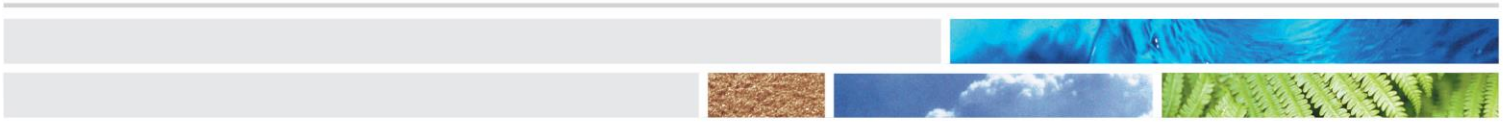
Environmental Protection Authority
Te Mana Rauhī Taiao

Below ground stationary container systems for petroleum – design and installation

HSNOCOP 44

Version 1.1
June 2013



APPROVED CODE OF PRACTICE

UNDER THE HAZARDOUS SUBSTANCES AND NEW ORGANISMS (HSNO) ACT 1996

New Zealand Government

Preface

This code of practice HSNOCOP 44 Below Ground Stationary Container Systems for Petroleum – Design and Installation, March 2013 is approved by the Environmental Protection Authority (EPA) as a code of practice pursuant to Sections 78 and 79 of the Hazardous Substances and New Organisms Act. It is confirmed that the requirements of Sections 78 and 79 have been met.

This publication is approved as a means of compliance for clauses 33(a), 73(3)(a)(iii), 73(3)(b)(iii), 73(4)(b), 77, 81(1), 32, 34, 35, 35A, 36, and 77 of Schedule 8 of the Hazardous Substances (Dangerous Goods and Scheduled Toxic Substances) Transfer Notice 2004 (as amended).

Approval of the Code is limited to those matters in the document that relate to legislative requirements under the HSNO Act and its regulations.

The intended publication date in the Gazette for the Notice of Approval of this Code is 11th July 2013.

Pursuant to Section 80 (1) (a) of the Act, a copy of the Code may be inspected at the Wellington office of EPA.

Pursuant to Section 80 (1) (b) of the Act, a copy of the Code is available from the EPA website www.epa.govt.nz.

Approved this 27th June 2013.

Andrea Gray

Acting Chief Executive

EPA New Zealand

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1. The HSNO Act and the place of Codes of Practice

The HSNO Act and regulations made under that Act are largely performance based, that is they specify a desired outcome without prescribing how to achieve it. They do not require that a single specific means be used to comply with any regulation and this allows for variations in method.

The HSNO Act, as well as the regulations, transfer notices and group standards made under that Act provide for codes of practice approved by the Environmental Protection Authority to identify acceptable solutions to comply with the specified regulatory requirements. An approved code of practice provides users with a method of meeting the control requirements with a degree of prescription and assistance.

The purpose of this approved code of practice is to provide a means for the design and installation of below ground stationary container systems for petroleum to minimise the possibility of a substance release from a below ground stationary container system.

The Hazardous Substances (Dangerous Goods and Scheduled Toxic Substances) Transfer Notice 2004 (as amended) and other applicable regulatory controls made under the Hazardous Substances and New Organisms Act 1996 specify requirements for below ground stationary container systems for petroleum.

This Code specifies specified means of compliance with clauses 33(a) and 73(3)(a)(iii), of Schedule 8 of the Hazardous Substances (Dangerous Goods and Scheduled Toxic Substances) Transfer Notice 2004 (as amended). The obligations under these clauses are met if the following sections of this Code are complied with:

- Clause 33(a):
  - sections 10 and 13 of this Code
- Clause 73(3)(a)(iii)
  - section 11 and 12 of this Code

This publication is approved as a means of compliance with:

- clause 73(4)(b) for pipework, and
- clause 77 which specifies markings on the tank, and
- clause 81(1) which specifies markings, and
- clauses 32, 34, 35, 35A and 36

of Schedule 8 of the Hazardous Substances (Dangerous Goods and Scheduled Toxic Substances) Transfer Notice 2004 (as amended).

2. Summary

The handling of petroleum products has always involved risk. The hazardous nature of the substances handled and the serious potential consequences of system failure require industries to be highly accomplished in the management of risk to avoid system failure.

One of the first principles in handling hydrocarbon fuels is to keep the substance within the primary containment system. The principle concern is to engineer, maintain and operate the system to ensure that at all times the substance is contained. The consequences of system failure may then be regarded as the result of exceptional circumstances rather than a hazard associated with normal operation.

The underground stationary container storage system is to be engineered, installed, operated and maintained so that the possibility of substance release into the ground is minimized by:

- A high standard of engineering and installation reflecting currently available and proven technology, and
- A secondary containment system, and
- The application of regular detailed inventory control so that any product loss will be detected at the earliest stage, and
- Prompt physical leak detection, and
- Immediate and appropriate response to substance release.

Specifically, the above is accomplished by:

- Careful selection of materials used, and
- Overfill protection, and
- Spill containment for the dip points, fill points and dispensers, and
- Strict supervision and control of installation standards and procedures, and
- Use of competent contractors, and
- Inventory control records maintained and available for inspection, and
- Verification of system integrity:
    - At manufacture, by tank testing, and
    - During installation, by tank testing and line testing, and
    - During operation, by interstitial space testing, monitoring of inventory levels, monitoring of sumps and by regular confirmation of the satisfactory operation of any supplementary systems.

This Code provides a means of compliance with the design and installation stages of the stationary container system for petroleum.

See Appendix E for guidance on the means by which a Person in Charge may comply with this Code.

3. Application of this Code

3.1. Scope

This Code applies to the design and installation of below ground stationary container systems that:

1. contain hydrocarbon substances, such as automotive fuel, aviation fuel, industrial fuels and solvents, with flammable hazard classifications 3.1A, 3.1B, 3.1C or 3.1D, and
2. comprise of secondary contained tanks (i.e. tanks consisting of a primary (inner) tank containing the hazardous substance and a secondary (outer) tank which provides secondary containment, and
3. have pipework constructed of fibreglass or HDPE utilizing components that are manufactured to recognized standards such as UL 971-1995, BASEEFA or equivalent, and
4. have the primary tank constructed of steel or fibreglass, with the secondary tank constructed of fibreglass or HDPE (high density polyethylene), or
5. have the primary tank constructed from steel with a secondary tank constructed of steel. The secondary tank must be corrosion protected and the life of the installation must be specified.

This Code is directed towards persons designing and installing the below ground stationary container systems for petroleum in situ, that is, the stationary tank is separately designed and fabricated.

3.2. Application of this Code

Those choosing to use this Code as their means of compliance shall design and install the below ground stationary container systems in accordance with this Code.

Compliance with this Code does not obviate the requirement to comply with other obligations of the HSNO Act, or other legislation such as the Health and Safety in Employment Act 1992 and the Resource Management Act 1991.

This Code is not limited to any specific industry type. It is applicable to service stations, commercial applications, industrial applications, emergency fuel supplies etc.

The installation of below ground stationary container systems is a specialised craft and persons must be competent installers. They shall be trained for the specific tasks they undertake e.g. pipefitting, concrete placement, electrical installation etc. This Code cannot serve as an instruction manual for untrained persons.

This Code must be read in conjunction with Schedule 8 of the Hazardous Substances (Dangerous Goods and Scheduled Toxic Substances) Transfer Notice 2004 (as amended).

Section 6 of this Code, Safety of Works is not a requirement of the HSNO Act. It has been included for guidance to emphasise elements of the installation process. The inclusion of this section does not obviate the requirement to comply with applicable legislation and practices.

3.3. Limits of this Code

This Code is limited to the stationary container system itself. It does not apply to:

- structures such as separators, storm water or wastewater collection systems
- pipework that is not connected to a below ground stationary tank, and pipework on wharves and jetties even where it originates from an underground tank
- stationary container systems for substances with a class 2 hazard classification including Liquefied Petroleum Gas (LPG), liquefied natural gases (LNG) or compressed natural gas (CNG)
- the fabrication of the stationary tank prior to delivery to site
- tanks with secondary containment that is not integral with the tank[1]

This Code does not cover the operation of the stationary container system once it has been installed. This is referenced in the approved code of practice HSNOCOP 45 Below Ground Stationary Container Systems for Petroleum - Operation.

3.4. Further Guidance

The installation of below ground stationary container systems, and in particular those for the storage and dispensing of fuels, are referenced in relevant standards or codes. These may also include features such as vapour recovery pipework and equipment. Further guidance may be sought from the publications in Appendix A of this Code.

3.5. Terminology

For users of this Code, the terms “shall” and “must” have the meaning that the provision is mandatory. The term “should” has the meaning that the provision is a recommendation and therefore is advisory.

[1] In this context, the secondary containment integral with the tank means that the secondary containment and the primary tank are accompanied i.e. the secondary containment is not separate and independent of the primary tank such as a pit liner

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The terms “normative” and “informative” have been used in this Code to define the application of the appendix to which they apply. A “normative” appendix is an integral part of this Code, whereas an “informative” appendix is for information and guidance.

4. Definitions

Where there is a conflict in the meaning of a term, the definition in the Hazardous Substances (Dangerous Goods and Scheduled Toxic Substances) Transfer Notice 2004 (as amended) shall prevail.

AS 1692 means the standard AS 1692:2006 Steel tanks for flammable and combustible liquids, including Amendment 1.

AS 1940 means the standard AS1940-2004 The storage and handling of flammable and combustible liquids, including Amendment 1.

As-built drawings mean the drawings that represent the system post construction and which show the dimensions and location of all elements of the completed works.

Authority means the Environmental Protection Authority.

Below ground stationary tank means a below ground stationary tank as defined by Schedule 8 of the Hazardous Substances (Dangerous Goods and Scheduled Toxic Substances) Transfer Notice 2004 (as amended) that is capable of storing hydrocarbon substances.

Code means this approved code of practice for Below Ground Stationary Container Systems for Petroleum – Design and Installation.

Emergency response plan has the meaning given to it in the Hazardous Substances (Emergency Management) Regulations 2001. It is a single plan which includes information which describes foreseeable emergencies and the actions to be taken, identifies persons responsible for taking particular actions, contact details for emergency service providers, how to obtain information about the hazardous substances, location and purpose of equipment to manage the emergency.

FRP or Fibreglass means fibreglass reinforced plastic, that is, fibreglass reinforced thermosetting resin composite.

Hazardous atmosphere zone is a three dimensional area in which an explosive atmosphere is present or may be expected to be present, in quantities such as to require special precautions for the construction, installation and use of potential ignition sources. The hazardous atmosphere zone is established in accordance with the requirements of Regulation 58 of the Hazardous Substances (Classes 1 to 5 Controls) Regulations 2001.

Hazardous substance location has the meaning given to it by Hazardous Substances (Classes 1 to 5 Controls) Regulations 2001. In relation to a class 3 substance this:

1. means an area where an amount of the substance that is in excess of the threshold quantity is located for more than—
2. (A) 18 hours, in the case of a substance that is not subject to the tracking provisions of the Hazardous Substances (Tracking) Regulations 2001, or

3. (B) 2 hours, in the case of a substance subject to the tracking provisions of those regulations:
4. does not include a vehicle, ship, or aircraft while it remains under the direct control of its driver, master, or pilot and under the jurisdiction of the Land Transport Rules, the Maritime Rules, or the Civil Aviation Rules, as the case may be.

HDPE means high density polyethylene

Location test certificate means a test certificate for the location where the hazardous substance is present. For class 3.1 substances the location test certificate must be in accordance with the provisions of Regulation 81 of the Hazardous Substances (Classes 1 to 5 Controls) Regulations 2001.

Monitoring Well means a well installed at a distance from the below ground stationary container system for petroleum and which is capable of being used to detect and monitor any loss of hydrocarbons from the system.

Non-Corrodible Tank means a stationary tank that is not corrodible from external factors and includes tanks that are:

1. constructed of fibreglass that is compatible with the substance, or
2. constructed with a steel inner wall with an interstitial space and a fibreglass or HDPE outer wall.

Observation Well means a well installed within the excavation for a below ground stationary container system for petroleum and which is capable of being used to detect any loss of hydrocarbons from the system.

Person in charge has the meaning given in Regulation 3 of the Hazardous Substances (Classes 1 to 5 Controls) Regulations 2001. In this application it is the person who, at the relevant time, is in effective control or possession of the below ground stationary container system for petroleum. This person could be the owner, operator, lessee or sub lessee of the site or stationary container system.

Relevant Authority means the organisation(s) including the Authority which has statutory control, or an obligation to control any aspect of a below ground stationary container system for petroleum.

Secondary containment system means the systems referred to in Hazardous Substances (Emergency Management) Regulations 2001 and means a system or systems:

1. in which pooling substances held in the place will be contained if they escape from the container or containers in which they are being held; and
2. from which they can, subject to unavoidable wastage, be recovered.

Site means that portion of the property at which the stationary container system is located that may reasonably be considered to be associated with the stationary container system and the operation thereof.

