UTG 9502	
Revision No.	7
Date	30/07/10
Authority	AF

Technical Data Sheet UTG 9502

Installation Guidance Notes

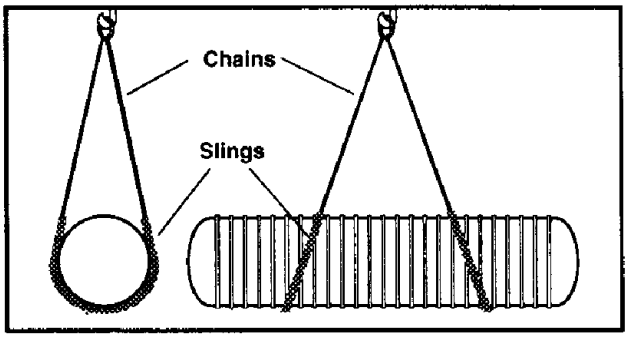
Concrete Surround – Underground Tanks

General

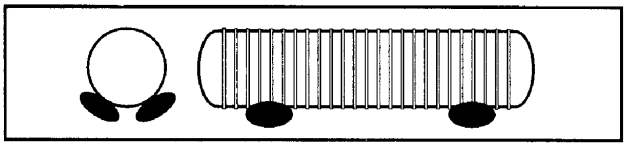
1. These guidance notes refer only to the installation of Conder Environmental Solutions underground GRP tanks suitable for concrete surround.
2. These guidance notes do not provide specific, site-related installation instructions.
3. If in any doubt about any aspect of the installation please contact Conder Environmental Solutions on 0870 264 0004.
4. Generally the depth from finished ground level to the top crown of the main tank shell should be no more than 2m meters.

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 to hold tanks.
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 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.



Tank Lifting



Tank Chocking

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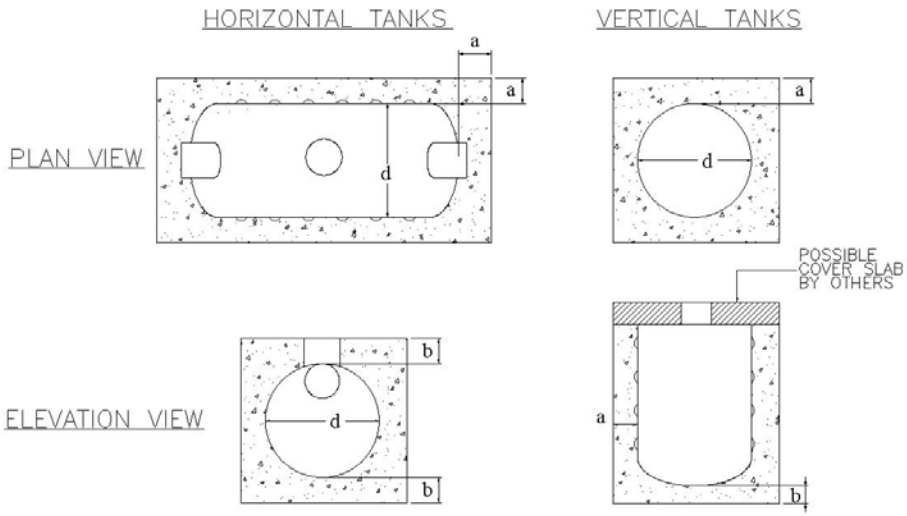
Pre-Installation Inspection

1. Tanks should be subject to a visual inspection prior to installation. Special consideration should be given to strap positions. Check for: fractures to the shell or ribs; delaminations; scratches or abrasions deeper than 1.5mm; stress cracks or star crazing.
2. Any damage should be notified to the delivery driver and to Conder Environmental Solutions.
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 concrete surround and that the inlet and outlet 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. Conder 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 for the minimum concrete surround thickness (tank sides /ends and base) as shown in the table below, while taking into account any shoring used.
3. Ground instability at formation level e.g. running sand, may necessitate over-excavation and stabilisation with hardcore or blinding concrete.



Tank Diameter ‘d’ (mm)	‘a’ minimum (mm)	‘b’ minimum (mm)
1000	150	150
1200	150	150
1500	200	200
1800	250	250
2500	300	300
3000	300	300
4000	350	300

Buoyancy and Anchoring

1. The dimensions, in the above table, may need to be increased if there is a risk of high ground water level at the tank location. To avoid floatation we recommend a factor of safety of 1.5 against floatation. Mass concrete has a minimum density of 2,300 kg/m^3

Concrete Specification

1. The specification for the concrete mix to surround the tank should be selected by the tank installer taking into account the site conditions and application requirements.
2. For a typical non structural application in good ground conditions, with non aggressive soils, a concrete with a 28 day compressive strength of 20 to 30N/mm^2 with a 25 to 50mm slump, complying with the relevant BS EN, is generally suitable. For non typical applications, aggressive soils or structural applications specialist advice should be obtained.

