

14. PIPEWORK INSTALLATION

Product and vent piping shall be installed so that it is completely surrounded by and supported by clean inert backfill. Backfill material shall be clean salt-free sand or pea gravel as specified in section 12.9.1.

14.1 Piping Material

Piping shall be constructed of a material that is compatible with the contents of the UPSS and sufficiently corrosion-resistant to ensure a life comparable with that of the tank to which it is connected.

Piping shall be constructed of either steel or fibreglass or other material approved by the Chief Inspector of Dangerous Goods.

Steel pipe shall be black or galvanised medium grade manufactured to BS 1387.

Steel pipe shall be protected from corrosion by a suitable anti-corrosion system.

FRP pipe constructed to a specification approved by the Chief Inspector of Dangerous Goods may be used.

Pipe fittings shall be malleable iron, steel or bronze. Caps on fill and dip points, etc. may be aluminium.

14.2 Pipe Laying Trenches

Trenches shall be made sufficiently large that all buried pipes can be separated from the bottom and sides of the trench by a minimum of 150 mm of sand (or pea gravel for fibreglass pipework), and have a minimum cover of 300 mm. Trenches shall be sufficiently wide to allow pipes to lie side-by-side with a minimum clear spacing of 50 mm. Pipes following the same route shall 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.

The 150 mm sand bed (or pea gravel) should be laid and compacted under pipe runs before piping is installed. Where necessary, temporary timber supports should be used to prevent movement during backfilling. Bricks shall not be used for this purpose.

14.3 Pipe Jointing

All pipes shall be examined before installation to ensure that the bore is clean. Any pipe showing internal dirt or other foreign matter shall be thoroughly cleaned by drawing a cleaning brush through with wire; on no account may rag or similar material be used.

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 screwed cap or plug whilst work is not actually being carried out on that section of the installation.

- 14.3.1 Steel Pipe Jointing:** Steel pipes shall be joined using a minimum of joints and long lengths of pipe used wherever possible. All joints shall be carefully made with good quality BSP taper threads, tightly assembled in a clean and true manner.

Dies shall be adjusted so that all screwed joints shall be made with not less than eight threads engaged, and shall tighten hard on the taper of the thread leaving three threads free of engagement

All traces of lubricant or cuffing oil shall be removed from threads of pipe and fittings by washing with solvent and allowing to dry. All internal burrs shall be removed from threads before making joints.

All joints shall be made using oil thread jointing compound spread evenly on the male threads only, care being taken that none is allowed to enter the pipe during fabrication.

Where screwed valves are used in a pipe, the connecting thread on the male pipe should be cut to a length where a tight joint is obtained before the end of the pipe bottoms on the valve body.

Joints made with brass-seated unions shall be examined closely to ensure that good even contact is made over each face and that faces are in good condition. All flanges shall have machined finish contact faces.

Swing joints or flexible connections shall be installed at the tank valve, the riser to the pump, the vent riser and on indirect fill lines, and at other major changes in direction where subsequent surface settlement may distort the pipework.

All joints shall be left exposed until AFTER pressure testing has been completed and approved.

- 14.3.2 I:RP Pipe Jointing:** Standards of manufacture and installation of fibreglass reinforced plastic pipe shall be as stipulated by the purchaser and approved by the Chief Inspector of Dangerous Goods, and in accordance with the pipe manufacturer's instructions.

Swing joints or flexible connections shall be installed at the tank valve, the riser to the pump, the vent riser and on indirect fill lines, and at other major changes of direction where subsequent surface settlement may distort the pipework.

14.4 Testing Pipework

All pipework shall be tested prior to backfilling to allow visual inspection of all joints and connections, and again following backfilling to ensure that pipework has not been damaged during backfilling.

All testing shall be witnessed and approved 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.

- 14.4.1 Distribution Lines:** New product distribution lines must be pressure tested before being placed in service. The line shall hold pressure for 10 minutes to be accepted as sound. Suction lines shall be tested to 250 kPa, pressurised lines shall be tested to 400 kPa.

Lines that have previously been in service may be tested with product. Care shall be taken to ensure that the tank is isolated and vented during the pipework test to avoid excessive pressure being applied to the tank.

