

Conder Underground Tanks: Granular Surround

Premier Tech Aqua Installation Guidelines

Ref: UTG9501

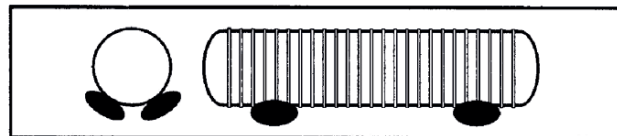
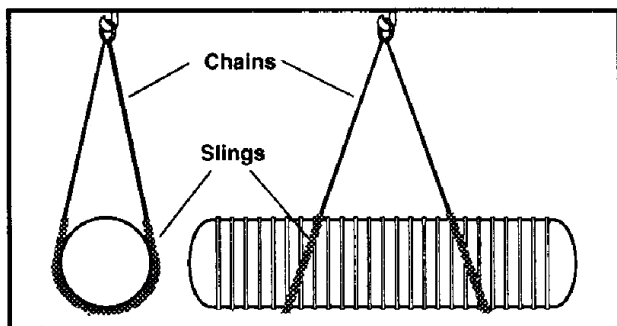
Revision No. 14

General

1. These guidance notes refer only to the installation of Premier Tech Aqua underground GRP tanks suitable for granular surround.
2. These guidance notes do not provide specific, site related, site-related installation instructions.
3. If in any doubt about any aspect of the installation please contact Premier Tech Aqua on 0870 264 0004.

Transportation, unloading and storage of tanks

1. Tanks must be held down during transportation using nylon straps, do not use chains, cables or wire ropes.
2. Do not over tighten straps, causing deformation of the tank shell.
3. Tanks are best lifted by a crane utilising webbing lifting straps – do not use chains, cables or wire ropes in contact with the tank.
4. It is recommended that a lifting beam is used for tanks longer than 8 meters.
5. Smaller tanks may be lifted with other suitable site equipment, but greater care is needed to control the lift and to ensure the tank is not damaged.
6. Not all tanks will have their centre of gravity at the centre of the tank. Therefore, the lifting straps need to be arranged to ensure the tank is stable during lifting.
7. Move tanks not only by lifting and setting, do not drag or roll.
8. Do not drop or roll tanks from the delivery vehicle.
9. Place tanks carefully onto a smooth, level, even surface, free from rocks, large stones or other debris that could cause point loads on the tank shell.
10. Chock tanks using tyres, sandbags or similar to prevent rolling.



11. In high wind conditions, consideration should be given to strapping down the tanks to prevent damage.

Pre-Installation Inspection

1. Tanks should be subject to visual inspection prior to installation. Special consideration should be given to strap positions. Check for: fractures to the shell or ribs; delamination's; scratches or abrasions deeper than 1.5mm; stress cracks or star crazing
2. Any damage should be notified to the delivery driver and to Premier Tech Aqua
3. Do not undertake any unauthorised repairs, as this will invalidate the tank warranty.
4. Check the invert depth is correct, the tank is correct grade for granular surround and that the pipe orientations are correct.
5. Where present, all fixings (nuts, bolts, screw fixings etc.) should be checked and retightened to correct any movement during transport. Premier Tech Aqua do not accept responsibility for fixings that have not been checked prior to the tank entering service.

Excavation

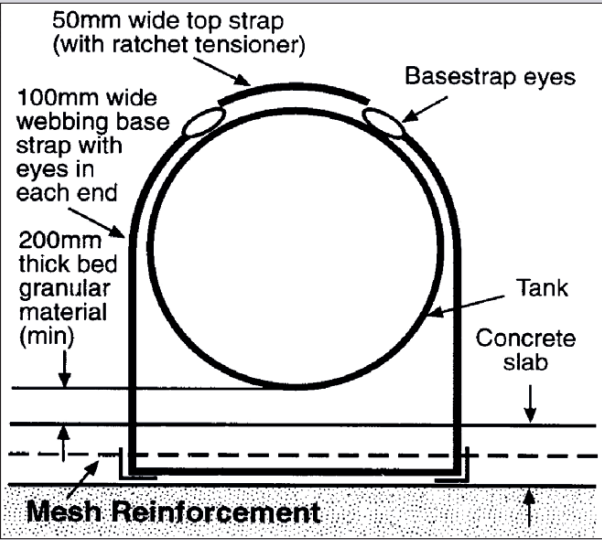
1. Excavations should be planned with due regard to Health and Safety requirements, and should be either shored or battered back to a "safe" angle.
2. The excavation should allow a minimum 450mm clearance between the tank sides/ends and the excavation wall or face of shoring. Clearance of a minimum 450mm is also required between adjacent tanks.
3. Soils with low bearing capacity (equivalent to less than 12 SPT blow counts) will require all tank clearances to be increased to half the tank diameter.
4. Ground instability at formation level e.g. running sand, may necessitate over excavation and stabilisation with hardcore or blinding concrete.
5. Geotextile material may be required to prevent migration of the tank backfill material.



