

4. PURPOSE

To ensure that the possibility of a product release from a UPSS of sufficient magnitude to be hazardous to life, health, property or the environment is minimised.

To stipulate procedures equipment and construction details that must be followed in the design, installation and operation of underground petroleum storage systems by all owners, operators and installers of UPSS.

To ensure that high standards of engineering and installation practice are applied in all UPSS.

To provide UPSS that will store and dispense their contents in a safe, efficient, effective and workable manner.

5. SCOPE

This code of practice applies to all underground petroleum storage systems where hydrocarbon products (such as automotive, aviation and industrial fuels, and non-toxic solvents) are stored underground in tanks.

All new storage systems shall be engineered and installed in accordance with this code.

All new and existing storage systems shall be operated in accordance with this code, and any alterations and additions shall meet all applicable requirements of it.

6. DEFINITIONS

For the purpose of this code, the definitions listed below shall apply.

6.1 **Applicable Regulations**

Regulations and/or by-laws that apply in the region, or municipality in which the storage system is to be installed, which apply to the work being carried out and to the equipment being installed in the course of the works.

6.2 **Approved**

Approved by the appropriate authority.

6.3 **Authority**

The authority having statutory control over, or obligation to control, a particular aspect of the works.

- 6.4 Contractor**
The person or company engaged by the principal to carry out installation or maintenance work.
- 6.5 Inspector**
The Inspector of Dangerous Goods responsible for the area in which the UPSS is situated.
- 6.6 Licensing Authority**
The authority responsible for the issue of dangerous goods licences in the area in which the UPSS is situated.
- 6.7 Monitoring Wells**
Wells installed at a distance from the UPSS to allow the spread of hydrocarbons through the ground to be monitored should a leak occur. (See section 16.)
- 6.8 Observation Wells**
Wells installed within the UPSS excavation to allow any hydrocarbons in the ground to be detected. (See section 12.9.3.)
- 6.9 Operator**
The person responsible for the operation of the UPSS.
- 6.10 Owner**
The owner of the storage system as distinct from the owner of the land upon which the storage system is installed.
- 6.11 Principal**
The person or company who contracts to have the work carried out on their behalf.
- 6.12 Project Engineer**
The person who is to administer the contract between the contractor and the principal on behalf of the principal. In most cases, the project engineer will be an employee of the principal; however, the principal may engage a third party to administer the works.
- 6.13 Purchaser**
The purchaser of an item of equipment as distinct from the eventual owner of that item.
- 6.14 Shall, Must, Should, May**
The words “shall” and “must” are to be understood as mandatory and

the word “should” as advisory. The word “may” means that discretion may be used.

6.15 Site

That portion of the property on which the storage system is located that may reasonably be considered to be associated with the storage system and the operation thereof.

6.16 Storage System

The whole system used for underground storage of hydrocarbon products comprising underground tanks, all associated pipework, fittings, vents, fill points and dispensing equipment.

6.17 Underground Tank

A tank capable of storing hydrocarbon products which is installed below the surface of the ground and entirely covered with backfill, and as defined in the Dangerous Goods Regulations.

6.18 UPSS

The Underground Petroleum Storage System.

7. INSTALLATION CONTRACTORS

The engagement of skilled professional UPSS installers is a vital factor in avoidance of system failures. The installation of storage systems for flammable and combustible liquids is a unique field. Whilst every effort is to be made to adequately design and document UPSS, the ability to recognise and react to unexpected, abnormal conditions encountered during an installation job requires experience as well as skill.

Experience has shown that a high proportion of system failures are attributable to poor workmanship. To ensure that high standards are achieved, the Principal shall only engage contractors whom he is satisfied are capable and knowledgeable in the type of work required, to undertake the installation of UPSS.

Furthermore, all installation work shall be supervised by a suitably trained and experienced project engineer or his nominee who must inspect work in progress, witness all tests and document his approval.

8. DRAWINGS AND SPECIFICATIONS

Drawings and specifications are required to provide guidance for installers and a record of all components of the UPSS. The drawings

must adequately describe the property and identify the size and location of the tanks, and products to be stored, as well as the location of the pumps and piping, protection system and cabling. The plans and specifications must also detail the materials of construction and piping dimensions, as well as dimensions and locations of vents. The choice of suitable approved equipment and materials is necessary to help ensure long-term system operation and integrity.

The plans shall also show cathodic protection component locations, when used.

If hold-down pads or other anchoring devices are included in the tank system design, dimensions and construction details must be included in the drawings.

Installation drawings and any amendments thereto shall be approved by the appropriate authorities prior to commencement of any installation work on site.

8.1 Site Specific Drawings

Site specific drawings shall detail the locations of:

- Site boundaries;
- Existing buildings, foundations, structures, and all services, including any LPG and/or CNG installations;
- New tanks;
- Existing tanks which are to remain in use;
- All decommissioned tanks;
- Vents;
- Fill points;
- Pumps and pipework; and
- Monitoring wells and observation wells.

The site-specific drawings shall clearly indicate the size of all tanks, existing and new, showing both tank capacity and physical dimensions, and shall include any hydrogeological information available.

The product to be stored in each tank shall be recorded.

Pipework size shall be shown unless pipe sizes are detailed on the standard drawings. If, for any reason, pipe sizes are different from sizes shown on the standard drawings, then they shall be shown on the site-specific drawings.

8.2 Standard Drawings

Standard drawings shall show standard details of installation work and shall be in accordance with standards detailed in this code of practice.

Standard drawings shall include:

- details of pipework and fittings to be used;
- tank installation and anchoring details;
- fill point and spill containment details;
- details of tanks and tank fittings;
- details of any observation and monitoring wells; and
- cathodic protection system details.

8.3 "As-Built" Drawings

On completion of the work, the contractor shall prepare "as-built" drawings of the UPSS, supplemented by any photographs taken during construction showing all relevant details and dimensions. He shall provide one set of drawings and photographs each to the principal and the owner.

The "as-built" plans may consist of installation drawings marked up by the contractor.

