

SECTION 2

SPEL Tankstor® Underground Tanks

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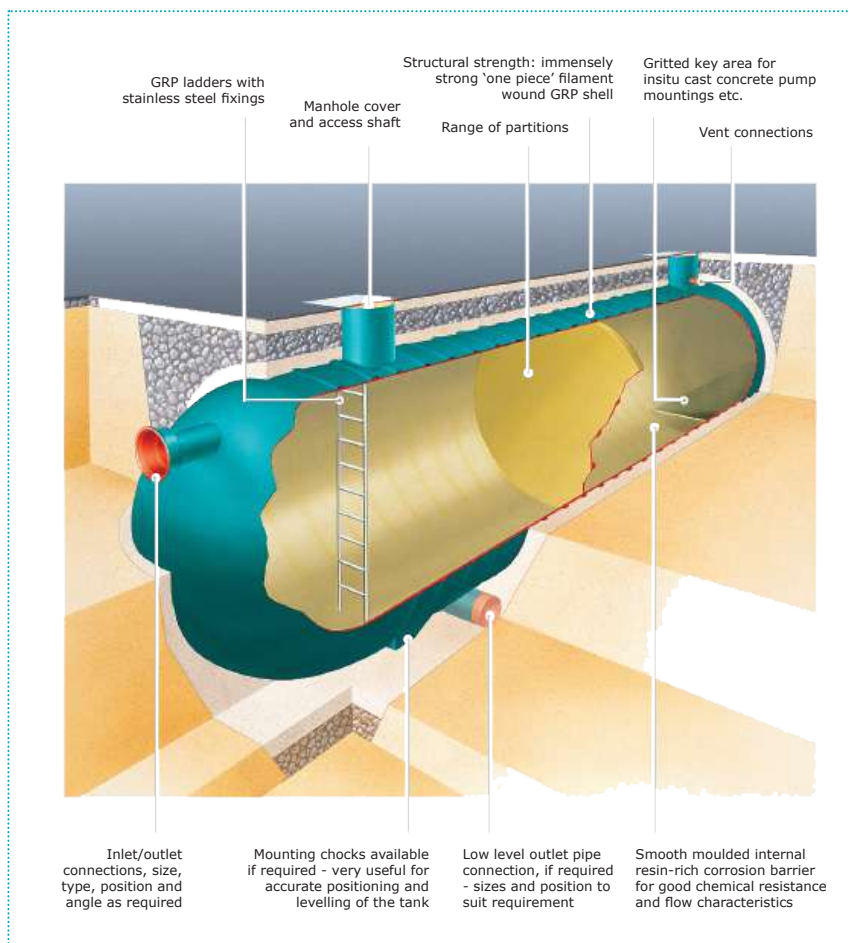
SPEL Septic/Settlement tanks

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Case Studies Included



Introduction



SPEL Tankstor® underground tanks have been developed over 45 years of experience in the market of underground GRP tanks.

In 1989 SPEL Products developed the technically advanced chop-hoop filament winding process to provide the most structurally sound and economic solution. This was patented in 1989 and further improved to the current wide range of tanks available in five diameters (1.2, 1.8, 2.6, 3.5 and 4m dia.) Designed originally to the well-recognised British Standard BS4994 and BS EN 976 they carry a 25 year shell Warranty and have a life expectancy of over 50 years depending on the tanks contents and process details.

SPEL Tankstor® underground tanks have many uses; storage, storm water attenuation, fire sprinkler system restoration tanks, separation, treatment and accidental spillage containment.

Connections are available in a range of diameters, types and couplings to suit site drainage. Access shafts in a range of diameters, square or rectangular can be fitted to suit requirements. Partitions (non-load bearing and load bearing) can be fitted to provide chambers or baffles. Pump platforms, access ladders and other fittings can be incorporated see left.

Modern Production Facilities

SPEL Products have modern factories with the latest 'state of the art' chop-hoop filament winders, computer controlled machines for the end domes and seven axis robotic spray-up for components. This ensures proper quality control and most economic production. Modern dust extraction and fire sprinkler system are included.

Quality Control

The manufacturing process is carefully monitored with a digital read out system. Chopping glass, winding glass, the resin-rich inner layer and main laminate resins are kept within specification parameters thus minimising human error.

Quality control procedures require each tank to be carefully inspected and tested. Ultrasonic thickness readings, material content weights, etc are checked and recorded against the tank's unique serial number. Additional periodic laminate testing is carried out by independent testing facilities including stress and strain analysis and also physical property tests to meet specific design criteria.



25 Year Warranty

Each SPEL underground tank shell carries a **25 year** warranty.

2.2 SPEL Tankstor® Underground Tanks

Technical Information

Process

SPEL underground tanks are manufactured by the chop hoop filament winding process developed in the US and specifically designed for underground tanks by SPEL Products, Patent No. 2233384.

GRP laminate

Design and specification for SPEL underground tanks

The SPEL underground tanks have been designed with reference to BS EN 13121, BS EN 976-1, 978 and BS EN 858-1:2002.

The quality and strength of glass reinforced plastic (GRP) laminates depends upon the following factors:

- The design criteria, eg. chemical resistance, temperature, internal and/or external loading.
- The efficiency and consistency of the manufacturing process and the high level of control to maintain resin and reinforcements within strict design parameters.
- The laminate construction from resin-rich corrosion resistant internal surface, resin-rich glass reinforced corrosion barrier, main laminate and the external resin-rich water penetration barrier providing excellent corrosion resistance from internal contents and complete sealing of laminate from ingress of water and/or contaminants externally.

Prior to determining the laminate construction and thickness using requirements, actual specimens are taken from filament wound laminates and independently tested. From the ongoing material tests and consideration of the various partial influence factors, which include the chemical resistance and a tank shell life to be excess of 25 years, a generous final design factor is determined.

The design of GRP laminates is clearly different from, for example, a steel structure where the material and loadings are clearly defined.

Tank manufacturers can cut their quality and price depending on the design factor determined.

SPEL underground tank laminates are designed to meet specific requirements, for example, hydrostatic load on tanks surrounded either in concrete or a free flowing pea gravel.

With experience gained in the United States, high quality underground tanks do not suffer from degradation to the degree envisaged in the British Standard, in fact tests carried out on laminates taken from underground tanks in the US after 25 years use, have shown very little loss of strength.

The important factors are the construction and composition of the laminate to resist the corrosive action of the internal chemicals and the water or contaminated underground water externally.

BS EN 978 – Tests to this Standard determine the alpha and beta, 'the long term deterioration due to creep and the effects of water or chemicals on the plastics'. Tests have been carried out, on pieces of shell cut from the tank barrel, by an independent test laboratory. The results are used in the equations (BS EN 976-1) to determine the stability of underground GRP horizontal cylindrical tanks for the non-pressure storage of liquid petroleum based fuels.

Chemical resistance and long term degradation

Further independent tests have been carried out in accordance with BS EN 858-1:2002 Section 8.1.4 'Chemical resistance of internal surfaces'. The tests involve full immersion of three test specimens for 1000 hours in four solutions; de-mineralised water at 40°C, fuel oil at 23°C, unleaded fuel at 23°C, caustic solution at 40°C.

The requirement in Section 6.2.7.1.3. 'Plastic materials' (BS EN 858-1) is for the glass reinforced test specimens under test to retain 80% of their strength when compared with the control specimen. The results of tests for tensile strength and flexural modulus have shown very little reduction, if any, in performance. In each case there was a reduction in flexural strength but an increase in modulus. Initially this might seem odd but it is possible that this could be part explained by at least two samples being immersed at 40°C hence a post cure compared to the control. All samples appeared to have passed seeing they came within the 80% retention of the control specimen.

Quality control

The SPEL chop hoop filament winding process specially developed for underground tanks is carefully monitored to Work Instructions. All materials are fully documented (digital read-out of resin and glass reinforcements) against each unique serial numbered tank shell.

All items are cured in accordance with the resin supplier's instructions. Where required eg. highly chemical resistant linings, the tank is post cured in accordance with the Work Instructions.

Ultrasonic thickness checks are made on all shells together with Barcol hardness checks. The acetone test is included where applicable.

The laminate is inspected visually to ensure proper laminate consolidation and surface finish.

Workshop conditions, Health & Safety and Environmental considerations.

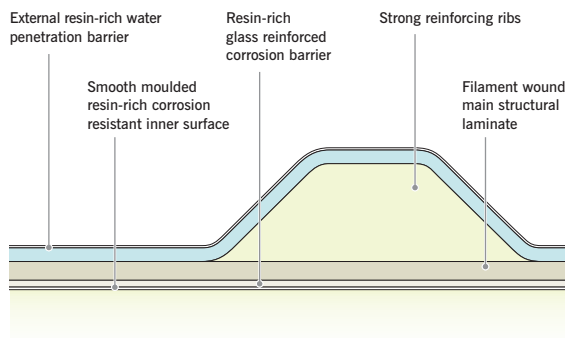
Included in process controls is work shop temperature, fume extraction to keep within Health & Safety occupational exposure limits and odour control to meet the strict Environmental Protection Act 1990 Part 1 requirements as dictated by the Local Authority 'Authorisation' requirements.

The record maintained since 1989, when the chop-hoop filament winding process was introduced, is that no tank has failed due to a design or manufacturing fault. Since 1989 thousands of underground tanks have been manufactured. The few tanks damaged were due to faulty installation or handling.

With this exceptional track record we are fully satisfied and confident that we have a specification and process control that produces exceptionally high quality laminates that have a life expectancy well in excess of 50 years.

The SPEL underground tank shell carries a 25 year warranty.

Laminate Specifications



GP – General purpose applications.

Constructed throughout with orthophthalic polyester resin and glass reinforcement.
Applications – potable water, sewage, surface water and mild chemicals.

CR – Chemical resistant lined tanks.

The smooth moulded resin-rich corrosion resistant internal surface and the resin-rich glass reinforced corrosion barrier are constructed from isophthalic polyester resin or terephthalic NPG polyester resin.
Applications – suitable for silage effluent, chemicals (acidic) and hydrocarbon materials.

HCR – Highly chemical resistant.

Aggressive chemicals and/or high temperatures. The smooth moulded resin-rich corrosion resistant internal surface and the resin-rich glass reinforced corrosion barrier are constructed from vinyl ester resins dependent upon chemical resistance and/or high temperatures.
Applications – transformer oil dump tanks, highly aggressive chemical process or holding tanks, and accidental chemical spillage containment tanks.

Suffix CG – Contaminated ground conditions.

The external resin-rich water penetration barrier can also be in chemical resistant or highly chemical resistant where tanks are to be installed in contaminated ground.

