

Fire Water Retention Tank

The tanks shall be constructed using the full concrete and reinforcement specifications in Sections 1, 2 and 3 below.

1 CONCRETE SPECIFICATION

1.1 Certificates

Concrete shall be produced in an audited plant only: It shall not be produced on site.

A numbered certificate, signed and stamped, shall be required for all concrete delivered to site. The certificate, the "Concrete Manufacturers' Specification Certificate",

If the Concrete Supplier requires further information the following shall be quoted to them:

- The concrete is to be to I.S. EN 206-1:2002: Strength Class: C28/35, 300 kg cement, maximum water cement ratio of 0.60, Exposure classes: XC4, XF3, XA1 (20-year life), Slump class: S2 (unplasticised), maximum aggregate size 20mm.

If plasticised concrete is desired, the slump class shall not exceed S3.

Polypropylene fibres may be incorporated into the concrete mix to improve the properties of concrete. Only fibres which have been tested and approved by National or European approval authorities may be used. The use of fibres helps to reduce plastic cracking and improve surface durability, but they are not a substitute for structural reinforcement (Section 8). Fibres shall be used in strict compliance with manufacturer's instructions and shall only be added at the concrete manufacturing plant.

1.2 Materials

Cement used in concrete and concrete products shall be certified to IS EN 197-1, and shall bear the Irish Standard Mark, or shall be certified by NSAI to be equivalent to IS EN 197-1. All aggregates shall be to IS 5 1990. Plasticisers and other admixtures shall be to EN 934. All admixtures shall be used in strict accordance with manufacturer's instructions and shall be added only by the concrete-mix manufacturer.

1.3 Curing of Concrete

All concrete shall be cured by keeping it thoroughly moist for at least seven days. Wetted floor slabs and tank walls shall be protected by polythene sheeting, kept securely in place. Alternatively proprietary curing agents may be used in accordance with manufacturer's instructions. When frost is a danger, straw bales shall be placed over the polythene on slabs. Concrete shall be at least 28 days old before being subjected to full load.

2 CONCRETE WORK FOR TANKS

2.1 Tank Floor

The floor slab shall be not less than 225mm thick throughout. It shall extend 250mm outside the walls. Timber or steel forms 225 mm deep, shall be fixed around floor perimeter before placing footing steel, wall steel, and floor steel mesh where specified in Section 8. The concrete shall be thoroughly compacted, and compaction around steel reinforcement shall be carried out with a poker vibrator. The floor shall be finished smooth.

2.2 Tank Walls

Walls shall be 225mm minimum Steel shuttering is recommended for tank walls but panels with timber may be used. All shuttering shall be clean and tight fitting to prevent loss of grout. To maintain cleanliness and facilitate removal they should be oiled lightly with proprietary mould oil prior to each use. Care shall be taken that oil does not get onto reinforcing bars and prevent bonding. All shuttering shall be properly tied and braced to withstand the pressure of the concrete.

2.3 Wall/Floor Joint

A key shall be formed in the floor at the centre of the proposed wall by using a splayed oiled timber runner temporarily fixed in the freshly poured concrete and withdrawn before final set. Alternatively a 150mm patent water bar or approved water-stop shall be fixed along the centre line of the proposed wall. Care shall be taken that the water bar is tied to the vertical steel to keep it in position during the pouring of the concrete floor (Fig. 1).

Within an hour or so (depending on weather) the surface of the proposed joint shall be sprayed with water and brushed off with a soft brush to expose the coarse aggregate. If left overnight, a stiff brush may be needed. The best joints are obtained by light brushing soon after pouring.