The information recorded shall include:

- the locations and sizes of all tanks, including any decommissioned tanks;
- the location and sizes of all piping, valves, pumps and dispensers;
- clear indication of which pumps are connected to each tank, and of product stored in each tank; the locations of pipework connections to each tank;
- the locations of all electrical conduits and all underground services within or adjacent to the area occupied by the UPSS;
- the locations and details of any observation and/or monitoring wells installed;
- details of any cathodic protection system provided, including locations of anodes;
- the date the installation was commissioned; and
- the dates of all modifications.

These drawings shall be updated whenever any modification is made to the UPSS.

8.4 Site Lay-out Drawing

In addition to the above drawings, the owner shall provide a drawing showing the site lay-out with all buildings, tanks, fill points, vents, dispensing equipment, pumps, pipe runs, observation and/or monitoring wells, and all electrical conduits and other underground services clearly indicated. Each tank shall be identified with its size, the product it contains, and the fill point(s) and dispensing equipment to which it is connected.

The owner shall supply one copy of this drawing to the Licensing Authority, and a second copy to the site operator, who shall update it whenever any change is made, and shall keep it permanently displayed in a readily accessible and visible position on the premises.

9. SAFETY OF WORKS

9.1 General

All work on the site shall be carried out with due regard to the safety of persons employed on the work, other persons employed on the site, and the general public.

The work shall be carried out in accordance with all statutory regulations pertaining to safe work practices.

In many cases, the principal will have his own safety requirements, particularly in the case where the principal is a major oil company. This section sets a minimum standard for safety precautions to be observed and shall be read in conjunction with the requirements of the principal.

9.2 Permits, Regulations and Standards

Before work commences, the project engineer shall ensure that all necessary permits have been obtained from the relevant authorities. The project engineer may instruct the contractor to apply for and obtain the permits; nevertheless it is the project engineer's responsibility to ensure that permits are obtained except where there is a statutory obligation upon the contractor to obtain certain permits.

The work shall be carried out in accordance with all applicable statutory regulations, whether those regulations require a permit to be issued or not.

9.3 Safety of Contractor's Personnel

The works shall be carried out in accordance with all applicable occupational safety and health regulations, including those regarding work in excavations.

The contractor and the project engineer shall both make themselves familiar with the regulations, particularly as they impact upon the execution of the contract for site works.

9.4 Excavation Safety

In general, every effort should be made to obviate the need for persons to enter the tank excavation. Where this is unavoidable, regulations shall be complied with, and particular care taken to eliminate any risks such as asphyxiation, presence of hydrocarbon vapours, or cave-in. No

one should ever enter an unshared or unbattered excavation unless the excavation has been certified to be stable by a competent person.

9.5 Safety of Third Parties

The contractor shall take all necessary precautions to ensure that the works are carried out in such a manner as to present no hazard to the site, customers, staff or the public in general.

The project engineer shall satisfy himself, on behalf of the principal, that all reasonable measures have been taken. This duty upon the project engineer shall in no way relieve the contractor from his responsibilities in this area.

All excavations and work areas shall be barricaded, and unauthorised persons kept clear of such areas. Where work areas are open to the public or staff working on the site at night, the contractor shall provide and maintain adequate lighting to keep the area safe.

Particular care must be taken on sites that continue in operation whilst work is being carried out. Equipment and materials to be used on-site shall be organised in such a manner as to cause no hazard to persons on the site.

Notwithstanding the above, both the contractor and principal shall maintain appropriate insurance cover for any damage or injury to persons or property during the course of the works.

9.6 Statutory Permits

The formal approval of the authority responsible for administration of regulations pertaining to UPSS must be obtained before starting any onsite work and its stipulations adhered to for every installation.

Applications should be made as early as is practicable, and a reasonable time before it is intended to commence any work on site. For new sites, or sites where special approvals are required, a substantial period will be necessary.

9.7 Safe Handling of Petroleum Products

Brief notes of general safety precautions are covered in Appendix C.

9.8 Electrical Equipment

Any electrical equipment can be a possible source of ignition. Where petroleum products are stored the location of equipment must be considered and hazardous areas identified. The requirements regarding electrical installations may be determined by applying the principle of zoning into regions of differing degrees of hazard in accordance with a code or Standard Specification as may be approved by the Chief Inspector of Dangerous Goods (NZS 6101, parts 1 and 3 is an acceptable standard). Electrical equipment that is installed into any such

zone must conform to the requirements of the Chief Electrical Inspector, Ministry of Commerce.

10. SITE ANALYSIS

Characteristics of the site that pertain to the UPSS are:

- The degree of environmental risk associated with the site.
- The corrosion environment to be addressed.
- The water table that will be encountered in the excavation.
- Properties of the soil with respect to the likely stability of the excavation.
- Practical considerations and site limitations.

10.1 Environmental Risk

The degree of environmental risk associated with an installation shall be evaluated with regard to the following parameters:

- The environmental sensitivity classification of the area in which the site is located.
- The permeability of the soil around and under the UPSS.
- The ability of the underground environment to transport hydrocarbons.

Three Environmental Sensitivity Zones are recognised:

Zone A Highly Sensitive Areas are areas where there is a high risk that any leakage from a UPSS will contaminate an aquifer which is used or has been identified for future use as a source of supply for a reticulated potable water system.

Zone B Moderately Sensitive Areas are areas that are within 100 metres (or such greater distance that the Authority shows is needed) of any pumping station drawing potable water from an underground source or of areas such as inland waterways and wetlands where any leakage from a UPSS will have a medium or long term adverse effect on that environment, as determined in consultation with the appropriate Authority.

Zone C Other Areas of Lesser Sensitivity where any leakage from a UPSS is unlikely to pose a significant threat to human life or the environment.

Secondary Containment (see section 12.10) shall be installed in all Zone A areas.

For Zone B sites, an environmental sensitivity survey must be carried out unless the principal, at his discretion, chooses to install a secondary containment system.

10.1.1 Environmental Sensitivity Survey

10.1.1.1 Where an Environmental Sensitivity Survey is to be made, the principal shall commission a competent person to carry it out.

10.1.1.2 The area of 100 metres radius (or such greater distance that the authority shows is needed) around the proposed installation shall be surveyed for locations which may create danger to people if flammable hydrocarbon leakage should find its way to them.