Filament wound shell	GP	CR	HCR	Suffix CG
Resin-rich corrosion resistant internal surface	Orthophthalic polyester resin	Isophthalic polyester resin	Vinyl ester resin	
Resin-rich glass reinforced corrosion barrier	Orthophthalic polyester resin	Isophthalic polyester resin	Vinyl ester resin	
Main laminate	Orthophthalic polyester resin	Orthophthalic polyester resin	Orthophthalic or isophthalic polyester or vinyl ester resin	
External resin-rich water penetration barrier	Orthophthalic polyester resin	Orthophthalic polyester resin	Orthophthalic polyester resin	Isophthalic polyester or vinyl ester resin
Tank end domes	GP	CR	HCR	Suffix CG
Gelcoat internal surface or resin-rich glass reinforced internal surface	Isophthalic polyester gelcoat	Isophthalic polyester gelcoat	Vinyl ester resin	
Resin-rich glass reinforced corrosion barrier		Isophthalic polyester resin	Vinyl ester resin	
Main laminate	Orthophthalic polyester resin	Orthophthalic polyester resin	Orthophthalic or isophthalic polyester or vinyl ester resin	
External resin-rich water penetration barrier	Orthophthalic polyester resin	Orthophthalic polyester resin	Orthophthalic or isophthalic polyester or vinyl ester resin	Isophthalic polyester or vinyl ester resin
Reinforcement materials for shell and end domes	GP	CR	HCR	Suffix CG
Resin-rich corrosion resistant internal surface	C-glass surfacing tissue (shell only)	C-glass surfacing tissue (shell only)	C-glass surfacing tissue or synthetic veil	
Resin-rich glass reinforced corrosion barrier	E-glass chopping roving	E-glass chopping roving	E-glass chopping roving	
Main laminate	E-glass chopping roving	E-glass chopping roving	E-glass chopping roving	
Filament wound shell	Plus E-glass winding roving	Plus E-glass winding roving	Plus E-glass winding roving	
External resin-rich water penetration barrier	No reinforcement	No reinforcement	No reinforcement	No reinforcement



Water Regulations Advisory Scheme Ltd

GP specification* is approved for contact with wholesome water for domestic purposes having met the requirements of BS6920-1:2000 and/or 2014 'Suitability of non-metallic products for use in contact with water intended for human consumption with regard to their effect on the quality of the water'.

2.4 Chop-hoop Filament Wound Shells

Laminate Construction to BS4994

SPEL Tankstor® underground tanks and separator shells are chop-hoop filament wound in quality glass reinforced plastics in accordance with the British Standard BS EN 13121.

To ensure a life expectancy in excess of 50 years underground and containing contaminated water or chemicals, the laminate construction must incorporate a chemical or corrosion barrier as defined in:

Section two (BS EN 13121) 7. Construction of chemical barrier

7.3 Where a thermoset lining is used, in order to achieve the optimum properties, the construction of the laminate in contact with the corrodent shall consist of the following:

(a) Surface layer

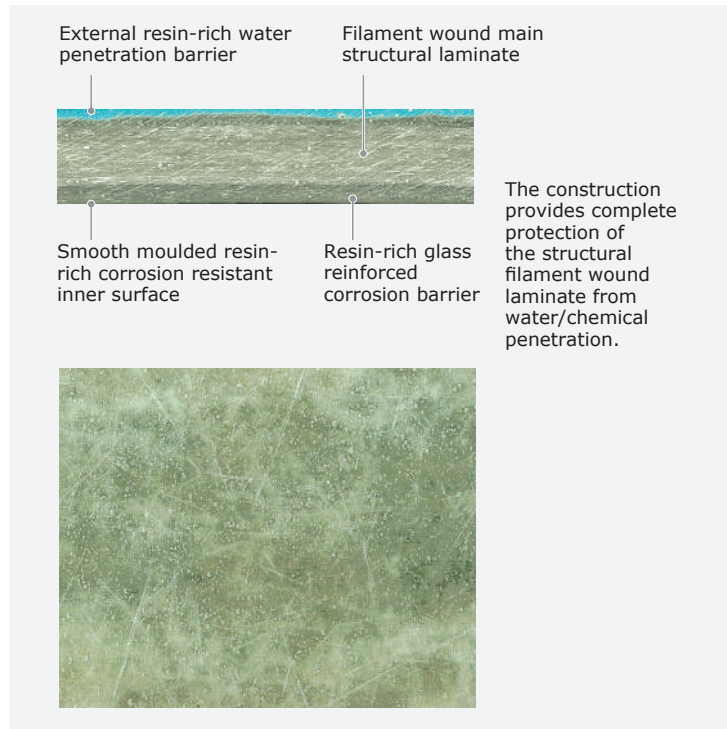
A resin-rich surface layer reinforced with C glass surfacing mat, synthetic fibres or other suitable material, with a thickness between 0.25mm and 0.50mm.

(b) Backing layer

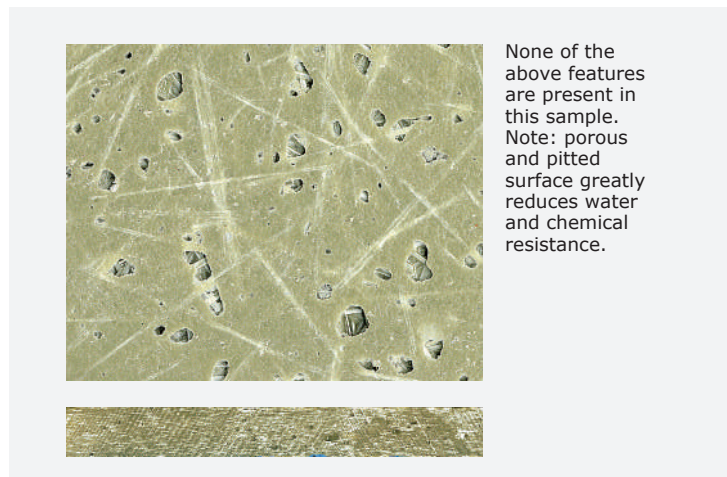
A backing layer normally containing a minimum of 1.2kg/m² chopped glass strand or CSM with a soluble binder with between 25% and 33% glass content, by mass.

For tanks and vessels which are constructed in accordance with categories II and III, it is permissible to reduce the backing layer to 0.6kg/m² chopped glass strand or CSM if agreed between the purchaser and the manufacturer.

SPEL Laminate Construction



A Competitor Laminate Construction



Questionnaire

Date _____
Company _____
Address _____
Business of Company _____
Contact _____ Position in Company _____
Telephone _____ Email _____
Project Title _____
Site Address _____

Requirements

Product Description _____
Operation or Process _____
Quantity Required _____ Working Capacity Required (litres) _____ Maximum Capacity (litres) _____
Contents (full description & concentrations) _____

pH Value _____ Specific Gravity (if known) _____ Viscosity _____
Maximum Working Temperature _____ Minimum Working Temperature _____
Will Tank be Filled by Pressure Discharge from Tanker? _____
Will the Contents be Agitated? _____

Tank Design Details (Please provide drawing if available)

Tank Dimensions: Select from SPEL Data Manual Section 2

Or Tank Series preferred: Series 200 (1.2m dia.) ☐
 Series 300 (1.8m dia.) ☐
 Series 400 (2.6m dia.) ☐
 Series 500 (3.5m dia.) ☐
 Series 600 (4m dia.) ☐

Fittings

Inlet/s & outlet/s: Number, diameter, type & position (please provide drawing)

Access openings: Dia. number & position _____

Optional Extras

Extension Access Shafts _____

Pump Requirements _____

Pump/s Required: Type _____ Number _____ Duty/Standby or Duty/Assist _____
 Flow Rate _____ Distance _____ Static Head _____

Agitator requirements _____

Inlet Tank Protection Abrasion Plate - **Yes/No**

Bauer Suction Pipe/s for Removing Contents/Silt etc _____

Level Indicators _____

Secondary Containment (double wall tanks) _____

Other _____

Installation Details

Tank Invert Depth _____ Water Table Depth (in winter) _____ Tank surround: pea gravel/concrete

2.6 SPEL Tankstor® Underground Tanks

Main dimensions for 200, 300 and 400 Series tanks

Tank capacity	200 Series	300 Series	400 Series
	1.2m inside diameter	1.8m inside diameter	2.6m inside diameter
litres	length in mm	length in mm	length in mm
1,000	 1,160		
2,000	 2,040		
3,000	 2,930		
4,000	 3,810	 1,950	
5,000	 4,700		
6,000	 5,578	 2,755	
7,000	 6,470		
7,300		 3,200	
8,000	 7,346	 3,535	
9,000	 8,236		
9,270		 4,015	
10,000	 9,120	 4,285	
12,000	 10,888	 5,070	
13,650	 12,347	 5,755	 3,390
16,000		 6,700	
17,000		 7,060	
18,200		 7,615	 4,250  4,000
20,000		 8,255	 4,400
25,000		 10,215	 5,250
27,300			 5,700
30,000		 12,175	 6,170
35,000		 14,155	
36,400			 7,400
40,000		 16,120	
40,600			 8,200
45,500			 9,050
50,000			 9,950
60,000			 11,830
70,000			 13,710
75,000			 14,700
80,000			 15,600
90,400			 17,560

Note: Intermediate sizes are available at extra cost.

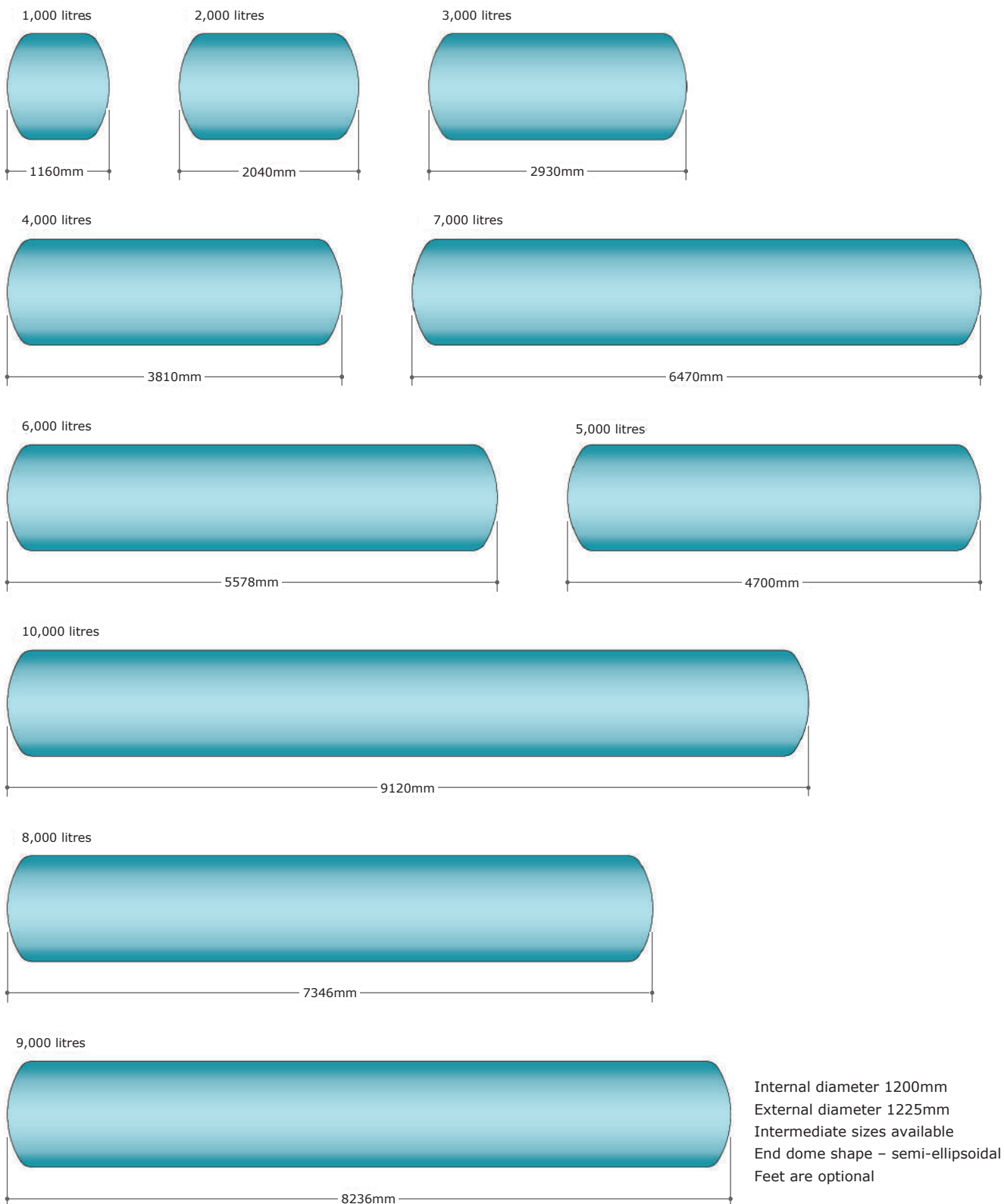
Main dimensions for 500 and 600 Series tanks

