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1 General Information

1.1 Purpose

This standard defines minimum design requirements for the prevention of falls from height to ensure that the risk of injury is eliminated or minimised to as low as reasonably practicable (ALARP).

Working at height refers to any situation where a person working at any level has the potential to fall from, through or into any place or thing. This may occur above, at, or below ground level.

1.2 Scope

This standard is the primary corporate reference on design elements to prevent falls from height when designing assets. More detailed information about specific design will be found in the various subsidiary documents referenced within.

Excludes:

- Management of work activities where falls is a risk, see [HSEAA-P-143 Falls](#)

2 Prevention of Falls

2.1 Policy and Principles

Fall from height risks must be eliminated or reduced to as low as reasonably practicable (ALARP).

2.2 Hierarchy of controls for fall protection

The hierarchy of controls is an essential consideration when designing assets to reduce fall risks.

The hierarchy of control is:

- **elimination** – remove the need for the worker to be exposed to the fall risk, such as by relocating equipment to ground level
- **substitution** – substitute with a safer option such as by replacing a vertical ladder with a stairway
- **isolation** – isolate the worker from the fall risk such as by installing a guardrail or grate
- **engineering control** – engineering a solution such as a ladder climbing system or davit entry to a wet well
- **administrative control** – warning signs
- **personal protective equipment** – gloves, hard hat, harness

Ideally the fall risk can be eliminated by eliminating the need for a worker to be in the fall risk situation at all. However, if the fall risk cannot be eliminated, then a lower level control, or combination of controls, must be applied. The highest practicable level of control must be used.

2.2.1 Asset-based controls

Asset-based controls are the physical asset features which reduce workers' exposure to fall risks.

Common asset-based controls are stable working platforms and walkways, rated edge protection, and davits.

Section 3 Asset Features describes the asset-based controls to be applied.

2.2.2 Fall injury prevention systems

A fall injury prevention system (FIPS) is a system or arrangement designed to prevent a person falling from one level to another. FIPS includes fall-restraint systems, fall-arrest systems and scaffolding systems.

2.2.3 Typical fall injury prevention controls

Typical fall prevention controls used on Water Corporation assets are shown in Figure 2-1 below. The controls shown include asset-based controls (e.g. guard railing), FIPS (e.g. ladder climbing system), and administrative controls (e.g. exclusion zone).

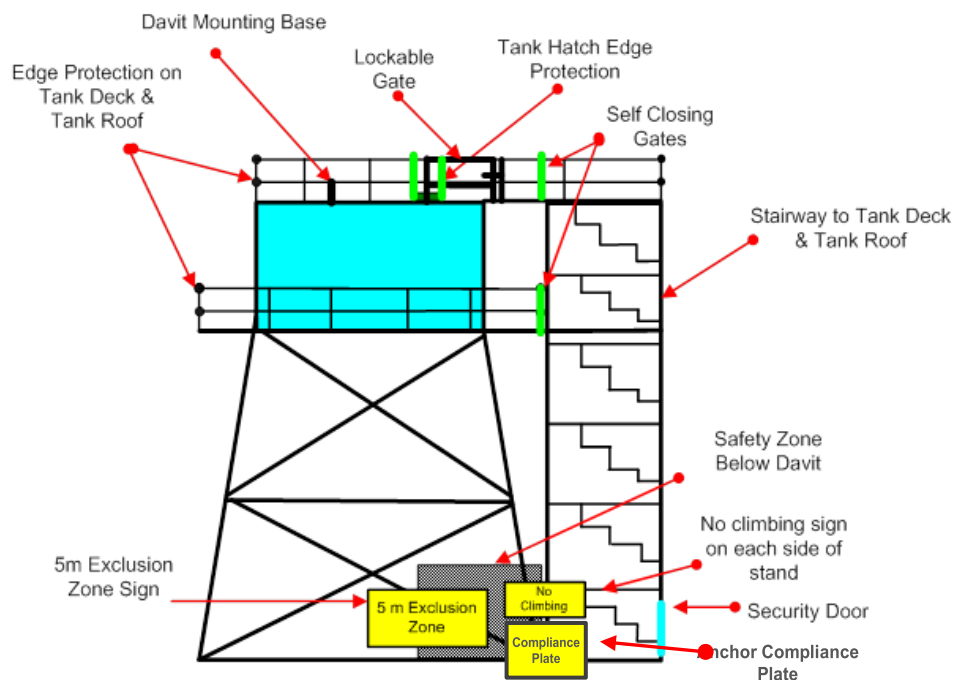


Figure 2-1 Typical fall prevention elements on an elevated tank

3 Asset Features

3.1 Site access by other parties

Consider asset features associated with other parties who may access a Water Corporation site such as related to:

- areas accessible to the public e.g. observation platforms
- access and egress for emergency services
- sites at risk of attracting trespassers e.g. high structures

3.2 Access to and Egress from Work Areas

Arrangements shall be provided for safe access to, egress from, and movement around the work area. This requires consideration of aspects such as:

- walkways
- stairways
- ladders
- fixed and temporary work platforms
- fall injury prevention systems
- requirements for the movement, storage and use of equipment and tools
- the safety of work surfaces
- signage
- lighting

3.2.1 Selection of an appropriate access or egress method

The required means of access and egress to a worksite are:

- level walkway
- sloping walkway
- stairway
- fixed inclined ladder
- fixed vertical ladder
- portable ladder

The appropriate access or egress method for a specific asset will depend on the circumstances. However the highest practicable level of protection must be used.

Where an asset-based access or egress method is not practicable, a non-asset based access method may be required, such as a Bosun's chair.

3.3 Stairways

A stairway is the preferred means of access to a work area where a large vertical distance is involved, and a level or sloping walkway is not practicable.

Requirements:

1. Where permanent access is required to another level 3m or greater, an access stairway shall be provided, where practicable.
2. Where access is required to another level less than 3m, a stairway shall be provided where indicated by a risk assessment.
3. Where a stairway is not practicable, the next highest control measure shall be provided. See 3.4 Fixed Ladders.
4. Access ladders on existing assets shall be upgraded to a stairway, where indicated by a risk assessment.
5. Stairways shall comply with AS1657 Fixed Platforms, Walkways and Ladders.

3.4 Fixed Ladders

Fixed ladders are used for access and egress where a stairway is not practicable.

Requirements:

1. Fixed access ladders shall be provided for access to a work site or platform where a higher form of access (e.g. stairway) is not practicable.
2. Where a fixed ladder is not practicable, an alternative safe access method shall be chosen such as portable davit. See section 3.11
3. The preferred type of ladder, in priority order is: step ladder, inclined rung ladder then vertical rung ladder.
4. Generally, fixed ladders shall not be provided for access into wet-wells, valve pits, access chambers and other below-ground structures. The provision of a fixed ladder shall be based on a risk assessment. Also see (5).
5. Wastewater pump stations without a non-fail isolation valve or penstock shall have an access ladder installed.
6. Fixed ladders shall comply with AS1657 Fixed Platforms, Walkways and Ladders.

3.5 Ladder Climbing System

A ladder climbing system (LCS) is a fall-arrest system which provides continuous fall protection for workers using fixed ladders. While using the ladder, the worker wears a harness anchored to a steel rail or cable by a rope grab. In the event of a fall, the locking mechanism in the grab will engage, gripping the rail or cable and arresting the fall. Free fall is limited to a maximum of 600mm.



Figure 3-1 A cable grab on a ladder climbing system

Requirements:

1. A ladder climbing system shall be fitted to:
 - fixed ladders over 3m, where practicable.
 - fixed ladders less than 3m high, where a potential fall is 3m or greater (such as where the base of the ladder is located near an edge from which someone could fall to a lower level).
 - other ladders, where indicated by a risk assessment.
2. A ladder cage should not be installed where a ladder climbing system is provided. (Cages do not provide sufficient protection from falls and can make rescue difficult.)
3. A ladder climbing system shall not be fitted to internal ladders inside water tanks, wet-wells, surge vessels or similar structures.
4. Ladder climbing systems shall comply with *AS/NZS 1891.3 Industrial Fall-Arrest Systems and Devices: Fall-Arrest Devices* and *AS/NZS 1891.4 Industrial Fall-Arrest Systems and Devices: Selection, Use and Maintenance*.