Site specific drawing means a drawing that is relevant for the site at which the stationary container system is being installed.

Standard drawing means a drawing of items that are common to multiple installations and which is used as a template.

Stationary container system has the meaning given to it by clause 2, Schedule 8 of the Hazardous Substances (Dangerous Goods and Scheduled Toxic Substances) Transfer Notice 2004 (as amended); that is the whole system used for below ground storage of hydrocarbon substances comprising below ground stationary tanks, secondary containment, all associated pipe work, fittings, vents, fill points and dispensing equipment.

Test certifier means a person who has been approved to issue a test certificate in accordance with the requirements of sections 83 and 84 of the Hazardous Substances and New Organisms Act 1996.

5. Responsibilities

The engagement of skilled professional persons is a vital factor to ensure the system is compliant, certifiable and that failures are avoided. The installation of stationary container systems for petroleum substances is a unique field. Whilst every effort is to be made to adequately design and document the stationary container system, the ability to recognize and react to unexpected, abnormal conditions encountered during an installation requires experience as well as skill.

Experience has shown that poor workmanship causes failures. To ensure that high standards are achieved, only contractors who are knowledgeable and capable in the required type of work must be engaged. Persons taking action under this Code, including those persons designing, constructing or installing below ground stationary container systems for petroleum shall be competent and have relevant training and experience of these systems. They should have:

- practical experience, and
- relevant qualifications, certificates and licences, and
- knowledge of this Code, and
- knowledge of Schedule 8 of the Hazardous Substances (Dangerous Goods and Scheduled Toxic Substances) Transfer Notice 2004 (as amended).

Methods of gaining these competencies may include attendance at courses offered by suppliers (e.g. tank fabricators and pipeline suppliers) and working in conjunction with persons who are already competent in this field.

Furthermore, all installation work shall be supervised by a project engineer who is trained and experienced in these activities. This person must inspect the work in progress, witness all tests and document their approval.

There shall be a person in charge responsible for ensuring that the hazardous substances under their control are correctly managed and that the environment and health and safety of people are not adversely affected. The specific requirements are detailed throughout the hazardous substances regulations. The person in charge must ensure that the relevant test certificates required by the Hazardous Substances and New Organisms Act are in place. At the time installation works are undertaken, particularly at a location where hazardous substances are present; the impact of these works must be taken into account.

5.1. Producer Statements

Producer statements/certificates shall be obtained from:

- The suppliers of equipment to certify that the items are compliant with this Code, and
- The fabricator of the stationary tank to certify that the stationary tank is designed and fabricated in compliance with a design standard specified in Schedule C of this Code.

Producer statements/certificates of compliance shall be prepared by:

- The installer of the stationary container system, who shall certify (producer statement) that the installation is compliant with that design standard and this Code, and
- The electrical contractor who shall certify (certificate of compliance) that the electrical elements of the installation are in compliance with the Electricity Act.

5.2. Checklist

A checklist is included in Appendix F of this Code to assist the person in charge with meeting the requirements of this Code.

5.3. Statutory Permits

The approval of all relevant authorities must be obtained before commencing any on site works pertaining to below ground stationary container systems and any conditions of approval made must be adhered to. Applications should be made as early as practicable and a reasonable time allowed before it is intended to commence work on site.

Where approval is required prior to commencing work then no work should be undertaken before such approval is obtained.

All work shall be carried out in accordance with all applicable statutory requirements whether or not they require a permit to be issued.

6. Safety of works

6.1. General

All work shall be carried out so that all persons are safe; it shall be performed in accordance with all statutory regulations, including the Health and Safety in Employment Act, pertaining to safe work practices.

6.2. Excavation Safety

All practicable steps must be taken to eliminate the need for persons to enter excavations for stationary tanks. Where this is unavoidable, all practicable steps must be taken to manage any risks such as the accumulation of vapour, gas or cave-in of the excavation.

Persons shall not enter an un-shored or un-battered excavation unless it has first been certified as safe for entry by a competent person[1]. Where tank pit excavations require shoring or interlocking sheet pile, the design shall be approved by a competent person.[2]

It is recommended that gas alarms are used for deep excavations to detect conditions which may lead to asphyxiation of personnel or an explosive condition.

In circumstances whereby there is a tank in the pit, action should be taken to prevent the tank from rolling e.g. by placing spacers and/or chocks or similar items about the tank. These may be removed once the tank is anchored in place.

6.3. Safety of Third Parties

All practicable steps shall be taken to ensure that the works do not compromise the safety of other parties such as customers, staff or the general public.

Worksites shall be barricaded to keep out persons who are not authorised to enter the area. Where work areas are open for access at night they shall be provided with sufficient lighting to ensure that all persons who enter the site are safe.

Particular care must be taken on sites that continue in operation whilst work is being carried out. Equipment, materials and work shall be organised so that all persons on the site are safe.

6.4. Safe Handling of Petroleum Substances

Brief notes of general safety precautions are covered in Appendix B of this Code.

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[2] Such as a Chartered Professional Engineer or similar person experienced in this field.

Where safety information is required for a specific substance, reference should be made to the relevant Safety Data Sheet (SDS), which must be available to all personnel within 10 minutes.

6.5. Hazardous Atmosphere Zones

Petroleum substances can emit flammable vapours. Electrical and sparking equipment can be a source of ignition and can therefore ignite these vapours. Hence, where petroleum substances are stored, hazardous atmosphere zones must be delineated in accordance with AS/NZS 60079.10.1:2009. Any activities or equipment used in these zones must be compatible with the zonal classification.

If hazardous atmosphere zones exist where it is intended to install a below ground stationary container system, these zones must be eliminated for the duration of the installation because of ignition risks introduced by the installation process.

7. Drawings and specifications

Drawings and specifications shall be prepared for all components of a below ground stationary container system for petroleum. They shall form part of the “Records” described in section 15 of this Code.

The drawings shall detail:

- the site adequately describing the property,
- the size and location of stationary tanks and substances they store,
- the location of pumps, pipework, protection systems and cabling,
- areas of high intensity land use and areas of low intensity land use,
- hazardous substance locations.

The drawings and specifications shall detail the materials of construction, pipework dimensions and dimensions and locations of vents.

The drawings shall include dimensional and constructional detail of any stationary tank hold-down pads or other anchoring devices.

The drawings shall provide relevant dimensions from a datum e.g. a fixed structure or boundary.

7.1. Site Specific Drawings

Site specific drawings shall detail in relation to below ground stationary container systems for petroleum:

- site legal boundaries;
- hazardous atmosphere zones;
- the boundary of any controlled zones including any which are within 5 metres of the legal boundaries of the site;
- buildings within the site;
- foundations, structures, and all services, including any LPG and/or CNG installations within the site;
- all stationary tanks including any decommissioned tanks on the site;
- vents;
- fill points;
- pumps and pipe work;
- secondary containment systems;
- monitoring wells and observation wells;
- storage areas for hazardous substances
- storage areas for gas cylinders
- fire protection systems, firewalls and vapour barriers

- stationary tanks including stored contents, capacity and physical dimensions
- pipe data, including type of pipe and sizes if this data is not included on standard drawings
- location of adjacent services.

7.2. Standard Drawings

Drawings shall show details of installation work and shall be in accordance with standards cited in this Code. Standard drawings can be used.

These drawings shall include details of:

- pipe work and fittings;
- stationary tank installation and anchoring;
- secondary containment;
- fill point and spill containment;
- stationary tanks and stationary tank fittings;
- observation and monitoring wells.

7.3. As-Built Drawings

As-built drawings of below ground stationary container systems shall be prepared. These may be the site development plans with any variations recorded. The drawings shall be supplemented by photographs taken during construction and shall show all relevant details and dimensions including the:

- site plan
- location and size of all stationary tanks, including any decommissioned stationary tanks;
- location and size of all pipework, valves, pumps and dispensers;
- pump to stationary tank interconnections including the location of pipe work connections to the stationary tanks;
- substance stored in each stationary tank;
- location of all electrical conduits, wiring and all below ground services within or adjacent to the area occupied by a below ground stationary container system for petroleum;
- location and details of any observation and/or monitoring wells;
- date when the installation was commissioned; and
- date of any modification or relocation and
- equipment and fittings.

These drawings shall be updated whenever any modification, repair or relocation is made to a below ground stationary container system for petroleum.

The site plan(s) shall indicate in relation to a below ground stationary container system:

- site legal boundaries.
- hazardous atmosphere zones
- buildings
- other stationary tanks
- storage areas containing any hazardous substances
- secondary containment systems for stationary tanks
- fire protection systems including any fire walls and vapour barriers
- fill points, vents and vapour recovery,
- pumps, pipe runs and dispensing equipment,
- any observation wells, and
- electrical conduits and other below ground services and
- any storage areas for compressed gas cylinders or packages containing hazardous substances.

The site plan should include the proximity of any environmentally sensitive areas.

The site plan must include details of pipe sizes, pipe routes, cable routes and container dimensions.

Each stationary tank shall be identified with its size, the contained substance and the fill point(s) and dispensing equipment to which it is connected.

The site plan should include its date of preparation and the drawing scale.

The site plan shall be updated whenever there is any modification, repair or relocation of the system.

7.4. Photographs

Photographs provide a good record and should be taken at all stages of the project. For items that are underground they provide a valuable record and are frequently the only means of identifying items without excavation.

8. Design and installation process

8.1. Process

The broad steps involved in the design and installation of a below ground stationary container system are:

Step	Item
1	Determine equipment
2	Design equipment
3	Obtain relevant approvals and consents
4	Install system
5	System integrity test
6	Certification

8.2. Equipment

The equipment for a below ground stationary container system for petroleum must comply with the following:

	Equipment
Tank	Non-corrodible tank or corrosion protected steel tank with a specified lifetime.
	Secondary containment system
	A system for stock reconciliation in the primary tank
	Interstitial space monitoring
	Spill containment at dip point
Pipework	Non-corrodible materials
	Secondary containment system for pressurized pipework3
	Leak monitoring for pressurized pipework2
	Fill point spill containment
	Below ground components of vapour recovery, if required.
Other	Dispenser sumps
	Overfill protection
Drainage	Product transfer areas draining to interceptor

[3] Pressurised pipework does not include the tank fill pipe or vent pipe

8.3. Equipment Records

Records are to be retained of all the installed equipment. Where it is not included on the as-built drawings it should be maintained in an equipment register. In all cases the fabricator's sales information and maintenance manual should be retained on file.

These records are to include:

Equipment Item	Details Required
Below Ground tanks	Material, fabricator, capacity, installer, serial number, fuel.
Below Ground Pipework	Material, manufacturer, sizes, installer
Above Ground pipework	Material, manufacturer, sizes, installer
Vents	Size, manufacturer, catalogue no.
Dispensers	Manufacturer, type, fuel being dispensed, serial number, and EPA Register approval number if for retail sale.
Dipstick	Capacity (in litres)
Pumps (if separate from dispensers)	Manufacturer, type, fuel being dispensed, serial number
Tank Gauging	Manufacturer, type, fuel being dispensed, serial number
Cathodic Protection	Manufacturer, type Note: Cathodic protection (CP) is generally not required for below ground stationary container systems unless a steel tank option is chosen. If a CP system is in service this record must be maintained.
Over fill protection	Manufacturer, type
Interceptor	Manufacturer, type, capacity
Earthing/Bonding	Installer

9. Ground conditions

The characteristics of the site that affect design, installation and operation of a below ground stationary container system for petroleum are to be determined and the design and installation process for that site are to be arranged accordingly.

Information pertinent to design and installation may be available from existing site records or knowledge.

9.1. Soil Test

Where ground conditions are unknown, soil testing may be required in the vicinity of the proposed tank excavations. This testing is to ascertain:

- The structural properties of the soil. This may include properties such as liquefiable ground conditions and the allowable proximity of the excavation to nearby building foundations
- The existence and depth of any water table, particularly where it may not be at least 2 metres below the bottom of the stationary tank excavation.

This information is also to be used when determining whether:

- Tank anchorage is necessary
- Excavations require shoring
- Dewatering is necessary.

Where a combination of steel primary tank and steel secondary tank is used, the corrosive properties of the soil must be determined. The life of the tank must be determined with these factors taken into account.

Where there is instability, geotechnical and civil engineers should be consulted on the requirements for installation of a below ground tank. Where required, the guidance provided by these engineers should cover:

- dewatering processes
- shoring and battering requirements for the trench
- provision of a stable tank bed including a bottom slab for tank support
- sidewall support for the tanks
- the use of filter fabric to prevent backfill migration due to water flow or differing backfill and native soil grading
- backfill requirements for support of the tank under traffic loads
- any additional requirements for the tank manufacturing specification arising from geotechnical/civil engineering investigations

If prior borehole testing has not been conducted, a site assessment may be necessary after installation work has commenced. This could arise where checks on site ground conditions during installation indicate unforeseen effects such as landfill and changing native ground conditions.

Tank suppliers may include instructions of work that is required to ensure the bed and sidewall trench are suitable for installing the suppliers tank. It is the responsibility of the installer or engineer to ensure that the tank is installed in accordance with the supplier's instructions or any additional requirements arising from a site assessment of soil conditions.