Tank capacity	500 Series	600 Series
	3.5m inside diameter	4.0m inside diameter
litres	length in mm	length in mm
45,000	 5,390	
60,000	 6,960	
75,000	 8,520	
80,000	 9,040	
90,000	 10,040	
100,000	 11,140	 8,710
120,000		 10,310
125,000	 13,840	
140,000		 11,891
150,000	 16,340	 12,690
160,000	 17,540	 13,485
170,000		 14,320
175,000	 18,940	
180,000	 19,440	 15,079
190,000		 15,871
200,000	 21,540	 16,635
220,000		 18,259
240,000		 19,899
250,000		 20,651
260,000		 21,450
270,000		 22,250
280,000		 23,020
290,000		 23,850
300,000		 24,650

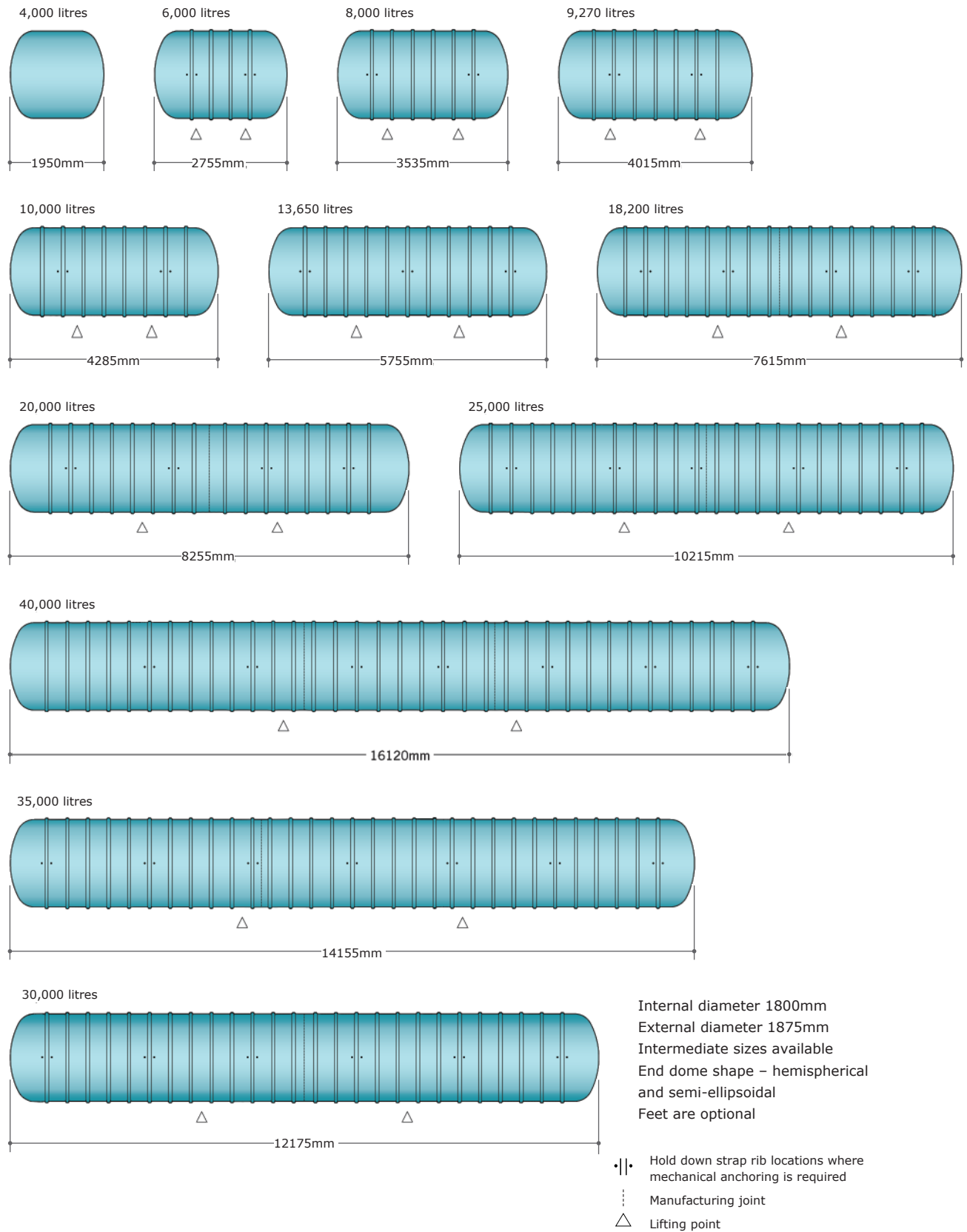
Note: Intermediate sizes are available.