5. Ladder climbing systems shall be installed in accordance with [6037565 Ladder Climbing System - Installation Testing and Maintenance Procedure](#)
6. Ladder climbing systems shall have an anchor point compliance plate fitted. Refer to [4437923 Prevention of Falls Equipment - Inspection, Testing and Maintenance.](#)
7. Ladder climbing systems shall be maintained in accordance with [4437923 Prevention of Falls Equipment - Inspection, Testing and Maintenance.](#)

3.6 Walkways and Platforms

Walkways and platforms are used for access and egress to site, and to provide a stable work platform for workers, material and equipment. Walkways and platforms must be stable and strong enough for their intended uses and provide protection from slips and falls.

Requirements

1. The design of walkways and platforms shall consider the range of uses and activities likely to be conducted from the walkway or platform over the life of the asset.
2. Walkways and working platforms shall comply with AS 1657 Fixed Platforms, Walkways, Stairways and Ladders – Design, Construction.

3.7 Grid Mesh Flooring

Grid mesh is used for flooring on walkways, access ways and working platforms. To avoid severe fall hazards, grid mesh flooring must be correctly designed, installed, used and maintained.

Requirements:

1. Grid mesh flooring shall be designed and constructed in accordance with [3889754 DS100 Suspended Flooring \(Grid Mesh and Chequer Plate\)](#)
2. Each panel shall be securely fixed to the supporting structure before the next panel is placed in position.
3. Where practicable, panels should be fitted to a structure prior to the structure being lifted into its permanent position.
4. Grid mesh, installed as part of a new asset or major asset upgrade, shall be inspected during the final OSH inspection for the project, prior to handover to Water Corporation. Refer to [589724 OSH Handover Report Guideline.](#)
5. Where grid mesh panels are removed, the opening shall be immediately protected by a suitable cover.
6. If grid mesh panels are removed, a protective barrier and/or exclusion zones shall be provided if there is a risk of a fall, or where otherwise indicated by a risk assessment.

3.8 Edge Protection

Edge protection guardrailing is a barrier which prevents a worker accessing an open edge or opening where there is a risk of a fall. Guardrails usually consist of handrails, midrails and toeboards.

Generally a fall risk exists if a worker can approach within 2m of an open edge or other fall hazard, such as a fragile roof. However this minimum approach distance must be increased where there are additional risk factors such as a windy location, or a sloping, slippery or uneven surface.

Edge protection may be permanent, such as a permanent guardrail around a working platform on a tank, or temporary, such as scaffolding or the Kennedy portable barrier system.

Edge protection has specific design requirements as detailed below:

3.8.1 Guardrails

1. A guardrail (or alternatively a fall injury prevention system - see 3 below) shall be provided:
 - where there is risk of falling 3m or more
 - where otherwise indicated by a risk assessment.
2. A guardrail shall be provided where there is a risk of falling 2m or more from the edge of a decking, fixed stair, landing, scaffold, suspended slab, formwork or falsework.
3. Where guardrailing in (1) is not practicable, a fall injury prevention system shall be provided. Examples of where a guardrail may not be practicable are:
 - where access is infrequent
 - where work is of low-intensity, low-complexity or short duration
 - where the risk exposure of providing guardrailing exceeds the benefit.
4. Where a fall hazard exists at the entry points to an asset (e.g. roofs or wet well), guardrailing shall be provided for a minimum distance of 2m on each side of the entry point.
5. Guardrailing around hatches and similar openings shall fully surround the opening. (Except for the access point with self-closing gate.)
6. Guardrailing shall be applied to regular work platforms and walkways where there is a fall risk within 2 m of the platform or walkway. e.g. a work platform on top of a tank located within 2 m of an open edge or fragile roof.
7. Guardrailing to areas *beyond* a regular work platform or walkway, where only infrequent access is required, shall be provided where indicated by a risk assessment.

e.g. On a tank roof, guardrailing would typically only be provided at locations where there is a significant fall risk - i.e. at the roof access point, or around a work area within 2m of an open edge or other fall hazard.