Buoyancy and Anchoring

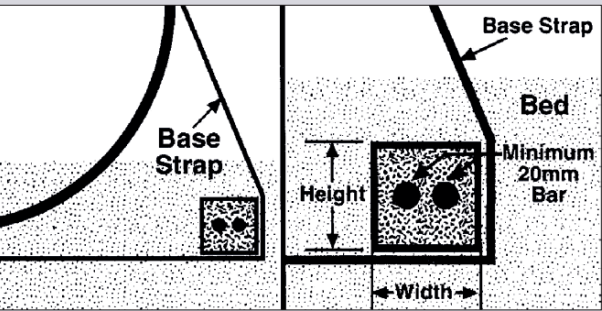
1. Where the depth of cover over the tank (tank crown level to final ground level) exceeds 70% of the tank diameter, the tank will not require mechanical anchoring to prevent uplift movement. This for the worst case condition of an empty tank with the tank excavation flooded to ground level.
2. If the depth of cover is less than 70% of the tank diameter, then mechanical anchoring is required.
3. There are two methods of mechanical anchoring:
 - a) Reinforced Concrete Anchor Slab

A reinforced concrete anchor slab of minimum thickness 200mm, sized to cover the excavation area. The slab should incorporate Premier Tech Aqua webbing anchor straps.



b) Concrete 'Deadman' Anchors

A reinforced (minimum two 20mm steel bars) concrete beam (pre-cast or in situ) along each side of the tank, of equal length to the tank, and with a cross section as detailed below. The beams should incorporate Premier Tech Aqua webbing anchor straps as illustrated below.



'Deadman' Anchor Sizing

Tank Diameter (mm)	Minimum Height (mm)	Width (mm)
1800	300	300
2500	300	300
3000	300	450
4000	200	900

The concrete 'deadman' anchors should not lie in tank shadow i.e. below the projection of the tank diameter.

If the maximum water table level (under all conditions) can be confirmed as being lower than the final ground level, then the requirement for anchoring can be reviewed. Please contact Premier Tech Aqua for details. In this situation the potential for the creation of a perched water table by the flow of groundwater into the backfill needs to be considered.

Primary Backfill Specification

1. Primary backfill material should be free-flowing granular material and can be:
 - a) Pea Gravel
 - Naturally rounded aggregate with particle size not less than 3mm and not greater than 18mm, compacted to a relative density of >70%.
 - Pea gravel shall be clean and free flowing, free from large rocks, dirt, sand, roots, organic materials or debris.
 - Upon screening analysis the backfill material shall have no more than 5% by weight passing a 2.38mm sieve.
 - b) Crushed Stone or Processed Stone
 - Crushed stone/gravel or processed stone with particle size not less than 3mm and not greater than 12mm, compacted to a relative density of >40%. Dry density must be at least 1,500 kg/m³.
 - The material shall be clean and free flowing, free from large rocks, dirt, sand, roots, organic materials or debris.
 - The material should be washed or screened to remove fine particles.
 - Upon screening analysis the backfill material shall have no more than 5% by weight passing a 2.38 mm sieve.



2. Use of other than specified backfill/bedding materials will void the tank warranty.
3. All backfill material shall be free of ice and snow at time of installation. Backfill material shall not, during placement, be frozen or contain lumps of frozen material.

Primary Backfill Installation

1. Tanks must be installed with Primary Backfill only within the region immediately surrounding the tanks.
2. The tank bedding depth, using primary backfill, i.e. directly below the tank, must be a minimum of 300mm below the tank to natural ground. This can be reduced to 200mm if a reinforced concrete anchor slab is used.
3. The Primary Backfill must extend a minimum of 450mm outward from the tank sides and ends.
4. Compaction should be by lightweight rollers or vibratory plate compactor until the minimum cover (with load) depth has been achieved. Compact evenly around the turret extensions to reduce the risk of distortion.
5. The use of geotextile barrier fabrics surrounding the Primary Backfill material is considered good installation practice. The fabric must be chosen to allow the flow of water in and out of the excavation but prevent the movement of fine soil particles into the Primary Backfill material.