10. Stationary tanks

10.1. Design and Construction

Only tanks designed and constructed in accordance with a standard specified in Schedule 8, clause 32 of the Hazardous Substances (Dangerous Goods and Scheduled Toxic Substances) Transfer Notice 2004 (as amended), or a code of practice approved by the Authority shall be used. The standards as at the date of approval of this Code are included in Appendix C of this Code. Appendix D includes information on standards for testing and installation of below ground tanks.

Both the design of a stationary tank and the fabricator who produces the stationary tank must be certified by a test certifier. Alternately, the design and fabrication of each tank must be individually certified by a test certifier.

Where a tank is divided into compartments, the compartments must:

- be used for the same substance or for different grades of the same substance such as 91 octane and 95 octane grades of motor gasoline, in which case:
  - if the primary tank is steel construction, the bulkhead between the compartments must be welded on both sides, or
  - if the primary tank is fibreglass construction, each compartment must be of separate construction[4], or
- be used with different substances, for example, motor gasoline and diesel or kerosene, in which case:
  - if the primary tank is made of steel there must be:
    - a double bulkhead with an interstitial space between the compartments, or
    - the bulkhead between the compartments must be welded on both sides and must be at least 2mm thicker than the wall of the primary tank, or
  - If the primary tank is made of fibreglass, each compartment must be of separate construction[3].

The interstitial space is to be monitored.

10.2. Fittings

Stationary tank fittings shall include separate fill, suction and vent connections and a dip tube equipped with a dipstick calibrated for the tank. The dipstick shall be capable of measuring the contents at any level within the tank.

[4] In this context separate construction means each compartment (i.e. inner tank) is constructed as a separate compartment. There must be an interstitial space between that compartment and any other compartment.

Every fill pipe including remote fill lines, or dip pipe that enters a tank and which is likely to be opened to atmosphere at some time during normal operation, shall be provided with a liquid seal sufficient to ensure that the lower end of the pipe is submerged by at least 25 mm of liquid at all times after the initial fill.

Where fittings are supplied separate from the tank, they must be supplied with installation instructions.

Fittings must comply with an appropriate standard or industry practice that is suitable for below ground stationary tanks containing petroleum.

10.2.1. Liquid level indicator

Each below ground tank must have a liquid level indicator that indicates the actual liquid level in relation to the safe fill level.

The liquid level indicator must be designed, constructed and installed to resist any heat and impact which it may be subjected to.

10.2.2. Striker Plate

There shall be a striker plate positioned under any opening where a dipstick or similar device is inserted into the tank. In tanks which contain fuel for aviation purposes, these striker plates should be flush fitting to prevent water being trapped behind the plate.

10.2.3. Dipstick System

Dipstick systems shall comply with the following:

- the dip point opening shall be provided with a cap that is liquid and vapour tight, and
- the dipstick shall be of non-ferrous construction, and
- where measurement is made with the dipstick in contact with the bottom of a tank, a durable striker pad shall be attached to the tank bottom, and
- the dipstick guide shall be tubular in section and incorporate a pressure equalizing hole(s) that connects the upper end of the dip pipe with the upper tank space. If the pressure equalizing hole is more than 1.5 mm in diameter, it shall be covered with anti-flash gauze not coarser than 500 microns, and
- the safe fill level shall be identified.

10.2.4. Filling Provisions

Below ground stationary tanks must not be filled with hazardous liquids to a level which exceed their safe fill capacity.

Filling systems for below ground stationary container tanks shall be arranged so that the inflow liquid passes through a fully enclosed pipe to a point that is not more than one pipe diameter above the bottom of a tank. In all cases it must not be more than 150 mm above the bottom of the tank.

Below ground stationary tanks must not be filled with a hazardous liquid of class 3.1A or 3.1B from any tank wagon other than a refuelling unit except by gravity and through a line having all connections gas tight and liquid tight unless –

(a) Another means of delivery had been approved under regulation 17 of the Dangerous Goods (Class 3 – Flammable Liquids) Regulations 1985; or

(b) The tank is filled in accordance with a code of practice approved by the EPA.

10.2.5. Draining

There shall be provision for drainage that will allow the entire liquid contents of a tank to be removed. This may be undertaken through the use of a suction spear or similar equipment.

10.2.6. Vents

Subject to clause 11.5 of this Code, the vapour space above the liquid level in a tank shall be vented to atmosphere. The tank venting system shall be separate from the fill fitting.

The vent system shall be designed, constructed and installed so as to ensure that the pressure or vacuum resulting from filling or emptying the tank shall not cause:

- stress in excess of the maximum design stress, or
- the tank to collapse.

Where the inner tank is constructed to AS 1692, it may be vented in accordance with section 5.4 of AS 1940.

10.3. Interstitial Monitoring

Below ground stationary container systems for petroleum with integral secondary containment shall be provided with a means of monitoring the interstitial space. This system must be capable of detecting leaks in the primary and secondary containers.

10.4. Stationary Tank Diameters

Below ground stationary container systems for petroleum that use suction pumping systems for petrol or similarly volatile substances should have a tank internal diameter that does not exceed 2.5 metres.

Where submersible pumps are used the diameter of a tank is limited by practical considerations only.

10.5. Stationary Tank Identification

Below ground stationary tanks shall be marked in accordance with clause 77 of the Hazardous Substances (Dangerous Goods and Scheduled Toxic Substances) Transfer Notice 2004 (as amended). The markings shall be permanently and legibly applied to a tank in a location that is visible

after installation. They shall be renewed as often as necessary to ensure they remain legible. They shall provide the following information:

- the specification to which the tank was designed
- the date on which the tank was manufactured
- the materials used in the construction of the tank
- the name or mark as well as the address of the fabricator
- the maximum and minimum design pressure of the tank
- the maximum and minimum design temperature of the tank
- the maximum permitted density of any liquid that may be contained in the tank
- the maximum safe fill level of the tank and the capacity of the tank
- a unique identifier that links the stationary tank to its records and test certificate.

10.6. Stationary Tank Testing

Unless the stationary tanks are field constructed, a copy of the test certificate should be provided by the fabricator. Stationary tanks should have been pressure tested at the fabricator's works.

These tests may include:

- a hydrostatic test which detects any leakage by observation or volumetric measurement; or
- an air pressure test, or
- a vacuum test.

Notwithstanding this works testing, an onsite test shall be conducted, with each compartment of a multiple compartment stationary tank tested separately.

Double skin tanks with the interstice liquid-filled for monitoring purposes shall have the liquid volume monitored prior to installation, during installation and during the initial fill of the tank.

Double skin tanks which do not have the interstice liquid-filled shall be pressure tested at a pressure no less than 35 kPa. The inner tank shall be tested first with the pressure of both the inner tank and interstice monitored for a minimum period of one hour. The air from the inner tank shall then be bled into the interstice until the pressure is equalized. The pressures of both the inner tank and outer tank shall then be monitored and the outer tank soap tested. See Appendix H for further details.

If any leak is found, it shall be repaired and the test repeated.

10.7. Stationary Tank Handling

Stationary tanks shall be handled in a manner that avoids any damage to the tank, its fittings or protective coating.

Stationary tanks shall be lifted using lifting lugs designed and installed by the fabricator. To avoid placing undue axial stress upon a stationary tank shell, lifting chains or straps shall be arranged at an angle of no more than 30^{o} to the vertical.

Where hold-down fittings are not provided, stationary tanks shall be secured to transport using webbing straps only. Stationary tanks shall be chocked to prevent any movement during transport that could damage the coating. Supports for tanks during transport shall be arranged so that they do not damage the tank or its protective coating.

Guide ropes shall be attached to each end of a stationary tank and these shall be manned during all lifting and placement operations.

Where practicable, works should be scheduled so that stationary tanks may be unloaded and placed adjacent to their excavation for site testing. Following testing, a stationary tank must be lifted directly into its final position in the excavation. Stationary tanks must not be dragged into position.

The stationary tank, and in particular its external shell, shall be inspected by a competent person prior to placement in the excavation.

Any defect in the shell shall be repaired using material and a procedure approved by the fabricator of the stationary tank.

The stationary tank shall be leak tested immediately prior to installation in accordance with clause 10.6. This testing shall be witnessed and the results recorded.

10.8. Stationary Tank Location

Stationary tank locations shall be determined with due regard for the following:

- the Hazardous Substances (Dangerous Goods and Scheduled Toxic Substances) Transfer Notice 2004 (as amended).
- delivery vehicle access
- location of pumps
- site boundaries
- building foundations
- environmental constraints
- hazardous atmosphere zones.

Where suction pumps are utilized, it will generally be proximity to pumps that will be the overriding criterion. As petrol tends to vaporise, the suction pipe length needs to be minimised. Delivery vehicle access can be improved by running fill lines to a location where the vehicle can safely unload.

Unless provision has been made in the excavation design to transmit loads to the wall of the excavation, stationary tank excavation shall be far enough away from structural foundations and existing stationary tanks so that no load can be transmitted to the excavation wall. As a guide, a slope of 45^{o} drawn from the nearest part of the foundation should not intersect with any part of the stationary tank excavation. An excavation must, as set out in section 9 of this Code, comply with the tank

supplier's installation instructions or, any other requirements arising from an investigation of ground conditions subsequent to the commencement of installation.

Stationary tanks shall be installed strictly in accordance with drawings and information provided by the tank supplier. Any amendments to these installation requirements shall be marked up on as built drawings.

10.9. Stationary Tank Installation

10.9.1. Principles

Stationary tanks shall be buried so that they are:

- Adequately supported by the surrounding backfill, and
- Protected from imposed loads from above by pavement and/or adequate cover of compacted backfill, and
- Provided with secondary containment systems.

Fig 10.9 (1) provides an example of a typical installation.

The tank must be installed in accordance with the instructions of the fabricator of the tank, but as a minimum, the provisions of this clause 10.9 must be complied with.

10.9.2. Installation

Stationary tanks shall be surrounded with material approved by the fabricator of the tank. This backfill material must be tamped into place to provide good support for the tank shell and ends.

The cover over a stationary tank shall comply with the requirements of the tank fabricator and shall be suitable for the loads imposed at the location. The minimum cover over stationary tanks shall not be less than:

1. Where the stationary tank is under an open yard where it will not be subject to frequent or heavy traffic loadings and is not less than 3 metres from any building
   - not less than 400 mm of earth; or
   - not less than 300 mm of cover, of which not less than 100 mm is reinforced concrete.
2. Where the stationary tank is under a building or in an open yard within 3 m of a building and will not be subject to traffic:
   - not less than 600 mm of earth; or
   - not less than 400mm of cover of which not less than 100 mm is reinforced concrete.
3. Where the stationary tank is subject to frequent or heavy traffic loadings:
   - Not less than 900 mm of earth: or

- Not less than 650 mm of cover of which not less than 150 mm is reinforced concrete. Where the concrete is supported by the walls of a concrete chamber, the earth component of the cover may be reduced to 350mm for a total cover of 500 mm.

4. Other combinations of reinforced concrete and earth cover that would provide equivalent bearing capacity may be used but the minimum cover over a stationary tank shall be not less than 300 mm.

10.9.3. Materials

10.9.3.1. Backfill Material:

Material used to surround FRP stationary tanks and pipe work must comply with the tank fabricator's specification. Material used to surround a steel stationary tank and pipe work must be sand that complies with the following:

The sand backfill surrounding steel tanks and pipework shall be clean, non-plastic, chemically inert, and free from salt, shells, organic matter, balls of clay, lumps of earth and corrosive materials. The corrosivity may require sample resistivities from the stock pile or samples taken by the soil box method in the case of a truckload.

The sand shall be free-flowing and comply with the following:

Sieve Aperture mm	Percent Passing
9.5	100
4.75	70 - 100
2.36	50 - 100
0.425	15 - 70
0.075	0

If the ground material is such that the backfill material will migrate, the backfill material shall be laid within a filter fabric that complies with the stationary tank supplier's recommendations and which is designed to prevent the ingress of fine soil or sand particles.

10.9.3.2. Test Report:

Pea gravel or sand shall be certified as conforming to specification by an accredited laboratory. A record of the laboratory test report shall be kept as described in section 15 of this Code.

10.9.3.3. Concrete:

Concrete shall have a minimum compressive strength of 17.5 MPa.

10.9.3.4. Filter fabrics

Filter fabrics are geotextiles designed to prevent movement of backfill materials while permitting water to pass through. They are intended to be buried and, if properly selected, to resist deterioration caused by both soil and the contained substances. Care in the selection of the fabric is essential as the composition, construction and mechanical properties vary widely.