Edge protection would generally *not* be provided to protect a wider zone, such as the complete roof circumference, where only infrequent access to the area is required.

Should it be necessary for a worker to access an unprotected area, such as approach within 2m of an open edge, alternative controls must then be applied. Alternative controls include an elevating work platform, fall-restraint tethering and /or control zones.

8. A self-closing gate shall be installed at the entry point to a work area where there is a fall risk. The gate shall be installed:
 - opening inwards at the point of entry to a roof or platform
 - opening outwards at the point of entry to a barrier around a wet-well, hatch, pit or similar opening
9. Guardrailing on surfaces with less than 15° pitch shall be constructed to withstand 55kg (0.55kN) applied at any point on the guardrailing. (For roofs with greater than 15° pitch refer to *AS1657 Fixed Platforms, Walkways and Ladders*.)

10. Guardrail design shall consider the expected range of work activities conducted over the life of the asset, and the integrated operation of the infrastructure and equipment, such as:

- ladder access to the work platform
- the location and uses of davits
- access for workers and equipment to openings and hatches
- transport and use of tools and equipment
- rescue and emergency access capability.

11. Where guardrails are required on steel structures or tilt up structures, where practicable, they shall be installed at ground level prior to lifting the structures into place.

12. Guardrails shall comply with AS 1657 Fixed Platforms, Walkways and Ladders, and AS 4576 Guidelines for Scaffolding, as appropriate.

3.8.2 Portable barriers

Portable barriers provide a temporary guardrail system where installation of a permanent guardrail is not practicable.



Figure 3-2 The Kennedy portable barrier system

3.9 Protection for Holes and Openings

Holes and openings through which a person could fall or receive a serious injury must be protected.

Different types of holes and openings require worker access for different reasons. Examples are valve pits, access chambers, wet-well access openings, tank hatches, and openings caused by the removal of grid-mesh flooring.

The appropriate control to be applied depends on the nature of the asset, the fall risks, and the types of work conducted. Effective controls may include a mix of covers, grates, edge protection or FIPS.

It is preferred that openings are protected by a physical fall barrier, rather than by FIPS as it is a higher level of control.

Examples of how openings can be protected:

- a grate covering a valve pit, drain, or duct
- a cover with a removable grate beneath – where frequent surface work can be conducted while leaving the grate in situ by opening the cover only (i.e. entry to the cavity is not required)
- a cover only - where frequent internal access to the cavity is required rather than surface only access – i.e. a grate is not required as the workers will always be anchored to FIPS for entry into the cavity

- no cover or grate - where permanent edge protection is used, such as around a valve pit, or in low fall risk situations

Requirements:

1. Holes and openings into which someone could fall, must be protected

3.9.1 Protective covers

1. Protective covers (i.e. covers intended for fall prevention) shall be made of a material of adequate strength to prevent entry of objects or persons, and be fixed securely.
2. Protective covers shall comply with load and deflection criteria in AS1170 (set) Structural Design actions - permanent, imposed and other actions.

3.9.2 Safety grates

1. A safety grate shall be considered for the following situations:
 - to protect an opening, such as a drain, wet-well opening, open tank hatch, or opening caused by the removal of grid mesh flooring
 - in circumstances where work could be conducted through an opening in the safety grate without needing to remove the grate. (i.e. Placing a safety grate in position allows the worker sufficient and safe access to the work, avoiding the need for additional fall prevention methods.)
2. A safety grate is not required beneath a protective cover where the main reason for opening the cover is for a worker to physically enter the opening. (However, the worker must be attached to a fall injury prevention system.)
3. Unless a safety grate is designed to be walked on, it shall have a *No Step* sign attached..
4. Safety grates shall comply with load and deflection criteria in AS1170 Structural Design actions - permanent, imposed and other actions.

3.9.3 Edge protection

1. Generally, openings larger than 2m x 2m or 2m diameter shall have edge protection installed, or workers must use FIPS. See [Section 3.8.1 - Guardrails](#).