Such locations would include, but not be limited to, basements, tunnels, manways, service pits, etc., where hydrocarbons could infiltrate and accumulate if they were floating on the groundwater.

10.1.1.3 The survey shall also take note of areas that would be damaged environmentally by the presence of petroleum products.

Such areas would include, but not be limited to, stormwater drains, natural waterways, and artesian water sources that are currently being used or that have been designated for future use.

10.1.1.4 If this survey indicates that there are locations within the area surveyed that require consideration, then the likelihood of hydrocarbons being transported towards these locations should be assessed by means of a hydrogeological survey.

10.1.2 Hydrogeological Survey

The hydrogeological survey shall be carried out by a competent person.

The hydrogeological survey shall determine the rate and direction at which a release of hydrocarbons will spread from the point of release.

The hydrogeological survey will take into account soil permeability and porosity, the existence, depth, fluctuation in level, and gradient of the water table, and the existence of service trenches with permeable backfill that may act as conduits for hydrocarbon movement.

Should the hydrogeological survey indicate that a continuing release of hydrocarbons would be likely to reach a hazardous or environmentally sensitive location in less than 30 days, monitoring wells shall be placed outside the tank excavation in the probable direction of travel of released hydrocarbons to ascertain the need for interception and recovery measures in the event of suspected leakage. These monitoring wells will be in addition to the observation wells within the tank excavation (see sections 12.9.3 and 16).

10.1.3 Survey Record

A copy of all survey information comprising the evaluation of the degree of environmental risk shall be retained by the owner of the installation.

10.2 Soil Test

The principal shall arrange for a soil test to be carried out on change of ownership of the UPSS and also on the removal of any existing tank. Prior to or during the installation of a new UPSS, soil testing may be required in the approximate location of the tank excavations to ascertain:

- Corrosive properties of soil, including resistivity (except where fibre reinforced plastic tanks and pipework are to be used) — see section 15.
- Structural properties of the soil for allowable proximity of the excavation to nearby building foundations, and the likely need for shoring of the excavation where prior knowledge of the site is limited.
- Existence and depth of water table, where it is not more than 2 metres below the bottom of the tank excavation.

This information, together with experienced judgement, will indicate whether tank anchorage is necessary.

- Existing soil contamination. For a variety of reasons, there may be existing residual hydrocarbons in the site soil. Where significant contamination has occurred, representative soil samples must be taken and checked as set out in section 21.2.2.

The amount and extent of contamination must be recorded and reported to the appropriate area authority, who may advise regarding the necessity for further testing and clean-up. The background level of contamination at a site must also be taken into account in any subsequent investigation of suspected leakage.

Where a hydrogeological investigation is carried out, the soil test may be carried out in conjunction with that investigation.

The results of the soil tests shall be passed on to the contractor for his information in assessing the need for shoring up or dewatering any excavations.

11. REMOVAL OF TANKS

Underground petroleum storage systems or individual components of such systems that are no longer required or that are no longer suitable for petroleum storage shall be properly decommissioned in order to ensure future safety and avoid environmental hazard.

When a site is decommissioned, all tanks shall be removed (unless it is impracticable to do so and the appropriate Authorities agree to their remaining in place) and the site checked for residual contamination

(see section 21.2.2). Where residual contamination is found, the degree and extent of contamination shall be recorded and reported to the appropriate authorities who may advise regarding the need for further testing and/or remedial measures.

Where one or more tanks forming part of a storage system are to be taken out of service, the tank or tanks shall be removed from the system unless it is unsafe or impracticable to do so and the appropriate authorities agree that the tank(s) remain in place until the entire system is decommissioned.

Tank removal or decommissioning must be carried out in accordance with this code, applicable statutory requirements and accepted safety standards. Special care must be taken to ensure that any escape of hydrocarbon vapours or liquid is minimised and isolated from any potential source of ignition, or escape into surface or ground water. Hose and pipe connections must be vapour tight, and any liquid or vapour emissions checked and stopped as soon as they occur.

11.1 Removal

11.1.1 Some or all of the following precautions may be required when removing underground equipment, the actual need to be determined for each individual site:

- erect barriers around the work site;
- display “No Smoking/Flammable Atmosphere” signs;
- ensure no sources of ignition within 15 metres, or as otherwise approved;
- slope or shore sides of excavation if deemed necessary;
- minimise amount of equipment moving on site;
- do not disturb any equipment that is to remain in place;
- avoid undermining driveways, foundations, etc.;
- avoid damage to coatings and/or cathodic protection systems, etc;
- be aware that contaminated backfill can be a fire and an environmental hazard.

See also Appendix C: Safe Handling of Petroleum Products.

11.1.2 Remove as much liquid as practicable from the tank using flameproof or air-powered pumping equipment. (Note: Sludge is not removable, particularly where there are no manholes.) Pump motors and suction hoses shall be bonded to the tank or otherwise grounded to prevent the accumulation of static electricity. If there is still product in the tank when the pumping equipment can recover no more, the contractor shall use a thief pump to remove as much of the remaining product as is practicable.

- 11.1.3 Excavate to the top of the tank.
- 11.1.4 Disconnect and drain all pipe connections, and remove all piping. Piping that cannot, for practical reasons, be removed shall be drained and filled with grout.
- 11.1.5 All removable internal fittings shall be removed from the tank and all openings securely plugged.
- 11.1.6 Excavate all around the tank. Remove it from the ground by lifting on the lifting lugs if sound, or by means of suitable strops passed under the tank. Take particular care not to rupture the tank.
- 11.1.7 The tank shall be clearly and durably signed, on the ends and on opposite sides, in letters at least 50 mm high:

TANK HAS CONTAINED LEADED PETROL*
NOT GAS FREE

**NO HOT WORK TO BE ATTEMPTED ON THIS TANK UNTIL IT HAS
 BEEN CERTIFIED GAS FREE. NOT SUITABLE FOR STORAGE OF
 FOOD OR LIQUID FOR HUMAN OR ANIMAL CONSUMPTION**

**Where other flammable liquids have been stored, use the applicable designation, e.g. DIESEL.*

In addition, the tank shall be labelled in at least two clearly visible places adjacent to the above warning with the standard Class 3 Dangerous Goods diamond label (400 mm x 400 mm).