2.8 SPEL Tankstor® Underground Tanks

200 Series Profiles

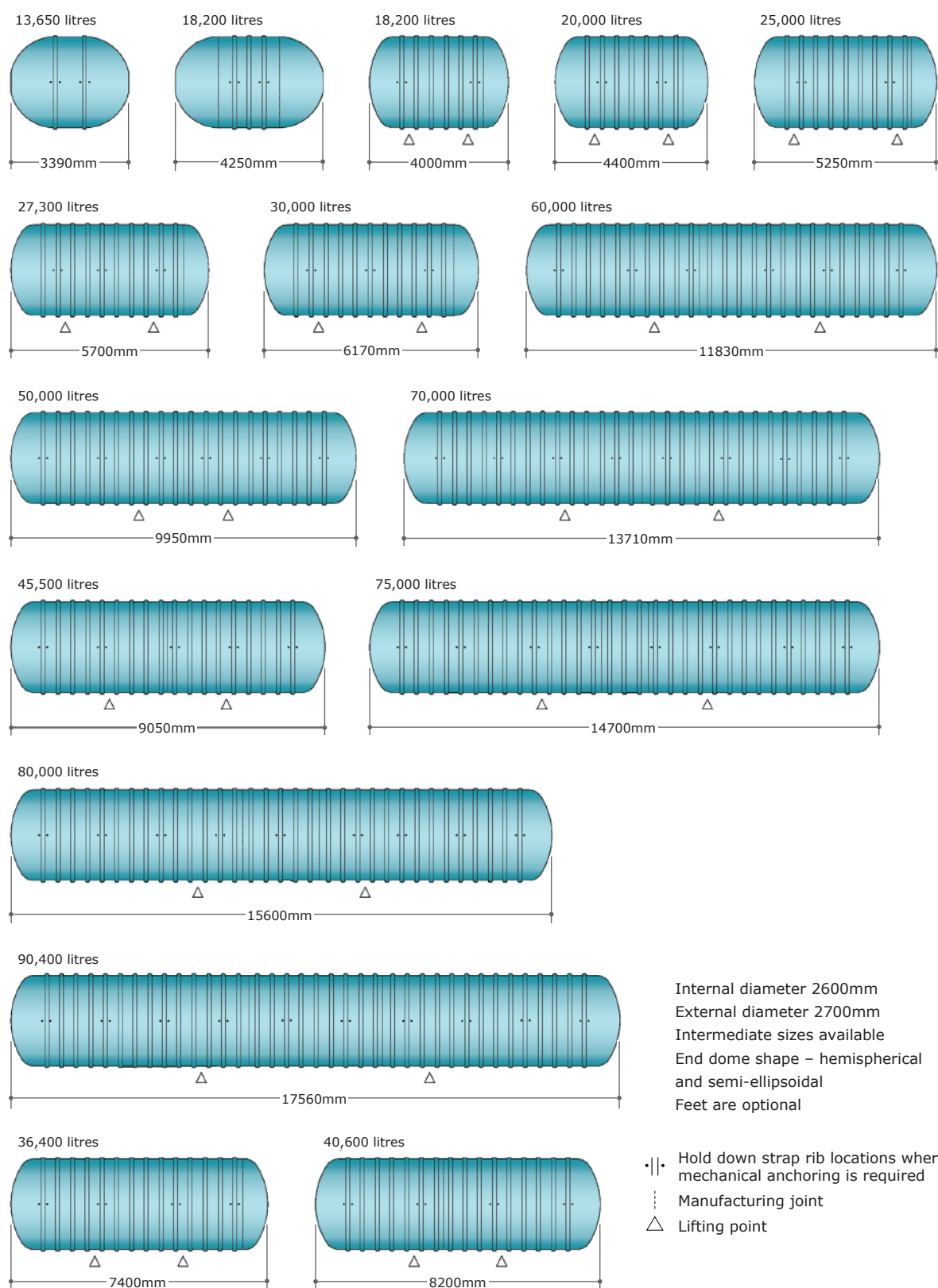


300 Series Profiles

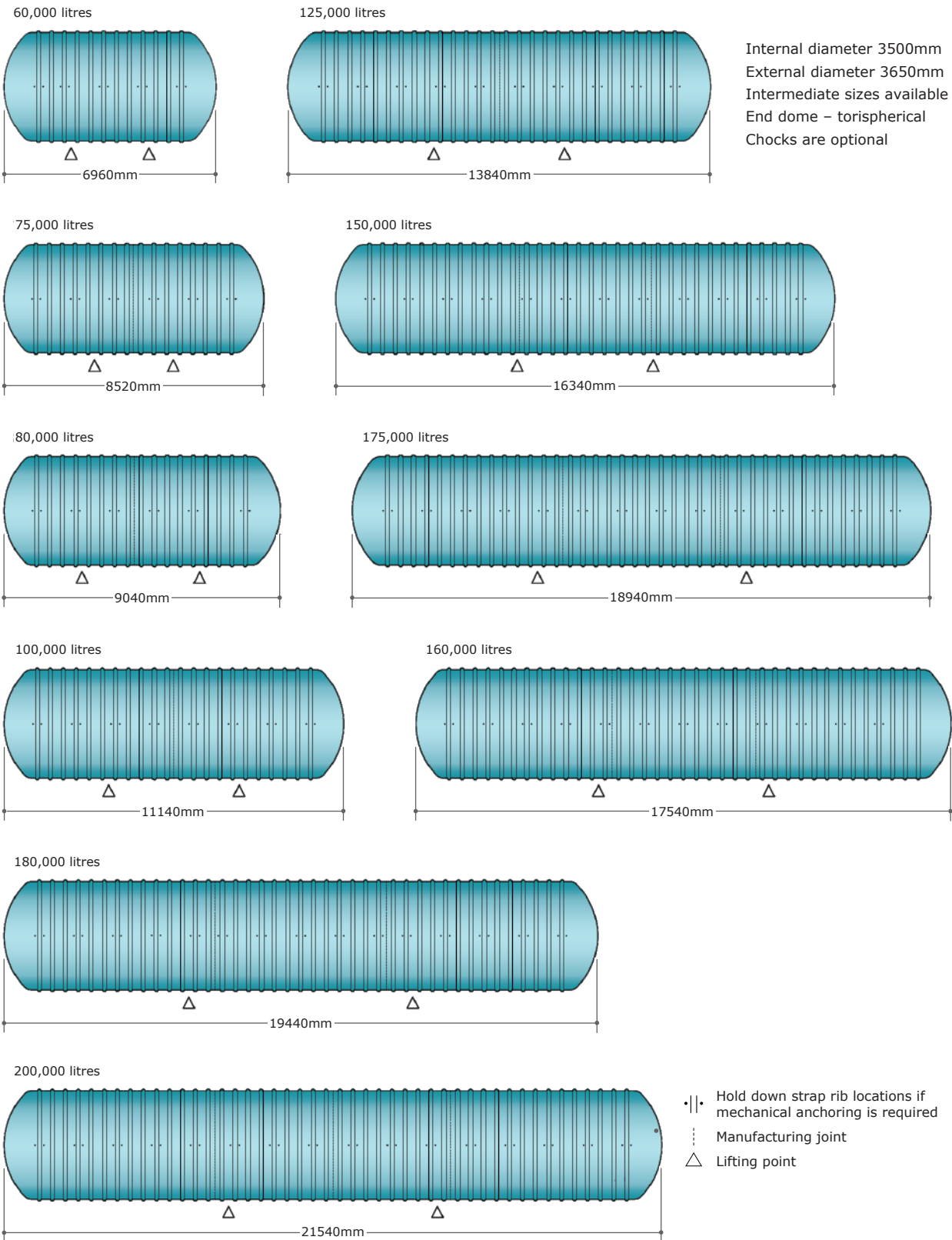


2.10 SPEL Tankstor® Underground Tanks

400 Series Profiles

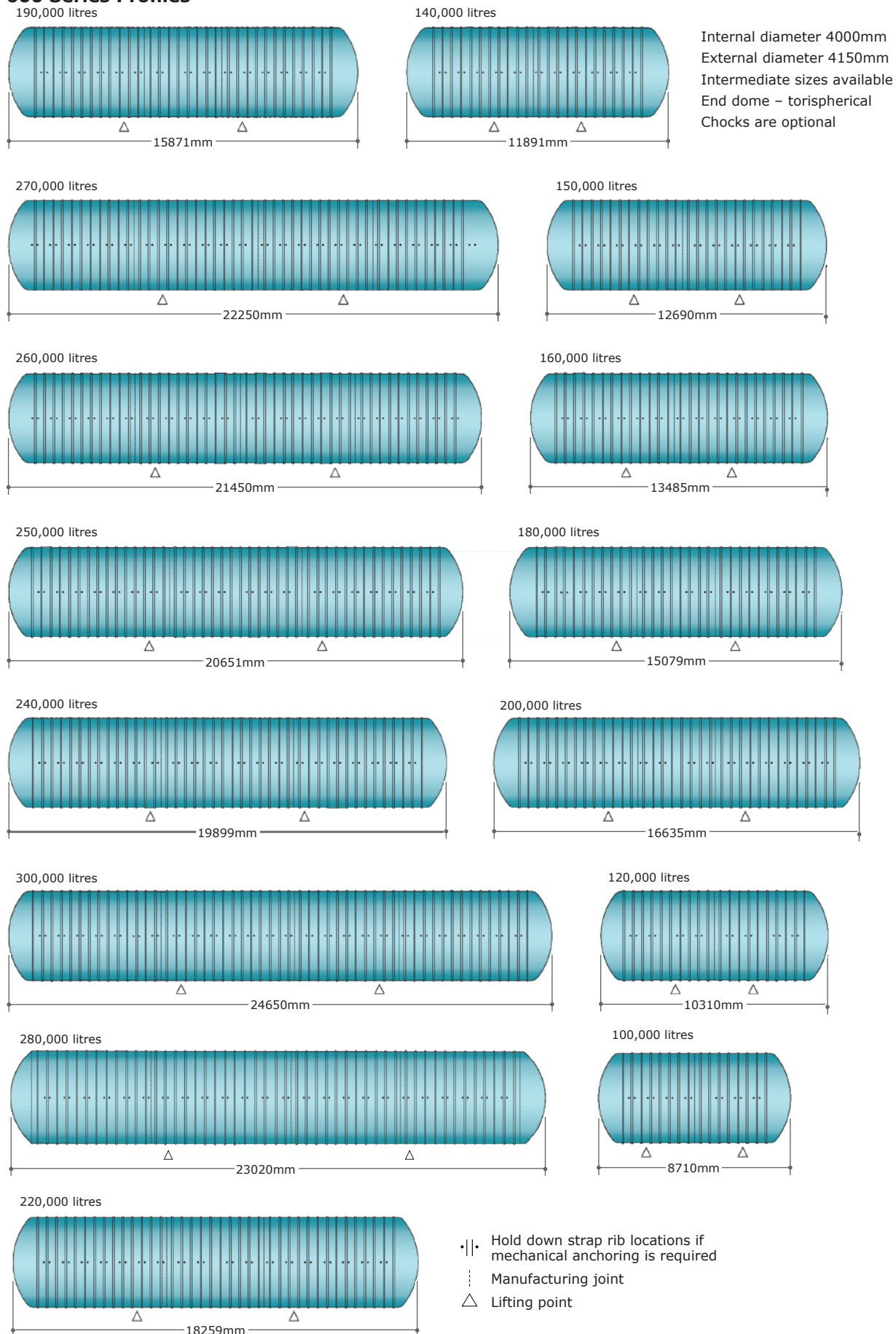


500 Series Profiles



2.12 SPEL Tankstor® Underground Tanks

600 Series Profiles



Access shafts, extension access shafts, ladders and partitions

Normally, circular access shafts are supplied in 450, 600, 750, 900 and 1200mm diameter. Larger square access shafts can be fitted to suit specific requirements. GRP ladders can be incorporated if required, complete with stainless steel fixings.

200/300 Series

Shafts can be laminated onto the tank up to a maximum height of 1000mm. Above this height extension shafts can be supplied separately for on-site fixing.

400 Series

Shafts up to 400mm high are laminated onto the tank. Above this height the shafts are supplied separately to be site fixed in sockets provided and sealed using Sikaflex or similar sealant/adhesive.

Alternatively, extension shafts can be provided to be site fixed onto stub shafts.

500 Series

Shafts up to 300mm high are laminated onto the tank. Above this height the shafts are supplied separately to be site fixed onto stub shafts.

600 Series

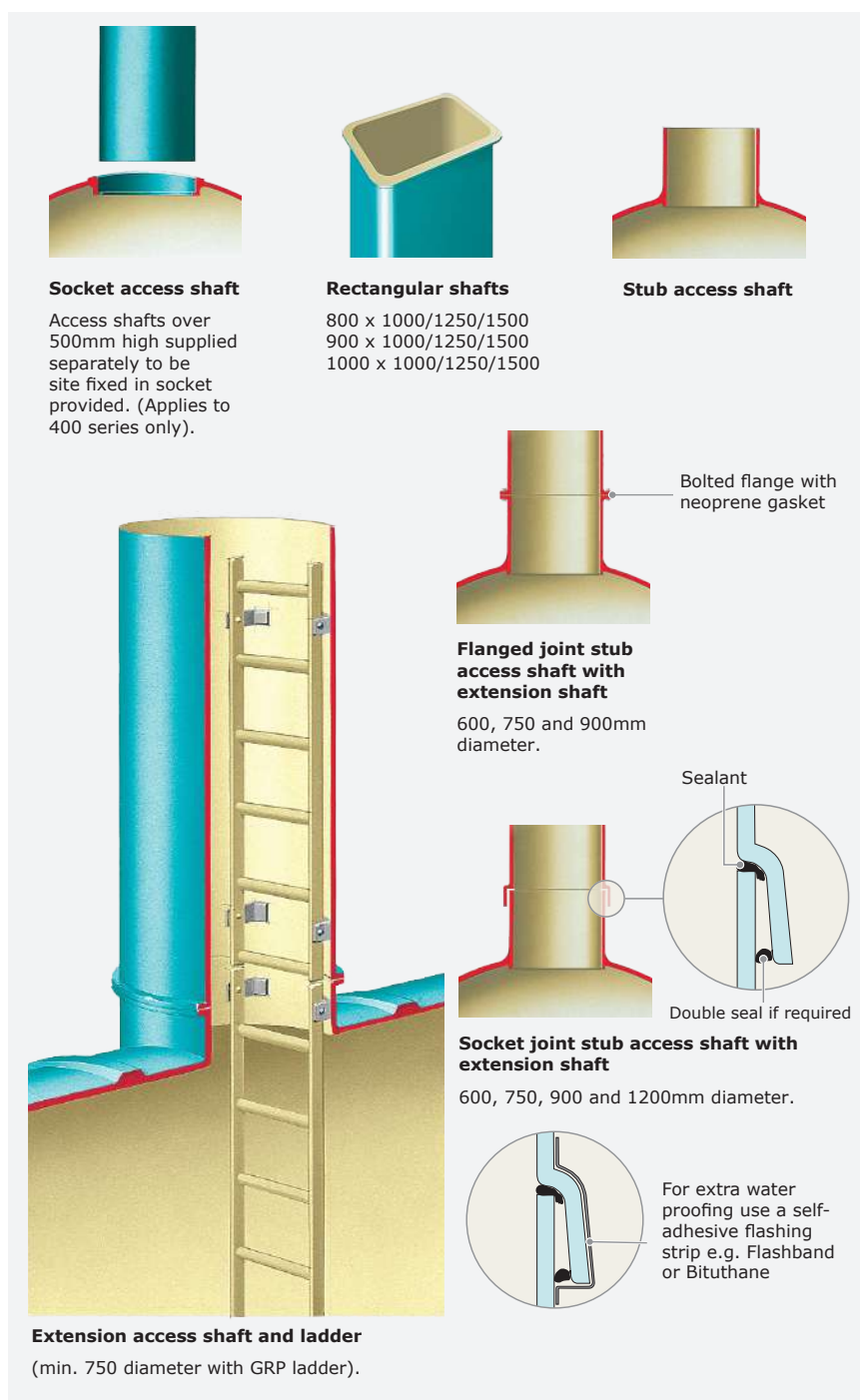
Stub access shafts are fitted 200mm high and extension access shafts fitted as 500 series.

Extension Access Shafts

These are supplied in 500mm increments

Partitions

Partitions for many applications available to meet clients' requirements.