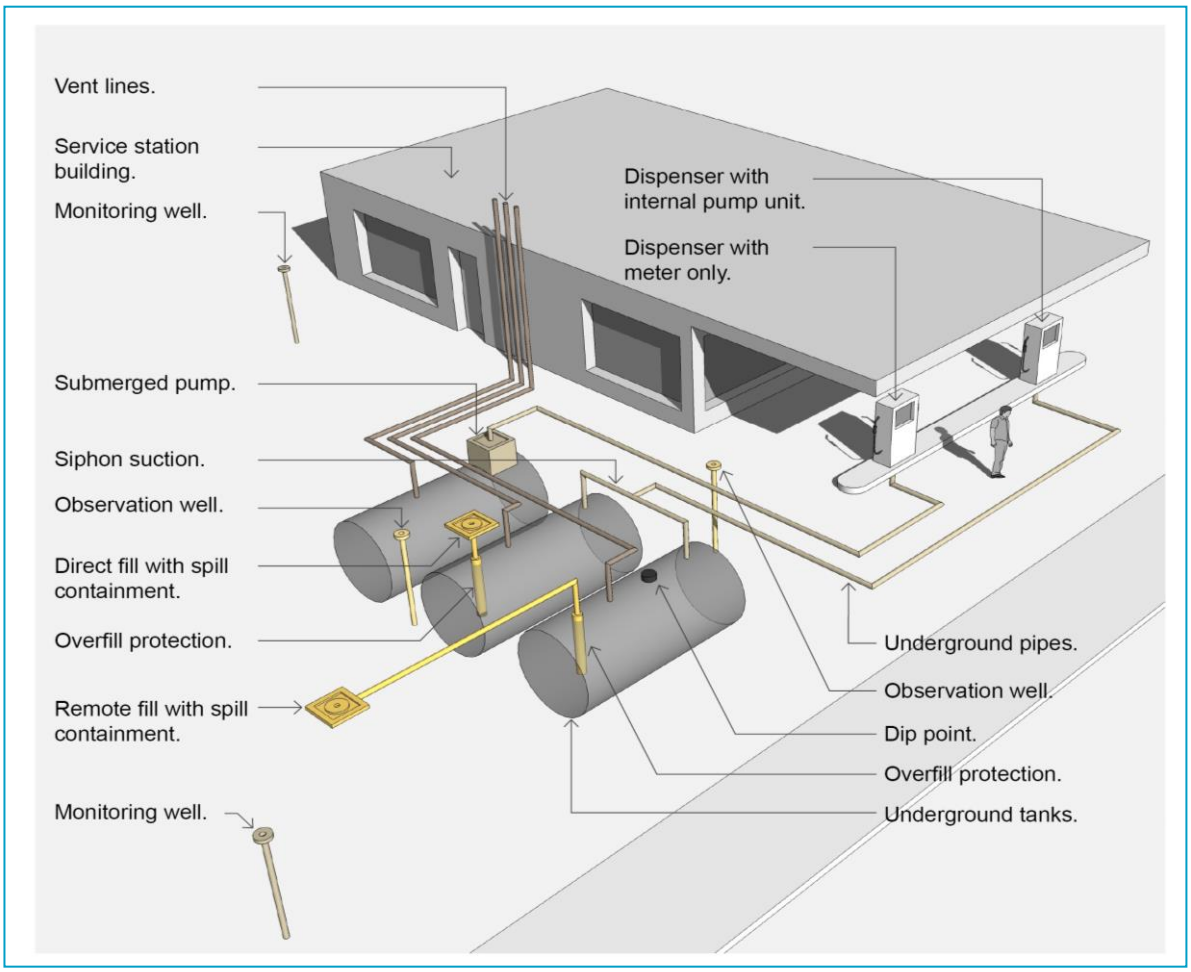
Filter fabric should be installed between the backfill and adjacent unstable soils, bogs, swampy areas or landfills to prevent the backfill from migrating and thus diminishing the support of the tank or paving. If dissimilar backfill materials are used in the same excavation, for example sand and pea gravel, they should be separated with filter fabric to prevent the finer sand particles from migrating into the voids between the pea gravel particles.

10.9.4. Excavation

Excavations for stationary tanks shall be sufficiently large to allow the placement of the full depth of pea gravel bed below the tank and with adequate clearance at ends and sides to allow backfilling around the tank to be properly placed. The floor, sides and ends of excavations shall be smoothly shaped and free from loose stones or projections that may reduce the minimum thickness of bedding material. The requirements of the tank fabricator for the excavation and placement of a tank are to be complied with.

Wherever practicable, persons should not enter stationary tank excavations. When persons enter excavations, all practicable steps shall be taken to ensure their safety. This shall include compliance with section 6 of this Code.

Fig 10.9 (1) Tank Installation (Typical)



10.9.5. Observation Wells

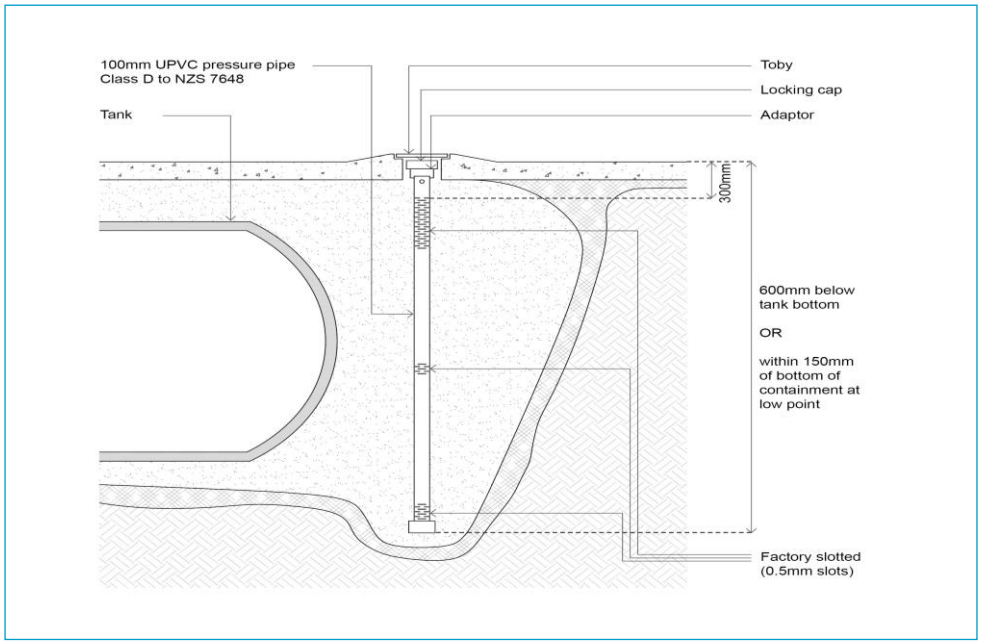
Observation wells shall be installed within the excavation alongside all new stationary tanks or groups of stationary tanks. See also section 13 — Leak Detection, and Figure 10.9 (2).

The toby box lid over the well shall be identified by either

- a solid black marking in the form of an equilateral triangle having a 50 mm side on a pale background, or
- a triangle cast in the lid or
- the words observation well cast in the lid.

The observation wells are to be located in diagonal corners of the excavation, the lowest point of tank excavation or, if the water gradient is known, a down-gradient point.

Fig 10.9 (2) Observation Well (Typical)



10.9.6. Bed of Excavation

Material approved by the tank fabricator is to be placed beneath a tank in accordance with the fabricators' specification and the site conditions. It is to be 150 mm minimum thickness.

10.9.7. Sides of Excavation

Material approved by the tank fabricator is to be placed about a tank in accordance with the fabricators' specification and the site conditions. It is to be 150 mm minimum thickness.

10.9.8. Placement

When a stationary tank is placed into an excavation, sand or pea gravel backfill shall be placed at its ends to provide stability while levelling is carried out. Stationary tanks should be laid in accordance with the fabricator's instructions. Generally tanks will be laid with a fall of at least 1:100 to the drain point end, otherwise they shall be level.

During stationary tank placement and subsequent backfilling operations, care shall be taken to ensure that no foreign material, including soil, enters the excavation. Any such material that enters the excavation shall be immediately removed so that it does not become trapped in the backfill material surrounding the stationary tank.

Immediately after placement of stationary tanks, any observation wells that are required shall be placed in position.

For multiple tank installations, a minimum separation of 600 mm shall be provided between the tanks.

10.9.9. Anchoring

Where a below ground stationary tank is to be located in an area subject to high water tables or flooding, provision shall be made to prevent the tank from floating out of position. Anchoring systems provided for the tank shall comply with the recommendations of the fabricator.

In circumstances where straps are used to hold down a tank to dead man anchors or bottom pads, the straps must not extend under load and must be resistant to the fuel being stored.

For further information, refer to section 6 Anchoring of PEI/RP100 – 11 Recommended Practices for Installation of Underground Liquid Storage Systems.

10.9.10. Float out and anchorage

It is critical that steps are taken to ensure that below ground stationary tanks do not float out of position when empty. i.e. the total buoyant force must be more than offset by the combined weight of the overburden (backfill material), paving over the tank, the weight of the empty tank and associated equipment.

A methodology for undertaking this calculation is given in Appendix A of PEI/RP100 – 11 Recommended Practices for Installation of Underground Liquid Storage Systems.

10.9.11. Ballasting

Where it is necessary and approved by the person in charge, stationary tanks may be ballasted with water (to the level of the water table or the level of the backfill.

If a tank:

- is to be used to contain aviation fuel, and
- it is unable to be ballasted with water, and
- the person in charge approves, and
- a stationary container test certificate is issued, and
- a location test certificate is issued,

then the tank may be ballasted with the aviation fuel.

In these circumstances, appropriate precautions must be taken (including delineation of hazardous atmosphere zones) to accommodate the flammable nature of the fuel. The stationary tank must not be filled to more than 95% capacity.

10.9.12. Backfilling

After placement and levelling of a stationary tank, sand/pea gravel shall be placed around its sides. Sand/ pea gravel shall be as specified by the fabricator and shall be placed dry to ensure free flow and compaction. The tank shall be adequately supported and vibration, tamping or other appropriate means shall be used to ensure that the fill material flows around it.

10.10. Bonding to Earth

Stationary tanks and other components of below ground stationary container systems for petroleum that:

- contain substances with 3.1A, 3.1B or 3.1C flammable classifications, or
- are in a group of tanks and one of those tanks contains a substance with 3.1A, 3.1B or 3.1C flammable classifications

shall be bonded to earth. This shall ensure equi-potential bonding and shall be completed in accordance with the requirements of the Electricity Regulations 1997, i.e. the resistance to earth shall not exceed 10 ohms. Where the stationary tank is constructed of non-conductive materials, the individual metallic fittings must be bonded to earth.

It is good practice to ensure that the stationary container system and any immediate structures such as the canopy poles are separately bonded to the same earth.

10.10.1. Secondary Containment

Below ground stationary tanks for petroleum shall have secondary containment that is integral with the tank.

The secondary containment system shall retain any liquids released from the primary storage vessel and must be able to be monitored for possible leakage emanating from either the primary or secondary container.

Care must be taken to ensure that secondary containment systems are not damaged during installation or backfilling.

The design life of a secondary containment system must be not less than that of the primary container.

10.10.2. Cathodic Protection

An installation comprising a steel tank with a steel secondary containment system may require a cathodic protection system to inhibit corrosion. A cathodic protection system shall be in addition to an outer corrosion protection layer of the tank.

The cathodic protection system, sacrificial anode or impressed current, must be suitable for the individual installation, taking into account:

- the number of stationary tanks to be protected; and
- the length of pipe work requiring protection; and
- soil resistivity; and
- other corrosive characteristics of the soil; and
- presence of stray currents.

10.11. Use in conjunction with oil burning installations

Stationary container installations used in conjunction with oil burning installations must comply with Part 13, Schedule 8 of the Hazardous Substances (Dangerous Goods and Scheduled Toxic Substances) Transfer Notice 2004 (as amended) in addition to the provisions of this Code.

10.12. Dispensers

Dispensers for the retail sale of class 2.1.1, 3.1A, 3.1B and 3.1C hazardous substances must comply with the provisions of Part 11, Schedule 8 of the Hazardous Substances (Dangerous Goods and Scheduled Toxic Substances) Transfer Notice 2004 (as amended).

11. Pipework systems

11.1. Principles

All pipe work shall self-drain to the stationary tank and should be laid with a fall of not less than 1:100.

11.2. Pipework System Design – Suction Systems

It is recommended that the suction line length be kept as short as possible commensurate with good installation practice and the other requirements of this Code.

Suction lines shall be fitted with a non-return (poppet) valve below the pump only, and shall be arranged to drain back to the stationary tank at a gradient of at least 1:100.

An anti-vortex plate shall be fitted on the bottom of the suction stub.

11.3. Pipework System Design — Pressure Systems

All pressurised pipelines shall be installed with integral secondary containment around the primary delivery pipe, which shall be monitored. This can be by sensors at a sump, periodic visual monitoring of the sump, monitoring vacuum in the interstitial space, monitoring pressure in the interstitial space or another method that is at least equivalent.