- 11.1.8 The tank shall be transported by road from the site to a secure location as soon as possible after it has been removed from the ground and labelled.

11.2 Storage of Used Tanks

Used tanks shall be stored in a secure location to which access of persons is restricted and in accordance with the Dangerous Goods Act and Regulations.

11.3 Re-Use of Tanks

Only tanks which have been fully cleaned down, show no visible signs of corrosion or deterioration, have been checked for metal thickness and fully tested as for a new tank, have been refurbished and recoated to “as new” condition and certified as suitable for the purpose by a competent person, may be re-used in UPSS, provided that the licensing authority for the area has agreed.

If a used tank is sold for re-use for any purpose, the vendor shall supply the purchaser with a written report stating the condition and

former use of the tank. A copy of the report, signed by the purchaser, shall be retained by the vendor.

In addition to a bill of sale used to transfer ownership, the person given possession of the tank must be notified in writing that it has held dangerous goods and is liable to contain flammable liquid or vapour. (Refer Appendix B for a typical Disposal Notice.)

11.4 Disposal for Scrap

- 11.4.1 A tank that is to be sold for scrap shall first be taken to an approved secure area and be made gas free.
- 11.4.2 The tank shall be rendered unusable.
- 11.4.3 A bill of sale, as detailed above, shall be used to transfer ownership of the tank to the scrap dealer.

11.5 Decommissioning Tanks

Where a tank in a group of tanks is decommissioned, it may only be left in place as long as the installation remains in operation.

- 11.5.1 Steps 11.1.1 to 11.1.4 inclusive shall be completed as for tank removal, with the exception of the tank vent line which shall remain intact and in operation.
- 11.5.2 The tank may be left empty to facilitate later removal when the site is decommissioned or rebuilt, but must still be covered by a Dangerous Goods licence.
- 11.5.3 The excavation shall be backfilled to the surface levels.
- 11.5.4 The location of the decommissioned tank and pipework, and the reason for its being taken out of service, shall be recorded on the "as-built" drawings of the storage system.

12. TANKS

12.1 Tank Construction

Tanks may be of steel or fibreglass construction.

Steel tanks for use in UPSS shall be constructed in accordance with the requirements of an approved standard, and shall have a corrosion-resistant coating as detailed in section 12.5 of this code.

Steel tanks shall be cathodically protected unless soil analysis shows the corrosion environment to be sufficiently inert that cathodic protection is not required.

Fibreglass tanks may only be used provided they are constructed by an approved manufacturer and tested and installed all to an approved standard.

Except as permitted in section 11.3 of this code, all tanks installed in underground storage systems shall be new.

Where double compartment tanks are used, the two compartments must be used for the same product, or for different grades of the same product such as regular and super grades of motor gasoline.

Tanks shall have all fittings, as specified by the purchaser and as shown on the purchaser's detail drawings, installed prior to testing by the manufacturer. Fittings shall include separate fill, suction and vent connections, and dip tube fitted with a calibrated dipstick to show tank contents at any level.

Approved standards are those currently approved by the Chief Inspector of Dangerous Goods, and are those listed in Appendix D for steel tanks, and Appendix F for fibreglass tanks.

12.2 Tank Size

When suction pumping systems are used with petrol or other similarly volatile products, the tank diameter should be restricted to 2.5 m maximum.

When submersible pumps are used, suction lift and therefore tank diameter is not limited. There is then no theoretical limit to the size of such tanks. Practical limitations will apply.

12.3 Tank Identification

Each tank shall be identified according to the requirements of the purchaser. Notwithstanding the purchaser's requirements, the following minimum information shall be permanently and legibly marked on the tank shell adjacent to the dip tube connection:

- Manufacturer's identification.
- Construction Specification, e.g. NZS 7521.
- A reference number unique to the tank.
- The date of fabrication.
- The tank capacity.

12.4 Tank Testing

The tank shall be tested at the manufacturer's premises prior to application of the coating.

The test shall either be a hydrostatic test wherein leakage can be directly observed or detected by accurate volumetric measurement; or an air pressure test using soapy water on all joints and fittings to detect leakage. Air test pressure must be 35 kPa. Any higher pressure may rupture the tank and is highly dangerous. The recommended test method is set out in Appendix E.

Both compartments of a double compartment tank must be tested at the same time, without applying differential pressure to the internal wall.

If any leak is found, it shall be repaired, and the test repeated. Test records certifying that each tank has been tested successfully shall be supplied to the purchaser, and a duplicate copy retained by the manufacturer.

12.5 Coating Steel Tanks

12.5.1 Surface Preparation: All external sharp corners and weld pinnacles on the tank shall be removed and the shell shall be abrasive blast-cleaned to S.A.2.5.

12.5.2 Coating Material: The coating material shall be an approved two-pack coal tar epoxy enamel or equivalent applied strictly in accordance with the manufacturer's instructions, and as approved by the purchaser (see also section 15.2).

A touch-up kit in sealed cans containing sufficient of each component to make 500 ml of mixed material shall be dispatched with each tank.

12.5.3 Application: The coating material shall be applied strictly in accordance with the manufacturer's instructions.

Successive coats shall vary in colour.

Sufficient material shall be applied to give a uniform coating with a minimum dry film thickness as recommended by the coating manufacturer.

12.5.4 Coating Test at Manufacture: The coating shall be carefully inspected for any obvious holidays, defects or damage. Coating thickness shall be checked using a paint thickness tester. Readings shall be taken at 1m intervals maximum along opposite sides of the tank.

The coating shall be subjected to a comprehensive holiday test using a high voltage spark holiday detector calibrated to NACE RP 74-09.

12.6 Records

Records of the leak test and the coating tests shall be retained by the purchaser, and copies attached to the "as-built" drawings.

12.7 Tank Handling and Site Testing

Tanks shall at all times be handled in such a manner as to avoid any damage to the tank, its fittings or its protective coating.

During application of coating, care shall be taken that sections of the coating are allowed to harden prior to any load being applied to that section of surface such as the tank being rolled or ladders or other equipment being placed against the side of the tank.

