

BALMORAL TANKS

# FIRE FIGHTING WATER TANKS

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FM518297



Member  
**bafsa**  
British Automatic Fire Sprinkler Association



 BRITISH WATER



**BALMORAL**

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Balmoral Tanks, Llantrisant Business Park, South Wales



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# Fire protection

## Water tanks for sprinkler systems

Automatic fire sprinkler, wet riser and mist system tanks are installed for two main reasons; property protection or life safety.

In both cases their efficiency in controlling and extinguishing fires has for over one hundred and twenty years protected lives and the environment and it should be accepted that all sprinkler systems will protect lives by restricting fire spread and protection escape routes.

Property protection systems are often installed at the request of the building occupier's insurer to protect the business by ensuring the building and contents are protected against fire.

Some systems are installed to comply with building or fire regulations primarily to protect employees, the public and fire fighters from the risks of fire. This type of system should be more accurately referred to as 'enhanced availability' sprinkler systems but are more commonly called 'life safety' sprinkler systems and include a range of added features which reduce the possibility that the system will ever be non-operational due to scheduled service and maintenance being carried out.

In both of these cases an essential part of the system is the water supply. This can take the form of a direct supply from the local water service main with or without a booster pump or, more reliably, having water stored in a tank with a pump or pumps to deliver the water to the sprinkler system.

The most common arrangement is a single water storage tank with two fire pumps, each capable of meeting the needs of the sprinkler system.

For enhanced reliability, the water storage tank can be split into two half-capacity tanks. This ensures that there is always a water supply available to the sprinkler system, even when one tank (or any of its equipment) is being serviced or maintained.

## Standard of construction for fire fighting tanks

It is essential that the water storage tank is of robust construction and is designed and constructed to need little maintenance or servicing. Balmoral fire fighting water storage tanks are designed in accordance with best practice and technical information relating to corrosion protection and design considerations. They are installed such that the need for emptying for maintenance is reduced to a period of not less than 10 years.

Where sprinkler systems are designed to the LPC Rules for Automatic Sprinkler Installations incorporating BS EN 12845:2009 the most commonly used water storage tanks have LPCB approval. LPCB listed tanks must comply with the rigorous manufacturing and test standard LPS 1276.

Type 'A' tanks with a 15-year maintenance free period can still be provided for contracts designed to the now obsolete BS 5306 Part 2:1990

A list of LPCB-approved tanks can be found in the LPCB 'Red Book' and on their website. These tanks come in sizes from 5m<sup>3</sup>-1300m<sup>3</sup> depending on the hazard category of the sprinkler system. If a larger capacity is required

a combination of approved tanks can be used.

The relevant sections of the LPC Rules for Automatic Sprinkler Installations incorporating BS EN 12845:2009 that apply to water storage tanks for sprinklers are:

- TB 203 Care and maintenance of automatic sprinkler systems*
- TB 204 Sprinkler system grading*
- TB 209 ESFR sprinkler protection*
- TB 218 Water supply diagrams*
- TB 221 Sprinkler in schools*
- TB 224 Water storage tanks (cisterns)*
- TB 229 Variations to BS EN 12845 rules*
- TB 233 Water supplies for life safety systems*

Sprinkler tanks are also listed by the US insurers' certification body UL and by the industrial insurer FM Global for use on specified sites. For contracts designed to NFPA 13 (US National Fire Protection Association Codes) either an FM or LPCB listed tank can be used subject to insurers' approval.

## Balmoral fire fighting water storage tanks

### Cylindrical galvanised steel or aluminium

This is the most common type of tank used for sprinkler systems. Construction is by galvanised steel or aluminium sheets that are bolted together to form a cylinder. A mastic seal is applied between each metal sheet or a butyl rubber or EDPM liner is fitted. These tanks are usually installed close to the protected premises on a prepared concrete base or occasionally inside the protected premises.

### Galvanised pressed steel panel

These tanks are constructed using square steel panels that are bolted together to form a cube shape to suit the space available. They can be installed inside or outside the premises.

### Hot press moulded GRP panel

These tanks are formed by bolting together square GRP panels to form a cube to suit the space available. They can be installed inside or outside the premises.

## Gravity

Can be any of the above options installed at elevated heights in a tall building, on a hill or on a separate high level platform. Depending on the tank's elevation, the 'static' pressure or 'head' can be sufficient to supply the needs of the sprinkler system.