Hence if monitoring is by sensor at the sump:

- install pipework so that any liquid that is released will flow to a sump that is located in a position where it can be observed visually or detected by sensors
- place sensors at the sump in a position that they are easily accessible for periodic testing
- ensure that any fittings used for testing during commissioning do not impede the flow of liquid from the interstitial space

Pressurised delivery lines shall have an emergency shut-off valve (‘double poppet’ shear valve) rigidly anchored at the base of each dispenser. The valve shall close automatically in the event of severe impact or exposure to fire. The actuator arm of the valve shall be secured to the frame of the dispenser by a trip wire to ensure actuation in the event of disturbance to the dispenser. In the case of multi product dispensers the emergency valve is to be installed in the individual delivery lines. The automatic closing feature of the emergency shut-off valve shall be checked at installation and annually thereafter by manually tripping the hold-open linkage.

11.4. Siphons

Siphons shall only be connected between tanks of the same top level and the same grade of substance.

11.4.1. Suction

Siphon connections may be installed between stationary tanks containing the same grade by connecting between suction stubs. It is recommended that a suction line draws off this connection so that the siphon may be primed initially.

11.4.2. Pressure

The suction port on a submersible turbine pump shall be connected to a high point on the siphon line. A check valve shall be fitted in line between the submersible turbine pump and the siphon line.

11.5. Venting System

Separate venting systems shall be provided for each stationary tank. These may be connected to a single outlet where required for vapour recovery purposes. It is preferable for this connection point to be above ground. Where stationary tanks are manifolded below ground, the tops of the tanks shall be set at the same elevation.

Vents and venting pipe work shall be designed in accordance with sections 11.5.1, 11.5.2 and other relevant requirements of this Code.

11.5.1. Vent Location

Vents shall terminate in the open air in such a position that flammable vapours will not accumulate or travel to an unsafe position.

Vent outlets from stationary tanks used to store Class 3.1A, 3.1B or 3.1C substances shall be not less than:

- 1.5 metres above the eave line of any building that is less than 3 metres from the vent;
- 2 metres laterally from any opening to a building;
- 4 metres laterally from any chimney or flue outlet;
- 1.5 metres laterally from a location where vehicles may park;
- 4 metres above the ground;
- 4 metres above the fill connection.

Hazardous atmosphere zones must be delineated about vents in accordance with the provisions of AS/NZS 60079.10.1 2009 and any electrical equipment installed within these zones must be compatible with the zoning.

Vent risers shall be located so that they are protected from mechanical damage.

Vent lines shall not run through or under any part of a building or its foundations. They shall not pass through the soffit.

Except in the case of aviation fuels, the vents of substances with 3.1A, 3.1B and 3.1C flammable classifications shall discharge upwards.

The vent for a stationary tank containing a hazardous liquid with a 3.1D classification need only terminate at a height and in a location that will prevent the ingress of foreign material.

All vents shall be protected against the ingress of foreign material.

Vent outlets shall prevent water ingress and tanks used for the storage of hazardous substances with 3.1A, 3.1B or 3.1C flammable classifications must be fitted with a flame arrestor. This flame arrestor must not reduce the capacity of the vent outlet and would typically be a brass wire gauze of 500 microns nominal aperture.

11.5.2. Vent Pipe Diameter

For pipe runs up to 60 m, the diameter of a vent pipe shall not be less than the greater of half the diameter of the stationary tank fill line or 50 mm nominal bore. Where a stationary tank may be simultaneously filled by two fill points the vent line diameter must be not less than 70% of the larger fill connection diameter. Where vapour recovery is in use, these principles must be applied except for the section of pipeline beyond any vapour recovery manifold point. In all cases the vent diameter shall be sized to prevent unsafe pressure in the stationary tank.

11.5.3. Vapour Recovery (Tanker delivery – Stage 1)

Where tanks are likely to contain motor spirit, the below ground components of vapour recovery systems e.g. pipework, vapour recovery hose connection point etc. are to be installed at the time of installation of the stationary container system.

11.6. Fill Lines System Design

There shall be a separate fill line for each stationary tank.

Each fill point shall be durably marked with a symbol which identifies:

- the stationary tank to which it is connected, and
- the substance stored in the stationary tank.

Fill points shall be located such that:

- they are readily accessible, and
- they are protected from accidental damage, and
- able to be locked, and
- when the filling hose is disconnected, backflow cannot occur.

Fittings shall be liquid and vapour tight.

Fill lines should be 100 mm diameter.

11.6.1. Spill containment

Each fill point shall be installed in such a way that any spillage at the fill point shall be contained for redirection to the stationary tank or recovered. An example is shown in Figure 11.6 (a). The spillage containment shall have a minimum capacity of 15 litres.

Any buried screw connection at the base of the spill containment vessel shall be double contained.(Note: This may be difficult to achieve where a spill container is replaced on an existing installation, in which case it is important that the threads are matched e.g. bsp to bsp and npt to npt, and that the joint is tested after installation).

11.6.2. Over fill protection

The fill fitting shall include an overfill protection device (see Figure 11.6 (b) as an example of a mechanical overfill protection device fitted on a tank).

11.7. Dispenser Sumps

Pipework boot penetrations and cable penetrations to dispenser sumps are to be liquid tight. Each dispenser shall have a sump located beneath the dispenser to collect and retain any leaks from the dispenser. This sump is to be tested prior to commissioning of the installation. The preferred testing method is by vacuum testing but if this is not possible then the sump shall be filled with water and there is to be no detectable change in level during a 24 hour period.

11.8. Tank Top Manways or Accessways where piping enters

Pipework boot penetrations and cable penetrations to tank top sumps are to be liquid tight. Penetrations shall be stress free and nominally at right angles to the sump wall. Each sump is to be tested prior to commissioning of the installation. The preferred testing method is by vacuum testing but if this is not possible then the sump shall be filled with water and there is to be no detectable change in level during a 24 hour period.

11.9. Marking of Pipelines and Fill Points

Fill points and above ground pipes such as vent pipe risers must be permanently marked. A marker secured by a cable tie to the vent pipe is not considered to be a permanent marker.

The marking at the fill point shall identify the substance.

The markings shall be renewed as often as necessary to ensure they are legible.

Fig 11.6 (a) Spill container (Typical)

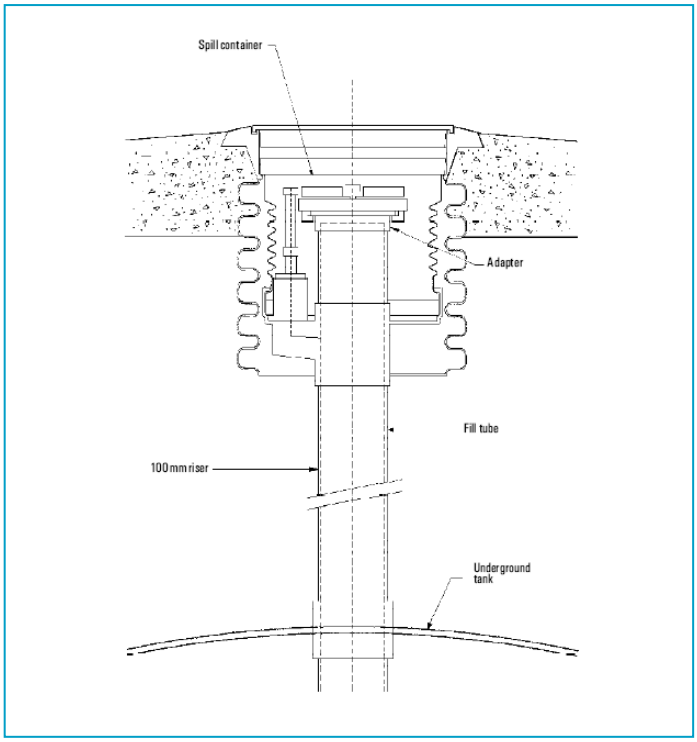
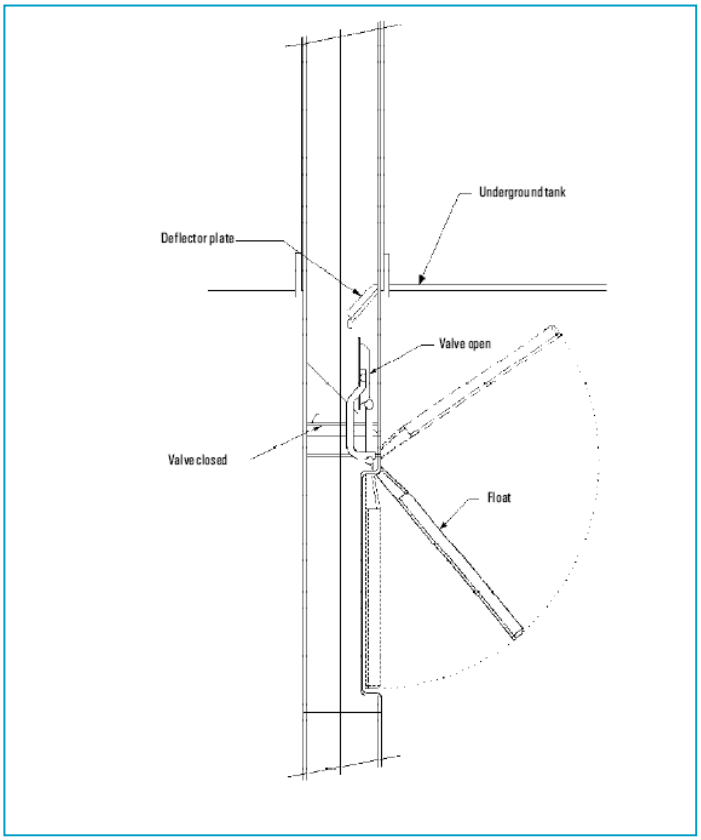


Fig 11.6 (b) Over Fill Device (Typical)



12. Pipework installation

Pipework shall be installed in accordance with the recommendations of the manufacturer. It shall be completely surrounded and supported by clean backfill.

Persons installing pipework shall be competent[5] persons.

The pipework system between any two sumps shall be designed and manufactured to a common standard.

Where differing pipework systems are to be jointed, they shall be joined inside a sump that can be monitored.

There should be no mechanical (flanged, screwed or clamped) joints installed below ground with the exception of the final connections to the above ground vents or vapour recovery lines. Where rigid pipes are used, swing joints or flexible connections may be necessary at the tank valve, the riser to the pump, the vent riser, on other indirect fill lines, and at other major changes in direction where subsequent surface settlement may distort the pipework.

12.1. Materials of Construction

Pipework shall be constructed of a non-corrodible material that is compatible with the contents of the below ground stationary tank to which it is connected. Pipework shall have a life comparable with that of the tank.

Pipework shall be constructed of fibreglass or HDPE utilizing components that are manufactured to recognized standards such as UL 971-1995, BASEEFA or equivalent. The requirements for steel pipework are excluded from this Code (see section 3).

12.2. Pipe Laying Trenches

Trenches shall be made sufficiently large that all buried pipework can be separated from the bottom and sides of the trench by a minimum of 150 mm of backfill material (e.g. pea gravel for fibreglass pipe work), and have a minimum cover of 300 mm unless the pipe is layed under a concrete slab in which case the minimum cover must be 100 mm. Trenches shall be sufficiently wide to allow pipework to lie side-by-side with a minimum clear spacing of 50 mm. Pipework following the same route should not be laid over or under each other.

Backfill shall be placed in layers not exceeding 150 mm loose depth and shall be thoroughly compacted to provide support at least equal to adjacent material.

[5] A competent person is a person who has been trained in the installation of pipework for below ground tanks and is experienced in undertaking this activity for the type of piping system being used.

The 150 mm layer should be laid and compacted under pipe runs before pipework is installed. Where necessary, temporary supports should be used to prevent movement during backfilling. Sandbags, or other systems that will provide support, without damage to the pipework, shall be used for this purpose.

Metallic tracer strips should be installed in all trenches exiting the tank slab so as to assist in future services location.

12.3. Pipe Jointing

All pipework shall be examined before installation to ensure that the bore is clean. Any pipework showing internal dirt or other foreign matter shall be thoroughly cleaned. When undertaking this, care must be taken to ensure that any internal membranes are not damaged.

Care shall be taken during installation to prevent the inclusion of foreign matter in the bore. All open ends of pipe shall be blanked off with a cap or plug whilst work is not actually being carried out on that section of the installation.

Pipework shall be joined as per the manufacturer's instructions using a minimum of joints with long lengths of pipe used wherever possible.

12.3.1. FRP and HDPE Pipe Jointing

Installation shall be in accordance with relevant requirements of the manufacturing standard and the pipe manufacturer's instructions.

12.4. Testing Pipework

12.4.1. Integrity test

All new pipework shall be pneumatically tested at completion of assembly and prior to containing product, to ensure integrity. Primary pipework is to be held at 70 kPa gauge pressure and secondary containment system pipework at 35 kPa gauge pressure. All joints and connections shall be visually inspected and leak tested with soapy water. All testing shall be witnessed by a competent person[6] who is approved by the test certifier. If pipework that has previously contained product is being reused, the pipework shall be tested for integrity using an inert gas, e.g. nitrogen.