3.10 Anchors

Anchors are secure points of attachment for fall injury prevention equipment: static lines, restraint systems, ladder climbing systems, and davit arms. The following types of anchors are used:

- permanent fixed anchor
- temporary anchor such as a temporary roof anchor or sling
- davit base
- ladder climbing system

Anchors have specific design and usage requirements.

The anchor compliance plate indicates the inspection and test status of the anchor.

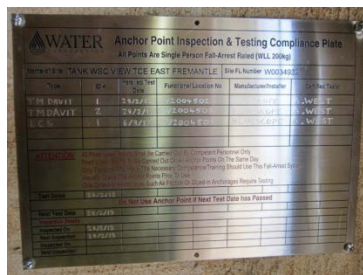


Figure 3-3 Anchor Point Inspection and Testing Compliance Plate

Requirements

1. Anchors shall be designed, manufactured, constructed, selected and installed in accordance with *AS/NZS 1891.4 Industrial Fall-Arrest Systems and Devices: Selection, Use and Maintenance*.
2. For frequent work, permanent anchors shall be established where possible. For infrequent work, temporary anchors may be established, such as slings around structural sections and temporary roof anchors.
3. Single point anchors (for single person attachment) shall have an ultimate strength of at least 15kN (1500kg).
4. Double anchors (for two person attachment) shall have an ultimate strength of at least 21kN (2100kg).
5. For anchors for static lines refer to manufacturers' requirements.
6. Where practicable, anchors shall be designed such that they do not require regular proof-load testing e.g. flush mount davit bases.
7. Permanently fixed anchors shall have an Anchor Point Inspection and Testing Compliance Plate (see Figure 3.3 above) displaying inspection and test status.
8. Permanently fixed anchors shall be inspected, tested and maintained by competent personnel in accordance with [4437923 Prevention of Falls Equipment - Inspection, Testing and Maintenance](#).

3.11 Davit Systems

Davits are commonly used for raising and lowering equipment, moving workers to a different work level, such as in confined space entry, and for performing rescues. Various davit types are used in Water Corporation. Davit systems include the davit base, davit arm, digital winch for raising and lowering, and a recovery winch with inertia reel (type 3 winch).

Davit systems have defined design and maintenance requirements.

Requirements:

1. The permanent davit base and supporting structures shall be capable of sustaining a fall-arrest ultimate load of 15kN (1500kg) applied at the suspension point of the davit.
2. Davit bases shall be located with regard for all intended uses, including consideration of the relationship to adjacent equipment and infrastructure such as valves, hatches and guardrails, and accessibility for proof-load testing.
3. Davit bases shall have an associated Anchor Point Inspection and Testing Compliance Plate fitted. Refer to [4437923 Prevention of Falls Equipment - Inspection, Testing and Maintenance](#).
4. Where practicable, davit bases shall be designed such that they do not require regular proof-load testing e.g. flush mount davit bases.

3.12 Signage

Signage is an administrative control which may be required in some circumstances.

Applicable signage types are:

- Keep Off Brittle and Fragile Roof
- No Step
- Control Zone
- Emergency Exit
- Safety Harness Must be Worn

For further details of signage refer to [384149 S197 Public Safety and Site Security Signage](#).

4 Emergency Rescue

When designing an asset, consideration must be given to access to people in a rescue situation.

5 Definitions

Term	Definition
ALARP	As low as reasonably practicable.
Code of Practice	Refers to the <i>WA Code of Practice for the Prevention of Falls at Workplaces 2004</i> .
fall-arrest system	A system designed to minimise the risk of injury associated with a free fall. A fall-arrest system must be designed so that a user cannot sustain a force greater than 6kN in the event of a fall.
fall prevention cover or grate	A cover or grate designed to prevent a person falling into or through an opening.
fall-restraint system	A system designed to prevent a user from getting into a position where a fall is possible.