During lifting on to and from the transport, the tank shall only be lifted using the lifting lugs installed by the manufacturer. Lifting chains or straps shall be arranged so as to be at an angle of no more than 30° to the vertical to avoid placing undue axial stress upon the tank shell.

Unless suitable holding-down fittings are provided, the tank shall be secured to transport using webbing straps only. The tank shall be chocked to prevent movement against the truck tray during transportation that may damage the coating. Cradles shall be so designed as to give even support to the tank and not damage the coating or dent or otherwise damage the tank shell.

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

Whenever possible, the works should be scheduled so that tanks may be lifted from the transport and placed adjacent to the excavation ready for site testing. Following testing, the tank must be lifted directly into its final position in the excavation. Tanks must not be dragged into position.

The tank, and in particular its coating shall be inspected by the Project Engineer or his nominee prior to placement into the excavation.

Where cathodic protection is to be installed, this inspection shall be carried out by the Cathodic Protection Contractor (refer section 15): Any defect in the coating shall be repaired using a material that is compatible with the coating and that can be readily applied in the field.

Immediately prior to installation on site, the tank leak test described in Appendix E shall be repeated and shall be witnessed by the project engineer or his nominee. The contractor shall also notify the inspector at least 24 hours in advance of the time at which the test will be carried out so that the inspector can attend if he so wishes. The contractor shall supply a copy of the test certificate to the Licensing Authority.

During connection of piping and cathodic protection wiring to the tank shell, it will be necessary for installation and inspection personnel to walk on top of the tank. A layer of durable material shall be placed over the exposed portion of the tank shell to ensure that the coating is not damaged by this traffic.

12.8 Tank Location

Tank location will be determined considering the following parameters:

- Dangerous Goods Regulations
- Delivery vehicle access
- Location of pumps
- Site boundaries

- Building foundations
- Environmental constraints.

Generally, it will 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.

Tank excavation shall be far enough away from structural foundations and existing tanks so that no load can be transmitted to the excavation wall. In general, a slope of 45° drawn from the nearest part of the foundation should not intersect with any part of the tank excavation. In practice, the soil test (see section 10.2) will indicate the allowable proximity to foundations.

The location of tanks to be installed shall be shown on the site drawings, and tanks shall be installed strictly in accordance with those drawings.

12.9 Tank Installation

Tanks shall be buried in such a manner as to ensure that they are:

- Adequately supported by the surrounding backfill;
- Insulated from direct corrosion attack by being surrounded by inert material; and
- Protected from imposed loads from above by pavement and/or adequate cover of compacted backfill.

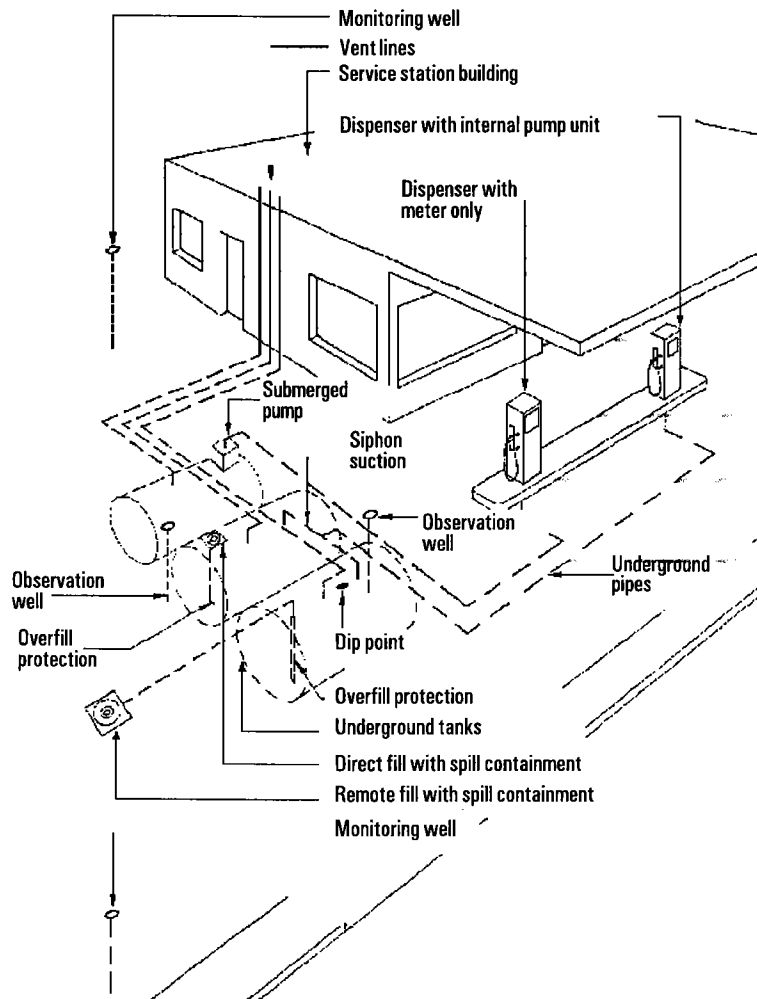
Steel tanks shall be surrounded with sand, but for FRP tanks, pea-gravel or similar approved materials shall be used. Whichever material is used, it must be properly tamped into place to provide good support to the tank shell and ends.

At sites where the nature of the ground is such that the sand or pea gravel may be washed away into the surrounding material and allow the tank to settle, the sand or pea gravel shall be surrounded with a suitable filter membrane to prevent migration. Minimum cover over tanks will usually be determined by the need to have all pipework draining back to the tank, but shall not be less than:

- (i) Where the tank is under an open yard where it will not be subject to frequent or heavy traffic loadings and is not less than 3 m 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.
- (ii) Where the tank is under a building or in an open yard within 3 m of a building and will not be subject to trams loading:
 - ◆ not less than 600 mm of earth; or

- ♦ not less than 400 mm of cover of which not less than 100 mm is reinforced concrete.
- (iii) Where the 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 total cover may be reduced to 500 mm.
- (iv) Alternative combinations of reinforced concrete and earth cover that provide appropriate equivalent bearing capacity may be used provided the minimum cover over the top of the tank is not less than 300 mm in any case.