Following completion of installation and integrity testing, pipework systems are to be stored under pneumatic pressure or vacuum until the site is commissioned. These systems shall be monitored using a pressure/vacuum gauge of appropriate calibration range and any variation in pressure or vacuum is to be recorded and investigated.

[6] A person who is trained and experienced in this activity.

12.4.2. Distribution Pipework

Pressurised pipework must be tested in accordance with the specifications of the supplier or otherwise at 150% of the working pressure. In all cases the test pressure must not be less than 400 kPa gauge pressure.

Non-pressurised pipework must be tested in accordance with the specifications of the supplier or otherwise at a pressure not less than 35 kPa gauge pressure.

Pipework secondary containment is to be pressure tested in accordance with the manufacturer's instructions. Typical test pressures for these systems are in the range 25 kPa or 70 kPa gauge pressure.

Vacuum testing shall be at -14 kPa gauge pressure.

During testing, stationary tanks shall be isolated from their pipework and vented so that they are not subject to the test pressure.

Valves or plugs in the underside of secondary containment shall be removed so that any leakage into the secondary containment during testing of the pipework can be readily detected.

12.4.3. Fill and Vent Lines

Fill and vent pipework shall be tested in accordance with the specifications of the supplier or otherwise at a pressure not less than 35 kPa gauge pressure.

During testing, stationary tanks shall be isolated from their fill and vent systems so that they are not subject to the test pressure.

12.4.4. Test Records

The person in charge or their nominee shall record all test procedures used for testing and also the test results.

Records of testing of pipework shall be kept in accordance with the requirements of section 15 of this Code.

12.5. Test Procedures for Pipelines

12.5.1. Test procedure for pipeline where the primary pipe can be soaped

Attach a pressure gauge to the pipe system. Raise the pressure in the system to the test pressure and hold for at least one hour. Apply a soap solution to all fittings and joints and inspect for any leaks indicated by the formation of bubbles.

During this testing, pipework pressure is to be monitored to check for any leaks indicated by a fall in pressure.

Any leak indication is to be recorded and investigated.

12.5.2. Test procedure for the primary pipe of double walled pipework

Attach a pressure gauge to the primary pipe. Ensure the interstice is sealed and install a pressure gauge to monitor the pressure in the interstitial space. Raise the pressure in the primary pipe to the test pressure and hold for at least one hour.

A leak is indicated if the pressure falls in the primary pipe and/or rises in the interstitial space.

Any leak indication is to be recorded and investigated.

12.5.3. Test procedure for secondary containment of pipework

Attach a pressure gauge to the interstitial space. Raise the pressure in the interstitial space to the test pressure and hold for at least one hour. Apply a soap solution to all fittings and joints and inspect for any leaks indicated by the formation of bubbles.

A leak is indicated if:

- the pressure falls in the primary pipe, or
- the pressure falls in the interstitial space.

Any leak indication is to be recorded and investigated.

The test pressure is to be that prescribed by the manufacturer. This is typically 70 kPa but may be 35 kPa where flexible termination fittings are used or flexible secondary containment is used.

12.5.4. Post Construction Testing

If leaks have been detected following completion of the stationary container system, the pipework and/or secondary containment is to be repaired and re-tested prior to being placed into service. The testing may be a repeat of the test procedures specified above.

13. Leak detection

13.1. General

Leak detection must be provided for the tank and for pressurised pipework. It is additional to inventory control. A leak detection system must be provided that can detect a leak from any portion of the tank, pipework and secondary containment system. The principal form of leak monitoring is monitoring of the interstitial space for “double skin” tanks and monitoring of the secondary containment for pressurised pipework. This enables the integrity of both the primary container and its secondary containment system to be verified.

The principal form of monitoring the stationary tank is monitoring of the interstitial space. The principles of leak monitoring include:

Component	Monitoring provisions
Tank/secondary containment	Monitor interstitial space. Alternatives may be quiet period monitoring or statistical inventory reconciliations, in which case periodic monitoring of the interstitial space should still be undertaken annually.
Suction pipework	Safe suction does not require the pipeline to be monitored
Pressure pipework	Pipework must be monitored
Vent, vapour and fill lines	Not required to be monitored
Pump/dispenser sumps	Monitor the sump

13.2. Tank Monitoring

13.2.1. Tank interstitial monitoring

Interstitial monitoring monitors both the inner and outer tank walls. There are a number of possible interstitial monitoring methods e.g.:

- filling the interstitial space with a non hazardous liquid under hydrostatic pressure and monitoring the level
- a continuous permanently mounted automated vapour or liquid sensor
- pressure/vacuum monitoring in accordance with the instructions of the tank fabricator
- monitoring any liquid formation in the interstitial space.

When interstitial monitoring of double skin tanks or pipe work utilizes a calibrated instrument, it shall include an annual inspection program to ensure that:

- the system is active, and
- the measurements are within the accuracy of the fabricators tolerances, and

- the measurements are recorded, and
- any losses outside the fabricator's tolerance are reported to the person in charge.

Typical details for an interstitial tank monitoring system utilizing a non hazardous liquid in the interstitial space are included in Appendix G.

13.2.2. Quiet Period Monitoring

Quite period monitoring occurs where stationary tanks equipped with an electronic sensing system, such as an automatic tank gauging system, continually monitors the tank during quiet periods.

The system must be capable of detecting a leak as small as 0.76 litres per hour with a 99.9% probability of detection and less than 1.2% probability of a false alarm.

13.3. Pipework and equipment

13.3.1. Pressurised Pipework

Pressurised pipework requires a substance release detection method that is in addition to an automatic line leak detector. This may include (non exclusive):

- interstitial monitoring (preferred)
- statistical inventory control
- electronic leak monitoring
- vapour monitoring.

13.3.2. Automatic line leak detection

Leak detection must be provided for all below ground pressurised pipelines.

Automatic line leak detection (mechanical or electronic) must be provided on below ground pressurized pipelines. The US EPA requirement for such devices is that they detect a leak of 11.4 litres per hour (3 US gallons per hour) at a line pressure of 69 kPa (10 psi).

Hence install the pipelines with a uniform slope to avoid creating pockets. Follow the instructions of the fabricator and the performance data to ensure the line-leak detector is applicable to the specific installation.

Leak detectors may only be removed from pressurized delivery lines for servicing or when a pressure test is to be carried out on lines using an inert gas such as nitrogen. In most instances, gas pressure testing can be performed with the detectors in place. If a leak is suspected in a line that is in service, it must not be pressure tested with product.

13.3.3. Interstitial monitoring

Interstitial monitoring must be provided on all pipelines that have secondary containment. This can be by sensors at a sump, monitoring vacuum in the interstitial space, monitoring pressure in the interstitial space or another method that is at least equivalent.

13.3.4. Non pressurised pipework

Suction lines and delivery lines that are below ground do not require leak detection provided:

- the suction line operates at less than atmospheric pressure
- the delivery line is supplied by gravity only
- the pipework is sloped so that the contents drain into the below ground tank. In the case of suction lines this can only occur when suction is released.
- only one check valve is included in the suction line and it is located directly below and as close as possible to the suction inlet of the dispensing pump.

If the pipeline does not meet these criteria it must have leak monitoring. This may include (non-exclusive):

- monitoring a secondary containment barrier (preferred),
- statistical inventory control
  piping tightness test every three years.

13.3.5. Pump/dispenser sumps

Options for monitoring the pump/dispenser sumps include:

- dipstick
- float sensor
- visual inspection.

As these can only be inspected by removal of the pump/dispenser panels, they should be inspected at each pump/dispenser service.

13.4. Statistical Inventory Analysis

Where Statistical Inventory Analysis (SIA) is used as a leak monitoring system, it shall be in addition to tank interstitial monitoring or utilized in circumstances whereby tank interstitial monitoring is unable to be used. It must:

- comply with a method that is certified by the SIA equipment supplier as meeting the requirements of US EPA/530/UST-90/007, or an equivalent standard in terms of protection to the environment, human health and safety.
- be calibrated and commissioned such that it is capable of detecting a leak of 0.76 litre/hour, with a probability of detection at least 0.95 and a probability of false detection no greater than 0.05, and
- be operated in compliance with the SIA equipment manufacturer’s written instructions
- be conducted at least monthly

13.5. Observation and Monitoring Wells

Any observation and monitoring wells that are required shall be placed during installation of the stationary container system.

These wells must be arranged to enable prompt confirmation of any suspected leakage, through the use of bailers or a portable gas analyzer to detect the presence of fuel or vapour.

It must be possible for this examination to be carried out at any time by the person in charge or the Relevant Authority.

For both types of well, the well liner must terminate in a secure cap designed so that it is impossible to connect any hose coupling to the well.

The number of wells required depends upon site conditions.

13.5.1. Observation Wells

Observation wells are used to check for loss into the tank pit.

One well is required for a single stationary tank, two for each group of adjacent stationary tanks up to five, and one additional well for each further group of up to four additional stationary tanks.

At least one observation well shall be placed so samples may be drawn from the lowest level of the pit

13.5.2. Monitoring Wells

Monitoring wells may be used to monitor the ground water table for water-borne hydrocarbons in the general area of below ground stationary container systems for petroleum. They are suitable as a back-up system only and must be supplemented by other leak monitoring systems. They should generally be placed down the ground water gradient from the stationary tanks.

Monitoring wells should only be used when:

- the top of any aquifer is not more than 7 m from the ground surface, and
- the permeability of the soil between the stationary container system and the monitoring well enables migration of the hydrocarbon. As a guide, soil permeability greater than 10^{-2} cm^2 is typically sufficient for this purpose.

When monitoring wells are used a competent person shall assess the site and establish the number and positioning of the monitoring wells. In addition advice should be sought from the relevant local authority on the placement of monitoring wells.

Monitoring wells shall:

- be located to maximize the likelihood of intercepting the impacted groundwater,
- be clearly marked and secured to avoid unauthorized access and tampering.
- have the slotted portion of the well casing designed to prevent the migration of soils into the well, but allow entry of the hazardous substance under both high and low groundwater conditions.
- be sealed from the ground surface to the top of the filter pack.

- be able to detect the presence of a minimum of 3 mm apparent thickness of free-phase substance in the well.
- not penetrate any soil layer lying below stationary tank excavation level that provides a natural barrier to travel of hydrocarbons to lower levels, especially where there is an aquifer at the lower level.

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14. System testing

14.1. Principles

System components should be proven at logical points prior to being placed into service. This is particularly relevant to the tightness of the stationary tank and pipework.

14.2. Recommended Tests

The components included in Tables14.1, 14.2 and 14.3 must be tested and recommended tests are also included.

Table 14.1 Test procedures prior to placing system components into the excavation.

Component	Test Procedure
Double skin tank	In accordance with section 10.6 of this Code
Pipework	Visual inspection.

Table 14.2 Test procedures after assembly of system components but prior to backfilling.

Component	Test Procedure
New pipework. (Pipework must be isolated from its tank during testing.)	In accordance with section 12.4 of this Code.
Tank top sumps and dispenser sumps	Vacuum test. If this is impractical, water fill as per manufacturer's instructions
Tank deflection	In accordance with fabricator's instructions.

Table 14.3 Test procedures prior to placing the storage system in service

Component	Test Procedure
Double skin stationary tank	In accordance with section 10.6 of this Code
Pipework	In accordance with section 12.4 and 12.5 of this Code.
Tank shell deflection	In accordance with fabricator's instructions.
Leak detection sensors	Ensure ability to detect alarm condition (e.g. water, contained substance).
Automatic tank gauges	Verify set up parameters (e.g. tank size, construction, tilt) and calibration.
Over fill prevention devices	Verify the device is set at the proper height and ensure proper operation.

Fill point spill containers	Check the operation of the liquid drain (if present) and the clearance between the fill-pipe cap and the manway cover. Remove liquids, trash installation aids, etc.
Shear valves	Ensure the valve is securely anchored and that the vale mechanism operates freely. Check the level of the shear section relative to the pump island surface.
Mechanical line leak detectors	Test for ability to detect 11 litres (three gallons) per hour leak according to fabricator's instructions.
Electronic line leak detectors	Verify set up parameters (e.g. pipework length, diameter, type). Test for ability to detect 11 litres (three gallons) per hour leak according to manufacturer's instructions.

14.3. System Tests

14.3.1. Pre-Installation Tank testing

Pre-installation inspection and tank testing is outlined in section 10.6 Stationary Tank Testing and Appendix H of this Code.

14.3.2. Pipework Testing

Testing of pipework is outlined in sections 12.4 and 12.5 of this Code for new pipework.

15. Records

15.1. General

The following records shall be passed to the person in charge and shall be readily available for inspection.