- 14.4.2 Fill, Dip and Vent Lines:** After the tank has been hydrostatically tested, fill, dip and vent pipework shall be tested. The fill line shall be capped and the level in the dip pipe raised until the total head of water above the bottom of the tank is 3.5 m. An extension shall be added to the dip pipe if necessary. If diesel is used for this test, the total head shall be 4.2 m.

The level in the dip pipe shall be recorded and the fill line, vapour and vent lines and connections to the top of the tank examined for signs of leakage. After a minimum of 15 minutes, the fluid level shall again be checked for any loss. A variation of more than 100 ml would give cause to suspect leakage and require a repeat of the test and investigation as to the cause of the loss.

- 14.4.3 Automatic Shut-off Valves:** Automatic shut-off valves shall be tested by manually tripping the hold-open linkage.
- 14.4.4 Test Records:** The project engineer or his nominee shall make a record of all tests witnessed together with the results of each test. Test records shall be retained with all other records pertaining

15. CATHODIC PROTECTION

15.1 General

Before any new steel tank or pipework is installed, a site investigation shall be carried out to establish soil resistivity levels and the presence or absence of stray currents in the ground.

UPSS that are constructed of steel shall be protected against failure due to corrosion by a suitable coating supplemented by cathodic protection, unless site investigation shows that the system will not be subject to corrosive attack.

The UPSS shall be protected from corrosion in its entirety. Tanks, pipework, fill lines, and vent lines are all potential areas for product leakage and/or water ingress and must therefore be protected against corrosion.

15.2 Coatings

The coating shall be:

- of high dielectric resistance;
- resistant to moisture transfer and penetration;
- stringly adherent to metal surfaces;
- applicable with a minimum of defects;
- resistant to mechanical damage;
- easily repairable on-site prior to installation; and
- proven by experience in service.

These properties can be obtained with coal tar epoxy, polyamide cured epoxy, or glass flake epoxy paints.

15.3 Corrosion Protection

Sacrificial anodes will in most cases be the most cost-effective method of providing corrosion protection. Site tests prior to installation will determine the type and number of anodes to be installed.

In situations where current demand will be high due to a large number of tanks, or where stray currents are known to exist underground, an impressed current system may be used.

A system shall be installed that is suitable for the individual installation, taking into account:

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

15.4 Testing and Monitoring

The owner shall be responsible for having all tests carried out and shall retain the test reports for the life of the system.

Upon completion of the installation, tests shall be carried out to confirm that the system is functioning correctly and that corrosion protection is being given. This situation should again be confirmed 6-12 weeks after installation and again one year later.

If all tests yield satisfactory results, then checks shall be made at intervals of 12 months.

Should any check reveal the need for remedial work (such as additional anodes), the system shall be upgraded without delay and the cycle of checking and monitoring shall recommence.

For impressed current systems, monthly checks of the rectifiers must be made to verify that the units are operational. Annual surveys of the system must also be carried out to ensure continued satisfactory operation.

The cathodic protection system must include permanent test points to facilitate the above checks.

15.5 Isolation

The components being protected by the cathodic protection system must be electrically isolated from components to which they are physically connected and for which cathodic protection is not intended. Isolating bushes must be installed at the connection between the product lines and the pumps, and special care taken to maintain isolation where such equipment as submersible pumps or electronic contents gauges are used.

The UPSS shall be isolated from electrical earth. A minimum of 300 mm separation must be maintained between all protected UPSS components and other metal conduits on the site. Wherever this 300 mm separation cannot be achieved, suitable insulating material must be placed between protected and unprotected items so that the current path between is at least 300 mm. Where shielding insulation is used, anode positions should be reviewed and adjusted if necessary.

On existing sites where additional storage facilities are to be installed, the newly installed cathodically protected systems shall be electrically isolated from existing non-protected systems.

15.6 Records

The owner shall ensure that records are kept and shall include the readings obtained in commissioning tests and the readings that should be expected in later checks so that any need for remedial work may be immediately recognised.

Records must also include the results of periodic checks and details of any remedial works carried out.

15.7 Practitioners

Site tests, installation works, commissioning and monitoring tests shall be carried out by or under the direct supervision of a competent person qualified to advise on corrosion control for buried metallic structures.

16. LEAK MONITORING

Observation wells and monitoring wells, where installed, shall be placed at the time of installation of the storage system. They should generally be placed down ground water gradient from the tanks.