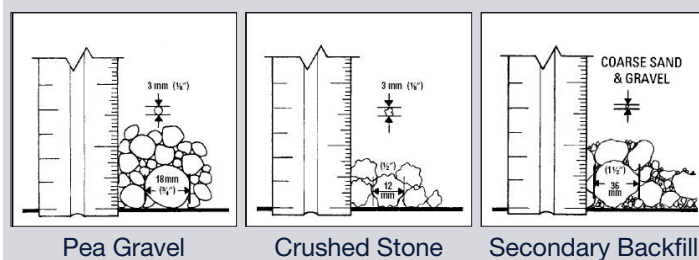
Secondary Backfill Specification

1. Secondary backfill shall not be used adjacent to the tank.
2. Secondary Backfill may be used only at a distance of 450mm from the tank walls.
3. The following are approved as Secondary Backfill materials:
 - a) Coarse Sand or Gravel
 - Coarse sand or gravel containing rocks no larger than 36mm on the largest dimension.
 - The material shall be clean and free flowing, free from dirt, clay, fine sand, roots, organic materials or debris.
 - Upon screening analysis this backfill material shall have no more than 5% by weight passing 0.075mm Sieve.
 - During placement this backfill material must be compacted to 95% relative compaction.

b) Select Native Backfill

- Clean native backfill, or clean selected backfill, containing rocks no larger than 36mm on the largest dimension.
- The material must be compacted to 95% relative compaction.
- The quality of this backfill material shall be such that it exhibits an ultimate bearing strength in excess of 170 kPa in the compacted state.

Backfill Materials



Tank Burial Depth and Cover

1. The minimum tank burial depths, with and without live load, are as follow:

Tank Minimum Cover (mm)

Tank Diameter (mm)	With Live Load	Without Live Load
1800	900	500
2500	900	500
3000	1000	500
4000	1200	500

2. The minimum cover with live load can be reduced by using a reinforced concrete slab above the tank, contact Premier Tech Aqua for information.
3. This grade of tank are designed to be installed below ground and completely surrounded with granular material.
4. Generally, the depth from finished ground level to the top crown of the main shell should be no more than two meters. This may vary dependent upon ground water conditions. Deeper inverts may be accommodated on a standard shell providing the water table level does not exceed two meters above the top crown of the main shell. For deeper burial with high water table conditions heavy duty shells are available. If the tank is installed outside these parameters it may suffer irreparable damage. Should you be in any doubt regarding suitable shell application please contact Premier Tech Aqua.



Control of Ground Water

1. Tanks must not be subjected to buoyant forces during installation, account should be taken of ground water levels and surface water run-off and their accumulation in the tank excavation. This applied event if tanks are mechanically anchored.
2. The tank excavation should be maintained empty of water, by pumping or whatever suitable means, until the tank cover depth reaches a minimum of 300mm above the tank.
3. If this is not achievable tanks may be filled with water as ballast until required conditions are achieved. If water filling is carried out during backfilling, water level inside tanks must not exceed the level of backfill material outside the tank.

Installation Procedure

1. Excavation and anchorage provision in accordance with preceding information. Ground water must be pumped to give a dry excavation.
2. Place primary backfill bedding material as described in preceding information. Ensure material is clean and contains no oversize material.
3. Lift tank into position and align as required for connecting pipework, access shafts, etc.
4. Secure anchor straps, if used.
5. Connect any low-level pipework as required.

6. Commence backfilling, with primary backfill material, in layers approximately 300mm, ensuring tank and any pipework is properly “haunched”.
7. Continue backfilling, with primary backfill material, evenly around the tank to at least 300mm above the tank top, connecting any high-level pipework, as required. Mount and seal any turret extensions.
8. Backfill evenly to grade using the same primary backfill material, or select secondary backfill material.
9. Compaction should be by lightweight or vibratory plate compactor until “traffic” depth has been achieved.
10. Compact evenly around the turret extension to reduce risk of distortion.
11. Cut turret extensions to length and fit manhole cover and frame.
12. Important: Ensure that no surface loadings are transferred from the cover direct to the tank. Cover frame construction should allow for ground movement (settlement).
13. Inspect tank internally to ensure roundness is maintained and deflection does not exceed 1% of the tank diameter.

Access Shaft Extensions

1. Loose shafts should be sealed using silicon sealant sikaflex-291, or similar, prior to installation to prevent ingress of groundwater under high water table conditions. It is the installation contractor's responsibility to ensure a watertight seal.
2. The turrets should be braced internally to prevent from bowing at each point with extendable braces and plywood or a temporary shuttering internally. Braces should be placed at all four sides of the shaft as well as in the connection between shafts if more than one extension is used. Alternatively, casting a concrete sleeve or ‘chimney’ could be constructed in the presence of braces. The design of the surround should be able to support the vertical loading that the tank will be subjected to during its lifespan once the installation is completed.