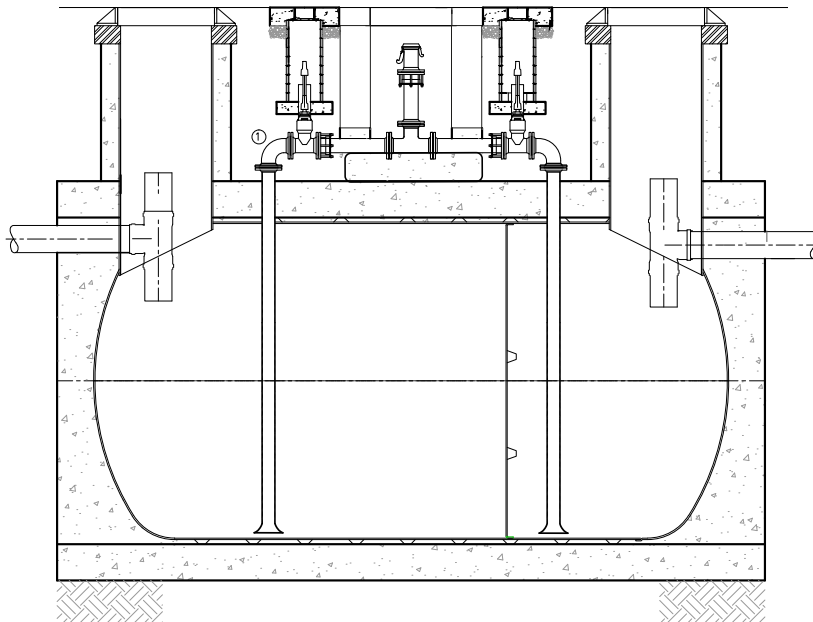
Partition with by-pass duct and pressure release valves.

Load bearing partition.

2.14 SPEL Tankstor® Underground Tanks

Vortex flow controllers & Bauer connections

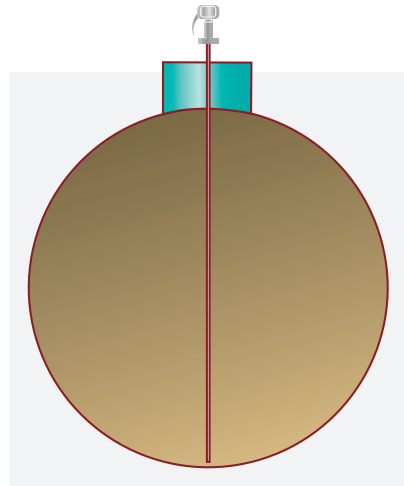
Scottish water sludge removal tank



Multiple sludge removal pipes can be linked to one tanker connection for emptying.

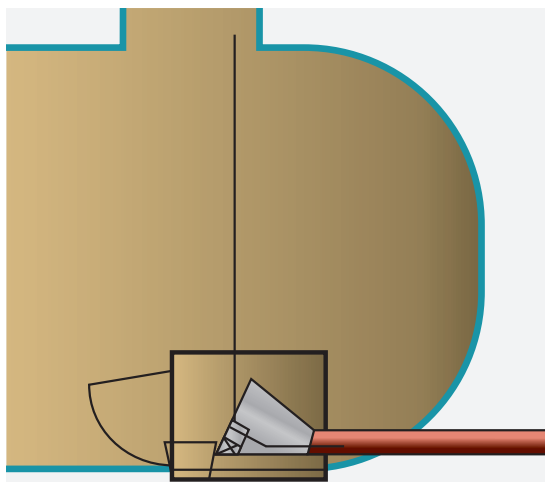
Emptying/sludge removal

Emptying/sludge removal available

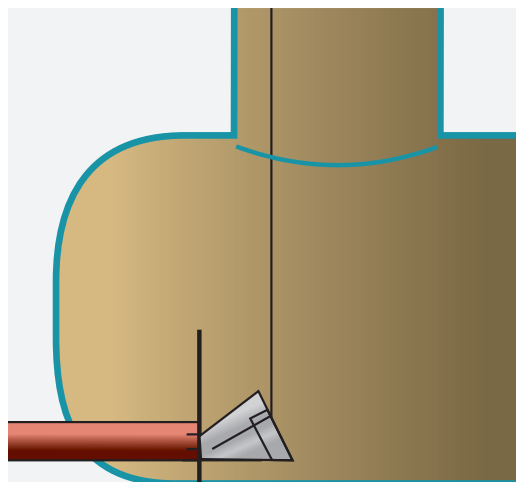


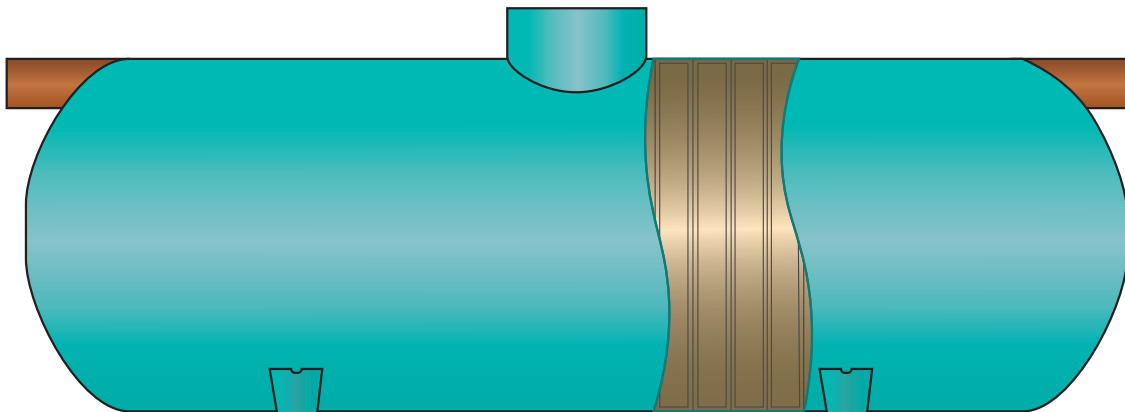
SPEL Storm-Brake stormwater attenuation system

Vortex flow controller with stainless steel debris cage and service access



Vortex flow controller with rodding access swivel plate and high level operation cable



SPEL Double skin/secondary containment tanks

Where there is particular concern about leakages occurring from tanks, an alternative to bunding is to provide a second skin to collect material lost. Monitoring of the cavity using liquid sensing probe can alert operators to the problem. Such systems are sometimes used for underground or tanks in remote areas, where undetected leaks to the environment may occur. Similarly tanks within process buildings may also be doubled skin.

Examples of SPEL tanks with secondary containment for above and below ground applications

2.16 SPEL Septic/Settlement Tanks

Selecting and siting the tank

Septic tanks have been used for many years for the primary treatment of sewage from rural properties not connected to the public sewer.

Building a conventional brick or concrete tank however has always been a laborious undertaking and leaks due to subsequent settlement are common.

SPEL Products commenced manufacturing septic tanks in 1974 and acquired an Agrément Certificate in 1977. Since then SPEL have developed a large range of horizontal cylindrical septic tanks to BS 6297/ BS EN 12566-1:2000/A1: 2003 from 3m³ capacity for single dwellings up to 200m³ litres capacity and over for larger communities.

Thousands of SPEL Septic tanks are in use today because of their proven performance and are a factory made sealed unit.

The ease and speed in which they can be installed in any ground conditions makes them very attractive to the installer.

SPEL septic tanks should be used in conjunction with a form of secondary treatment (eg. a drainage field, drainage mound or constructed wetland).

- 25 year warranty.
- Life expectancy of over 50 years.
- Designed and manufactured with reference to BS4994/ISO976.
- Scottish Water Solutions kit framework supplier.

Basic design principles

The primary function of a septic/settlement tank is to provide quiescent conditions to enable suspended solids to settle out, be retained and to produce a final effluent of as high a quality as possible. The higher the quality, the greater the efficiency and life of the soil infiltration system.

The controlled flow principle of the SPEL tank through two chambers provides excellent conditions for settlement and sedimentation. The tank has been so designed to extend the flow path between the inlet and outlet as far as possible for maximum overall efficiency.

Nominal capacity

SPEL septic tanks for domestic properties are based upon the following table for number of persons served. For larger installations the nominal capacity will depend on one or more of the following design criteria:

- Population total loading;
- minimum sizing criteria including sludge storage capacity;
- additional design criteria for domestic wastewater flows from sources such as hotels, restaurants or commercial premises.

Series	Nominal capacity (m ³)	Length (m)	Number of persons to be served	
			Normal flow 180L/ person/day	Extra flow* 250L/ person/day
200	3	2.93	5	4
200	4	3.81	11	8
200	5	4.70	16	12
200	6	5.8	22	16
300	5.86	2.69	21	15
300	8	3.54	33	24
300	10	4.19	44	32
300	13.65	5.76	64	46
300	20	8.25	100	72

*Where a sink waste disposal unit is fitted.



Siting the tank

British Standard BS 6297: 1983 recommends that sewage treatment works should be as far from habitable buildings as is economically practicable. The direction of the prevailing wind should be considered in relation to any properties when siting the works.

In accordance with the Building Regulations 2000. H2 2002 edition SPEL septic tanks should be sited at least 7m from any habitable parts of buildings, and preferably downslope.

The tank should not be installed near a road or driveway, where it could be subjected to high external loads, unless the installation is designed to withstand such loadings so they are not transferred to the tank shell.

Where the tank is to be emptied using a tanker, it should be sited within 30m of a vehicle access provided that the invert level of the septic tank is no more than 3m below the level of the vehicle access. This distance may need to be reduced where the depth to the invert of the tank is more than 3m. There should also be a clear route for the hose such that the tank can be emptied and cleaned without hazard to the building occupants and without the contents being taken through a dwelling or place of work.

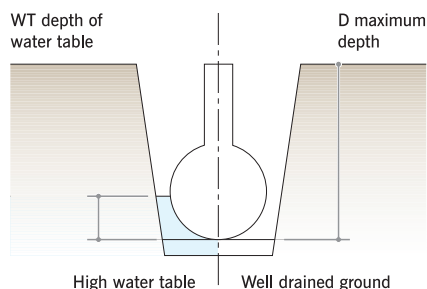
Ventilation

Adequate ventilation of the septic tank and the inlet pipework shall be provided to prevent the accumulation of fermentation gases.

Specifications and installation methods

Selecting the tank specification

Standard, heavy, extra heavy or special tank specifications are available dependent upon tank burial depth and water table level in winter.



Standard tanks

Series	WT(m)	Surround Concrete D(m)	Surround Pea Gravel D(m)
200	1.0	4.0	2.0
300	0.9	4.0	2.6
400	1.3	5.0	4.0
300	20	8.25	100

For other specifications refer to burial depth charts in section 13 of this manual or contact technical sales.

Installation – quick and simple

Installation is a quick, simple and uninterrupted operation. The following recommendations are for guidance only. More detailed instructions are provided with each tank.

Dry, well-drained ground

Excavate sufficiently to permit easy placing and backfilling around tank allowing for timbering and sheeting to retain subsoils liable to move laterally.

Check excavation depth taking into account the drain invert depth and a concrete foundation of 150-200mm. Place the concrete in centre of excavation base and lower tank into position 'puddling' it into the concrete to form a cradle.

Check tank is truly vertical and connections marked IN and OUT are in their right position.

Backfill with dry sand, pea gravel or selected non-cohesive material, free from large stones, bricks or sharp objects. Consolidate thoroughly to prevent voids and localised stress concentrations. Connect pipework.