These wells will enable prompt confirmation of suspected leakage as they may be readily examined for the presence of fuel or vapours using bailers or a portable gas analyser. This examination may be carried out at any time by a representative of the owner, or by an authorised officer of the authority. The site operator must check each well regularly, at least once every month, for any liquid hydrocarbons, and record his observations.

Typical details for the construction of observation and monitoring wells are shown in Figures 12.9(a), (b) and (c) and 16.0. For both types of well, the well liner must terminate in a locking cap so designed that it is impossible to connect any hose coupling to the well.

The number of wells required depends upon site conditions.

16.1 Observation Wells

Observation wells are normally used to observe secondary containment areas in lined excavations or where the water table is normally within the excavation or where there is an impermeable lining in the floor of the excavation, to monitor the back-fill area around underground tanks.

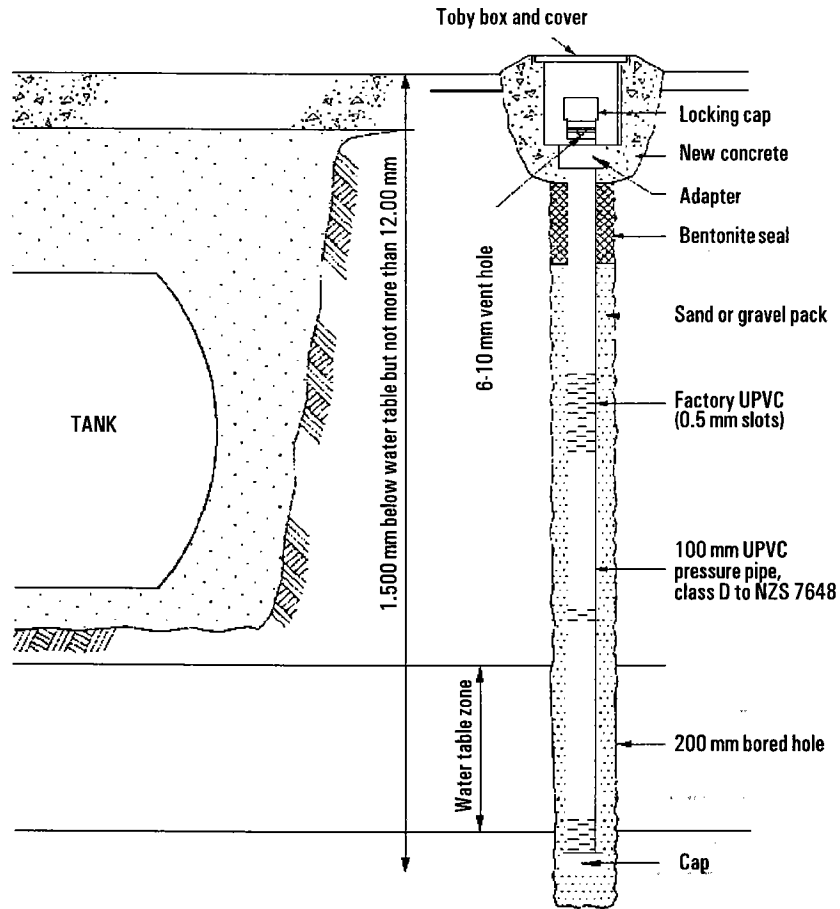
One well is required for a single tank, two for each group of adjacent tanks up to five, and one additional well for each further group of up to four additional tanks.

The first observation well shall always be at the lowest point of the tank excavation.

16.2 Monitoring Wells

Monitoring wells are used to monitor the ground water table in the general area of the UPSS for any sign of hydrocarbons at the water surface on sites where there is no secondary containment.

Fig.16.0 Monitoring Well (Typical)



They provide a leak detection capability equivalent to an observation well, but should only be used where soil permeability is high and the normal water level is below the tank excavation but within 12 m of ground level.

Monitoring wells should be installed at a distance from the tank(s) agreed with the regional authority having regard to the site conditions and probable spread of any leakage that might occur.

Care must be taken to ensure that monitoring wells do not penetrate any soil layer lying below tank excavation level that provides a natural barrier to travel of hydrocarbons to lower levels, especially where there is an important aquifer at the lower level.