Fig. 12.9 Tank Installation (Typical)



12.9.1 Materials

12.9.1.1 Sand: The sand backfill surrounding steel tanks and pipework shall be clean, non-plastic, chemically inert, free from salt, shells, organic matter, balls of clay, lumps of earth and corrosive materials. The backfill shall be approved by the corrosion practitioner referred to in clause 15.7. The latter may require sample resistivities from stock pile or truckload in which case such samples shall be taken by the soil box method in accordance with the corrosion practitioner’s instructions. The sand shall be free-flowing and of an approved grade complying with the following:

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

12.9.1.2 Pea Gravel: Pea gravel used to surround FRP tanks and pipework must comply with the specification recommended by the tank manufacturer and approved by the Chief Inspector of Dangerous Goods. Wherever fines are present it shall be laid within an approved filter membrane designed to prevent the ingress of fine soil or sand particles, in strict accordance with the tank manufacturer’s recommendations.

12.9.1.3 Test Certificate: The contractor shall furnish the project engineer with a test report for the sand or pea gravel certifying that it complies with the relevant specification.

12.9.1.4 Concrete: Concrete shall have a minimum compressive strength of 17.5 MPa.

12.9.2 Excavation: The excavation for the tank(s) shall be sufficiently large to allow the placement of the full depth of sand/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 the excavation shall be smoothly shaped and free from loose stones or projections that may reduce the minimum thickness of bedding material to less than 150 mm at any point. The excavation shall also accommodate the anodes of the cathodic protection system where installed. The excavation and placement of the tank should be completed without anyone having to enter the excavation. If circumstances require people to enter the excavation, then statutory regulations shall be complied with. See sections 9.2 and 9.3 also.

Fig. 12.9(a) Single Tank and Monitoring Well

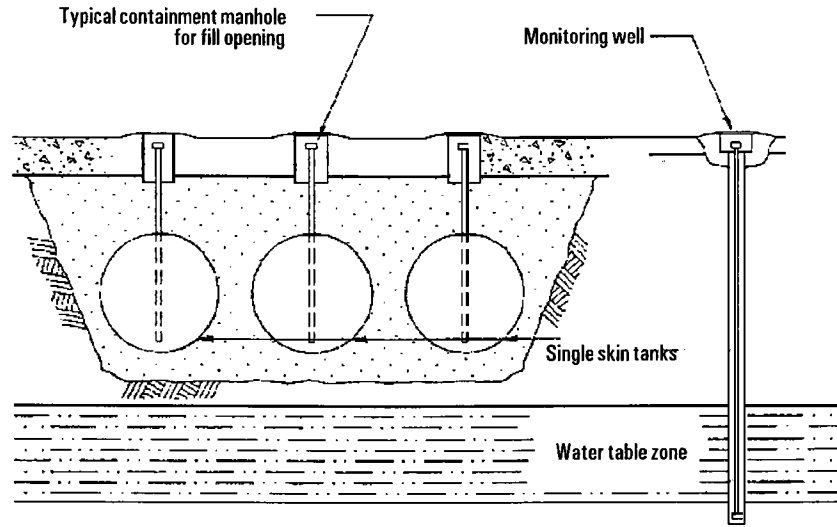


Fig. 12.9 (b) Single Tank with Plastic Liner and Observation Well

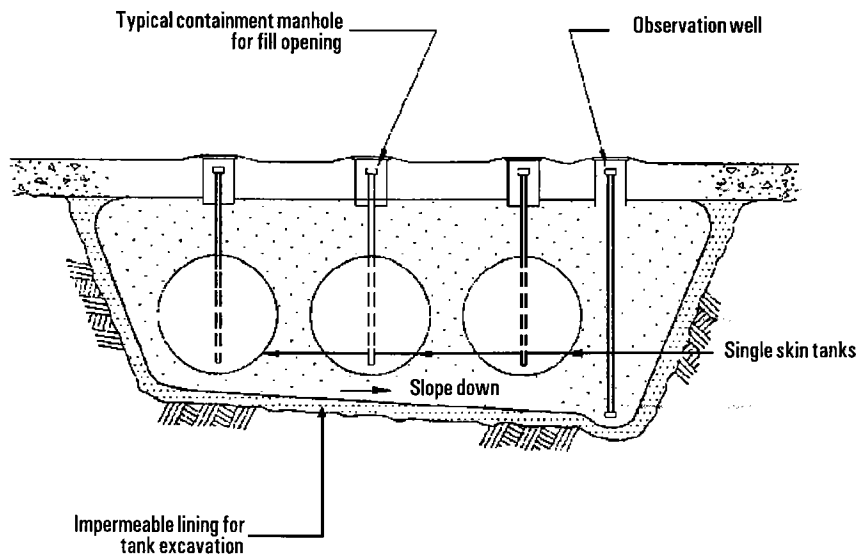
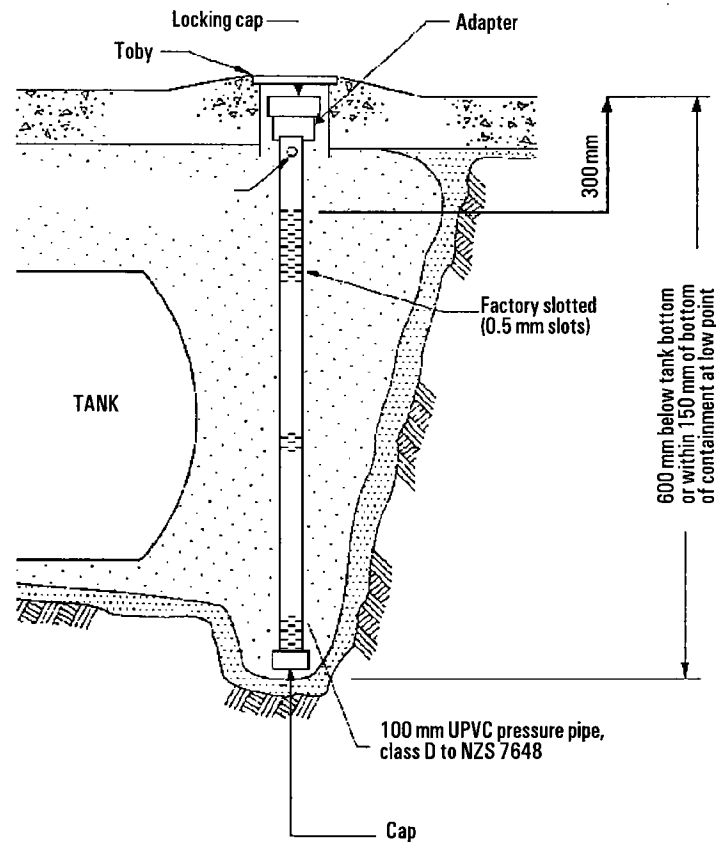