15.1.1. As-built drawings

The “as-built” drawings and photographs described in section 7.3. of this Code

15.1.2. Equipment List

Record details of installed equipment, including

Equipment Item	Details Required
Below Ground tanks	Material, manufacturer, capacity, installer, serial number, fuel.
Below Ground Piping	Material, manufacturer, sizes, installer
Above Ground piping	Material, manufacturer, sizes, installer
Vents	Size, manufacturer, catalogue no.
Dispensers	Manufacturer, type, fuel being dispensed, serial number. EPA Register approval number if for retail sale.
Dipstick	Capacity (in litres)
Pumps (if separate from dispensers)	Manufacturer, type, fuel being dispensed, serial number
Tank Gauging	Manufacturer, type, fuel being dispensed, serial number
Cathodic Protection	Manufacturer, type
Over fill protection	Manufacturer, type
Interceptor	Manufacturer, type, capacity
Earthing/Bonding	Installer

15.1.3. Secondary Containment Systems

Details of any secondary containment systems

15.1.4. Records of Tests

15.1.4.1. Stationary tank manufacturing tests

Records of tests carried out on the stationary tank at the fabricator’s premises including leak and coating tests.

15.1.4.2. Backfill

The certificate for the material used for backfilling around the stationary tank and pipe work.

15.1.4.3. Leak tests

The records of all stationary tank and pipe work tests carried out at the time of installation and any subsequent tests. These records shall also include details of any repair work that has been carried out to the stationary tanks and associated pipe work.

15.1.4.4. Cathodic protection tests

The results of the commissioning tests and ongoing routine tests of the cathodic protection system.

15.1.5. Observation Wells and Monitoring Wells

The location of observation wells and/or monitoring wells.

15.1.6. Check List

Refer to the checklist in Appendix F to assist with meeting the requirements of this Code.

15.1.7. Repairs

Details of any repair work that has been carried out to the stationary tanks and associated pipe work.

15.1.8. Recommended inclusions

It is recommended that records include:

- the direction of groundwater flow (if known)
- the proximity of any environmentally sensitive areas, including the distance to any surface water bodies or potable water within 100 metres
- the location of monitoring wells
- Consents or permits relating to the stationary container system, including details of conditions.

16. Compliance

16.1. Inspection and Enforcement

Responsibility for the relevant Inspection and enforcement under the HSNO Act is as follows:

- Inspection and certification is conducted by independent test certifiers approved by the EPA. A register of these test certifiers is on the EPA website at: http://www.epa.govt.nz/search-databases/Pages/testcertifiers-search.aspx
- Enforcement in the workplace is carried out by the Department of Labour.

16.2. Certification

The person in charge must ensure that all test certificates are obtained and are current. This includes stationary container system test certificates and where relevant, a location test certificate. No person shall put a hazardous substance into a stationary container system unless that stationary container system is issued with a test certificate by an approved test certifier.

16.3. Location Test Certificate

To obtain a location test certificate for a new below ground stationary container system for petroleum the information provided to the test certifier will need to include evidence that:

1. At least thirty days notice has been given to an enforcement officer of the Department of Labour advising that the site containing the stationary container system is to be commissioned.
2. An approved handler is available to the site, unless the site is for diesel.
3. All substances in the stationary tanks are secure and can only be accessed by authorised persons using the appropriate keys or tools in the locks securing access.
4. The location and boundaries of all hazardous atmosphere zones and controlled zones have been established and detailed on the site plan.
5. Any electrical equipment within hazardous atmosphere zones complies with the Electricity Regulations and be able to demonstrate by inspection that there are no other ignition sources present within hazardous atmosphere zones.
6. Any openings into below ground stationary tanks for petroleum are separated from any LPG stationary tanks or, other stationary tanks for class 2.1.1 gases, by not less than 6 metres.
7. All site signage is in place.
8. Unless it is an unattended dispensing station, there are at least two fire extinguishers located within 30 metres of the stationary container system. These must have a capacity of at least 30B.

9. An emergency response plan has been prepared, made available to all affected persons and tested at appropriate times.
10. Secondary containment for the stationary container system has been provided.
11. Relevant site plans and drawings have been prepared including:
    a. A drawing showing the relationship between the hazardous substance locations and the site legal boundaries.
    b. A drawing showing the hazardous atmosphere zones.
    c. A drawing plan showing the controlled zones.

16.4. Stationary Container System Test Certificate

The *Guide for the Certification of Stationary Tanks and Process Containers*[7] provides a guide to the procedure for this certification. Both the tank design and the system installation must be certified.

Below ground stationary tanks can be grouped into two categories:-

1. Workshop constructed by a certified fabricator; or
2. Field constructed or workshop constructed as a one off.

It is anticipated that the majority of below ground stationary tanks will be workshop constructed by certified fabricators. The certified fabricator must be approved for a specific design or designs that are certified by a test certifier.

If the fabricator is not approved they are still able to manufacture a tank, but it must then be considered as a field constructed tank and individually certified.

The issue of test certificates is undertaken in accordance with Schedule 8 clauses 92 and 94 of the Hazardous Substances (Dangerous Goods and Scheduled Toxic Substances) Transfer Notice 2004 (as amended) by test certifiers approved by the EPA. The specific clauses are:

Field constructed or workshop constructed as a one off:

- Stationary tank design and construction (clause 92(2)(b)(i) and (ii)).

Workshop constructed by a certified fabricator:

- Design for a stationary tank or process container (clause 94(1)(a));
- Fabricator for the construction of a certified design (clause 94(1)(b));

[7] Available from the EPA website at http://www.epa.govt.nz/Publications/Guide-for-the-Certification-of-Stationary-Tanks-and-Process-Containers.pdf

16.4.1. Certification of design for workshop fabricated tank.

For workshop constructed tanks, a tank design may be approved by an approved test certifier, so long as the test certifier is provided with sufficient information to allow the design to be approved. The design is then registered with the EPA. Once registered, these designs may be used on a regular basis. The characteristics of the design do not change with the location of the installation, or the application. Typical examples of tanks that fall into this category are farm tanks and service station tanks fabricated to UL2085, AS1692 etc.

16.4.2. Certification of fabricator

To construct a workshop constructed tank to an approved design, a fabricator must be certified by a test certifier approved by the EPA for this purpose. The design must be approved first, and the fabricator then certified to fabricate that specific design. The design can include a range of tank capacities to the same basic design providing sufficient detail for each tank size is included in the design.

16.4.3. Certification of the stationary container system

It is anticipated that most stationary container systems with below ground tanks will utilise a tank that has been constructed by an approved fabricator to an approved design. In this circumstance the test certifier certifying the installation of the stationary container system is not likely to need to verify the tank design and construction. The test certifier is likely to need to verify that the tank has maintained its integrity.

The test certifier certifying the installation is required to be assured of the integrity of the system. This includes:

1. stationary tanks
2. pipework and vents
3. secondary containment; and
4. dispensers.

In order to achieve this, the test certifier should be involved for the duration of the installation project. The test certifier should be involved no later than completion of the construction drawings.

There are several checkpoints during the installation process and the test certifier may require to be directly involved at these points or may require information to be provided from a competent person. Typical checkpoints include:

- completion of design
- checking a tank prior to installation in the ground
- anchoring/hold down arrangements of a tank
- checking the tank in ground prior to being covered up

- seeing the bedding material, compaction and back fill provided about the tank, particularly in the region indicated by 5:00 to 7:00 o'clock about tank
- pipework prior to being covered over
- pressure or vacuum held in pipework for the duration of the installation
- vents and fill points
- concrete
- dispensers and above ground equipment, and

as built drawings

Appendix A: References and sources of information

(Normative)

References

Hazardous Substances and New Organisms Act 1996

Hazardous Substances (Emergency Management) Regulations 2001

Hazardous Substances (Classes 1 to 5) Controls Regulations 2001

Hazardous Substances (Dangerous Goods and Scheduled Toxic Substances) Transfer Notice 2004 (as amended).

Contaminated Land Management Guidelines No 1 – Reporting on Contaminated Sites in New Zealand (available from MfE website www.mfe.govt.nz/publications)

Environmental Guidelines for Water Discharges from Petroleum Industry Sites in New Zealand 1998 (available from MfE website www.mfe.govt.nz/publications)

Underground Petroleum Storage Tanks and Related Wastes – Code for Transportation and Disposal of (available from the Department of Labour website http://www.osh.govt.nz/order/catalogue/index.shtml)

PEI/RP100 - 11 Recommended Practices for Installation of Underground Liquid Storage Systems (available from the Petroleum Equipment Institute http://www.pei.org)

UL 971-1995 Nonmetallic Underground Pipework for Flammable Liquids

Department of Labour. (1992), Code of practice for the design, installation and operation of underground petroleum storage systems.

HSNOCOP 45 Below Ground Stationary Container Systems for Petroleum - operation

Further guidance

PEI/RP300-09 Recommended Practices for Installation and Testing of Vapour Recovery Systems at Vehicle-Fuelling Sites

HSNOCOP 19 Code of Practice for Disused Below Ground Stationary Tanks on Farms

AS/NZS 60079.10.1:2009 Explosive gas atmospheres Part 10.1: Classification of areas – Explosive gas atmospheres.

Sources of information

The acts and regulations referred to in this Code are available at:
www.legislation.govt.nz

The Hazardous Substances (Dangerous Goods and Scheduled Toxic Substances) Transfer Notice (as amended) referred to in this Code is available on the EPA web site at:
http://www.epa.govt.nz/Publications/Transfer-Notice-35-2004.pdf

The group standards are available on the EPA web site at:
http://www.epa.govt.nz/hazardous-substances/approvals/group-standards/Pages/default.aspx

The registers referred to in this Code (other than the registers of hazardous substances) are available on the EPA New Zealand web site at:
http://www.epa.govt.nz/Pages/default.aspx

A register of test certifiers can be found on the EPA website at: http://www.epa.govt.nz/search-databases/Pages/testcertifiers-search.aspx

Further Information on hazardous substances is available on the EPA website at:
http://www.epa.govt.nz/hazardous-substances/Pages/default.aspx or

call the Hazardous Substances Compliance Line: 0800 376 234; or

contact EPA New Zealand at:
PO Box 131, Wellington
Tel: 04 916 2426
Email: hsinfo@epa.govt.nz
Website: http://www.epa.govt.nz
You may also contact the Ministry of Business, Innovation and Employment at:
Tel: 0800 20 90 20
Email: info@dol.govt.nz
Website: www.mbie.govt.nz

Appendix B: Safe handling of petroleum substances

(Informative)

1. General

All petroleum substances are hazardous. They can cause EXPLOSION or FIRE.

Most petroleum substances are TOXIC when not used with due care.

Reference must be made in the first instance to the Safety Data Sheet.

2. Fire and Explosion

All petroleum substances must be treated as being potentially explosive, even in small quantities.

Petrol, aviation gasoline and most solvents evaporate readily, producing an explosive mixture with air. Kerosene, aviation turbine fuel and the less volatile solvents can also produce explosive vapour, particularly in poorly ventilated areas. All substances can accumulate static electricity which may trigger an explosion — kerosene-type substances are particularly susceptible.

Automotive diesel, fuel oils and lubricating oils can produce explosive conditions if sprayed or heated, even over small areas.

3. Precautions Against Fire and Explosion

Keep all SOURCES OF IGNITION away from petroleum substances and their vapour. Sources of ignition include:

- Matches, lighters and cigarettes, etc.
- Any flame or spark.
- Any non-flameproof electrical equipment, including switches, hand torches, electric radiators, vacuum cleaners, power tools and radios.
- Welding sets, leads, connections and hand-pieces.
- Gas welding torches.
- Motor vehicles and all internal combustion engines.
- Tools which can cause a spark if dropped, etc.
- Grinders.

Petroleum vapour is heavier than air and will readily collect in pits, drainage sumps, cellars, and any low areas. Small quantities of vapour can be quickly and safely dispersed by good and rapid ventilation.

- The presence or absence of petroleum vapour can be checked by a vapour tester
- Do not enter any stationary tank or pit that has contained or does contain petroleum substances unless it has first been tested and a safety certificate issued by a competent person

- Do not do any hot work (e.g. welding, gas cutting, grinding, drilling or power wire-brushing) on any stationary tank or container that still contains any substance or that has not been tested and certified gas free by a competent person.
- Do not transfer or pour petroleum substances from one container to another, without ensuring that both containers are fully earthed, and that an effective earthing connection is made between hose nozzle and receiving container before any transfer is started, and is maintained as long as the transfer continues.

4. Toxic Hazards

Petroleum vapour can quickly asphyxiate. At lower concentrations, they irritate the eyes and lungs, and may cause nausea, headache and depression.

Petroleum substances will irritate the eyes and skin and may cause dermatitis on prolonged or repeated contact.

In addition, petrols used to contain and aviation gasoline may still contain toxic lead compounds. Internal surfaces of stationary tanks which have contained these substances will be contaminated and must be treated as highly toxic, even after all of the substance has been removed.

5. Precautions Against Toxic Hazards

- Avoid splashing, or any contact with the eyes or skin.
- Wear PVC gloves and boots, and cotton overalls. Wear goggles or face shield if splashing is possible.
- If clothing gets contaminated with substance, remove under a running shower.
- If eyes or skin contact occurs, treat as under First Aid Treatment on following page.