Lift height (rate of rise)

1. Determine the lift height (m), or rate of rise (m/h) for the specific concrete type used, to ensure that a design pressure (*P max*) of 15kN/m^2 on the tank is not exceeded.

Vibration

1. The design of the tank assumes minimal compaction of the surrounding concrete. Where necessary, this may be extended to include light internal vibration. Do not use deep revibration which will substantially increase the pressure on the tank, possibly causing failure.

Impact of Concrete on Discharge

1. The effects of concrete discharge impact are considerable. These effects must be considered to enusre the maximum pressure of 15kN/m2 on the tank is not exceeded. Under no circumstances should concrete be discharged directly onto the tank.

Live Load

1. If the tank is installed in an area where traffic, or other superimposed loadings can be applied, a structural engineer should be consulted, to design a reinforced concrete slab spanning over the tank. This is to prevent the load being transmitted to the tank (or its concrete surround). If this slab is constructed immediately above the tank, it should be separated from the concrete surrounding the tank by compressible material.

Tank Burial Depth

1. This grade of tank is designed to be installed below ground and completely surrounded with concrete.
2. Generally, the depth from finished ground level to the top crown of the main shell should be no more than two metres. This may vary dependant upon ground water conditions. Deeper inverts may be accomodated on a standard shell providing the water table level does not exceed two metres 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 Conder Environmental Solutions.

Control of Groundwater

1. Tanks must not be subjected to buoyant forces during installation, taking account of ground water levels and surface water run-off, and their accumulation in the tank excavation. This applies even if the tanks are mechanically anchored.

Installation Procedure

1. Maintain a completely dry excavation until the final pour of concrete has set. Failure to do this may result in voids beneath the tank and subsequent tank failure.
2. Place the concrete in the base of the excavation to form a level and smooth base onto which the tank can be placed. The base concrete thickness should be in accordance with the information provided above.
3. Place the tank onto the concrete base, while the concrete is still wet, and determine the correct orientation for the tank pipework. Connect the pipework to the tank, ensuring correct alignment.
4. Fill each chamber of the tank with clean water to a depth of 300mm and recheck the pipework levels and connections. Commence backfilling evenly around the tank with concrete ensuring there are no voids, particularly at the bottom of the tank shell. Continue filling the tank chamber(s) with water whilst evenly backfilling with concrete around the tank ensuring that the progressive water level is no more than 300mm above the concrete level.
5. Connect and seal turret extensions prior to completing the concrete encasement of the main tank (the height shown in the above table). Allow the concrete to cure.
6. Using appropriate formwork continue pouring concrete around the tank superstructure, i.e. access turrets, in lift heights not exceeding 500mm, allowing the concrete to set between each lift. The lift height, rate of concrete rise, or concrete compaction must not be to an extent which causes any part of the tank superstructure to distort, as this will damage the tank.
7. Complete the backfill to ground level using free flowing granular material. Trim all access turrets and prepare suitable footings for each manhole frame ensuring any loads on the covers are not transmitted to the tank access turrets or access extensions, if fitted.

Access Shaft Extensions

1. Access extensions should be surrounded with concrete poured in 500mm lifts, allowing an initial set between each lift. The pressure from concrete placed in higher lifts may cause access extensions to distort or collapse.
2. 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.

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UTG 9501	
Revision No.	13
Date	30/07/10
Authority	AF

Technical Data Sheet UTG 9501

Installation Guidance Notes

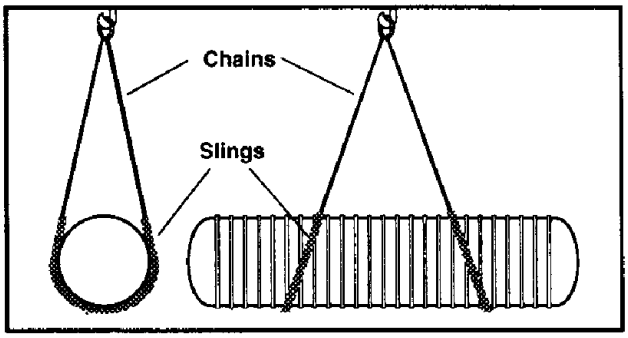
Granular Surround – Underground Tanks

General

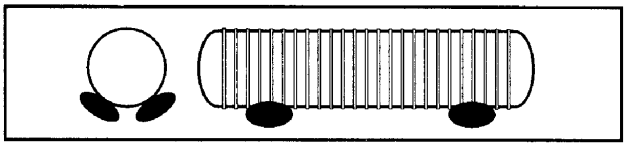
1. These guidance notes refer only to the installation of Conder Environmental Solutions underground GRP tanks suitable for granular surround.
2. These guidance notes do not provide specific, site-related installation instructions.
3. If in any doubt about any aspect of the installation please contact Conder Environmental Solutions 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 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.