# Fire protection

## Positive head or suction lift

Section 10.6 of BS EN 12845:2009 requires the following (see also LPC Rules TB 210:2008). Wherever possible, horizontal centrifugal pumps shall be used, installed with a positive suction head in accordance with the following:

- ▶ At least two thirds of the effective capacity of the suction tank shall be above the level of the pump centre line
- ▶ The pump centre line shall be no more than 2m above the low water level of the suction tank (level X in 9.3.5).

If this is not feasible, the pump may be installed under suction lift conditions or vertical turbine pumps may be used.

Note: Suction lift and submersible pump arrangements should be avoided and only used when it is not practicable to arrange positive suction head.

## Corrosion protection of steel tanks

The 'weight' of galvanised coating on steel panels and sheets used in the construction of superior quality sprinkler tanks can be up to 610g/m<sup>2</sup> on both sides of tank wall.

An alternative corrosion protection system which has been specifically approved and listed by the LPCB can be used. In the LPCB listings of approved equipment, these tanks will have either a 'g' or 'e' respectively in their approval number, ie, 123c/06g or 123c/02e.

## LPCB-approved tanks

Balmoral Tanks provides LPCB-approved fire fighting water tanks up to 1300m<sup>3</sup> in capacity. Greater capacity tanks are available.

All LPCB listed tanks must bear a plate stating:

- ▶ The name and address of the manufacturer
- ▶ The date of installation
- ▶ The LPCB Reference Number including the type suffix ('Superior' or 'Single') which has been specified by the purchaser and agreed by the manufacturer
- ▶ The maximum capacity in cubic metres
- ▶ Multi-supply tanks must indicate the capacity for the automatic sprinkler system separately

## Water quality

The preferred source of water to supply the sprinkler tank is from the service mains as it is clean and free from extraneous matter that could cause clogging of the sprinkler pipes.

## How much water is needed?

This depends on the hazard classification of the sprinkler system and the sprinkler rules used. Usually the greater the hazard the larger the volume of water required to control or extinguish the fire. The duration of water application also increases with the hazard.

What affects the amount of water required?

- ▶ The sprinkler design standard being used
- ▶ Hazard classification and design density
- ▶ Type of system, wet or dry pipe
- ▶ Height of the highest sprinkler above the lowest sprinkler
- ▶ Duration of water supply

- ▶ Whether the tank is a Full holding or Reduced capacity
- ▶ The capability of mains supply to fill the tank in an acceptable time (36 hours for BS EN 12845)

## Full holding or reduced capacity

A tank is classified as 'full holding capacity' when all water necessary for the sprinkler system is stored on site. For example an Ordinary Hazard 15m (OH3 15m) wet-type sprinkler system would have a 135m<sup>3</sup> tank.

A 'reduced capacity' tank for the same hazard could be as small as 30m<sup>3</sup> provided the inflow from the service mains could make up the shortfall of 105 m<sup>3</sup> in 60 minutes.

## What duration of water should be provided?

BS EN 12845 Light Hazard	30 minutes
BS EN 12845 Ordinary Hazard	60 minutes
BS EN 12845 High Hazard	90 minutes
BS 9251 Residential	30 minutes
BS 9251 Domestic	10 minutes
Schools (TB221) OH1	30 minutes
Schools (TB221) OH2+3	60 minutes
FM/NFPA	Varies; 30-240 minutes

## Tank support base

The support base for the sprinkler tank will vary depending on the type of tank installed. The most common types are circular or rectangular concrete bases, low level concrete walls or steel beams. When the tank is ordered, the tank manufacturer will issue detailed drawings of the type of base required for their particular tank. These plans must be strictly adhered to and should not be modified without written permission from the manufacturer.

Generally speaking, cylindrical tanks should be installed on a new concrete base. Where existing slabs are used, they must be free from any contaminants that may affect the liner.

## Tank painting

The external surface of the tank can be painted to choice by the client but the tank manufacturer should be consulted to ensure that any coating used does not damage the tank wall and does not invalidate the LPCB listing and any manufacturers' warranty.

## Tank location

Whenever possible the sprinkler tank should be located within 5m of the sprinkler pump house.

Careful consideration must be given to the location of the sprinkler tank. Areas to be avoided are:

- ▶ Near trees where roots could damage the tank base
- ▶ In areas where water can accumulate near the tank base and accelerate corrosion or in time undermine the tank base
- ▶ Near pipes or underground services where the weight of the tank may damage them. For every metre of tank height the weight of water on the ground will be one tonne per square metre
- ▶ Near hot or corrosive exhaust extracts/pipes where the tank's protective coating could be damaged

## Planning approval

During the planning stage drawings and details of the location of external sprinkler tanks should be submitted to the insurer for their approval and comment before installation take place.