Term	Definition
FIPS, fall injury prevention system	A system designed to do the following: (a) arrest a person's fall from one level to another, or (b) minimise the risk of injury or harm should a person fall from one level to another. Examples of FIPS are ladder climbing system and scaffolding.
grid mesh	A metal or fibre-reinforced plastic panel used in the construction of walkways or platforms.
Kennedy barrier	A portable barrier / guardrail system providing edge protection around entry points such as wastewater wet-wells.
LCS, ladder climbing system	A fall-arrest system which provides continuous fall protection for persons using ladders. It consists of a rail sleeve or cable to which an operator wearing a fall-arrest harness can connect with a short lanyard and cable grab while ascending or descending the ladder.
practicable	Means capable of being done and reasonable to do considering all factors.
rated anchor / anchor point	An anchor point for a davit base or FIPS equipment intended for fall-restraint or fall-arrest and complying with <i>AS/NZS1891.4</i> .
must	Means mandatory.
Should	Means <i>recommended</i> and should be done unless there is an alternative equally safe or safer method.
worker	May be Water Corporation employee or contractor.
working at height	Refers to any situation where a person working at any level has the potential to fall from, through or into any place or thing, including falling down sloping surfaces. The situation may be above, at, or below ground level e.g. working on an elevated tank, working in or around a wastewater wet-well or working near an excavation.

6 References

Maintenance

- [4437923 Prevention of Falls Equipment - Inspection, Testing and Maintenance](#)
- [6037565 Ladder Climbing System Installation - Testing and Maintenance Procedure](#)

Occupational Safety and Health

- [HSEAA-P-143 Falls procedure](#)
- [6902367 B-Safe Rope Grab Instruction Manual](#)
- [2776585 WC-OSH 036 Reinstated Grid Mesh Panel Assessments Procedure](#)
- [7406902 Access into Wet Wells or Access Chambers - Guidelines](#)
- [367451 S152 Public Safety at Construction Sites](#)
- [384149 S197 Public Safety and Site Security Signage.](#)
- [4614553 Rescue Planning Guideline](#)
- [7584548 Rescue Plan Tracker](#)
- [6410437 Radio Frequency Radiation Safety Procedure](#)

Design Standards

- [168446 DS51 Design and Construction of Wastewater Pumping Stations and Pressure Mains 4.5 to 90 Litres per Second Capacity](#)
- [1596772 DS61 Water Supply Distribution – Tanks](#)

DS62 – Standard Security Treatments (Restricted access – contact the Security Program Manager)

- [1052757 DS62 Guidance Notes for Security Treatments](#)
- [3889754 DS100 Suspended Flooring \(Grid Mesh and Chequer Plate\)](#)

Standard Drawings

- [Security and General Fencing - Planset GX54](#)
- [Prevention of Falls Equipment - Planset IP76](#)

Legislation and related documents

- [Occupiers' Liability Act 1985](#)
- [Prevention of Falls at Workplaces - Code of Practice \(2004\)](#)
- [Code of Practice: Excavation \(2005\)](#)

Referenced Australian Standards

AS 1170 (set)	Structural Design actions - permanent, imposed and other actions
AS 1657	Fixed Platforms, Walkways and Ladders
AS/NZS 1891.3	Industrial Fall-Arrest Systems and Devices: Fall-Arrest Devices
AS/NZS 1891.4	Industrial Fall-Arrest Systems and Devices: Selection, Use and Maintenance
AS 1892.5	Portable ladders Part 5: Selection, safe use and care.
AS/NZS 4576	Guidelines for Scaffolding

Document Revision History	
10 August 2007	First issue
8 April 2008	Section 13 revised
10 March 2009	Major revision
7 July 2010	Major revision including clarification for ease of understanding
16 July 2013	Major revision after a wide stakeholder review. (Refer to 9228871 for a list of revisions).
15 November 2018	Document updated to reflect only design requirements relating to prevention of falls. Content relating to falls risk when working is now addressed by HSEEA-P143 Falls . Refer to NOC 20377247 .
16 December 2018	Accountability changed to Level 2 Design Assets and a new Custodian Michael Smith.

7 Compliance Mapping

Applicable Legislation, Standards and Codes of Practice

Key regulatory documents relevant to fall prevention are:

- *Occupational Safety and Health Act 1984*
- *Occupational Safety and Health Regulations 1996*
- *Code of Practice on the Prevention of Falls at Workplaces 2004*
- Various Australian standards.