Fig. 12.9(c) Observation Well (Typical)

12.9.3 Observation Wells: Observation wells shall be installed within the excavation alongside all new tanks or groups of tanks. See also section 16 — Leak Monitoring, and Figures 12.9(b) and 12.9(c). The toby box lid over the well shall be identified by a solid black marking in the form of an equilateral triangle having a 50 mm side, on a pale background.

12.9.4 Sand Bed: A sand or pea gravel bed of 150 mm minimum thickness is to be placed on the floor of the excavation.

12.9.5 Placement: The tank shall be placed into the excavation and approved sand or pea gravel backfill shall be placed at the ends to stabilise the tank temporarily while levelling is carried out. The tank should be laid with a fall of at least 1:100 to the drain point end.

During tank placement and subsequent backfilling operations, care shall be taken to ensure that no foreign material, including soil, enters the excavation and becomes trapped in the sand/pea gravel surrounding the tank. The project engineer shall closely supervise placement.

and backfilling operations and ensure that any such material is immediately removed from the excavation, even if it means having to remove the tank to do so.

Immediately after placement, observation wells, when required, shall be placed into position.

12.9.6 Ballasting: When the project engineer considers it necessary, tanks may be ballasted with water. With the approval of the licensing authority, only aviation fuel tanks may be ballasted with product.

12.9.7 Backfilling: After placement and levelling of the tank, sand/ pea gravel shall be placed around the sides of the tank. Sand/ pea gravel shall be as specified and shall be placed dry to ensure free flow and compaction. The contractor shall ensure that the tank will be adequately supported and shall use vibration, tamping or whatever means are necessary to ensure that the sand flows in under the sides of the tank.

12.10 Secondary Containment

The purpose of secondary containment is to retain liquids that may be released from the primary storage vessel, so that sensitive resources as outlined in section 10.1 are protected from contamination.

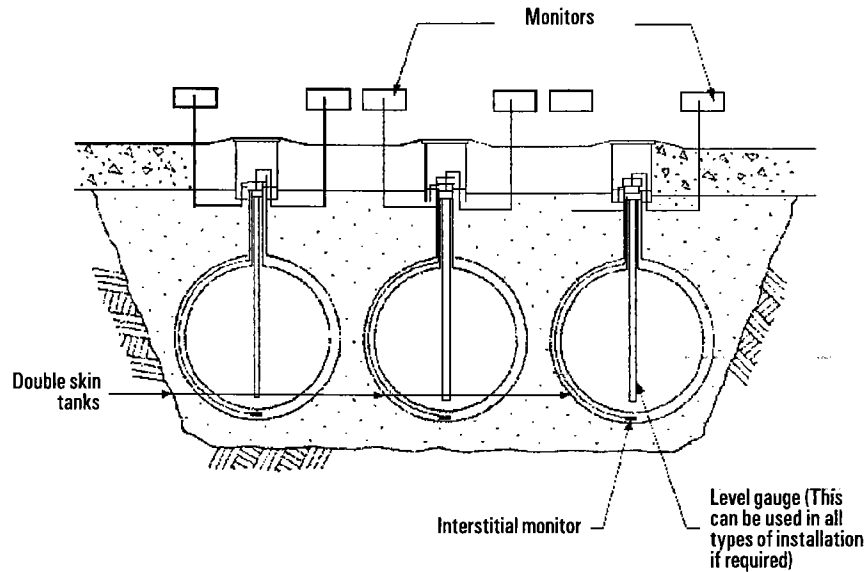
All secondary containment systems must be able to be monitored for the presence of hydrocarbons and the secondary containment barrier must provide effective protection against further migration of the primary vessel's contents for a minimum period of two months.

Where secondary containment is installed, it may be achieved by using an impermeable liner or double-walled tanks and pipework.

Where double-walled tanks are used, the interstitial space of each tank must be fitted with an approved monitoring device, in place of observation wells within the excavation.

12.10.1 Impermeable Linings: The whole of the tank pit and all pipe trenches shall be completely lined with an approved impermeable material before backfilling. The impermeable liner shall extend to the underside of any cover slab or pavement used, or to ground level. It shall be continuous and may be formed of a single layer of high density polyethylene sheet at least 1mm thick and welded at all joints or other approved material capable of retaining leakage of hydrocarbon products. Every care must be taken to ensure that the liner is not damaged in any way during installation or backfilling.

Fig 12.10 Double Skin Tank with Interstitial Monitor and Level Gauge



12.10.2 Double-walled Tanks and Pipework: Double-walled tanks and pipework must be tested, installed, backfilled and protected as set out in this code for other tanks and pipework (see also Appendix E). In addition, the manufacturer’s recommended handling, installation and testing procedures must be followed, and provision made for prompt detection of any leakage that may occur.

12.10.3 Automatic Leak Detection: Where an approved automatic leak detection system is installed, secondary containment need not be extended to include underground pipework.

13. PIPING SYSTEMS

All pipework should be laid with a fall of not less than 1:100 towards the tank so that it can drain completely.

13.1 Piping System Design – Suction Systems

Suction lines should be not less than 50 mm nominal bore.

To minimise the likelihood of suction problems, it is recommended that suction line length be kept as short as possible commensurate with good installation practices and the other requirements of this code.

Suction lines shall be fitted with a tank valve at the tank and a non-return (poppet) valve below the pump, and shall be arranged to drain

back to the tank at a gradient of at least 1:100. The non-return valve shall be so placed that it is protected from damage should the pump be damaged or knocked over.