Tank Lifting



Tank Chocking

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Pre-Installation Inspection

1. Tanks should be subject to a visual inspection prior to installation. Special consideration should be given to strap positions. Check for: fractures to the shell or ribs; delaminations; scratches or abrasions deeper than 1.5mm; stress cracks or star crazing.
2. Any damage should be notified to the delivery driver and to Conder Environmental Solutions.
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. Conder do not accept responsibility for fixings that have not been checked prior to the tank entering service.

Excavation

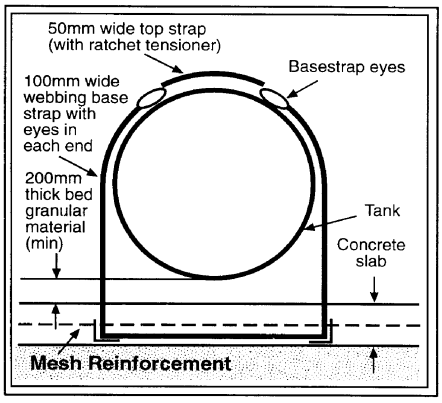
1. Excavations should be planned with due regard to Health and Safety requirements, and should be either shored or battered back to a “safe” angle.
2. The excavation should allow a minimum 450 mm clearance between the tank sides /ends and the excavation wall or face of shoring. Clearance of a minimum 450 mm 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:

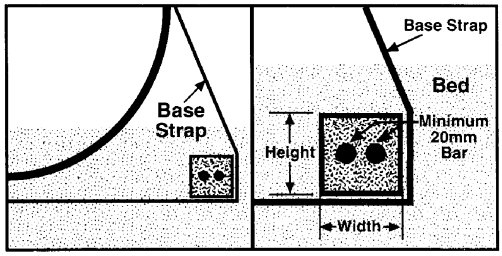
   a) <u>Reinforced Concrete Anchor Slab</u>

   A reinforced concrete anchor slab of minimum thickness 200 mm, sized to cover the excavation area. The slab should incorporate Conder Environmental Solutions 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 Conder Environmental Solutions 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 Conder Environmental Solutions 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 3 mm and not greater than 18 mm, 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 2.38 mm sieve.

   b) Crushed Stone or Processed Stone

   Crushed stone /gravel or processed stone with particle size not less than 3 mm and not greater than 12 mm, compacted to a relative density of >40%. Dry density must be at least 1,500kg/m^3.

   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 300 mm below the tank to natural ground. This can be reduced to 200 mm 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 36 mm 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

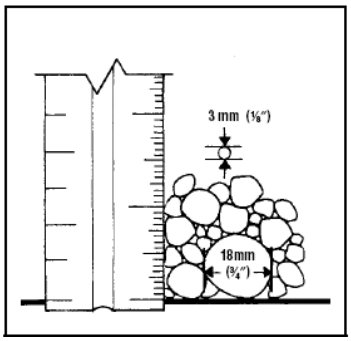
b) Select Native Backfill

Clean native backfill, or clean selected backfill, containing rocks no larger than 36 mm on the largest dimension.

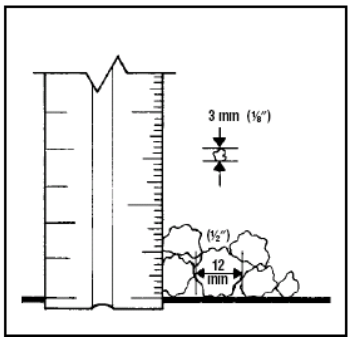
The material must be compacted to 95% relative compaction.

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.

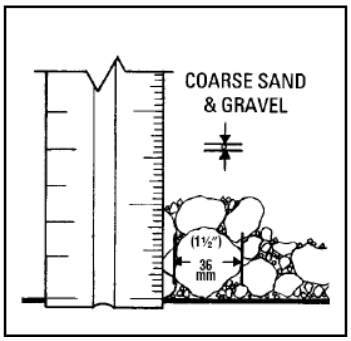
Backfill Materials



Pea Gravel



Crushed Stone



Secondary Backfill

Tank burial depth & cover

1. The minimum tank burial depths, with an without live load, are as follows:

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 Conder Environmental Solutions 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 dependant 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 Conder Environmental Solutions.

Control of Groundwater

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 applies even 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 300 mm, ensuring tank and any pipework is properly “haunched”.
7. Continue backfilling, with primary backfill material, evenly around the tank to at least 300 mm 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 rollers or vibratory plate compactor until “traffic” depth has been achieved
10. Compact evenly around the turret extensions 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 contractors responsibility to ensure a watertight seal.