Notes for Physician

Administration of medicinal liquid paraffin may reduce absorption through the digestive tract. Gastric ravage should only be done after endotracheal intubation in view of the risk of aspiration which can cause serious chemical pneumonitis for which antibiotic and corticosteroid therapy may be indicated. Motor gasolines may contain lead compounds; however, the quantities involved are unimportant in the context of the treatment of acute gasoline poisoning.

6. Emergency action

In case of petroleum spillage:

Extinguish all naked flames.

Shut down any other potential sources of ignition.

Ensure area is well ventilated.

Small Spill: Absorb spills in enclosed areas. Absorb outside spills using sand, earth, or a proprietary absorbent.

Large Spill: Contain and pump into storage.

Petroleum Fire

- Use dry powder, foam, B.C.F., or carbon dioxide extinguishers.
- Do not use water jets - these will spread the fire.

First Aid Treatment

Petroleum Substances Swallowed:

- Do not induce vomiting! The main hazard following accidental ingestion is aspiration of the liquid into the lungs, and children are more susceptible than adults.
- Give 250 mls (1/2 pint) of milk to drink; if not available, give water.
- SEND TO THE HOSPITAL IMMEDIATELY.

Eye Contact:

- Wash with copious amounts of water for at least 10 minutes.

Skin Contact:

- Drench the skin immediately with cold water.
- Remove contaminated clothing under a running shower and wash all contaminated skin with soap and water.

Inhalation:

- Move victim to fresh air.
- Keep the patient warm and at rest.
- If unconscious, place in the recovery position.
- If patient not breathing, give artificial respiration.
- Give cardiac massage if necessary.
- SEND TO THE HOSPITAL.

Appendix C: Approved standards for the design and construction of below ground stationary tanks

(Normative)

Steel Stationary tanks (Inner tanks)

AS 1692-2006: Stationary tanks for flammable and combustible liquids. Category 4 tanks in this standard relates to below ground tanks.

BS EN 12285-1: 2005 Workshop fabricated steel tanks. Horizontal cylindrical single skin and double skin tanks for the underground storage of flammable and non-flammable water polluting liquids

Fibreglass Stationary tanks

ASTM 4021-1992 Standard Specification for Glass Fibre Reinforced Polyester Underground Petroleum Storage Tanks

UL 1316 - 1994 the standard Glass-Fiber-Reinforced Plastic Underground Storage Tanks for Petroleum Products, Alcohols, and Alcohol-Gasoline Mixtures

Appendix D: Standards for the testing and installation of below ground stationary tanks

(Informative)

Fabricator Certification

Fabricators wishing to produce below ground petroleum storage stationary tanks must first obtain approval of their manufacturing works from an approved test certifier to become a certified fabricator.

In order to become certified, it will be necessary for the fabricator to submit full Quality Assurance/Quality Control manuals and to nominate the certified design specification.

These manuals are to address the following:

- Prototype testing in accordance with the design specification.
- Complete inventory of equipment used in manufacture.
- List of laboratory equipment with calibration certificates and proposed quality control tests citing the relevant standards to which the tests will be carried out.
- Personnel qualifications

A history of the Company should be provided showing management structure and the numbers of staff employed stating years of relevant experience and qualifications held. A current annual report should be provided to back up the application for approval. This report should show the annual turnover of the company in addition to listing the major projects carried out.

It is advised that the company obtain accreditation to the ISO 9000 series Quality Systems.

Standards for the testing and installation of FRP tanks

The following specifications are applicable to the testing of glass fibre reinforced polyester resins:

ASTM D2393-96	Standard test method for viscosity of epoxy resins and related components
ASTMD638-87a	Standard test method for tensile properties of plastics
ANSI/ASTM D2587-68	(Reapproved 1979) — Standard test method acetone extraction and ignition of glass fibre strands yarns and roving for reinforced plastics
ASTM D584-68	(Re-approved 1979) — Standard test method for ignition loss of cured reinforced resins
ASTM D790-86	Standard test method for flexural properties of un-reinforced and reinforced plastics and electrical insulating materials
ASTM C581-87	Standard practice for determining chemical resistance of thermosetting resins used in glass fibre reinforced structures intended for liquid service
ASTM D2563-70	(Re-approved 1987) - Standard practice for classifying visual defects in glass reinforced plastic laminate parts

Appendix E: Means of compliance with this Code

(Normative)

Persons in charge of below ground stationary container systems for petroleum must take the following actions to comply with this Code.

1. General

Design, construction, installation, operation, maintenance, repair and alteration of below ground stationary container systems for petroleum must be performed in accordance with the requirement of this Code by persons who have appropriate levels of competence and experience.

A stationary tank design and the fabricator who constructs the below ground petroleum system in accordance with that design must both be certified by a test certifier.

2. Test Certificates

Prior to commissioning of a new site, the person in charge must obtain separate test certificates for the hazardous substance location and the below ground stationary container systems.

3. Test Certificate for Hazardous Substance Location

To obtain a location test certificate for a new below ground stationary container system for petroleum the information provided to the test certifier will need to include evidence that:

3.1 At least thirty days notice has been given to an enforcement officer of the Department of Labour advising that the site containing the stationary container system is to be commissioned.

3.2 An approved handler is available on the site unless the site is for diesel.

3.3 All substances in the stationary tanks are secure and can only be accessed by persons using the appropriate keys or tools in locks securing access.

3.4 The location and boundaries of all hazardous atmosphere zones and controlled zones have been established and detailed on the site plan.

3.5 Any electrical equipment within hazardous atmosphere zones complies with the Electricity Regulations and be able to demonstrate by inspection that there are no other ignition sources present within hazardous atmosphere zones.

3.6 All openings on the below ground stationary tank for petroleum are separated from any LPG stationary storage stationary tanks or, other storage stationary tanks for class 2.1.1 gases, by not less than 6 metres.

3.7 All site signage is in place

3.8 Unless it is an unattended dispensing station, there are at least two fire extinguishers located within 30 metres of the stationary container system. These must have a capacity of at least 30B.

3.9 An emergency response plan has been prepared, made available to all affected persons and tested at appropriate times.

3.10 Secondary containment for the stationary container system as specified in 12.11 of this Code has been provided.

3.11 Relevant site plans and drawings have been prepared including:

a. A drawing showing the relationship between the hazardous substance locations and the site legal boundaries.
b. A drawing showing the hazardous atmosphere zones.
c. A drawing plan showing the controlled zones.

4 Test certificate for below ground petroleum storage stationary tanks.

To obtain a test certificate for a new below ground stationary container system for petroleum the person in charge of the system must ensure that:

Prior to the introduction of a hazardous substance into the stationary container system, it must be certified by a test certifier approved by the Authority. In order to achieve this certification, the test certifier is required to be assured of the integrity of:

1. Stationary tank
2. Pipework and vents
3. Secondary containment, and
4. Dispensers

In order to achieve this, the test certifier should be involved during the duration of the project. The test certifier should be involved no later than completion of the construction drawings.

There are several checkpoints during the installation process and the test certifier may require to be directly involved at these points or may require information to be provided from a competent person. Typical checkpoints include:

- Completion of design
- Tank, prior to installation in the ground
- Anchoring/hold down of tank
- Tank in ground prior to being covered up
- Bedding material, compaction and back fill (particularly 5:00 to 7:00 o’clock about tank)
- Pipework prior to being covered over
- Pressure held in pipework for the duration of the installation
- Vents and fill points
- Concrete
- Dispensers and above ground equipment
- As built drawings

Appendix F: Checklist for installation

(Informative)

This checklist has been developed to assist the installer and person in charge with meeting the requirements of this Code.

Item	Tick when supplied
Stationary tank design producer statement and test certificate	☐
Stationary container system installation producer statement and test certificate	☐
Electrical certificate of compliance	☐
Electrical inspection certificate	☐
Stationary container pressure tests	☐
Pipework pressure tests	☐
Verification of bedding materials	☐
Producer statement for concrete	☐
As built drawings	☐
Confirmation of commissioning – details of equipment performance	☐
Schedule of equipment and provision of all related documentation, including specifications, operating manuals and maintenance manuals.	☐
Operation manuals	☐
Maintenance manuals	☐

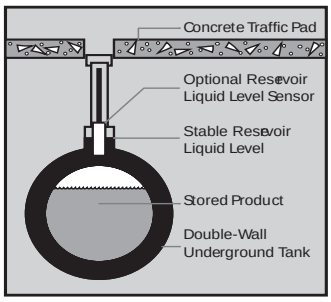
Appendix G: Typical interstitial monitoring operation instructions

(Informative)

The interstitial space between the primary and secondary tanks is filled with a liquid up to and including a stand pipe on the tank “reservoir” that can be accessed from ground level and the stability of the liquid column checked.

A typical example of a wet annular space is:

- Use antifreeze solution in cold climates
- Maximum burial depth from tank top is 2.1m below grade unless advised by fabricator’s engineer.
- Monitoring cavity must be vented to the atmosphere at all times
- After installation, set the liquid level in the reservoir so the reservoir is half full
- A reservoir sensor, if installed, will alarm for preset events

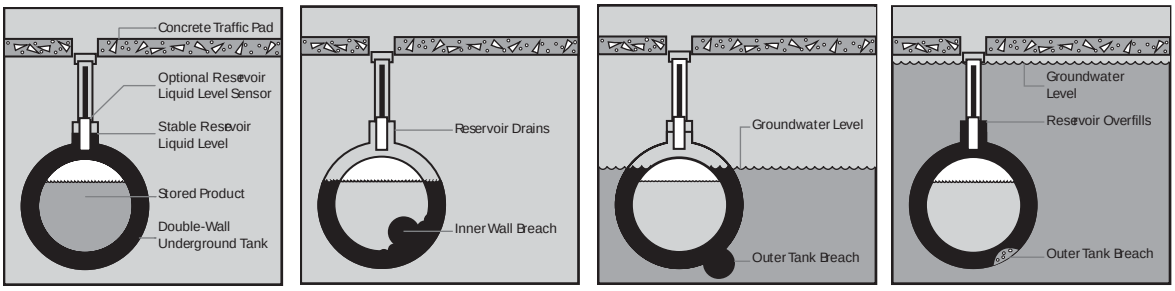


In order to carry out a tank tightness test the following steps are carried out:

1. Remove the access cover over the stand pipe and ensure there is liquid in the standpipe up to a convenient level and that it is stable at that level (i.e. allow the liquid time to settle after filling – usually about 3 hours).
2. Measure the liquid level with a tape or dip stick, wait 4 hours and re-measure the liquid level.
3. If after 4 hours the liquid level is within 25 mm of the original liquid level, the tank has passed the tightness test.
4. Some variation of the liquid level may occur between tests due to evaporation etc. If this occurs liquid (water) may need to be added to return the liquid to the required level.

Typical conditions that may occur are shown on the next page.

Normal Conditions	Inner Wall Breach	Outer Wall Breach Groundwater Below Tank Top	Outer Wall Breach Groundwater Over Tank Top
The reservoir liquid level will be stable if both the inner and outer tanks are tight. A reservoir sensor, if fitted, will activate an alarm if the reservoir drains or overfills.	Interstitial fluid drains into the primary tank causing the reservoir liquid level to drop. No petroleum product escapes from the primary tank to contaminate the annular space.	If the groundwater is below the tank top, the interstitial fluid drains into the ground, causing the reservoir liquid level to drop.	If the groundwater is over the tank top, the reservoir will fill up with groundwater.



Appendix H: Recommended pressure tests for new tanks prior to installation

(Informative)

Testing of Double-Walled Tanks which do not have a liquid filled interstice

To prevent damage from over-pressurisation of the interstitial space the following procedure should be followed:

1. Vent the interstitial space to the open air.
2. Pressurise the inner tank to 35 kPa.
3. Seal the inner tank and disconnect the external air supply.
4. Monitor the pressure for a period of at least 1 hour. While air tests are generally inconclusive without soaping and careful inspection for bubbles, this step is recommended to detect a very large leak in the inner tank and to prepare for the next step.
5. Pressurise the interstitial space with air from the inner tank. Use a second gauge for measuring this interstitial space pressure.
6. Soap the exterior of the tank and inspect for bubbles whilst continuing to monitor the gauges to detect any pressure drop.
7. When the test is complete, first release pressure in the interstitial space and then release pressure on the primary tank.

WARNING: Pressurisation of the interstitial space directly from an outside air source is dangerous and is strictly prohibited.

Never enter the tank whilst the interstitial space is under pressure.

Comments

a. The capacity of the interstitial space is very small in relation to the primary tank capacity. Compressors commonly used for testing can over-pressurise the space in seconds, causing serious damage to the tank.

b. A slight decrease in pressure in the inner tank may occur when the interstitial space is pressurised. A pressure drop of 2 kPa (0.3 psi) or less is typical.

c. The space between the inner and outer tank walls is variously referred to as the “annular space”, “annulus”, “interstitial space” and “interstices.

The primary containment vessel is referred as the “inner tank” and the exterior shell of the tank as the “outer tank”.

Environmental Protection Authority
Te Mana Rauhī Taiao

BP House, (Level 1), 20 Customhouse Quay, Wellington 6011, New Zealand

New Zealand Government