Wet or clay ground

Where there is a possibility of a high water table or the ground consists of dense or wet non-cohesive soils where drainage is slow, the tank should be surrounded in 10-1 semi dry mix concrete to an approximate thickness of 200-250mm. This is to prevent the possibility of floatation.

If the ground is saturated or consists of heavy clay which can exert high swelling pressures the tank should be surrounded in concrete as follows:

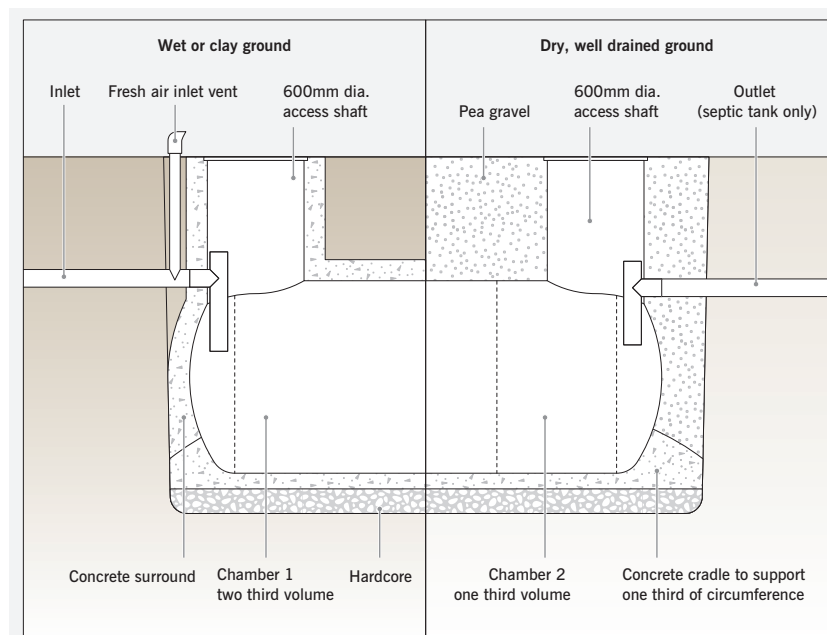
Using interlocking trench sheeting, shore the sides of the excavation placing timber walings to support the sheeting as required.

If pumping is necessary, dig a pump well in one corner of the excavation. Excavate as above but allow for 250-300mm of hardcore in addition. Lay the hardcore, consolidate it and cover with a polythene membrane prior to placing concrete and position the tank as described previously.

After the foundation concrete has reached its initial set, proceed with backfilling with concrete to a thickness of approximately 150-200mm.

At the same time as the concrete backfill is being placed, pump water into the tank to a corresponding level to equalise the pressures on the tank wall and to prevent floatation.

After the tank has been surrounded with concrete keep the excavation free from water by pumping until the concrete has set. Connect pipework and install the manhole cover and vent connection.



Typical installation for SPEL septic tanks

For detailed installation instructions refer to section 13.

2.18 SPEL Septic/Settlement Tanks

Effluent disposal and tank emptying

Effluent disposal

If conditions are suitable the cheapest and one of the most efficient means of disposal is by means of a subsurface irrigation system. It is simple to install but requires careful design and installation to work efficiently.

To determine the most suitable siting and area of land required for a subsurface irrigation system a percolation test in accordance with the British Standard BS 6297: 1983 may be necessary. However, we recommend seeking advice from the Local Authority officers whose experience and knowledge of local conditions can be invaluable.

Percolation test in accordance with BS6297

To determine the area of land required a percolation test is essential; the following method should be adopted.

Excavate a hole 300mm square to a depth 250mm below the proposed invert level of the land drain. Where deep drains are necessary the hole should conform to this shape at the bottom but may be enlarged above the 250mm level to enable safe excavation to be carried out. Fill the 300mm square section of the hole to a depth of at least 250mm with water and allow it to seep away overnight. Next day, refill the test section with water to a depth of at least 250mm and observe the time, in seconds, for the water to seep away completely.

Divide this time by the depth in millimetres of water placed in the hole. The answer gives the average time required for the water to drop 1 mm. Take care, when making the test, to avoid abnormal weather conditions such as heavy rain, severe frost or drought. Carry out the test at least three times and take the average figure.

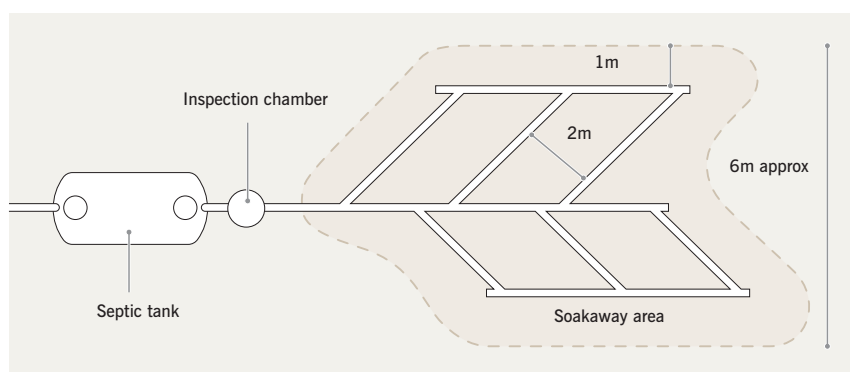
Where deep excavations are necessary a modified test procedure may be adopted using a 300mm earth auger. Bore the test hole vertically to the appropriate depth taking care to remove all loose debris.

Make water level observations referring to a fixed datum using a dip stick or some suitable alternative water level indicator.

Time to fall	Number of persons to be served							
	3-4		5-6		7-10		11-14	
25mm (mins)	m	ft	m	ft	m	ft	m	ft
2 or less	11	36	16	52	27	90	37	120
3 or less	16	52	24	80	40	130	56	180
4 or less	21	70	32	105	53	175	75	250
5 or less	27	90	40	130	67	220	93	305
10 or less	53	175	80	260	134	440	186	610
15 or less	80	260	120	400	200	660	280	920

A guide to the length of perforated land drain requirements. The table above is for guidance only. It is based on a trench floor width of 450mm. You should consult your local authority for their recommendations.

Typical land drain arrangement. Average installation for single dwelling – 30m of land drain.



The value found in this way is called the percolation value (V_p in s) of the soil and can be used to determine the area of drainage trench floors required to disperse effluents.

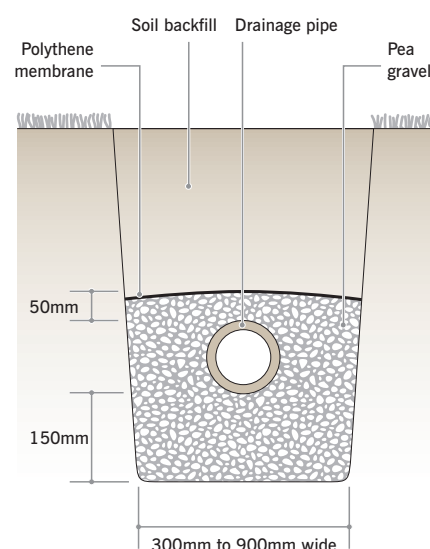
The floor area of subsurface drainage trench (A_t in m^2) required to disperse effluents from septic tanks may be calculated from:

$$A_t = P \times V_p \times 0.25$$

Where P is the number of persons served by the tank; and V_p is the percolation value obtained as described.

The area determined should be used to calculate either a length of land drain, or alternatively the floor area of one or more shallow soakaways. Drainage trenches should be from 300mm to 900mm wide, and areas of undisturbed ground 2m wide should be maintained between parallel trenches.

Section through a land drain.



Effluent disposal and tank emptying

Siting

A drainage field or mound serving a wastewater treatment plant or septic tank should be located:

- a) at least 10m from any watercourse or permeable drain;
- b) at least 50m from the point of abstraction of any groundwater supply and not in any zone 1 groundwater protection zone;
- c) at least 15m from any building;
- d) sufficiently far from any other drainage fields, drainage mounds or soakaways so that the overall soakage capacity of the ground is not exceeded

The disposal area should be downslope of groundwater sources.

Design and construction

To achieve even distribution, land drains should be laid in a herringbone or similar pattern depending on the site. Unglazed earthenware joint-less pipes or rigid perforated plastic or vitrified clay pipes should be laid with a fall of 1 in 200 at a minimum depth of 500mm. The pipes should be laid on a 150mm layer of clinker, clean gravel or broken stone 20mm to 50mm grade and trenches filled to a level 50mm above the pipe and covered with strips of plastic material laid to prevent the entry of silt. The remainder of the trench can be filled with normal soil.

If the winter water table level rises to within 1m of the invert of the irrigation system an alternative method of disposal may be necessary. This can sometimes be achieved by discharging into shallow trenches laid in the topsoil. Alternatively the effluent can be pumped to a suitable area.

Constructed wetlands/reed beds

Reed bed treatment systems or other constructed wetland treatment systems can be used to provide secondary or tertiary treatment of effluent from septic tanks or packaged treatment works. The systems purify wastewater as it moves through the gravel bed around the rhizomes and roots, by removing organic matter (BOD), oxidizing ammonia, reducing nitrate and removing a little phosphorous. The mechanisms are complex and involve bacterial oxidation, filtration, sedimentation and chemical precipitation.

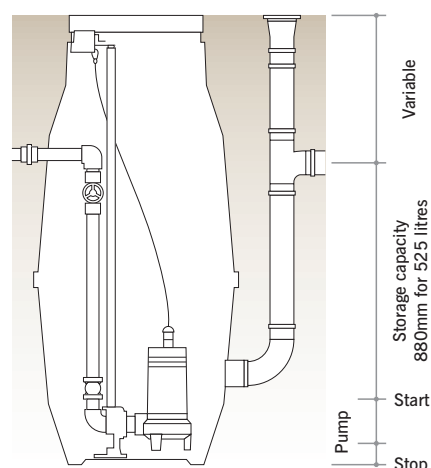
Reed bed treatment systems should be designed and constructed in accordance with BRE Good Building Guide No. 42. Other forms of constructed wetland treatment system should be designed and constructed by specialists.

Emptying the tank

To maintain the efficiency of the SPEL septic tank, it should be de-sludged approximately every twelve months. For efficient and quick sludge removal from the larger SPEL septic tanks, sludge draw-off pipes can be fitted complete with Bauer type couplings. Where access for servicing the septic tank is difficult the draw-off pipes can be extended.