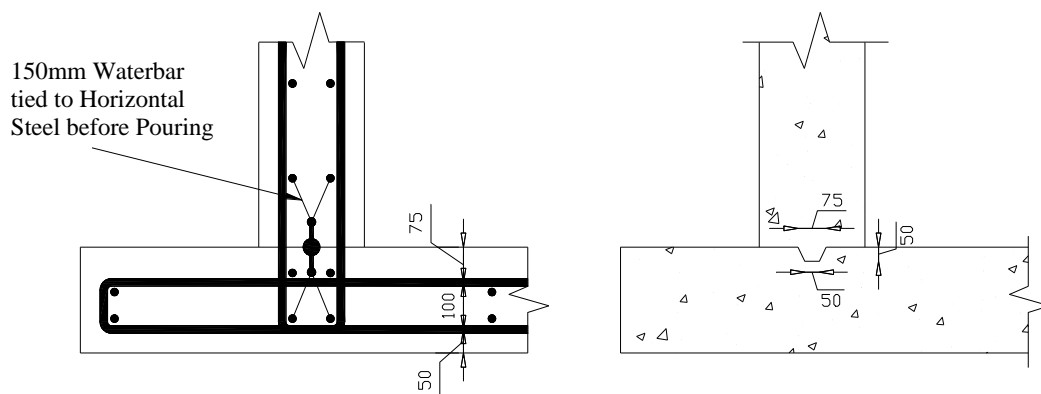


Figure 1 Wall-Floor Joints

2.4 Contraction Joints in Tank Walls

When an individual tank wall is more than 17m long, provision shall be made for substantially increasing the horizontal steel in the tank wall, or alternatively forming an induced type of contraction joint with water bar. Where extra horizontal steel is adopted, it shall be provided to all external walls of the tank to Table 1

Table 1

Length of wall	No. of extra bars in each face
17 - 19m	1
19 - 24m	2
24 - 30m	3

(Spacing of horizontal steel shall be adjusted to accommodate the extra steel).

Alternatively, an induced crack type vertical contraction joint shall be provided as per Fig. 2. Fifty per cent of the horizontal steel shall be discontinued across the joint (remove 50mm of horizontal steel on each side of joint from every second bar). A 200mm patent water stop shall be provided in the centre of the wall, and a 200 mm rear stop placed on the subbase across the wall footing as far out as the bottom steel, or across the complete floor in tanks less than 4m wide.

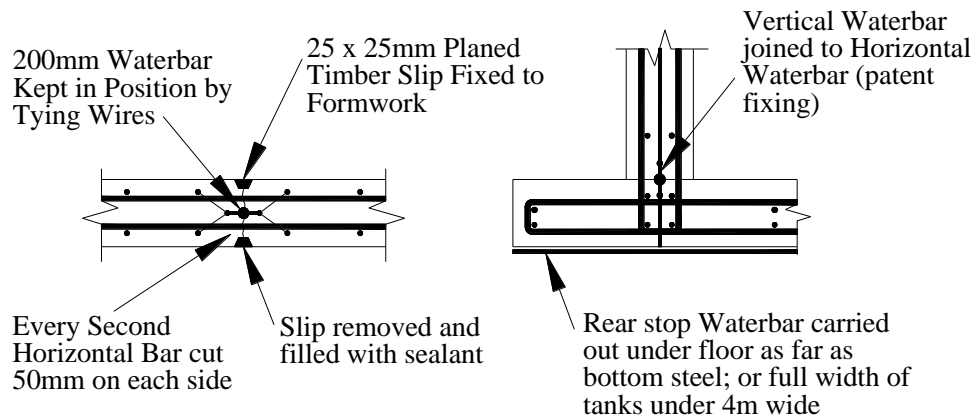


Figure 12 Contraction Joints in Tank Walls

All water stops, and junctions, shall be fixed as per manufacturer's instructions. The wall joint shall be brushed out and sealed with acid-resistant sealer. In tanks longer than 17m, such induced vertical joints shall be installed, equidistantly, at intervals of not more than 13m.

2.5 Pouring Concrete to Tank Walls

All dirt and debris shall be removed from within the shuttering. Concrete shall be placed in evenly spread layers of not more than 600mm deep. Vibration, by poker vibrator of diameter not less than 50mm shall follow closely on placing. The poker shall be inserted at maximum 400mm centres. It shall be allowed to sink under its own weight to the depth of the layer plus 100mm into the layer beneath, and when air bubbles cease to rise, be withdrawn slowly but evenly leaving no significant depression in the concrete. Care shall be taken to prevent the vibrator contacting either the shutters or the reinforcement. Concrete shall not be poured under 4 °C in a falling thermometer.

2.6 Removal of Shuttering

Shuttering shall not be removed from walls for at least 12 hours in warm weather, longer in cold weather. Shuttering under soffits of beams and slabs shall be left in position for at least 14 days. Tie bars on internal walls shall be cut or snapped off, and all small blemishes caused by removal of bolts and tie bars shall be filled with 1.5:1 washed sharp sand-cement mortar. Honeycombing, if it occurs, shall be repaired with a sand: cement mortar incorporating SBR (Styrene Butadine Rubber), or a water-resistant polymer bonding admixture in accordance with manufacturer's instructions.

2.7 Back Filling

Back filling shall not be carried out until walls are at least 28 days old. Suitable excavated clay may be used provided it contains no topsoil or excess water. Back fill shall be placed in layers, and thoroughly compacted. To prevent the possible ingress of pollutants to ground water the top metre of backfill shall be of impervious material and sloped away from the tank. Back filling with very heavy plant or the use of heavy vibrating rollers should be avoided unless special precautions are taken.