Each suction line shall have its own individual suction stub within the tank. The suction stub shall be of at least the same diameter as the suction line it serves.

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

Tanks may only be syphon connected where the tank top levels do not differ by more than 50 mm.

13.2 Piping System Design – Pressure Systems

UPSS owner/operator may choose to use a system of delivery lines pressurised by pumps in the underground tanks. Any pressurised product line must be equipped with a leak detection device that is activated immediately leakage is detected in piping downstream of the pump.

When product delivery lines are pressurised, there shall be a rigidly anchored emergency shut-off valve installed in the supply line at the base of each individual dispenser. The valve shall contain a device designed to close automatically in the event of either severe impact or exposure to fire. The automatic closing feature shall be checked at the time of installation and annually thereafter by manually tripping the hold-open linkage.

13.3 Venting System

A separate tank venting system shall be provided for each tank. The vent tiffing shall meet or exceed the requirements of the Dangerous Goods Regulations and be approved by the project engineer.

Note: In relation to size section 13.5 applies.

13.4 Vent Location

Vent pipes shall terminate in the open air in such a position that flammable vapours will not accumulate or travel to an unsafe position; but in no case less than 4m above ground, nor less than 1m above the fill connection, and in accordance with the Dangerous Goods Regulations.

Vents from tanks used to store Class 3(a) or 3(b) products shall be not less than:

- 1.5 m above the eaves line of any building that is less than 3 m from the vent;
- laterally from any opening to a building;

- 4 m laterally from any chimney or flue outlet;
- 4 m laterally from any exposed electrical equipment;
- 15 m laterally from a location where vehicles may park.

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 (including soffits) or its foundations.

Except in the case of low volatility products and aviation fuels, the vent shall discharge upwards and shall be protected from ingress of foreign material. The vent shall be fitted with a flame arrestor, a brass gauze shield of 500 microns mesh being sufficient for this purpose.

13.5 Vent Pipe Diameter

No vent pipe may be smaller than half the diameter of the fill line connected to the same tank, nor less than 50 mm nominal bore for a run of up to 60 m. Where it is possible to fill the same tank via two fill points simultaneously, the vent line diameter must be at least 70% of the larger fill connection diameter.

13.6 Fill Lines System Design

There shall be a separate fill line for each tank.

Each fill point shall be identified as required by the Dangerous Goods Regulations and shall also show:

- the tank to which it is connected;
- the product stored in the tank.

Fill points shall be located such that:

- they are readily accessible;
- the fill point fitting shall be installed so that it will be protected from accidental damage and shall be able to be locked. Fittings shall be liquid and vapour tight.

Fill lines should be 100 mm diameter.

Each fill point shall be installed in such a way that all spillage at the fill point shall be contained and kept for recovery or redirected to the storage tank. A suitable device is shown in Figure 13.6(a).

The fill fitting shall be a system approved by the project engineer as complying with this section, and may include an **overfill protection** device (see Figure 13.6(b)).

Fig 13.6(a) Spill Container (Typical)

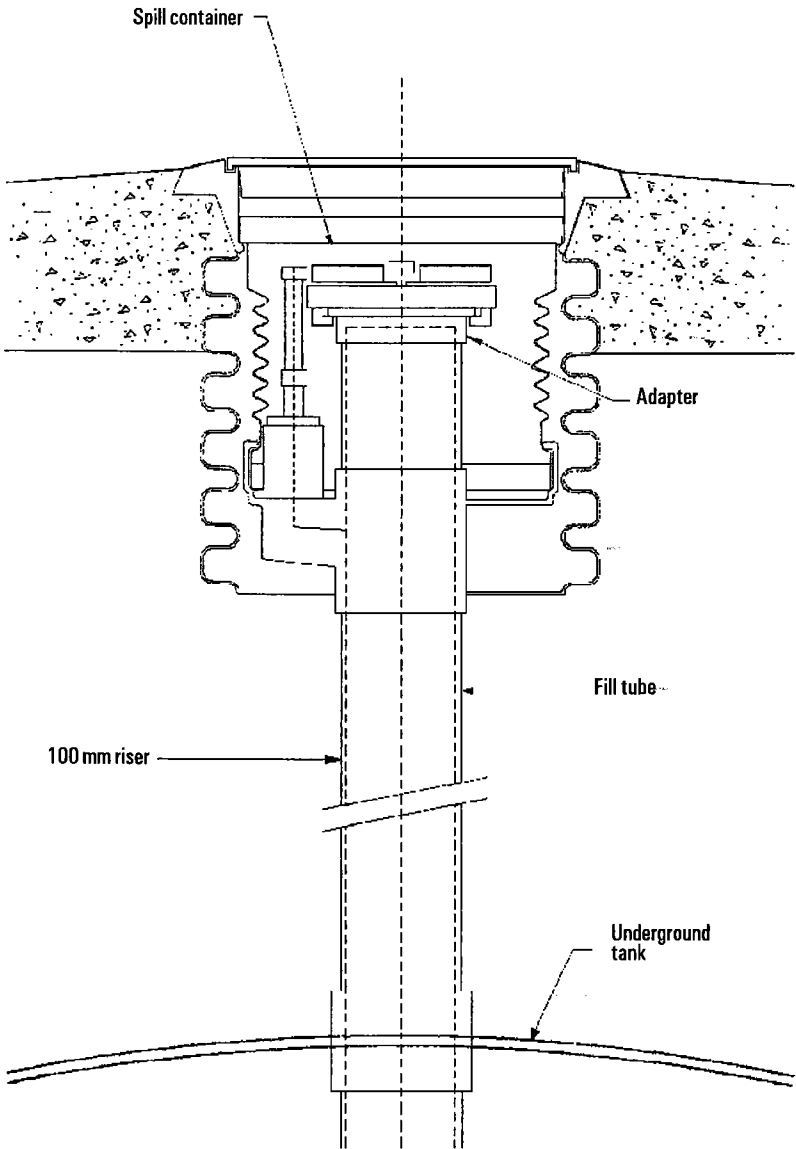


Fig. 13.6(b) Over Fill Device – Optional (Typical)