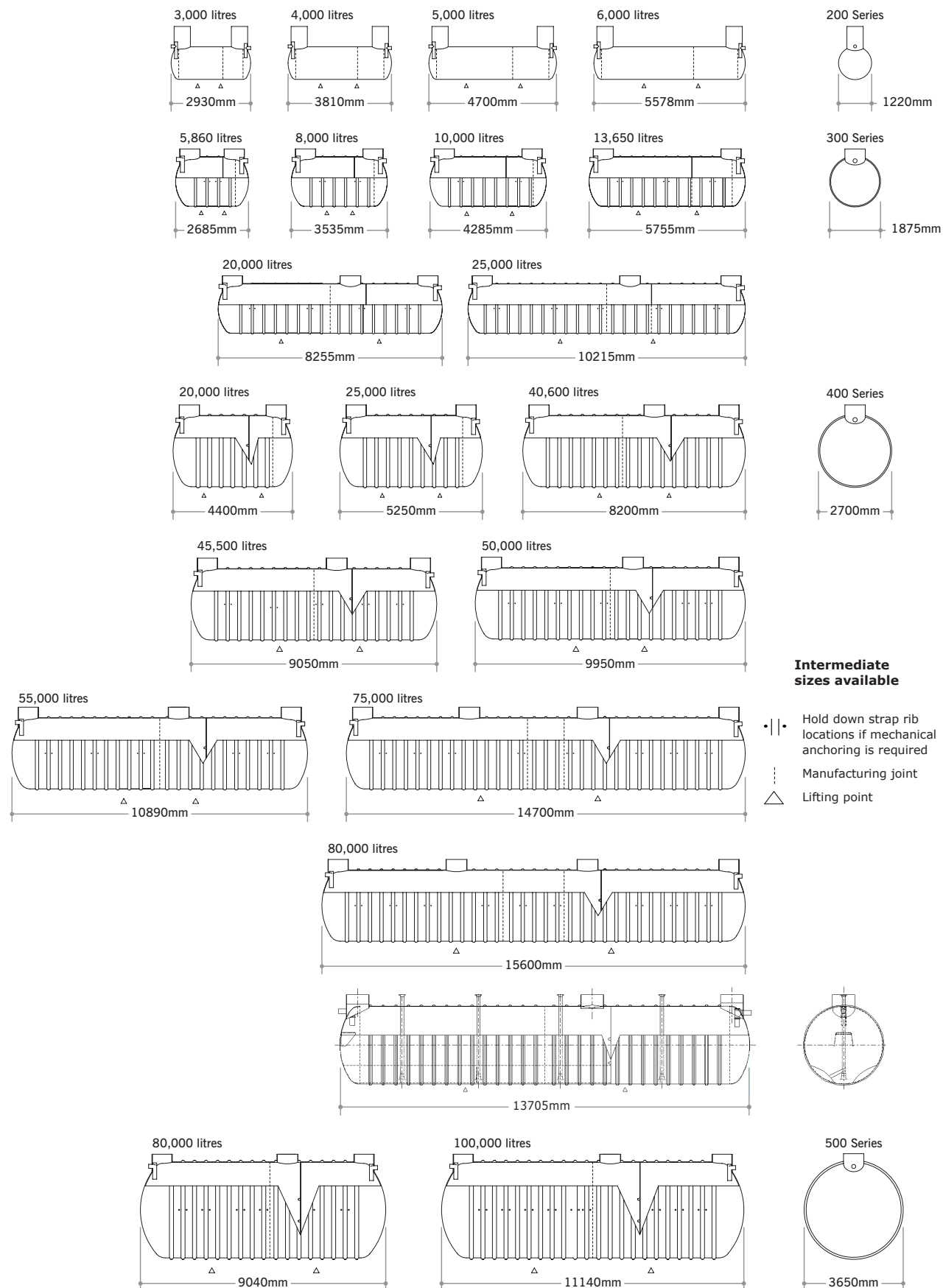
SPEL Package Pumping Stations

Available where it is necessary to raise the effluent to a suitable filtration area or public sewer (see section 9) The SPEL pumping stations are available with a range of pump capacities to suit most situations. Full technical details will be forwarded on request.



2.20 SPEL Septic/Settlement Tanks

Constructed to BS6297



Options available

Pipe configurations, baffles, vent holes, chocks, access shafts and sludge removal pipework

Inlet and outlet configurations

Standard inlets and outlets can be replaced with bespoke pipework, including twin (T) pipes, large diameter pipes and weir fittings, to suit site conditions. Baffles can be fitted as required.

Vent connections

Vent connections can also be specified.

Benching

Internal benching can be incorporated into the first chamber to facilitate sludge removal.

Chocks

Chocks can be moulded to the tank shell to stabilise the tank and ensure it is maintained in a vertical position on a flat concrete slab.

Sludge removal pipework

Any desired configuration can be supplied including vertical and inclined pipes with male or female Bauer or similar connections. Also with GRP bellmouth or 'T' inlet. (As shown right).

Access shafts

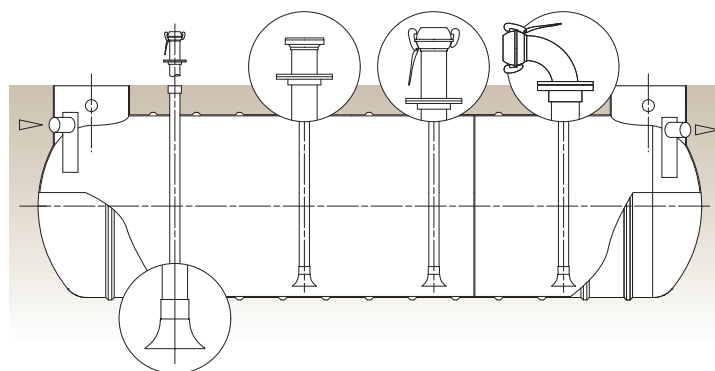
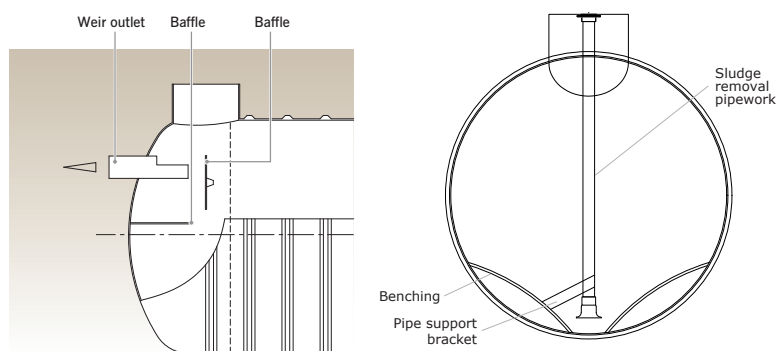
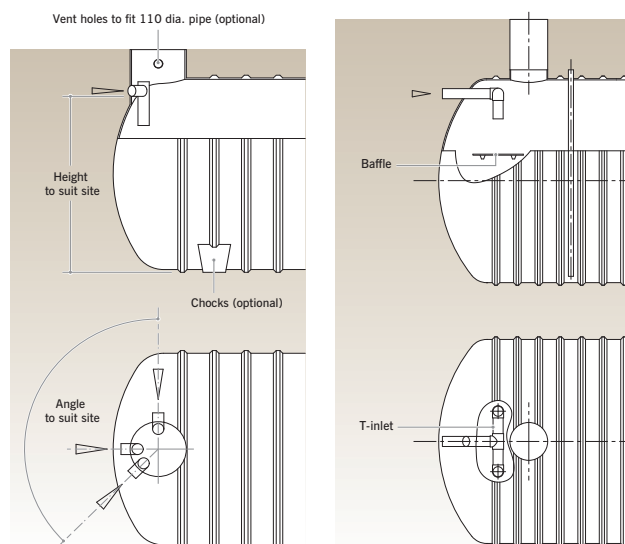
Access shafts can be situated at any location on the tank and are available in a range of standard sizes and configurations.

Standard sizes available are:
600, 750, 900, and 1200 diameter.
800x1000/1250/1500 rectangular.
900x1000/1250/1500 rectangular.
1000x1000/1250/1500 rectangular.

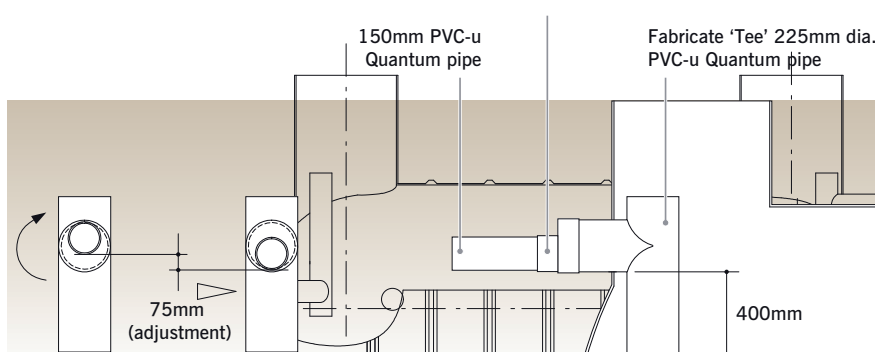
For further details and illustrations see 2.13.

Adjustable inlet level

Multiple tank installations (see opposite).



Level invert reducer socket (225mm x 150mm)



2.22 SPEL Cesspools

SPEL cesspools are available where a septic tank and drainage field/sub surface irrigation system for disposal of the effluent is unacceptable.

SPEL cesspools are a factory made watertight underground tank for storage of sewage and comply with BS EN 12566-1.

Siting

SPEL cesspools should be sited at least 7m from any habitable building and preferably downslope. They should however be sited within 30m of a sludge removal tanker access and at such levels and position to operate and without hazard to the building occupants.

Design and construction

SPEL cesspools are designed and manufactured generally in accordance with BS4994/ISO976 and meet the requirements of BS EN 12566-1.

Filament wound in glass reinforced polyester GRP they are strong yet light in weight for easy handling on site. An inlet connection – 160mm UPVC socket, or as required, is fitted in a 600mm dia. access opening. Extension access shafts are available to suit tank invert depth and ground level.

Specification

SPEL cesspools are suitable for well drained or wet ground conditions. The correct specification depends on the tank invert depth and the water table in winter – see section 13 for burial depth/water table level charts. For general guidance see table opposite.

Sizing

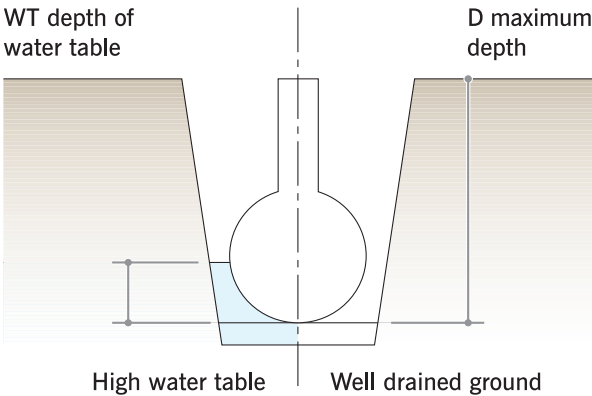
SPEL cesspools should be sized according to the Building Regulations 2000 – H2 as follows:

2 persons – 18200 litre capacity. This size should be increased by 6800 litres (6.8m³) for each additional user.

Note: For installation see section 13.

Standard tanks (other specifications see section 13)

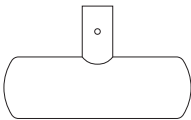
Series	WT(m)	Surround Concrete D(m)	Surround Pea Gravel D(m)
200	1.0	4.0	2.0
300	0.9	4.0	2.6
400	1.3	5.0	4.0



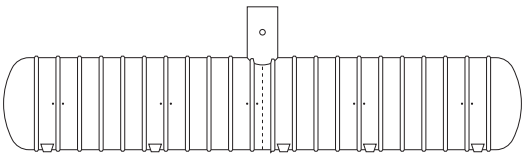
Typical SPEL Cesspools

Tanks are custom built so extra shafts, extension shafts and fittings can be supplied if required.

