manufacturer's instructions. These instructions will often have special requirements. Key points to check when maintaining these appliances and fixtures are the provision of:

- adequate water supply
- protected water supply
- adequate drainage

**An adequate water supply** includes both suitable pressure and flow of water. The pressure needs to be suitable for the specialist fixtures and fittings. Correct flow rates at their outlets should be checked against manufacturer's instructions and Building Code requirements. For example, some flushing devices may be specially designed to deliver high pressure water.

**Protection of the water supply** from contamination is critical when maintaining specialist sanitary appliances and fixtures. Backflow provisions will often be high hazard design. Care must be taken when working on such installations to ensure any backflow prevention device is not compromised when completing maintenance work on the system. For example, isolating the water supply may affect the operation of backflow prevention devices. Note that hazard ratings for fixture and appliances are listed in G12 /AS1 Section 3.0 Water Supplies.

**Adequate drainage provisions** must be checked when maintaining specialist sanitary appliances and fixtures. Refer to the previous installation section in this Study Guide.

## Activity 9

Take some time to consider your own maintenance experiences on jobs:

1. What are your own maintenance nightmares and jobs where you have been involved with trouble shooting and fixing?
2. How did these installations compare with the installation requirements of specialist sanitary installations?

***Check your answers at the back of the study guide.***

# Activity answers

## Activity 1

1. A soil fixture is a sanitary fixture designed to receive *human* waste. For example, *WC pans, urinals, bedpan disposal units*, slop sinks, and water-flushed sanitary towel disposal units. These are fixed permanently to the wall or floor.
2. A basin is a sanitary appliance: True or *False*
3. What is the minimum discharge pipe size for a basin as per AS/NZS3500? *40mm*
4. WC pans must have a minimum trap seal of *80 mm* and be large enough to hold a *full flush* if they become blocked.

## Activity 2

1. What is a design which includes a different way to meet the objectives of the building code?  
*An alternative solution*
2. What do you call a calculation that can be used to prove an installation design will comply with the code?  
*A verification method*

## Activity 3

1. What are the conditions that are likely to require equipotential bonding?
  - *Electricity is provided within a building*
  - *Water supply pipe is metallic*
  - *Building users are able to make contact with exposed parts of the metal water supply pipe, or any sanitary fixtures attached to it*
  - *The metal pipe is in contact with the ground, and forms a continuous metallic link from the ground to those parts of the pipe exposed to building users*

Find the following regulatory installation information in AS/NZS 3500.2 Section 13 Fixtures and Appliances and G13.

Then answer these questions.

1. What is the general installation requirement for securing a fixture in terms of support?

*Securing will not rely on support by trap, pipes or water connections and fixture can be disconnected*

2. Refer to AS/NZS 3500.2 Section 6 6.4 Trapping of fixtures and appliances on page 72. Which fixture may be connected in pairs to a single trap?

*Basins, sinks, showers, laundry troughs, and ablution troughs*

3. Refer to G13 to find special requirements for the trapping of a pair of kitchen sinks. What must all wastewater discharge pipes incorporate that is connected directly to the fixture?

*Domestic: When installed with a waste disposal unit and dishwasher a 50mm trap and 50mm discharge pipe are required. Commercial: separate traps are required.*

4. If water traps are not removable, what must they be fitted with?

*A waste trap for each cleaning eye.*

#### Activity 4

1. Answers will depend on own workplace.

#### Activity 5

Installation	Definition of specialist sanitary fixtures/appliances and their use
Ablution trough	<i>Hand washing facilities. An ablution trough is a fixture for holding water for cleansing purposes which has a number of taps spaced for multiple use</i>
Autopsy table	<i>Examining human remains. An autopsy table is a fixture on which post-mortem examinations are performed and which has provision for drainage to the sanitary plumbing system</i>
Bain-marie	<i>Keeping food hot. They are designed to heat or cook food by using heated water to supply heat to the container holding the food, and are used in commercial food production</i>
Bar sink	<i>Rinsing in commercial drinking establishments. A sink specifically designed for use in bars and similar situations for rinsing beer, spirits and wine swill from glasses prior to placing them in a glass washer or sterilizer</i>
Bedpan steriliser	<i>Sterilising portable toilet facilities. A fixture designed for sterilising bedpans using very high water temperatures and steam. Note the smaller discharge pipe as this fixture is designed to use small amounts of water</i>

**Activity 6**

Installation	Description: Installation of fixtures and appliances
Bedpan washer	<i>AS/NZS 3500 fixture unit rating 6 — flush. Valve 4 — cistern flush minimum trap/discharge pipe 80 or 100mm</i>
Dental unit	<i>AS/NZS 3500 fixture unit rating 1 minimum trap/discharge pipe 40mm</i>
Drinking fountain	<i>G13/AS1 discharge units 1 minimum trap/discharge pipe 25 mm AS/NZS 3500 fixture unit rating 1 minimum trap/discharge pipe 25mm</i>
Glass washing machine	<i>AS/NZS 3500 fixture unit rating 3 minimum trap/discharge pipe 40mm AS/NZS 3500 fixture unit rating. When connected to a commercial sink use the sink's rating. For flow rates of .5 litres/second or higher, use table 6.2</i>
Potato peeler	<i>AS/NZS 3500 fixture unit rating 3 minimum trap/discharge pipe 50mm</i>
Laboratory sink	<i>AS/NZS 3500 fixture unit rating 1 minimum trap/discharge pipe 50mm</i>

**Activity 7**

Tapware	Backflow Risk	Explain your choice of risk level should the water supply be interrupted
Flush valve (A)	1	<i>Should the floor waste gully become flooded (e.g. due to a blocked drain) the submerged flush valve outlet would allow contaminated fluid to suck back into the potable supply.</i>
Shower mixer (B)	2	<i>The handheld rose is unlikely to stay submerged in contaminants as it retracts automatically when not in use.</i>
Wall mounted faucet (C)	3	<i>The wall mounted faucet spout allows an airgap which should prevent backflow. However, the spout is still capable of being submerged in contaminated fluid, e.g. a bucket, and so a backflow risk still exists.</i>

**Activity 8**

Answers will vary.

**Activity 9**

Answers will depend on own workplace.

## **Got questions?**

If you have any questions, please contact your assessor directly.

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