3 REINFORCEMENT

3.1 Steel Reinforcement

Steel reinforcement shall consist of high yield (H.Y.) steel with ribbed finish complying with the current edition of BS 4449. All steel shall be free from mill scale and heavy deposits of rust. Steel bars shall not be straightened and rebent. Where the length of bar required exceeds, the length supplied, a lapped joint shall be adopted: the overlap shall be at least 40 times the bar diameter.

3.2 Tank Walls

Both inside and outside faces of each wall shall be reinforced.

3.3 Cutting, Bending and Fixing Steel

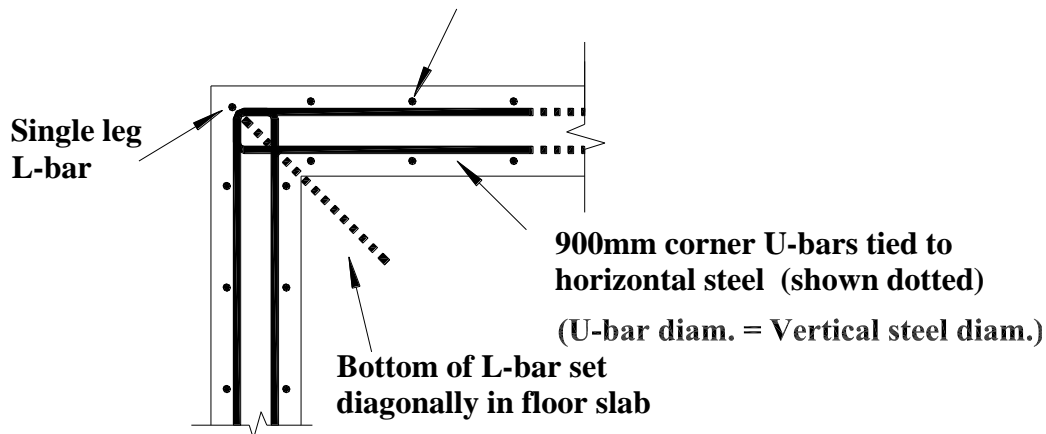
Anchor steel in wall footing shall be cut and bent in a U-shape to suit wall height as shown in Fig. 3. Wall footing steel shall be of the same diameter as main steel for walls. It shall extend into the floor as shown on Drawing 11-03 and shall extend into the toe of the wall 200mm beyond the outside face of the wall. Reinforcement for the wall shall be cut and bent in a U-shape to suit the wall thickness, as shown on Drawing 11-03. Every second U-bar (long) shall extend to within 475mm of the top of the wall. Every other U-bar (short) shall extend up the wall at least one quarter the wall height (H) plus 300mm.

Distribution (horizontal) steel at spacing 400mm shall be placed **inside** U-bars in wall and floor as shown. Junctions of bars shall be secured with standard tying wire to ensure that steel is kept firmly in position during concreting. Tack welding may be used instead of tying wire.

3.4 Reinforcing Steel at Corners

At each corner of the tank a series of two horizontal U-bars shall be fixed as per Fig. 14. Each leg of the U shall be at least 900mm long and equal in diameter to the vertical steel. Also, the long vertical wall bars within 900mm of the corners shall be extended up to within 50mm of the top of the wall to meet the top pair of horizontal U-bars. Each subsequent pair of horizontal U-bars shall be tied to each corresponding horizontal distribution steel bar in the height of the wall. A single leg vertical bar of the same diameter as the main vertical steel shall be fixed at the outside corner of the horizontal U-bars. The lower end of this vertical bar shall be bent diagonally into the floor for a distance of at least 500mm.

**Vertical long bars within U-bars
to finish 50mm from top of wall**



3.5 Concrete Cover to Steel

Steel reinforcement shall be protected by adequate concrete cover from the corrosion caused by the environment. Standard patent spacer blocks shall be used to provide the minimum cover 50mm, fixed to the reinforcement at regular intervals so that specified concrete cover is maintained throughout.

3.6 Leak detection system

A leak detection system shall be installed under the Fire Water Retention Tank to ensure the containment of fire water. The leak detection system shall consist of 100mm land drainage pipes distributed in a herringbone pattern under the tank. The greatest distance between two pipes shall not exceed 3 metres. The pipes shall be laid on a slope and connected to an inspection tank, of at least 1.0m³.