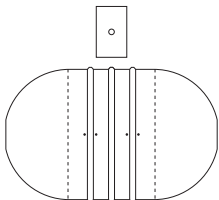
Shafts supplied loose for 400 series tanks to be sealed into socketed access opening. Length of shaft supplied to suit site requirements.



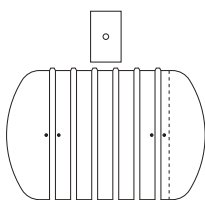
200 series available 4,000 – 10,000 litres for temporary non residential applications



300 series 25,000 litres



400 series (HE)
18,200 litres



400 series
18,200 litres

Project: Endmoor WWTW

Client: United Utilities PLC

Consultant/Contractor: C2V Plus

Products:

2 no. SPEL Primary Settlement/Septic tanks 500 Series 130,000 litre to BS 6297:2007



The two SPEL Primary Settlement/Septics were supplied complete with the SPEL Mechanical Anchoring sets for installation in this difficult hilly terrain for the primary treatment of sewerage.

United Utilities are working to improve and increase capacity at Endmoor wastewater treatment works. This works discharges into Peasey Beck, however, the population in Endmoor is forecast to increase by 38% in coming years. Therefore, if work wasn't undertaken to increase capacity to cope with the increased demands there would be negative impacts on water quality in the beck. Peasey Beck is a 19.6-kilometre-long beck flowing through Cumbria. It rises on Lambrigg Fell where it is known as the Killington Beck, flows through Killington Reservoir and converges with Stainton Beck to form the River Bela at Milnthorpe.



The source of the beck is on Lambrigg Fell at 300 metres between Kendal and Sedburgh

Client: Scottish Water Kit Framework Supply

Products:

SPEL Primary Settlement/Septic tanks

SPEL Spillage Containment tanks

SPEL 'H' Series Package Pumping Stations



SPEL Products have been a Kit Framework Supplier for primary settlement and septic tank to Scottish Water since 2007. The Company has also been working closely with the Scottish Water appointed consultants and contractors for many years building up a trust and support that has continued until the current time.

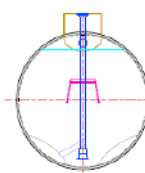
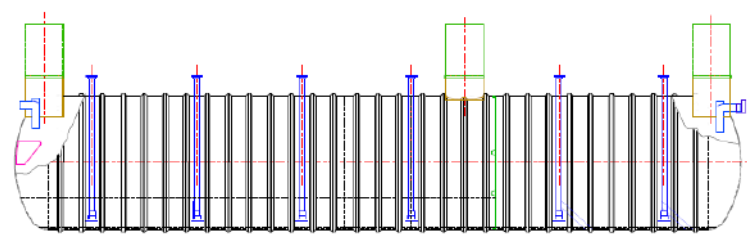
Improvements in the design and performance of the septic tanks includes the feature of benching to improve flow characteristics, Bauer sludge removal pipes and fittings and adjustable invert level outlet connections for multiple tank installations.



SPEL Septic Tanks 600 Series 240,000 litre
Port Ellen, Islay, Western Isles



SPEL Septic Tanks 600 Series 200,000 litre
Kinlochard WWTW, Aberfoyle



Typical SPEL Primary
Settlement/Septic tank with
Bauer sludge removal pipes
and benching

Designed with reference to
BS6297:2007



Transporting to outlying places, especially the western isles sometimes requires ferrying



SPEL CR Chemical Holding tanks

SPEL Chemical Containment/Holding Tanks are supplied with specifications to suit the chemicals present. Both CR, chemical resistant with isophthalic based resins and HCR, highly chemical resistant with vinyl ester resins, are available to suit conditions.



SPEL HCR Chemical Holding tank

Sample products supplied

Whitehilllocks WWTW

SPEL Tankstor® 300 Series 5,860 Litre Lime Spillage Tank - HCR specification

SPEL Tankstor® 400 Series 30,000 Litre Aluminium Sulphate Spillage Tank - HCR specification

Loch Ness WTW

SPEL Tankstor® 500 Series 100,000 Litre Tanks – 2 No. HCR specification suitable for Citric Acid, Sodium Hypochlorite & Sodium Metabisulphate

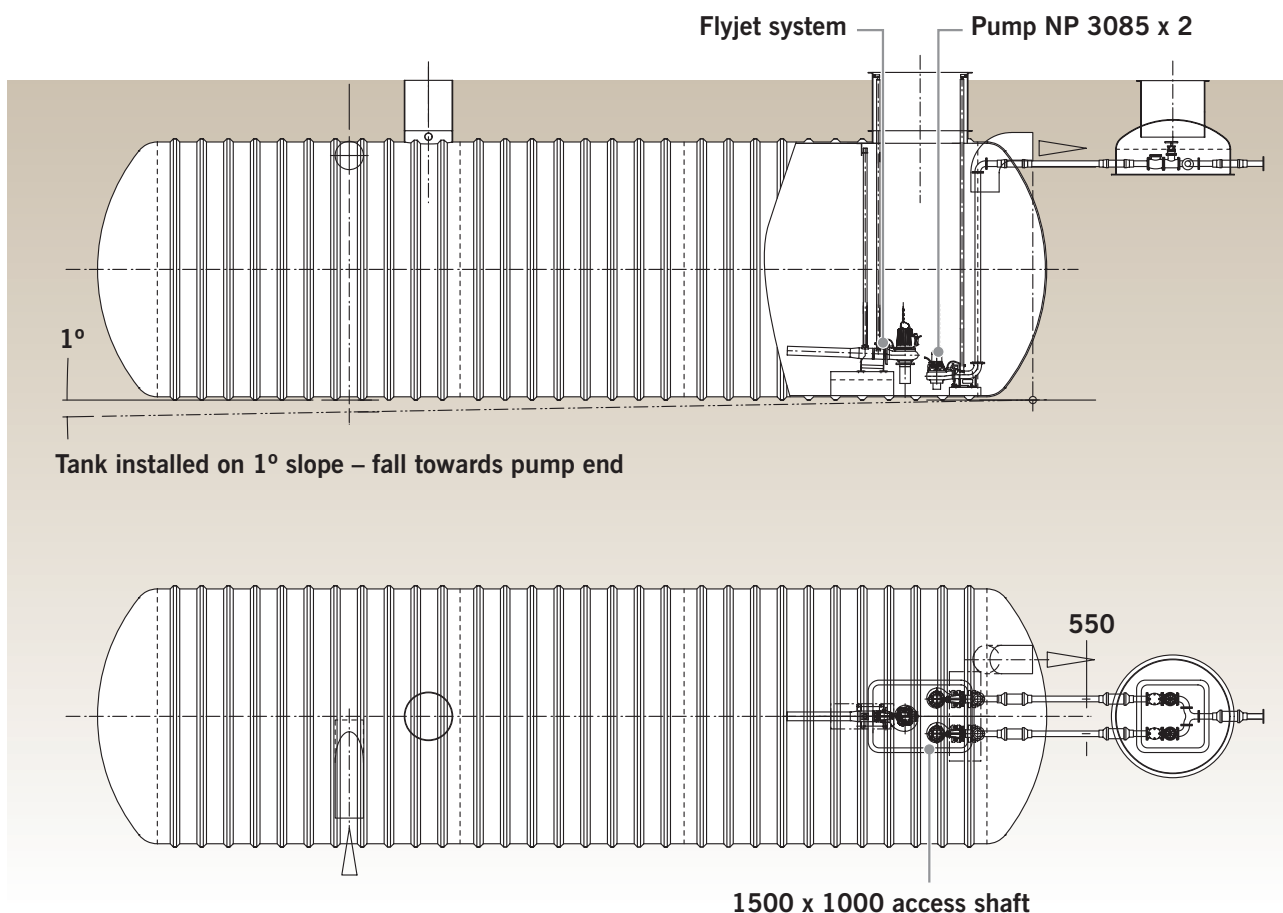
Lomond Hills WTW

SPEL Tankstor® 300 Series 15,000 Litre Tank - HCR specification suitable for Sodium Hydroxide

SPEL 'H' Series Package Pumping Stations

SPEL 'H' series Package Pumping Stations have also have been supplied; at Fortrose and Rosemarkie WWTW in Ross-shire are examples.

These SPEL Package Pumping Stations are available for Sewers for Adoption schemes and are WRc approved in sizes up to 300m cube in a single unit. The advantages of factory built off-site is providing substantial savings e.g. factory fitted complete with tested pipe work, valves and associated pump stools eliminating the expensive 'confined space' site work. Control panels pumps and commissioning can also be provided.



SPEL 600 series 180,000 litre capacity incorporating ITT Flygt pumps, Flyjet unit, separate valve chamber with stainless steel pipework, Tomeet Sewers for Adoption 5th edition. Fortrose and Rosemarkie WWTW Ross-shire, Scotland.

Boeing at Gatwick Airport

CASE STUDY

Project: Boeing GoldCare Hanger, Gatwick Airport

Client: Boeing Corporation

Contractor: John Sisk

Products:

13 no. SPEL Tankstor® 600 Series 240,000 litres capacity



The tanks were installed on a concrete base slab with a granular bedding and backfill. To ensure the tanks were solidly held in position and no possibility of shifting they were anchored down with the SPEL Mechanical Anchoring System.

Galvanised sinkers were provided to cast into the concrete slab. However these strap sinkers were modified and fixed into the concrete slab by drilling and bonding with Fischer injection mortar FIS EM Plus, a high-quality epoxy mortar for top load-bearing capacity in cracked and non-cracked concrete and for seismic applications.

An alternative is to use the standard strap holding down brackets and expansion anchor bolts which SPEL can provide.

See Data Manual Section 13.

Shifford's Bridge Nitrate Improvement Scheme

CASE STUDY

Project: Nitrate improvement scheme

Client: Severn Trent Water

Consultant/Contractor: Mott MacDonald Bentley

Products:

SPEL Tankstor® 4 No. 11,000 litre capacity
CR - chemical resistant underground tanks

The borehole at Shifford's Bridge is located in Shropshire, a rural agricultural area, where rising nitrate trends required improvements to maintain supplies within strict water quality limits.

Two schemes were put forward by Mott MacDonald Bentley (MMB), one, to provide blending in order to maintain nitrates within acceptable limits and the other to construct a nitrate removal plant. Severn Trent Water opted for the latter due to the nature of the facility. The new nitrate plant is capable of treating 3.3ML/d.

The delivery team worked closely with the supply chain partners to ensure a 'right first time' approach. This involved utilising the knowledge and experience of the integrated design team and 3D modelling.

SPEL Tankstor® underground attenuation tanks were incorporated with high level sensors to reduce the risk of overspill/leakage and preventing pollution to the principal aquifer.

The final product has met or exceeded the Severn Trent Water's expectations with the new plants greater efficiency and reduced maintenance.



We have been privileged to work with MMB on this successful project.

Project: Ardersier WWT

Client: Scottish Water

Products:

SPEL H-Series Package Pumping Station - 150,000 litres capacity

SPEL Tankstor® Underground Tank - 125,000 litres capacity

Supplied complete with internal pipework, pump pedestals, stainless steel guide rails and lifting chains and Flygt pumps all as per Scottish Water specification