## Reference publications

- ▶ LPCB Red Book: List of Approved Fire and Security Products and Services
- ▶ LPS1276 Issue 1.1: Requirements for the LPCB Certification and listing of above ground suction tanks for sprinkler system
- ▶ WIS4-25-01: Water Industry Specification for the use of steel tanks in the water industry
- ▶ BS4211: Ladders for Permanent Access
- ▶ BS5493: Protective coating of iron and steel structure against corrosion
- ▶ BS8007: Code of practice for the design of concrete structures for retaining aqueous liquids
- ▶ BS EN ISO 12944: Paints and varnishes – Corrosion protection of steel structures by protective paint systems
- ▶ LPC Rules for Automatic Sprinkler Installations: Incorporating BS EN 12845 fixed fire fighting system – Automatic Sprinkler systems – Design, installation and maintenance
- ▶ BS9251: Sprinkler system for residential and domestic occupancies: Code of practice
- ▶ LPCB Scheme Document SD037: Suction tanks for fire pumps for automatic sprinkler pumps
- ▶ FM Global Data sheets
- ▶ National Fire Protection Association Standards



## FM Global

FM Global approval is based upon a satisfactory evaluation of the product and the manufacturer in the following major areas:

- ▶ The structural integrity of the tanks to withstand anticipated design conditions
- ▶ The ability of the manufacturer to properly design, fabricate and erect bolted steel or aluminium tanks in accordance with industry practises and the requirements of FM approvals, and
- ▶ The ability to provide a highly reliable and durable structure for the storage of water for fire protection purposes

## Tank shell

Tanks sheets must have a minimum thickness of 2.5mm with bolted joints designed in accordance with AWWA-D103 formulae. Tanks shall be of bolted construction to withstand liquid load of 1000kg/m<sup>3</sup> and a minimum wind load of 862 N/m<sup>2</sup> (45m/s) which may increase if local conditions require it.

Seismic loading will be determined on a site by site basis and call on one of the five zones: 50-year, 100-year, 250-year, 500-year and >500-year.

## Tank roof

The roof must be able to withstand a live load of 0.75kN/m<sup>2</sup> and a wind speed of 45m/s. Local conditions may dictate higher loads. No part of the roof structure can be below the water level.

## Accessories (see page 25-27 for more information)

Shell manway to be a minimum Ø600mm and placed in the first full ring from ground level.

Screened roof vent shall have at least 1.5 times the cross-sectional area of the suction or infill line, whichever is larger. The screen shall have 10mm openings and be manufactured in non-corrosive metal.

Infill line capable of filling tank in less than eight hours. Suction line to penetrate tank shell and terminate with downward pointing 90° elbow and 6mm anti-vortex plate at least twice the diameter of the suction line. The anti-vortex plate must be situated 150mm, or half the suction line, above the foundation.

Test return line to discharge in different quadrant to the suction line.

Exterior ladder to begin 2.4m above the foundation, with a gated section to enable access.

## Corrosion protection

Shell plates must have a:

- ▶ Galvanised coating with a minimum thickness of 305g/m<sup>2</sup> per exposed surface and an internal Butyl or EPDM rubber liner, or
- ▶ Galvanised coating with a minimum thickness of 610g/m<sup>2</sup> per exposed surface, or
- ▶ Galvanised coating with a minimum thickness of 305g/m<sup>2</sup> per exposed surface, with the internal surface coated with two layers of bituminous coating having a total thickness of between 0.2mm and 0.5mm.

## Tank heating and insulation

Should it be required, heating must be of such capacity so that the temperature of the coldest water in the tank shall be maintained above 5.6°C during the coldest weather.

External insulation can be provided by a metal jacket to protect it from the weather.

Internal insulation is permitted provided it is fitted in accordance with FM guidelines and conforms to the following characteristics:

- ▶ Have minimum density of 30kg/m<sup>3</sup>
- ▶ Be flame retardant with a minimum Euroclass E fire classification
- ▶ Have minimum compressive strength of 1% nominal compression at 100kPa

*Balmoral Tanks gratefully acknowledges BAUSA for its kind assistance with the text used on pages 1-3*

# CYLINDRICAL SECTIONAL WATER TANKS

Balmoral cylindrical sectional tanks are manufactured in aluminium, galvanised and stainless steel. The range of materials on offer provides customers with cost effective and project specific options in the fire protection, potable and irrigation water storage sectors.



# Cylindrical sectional water tanks

## Advantages of cylindrical bolted tanks

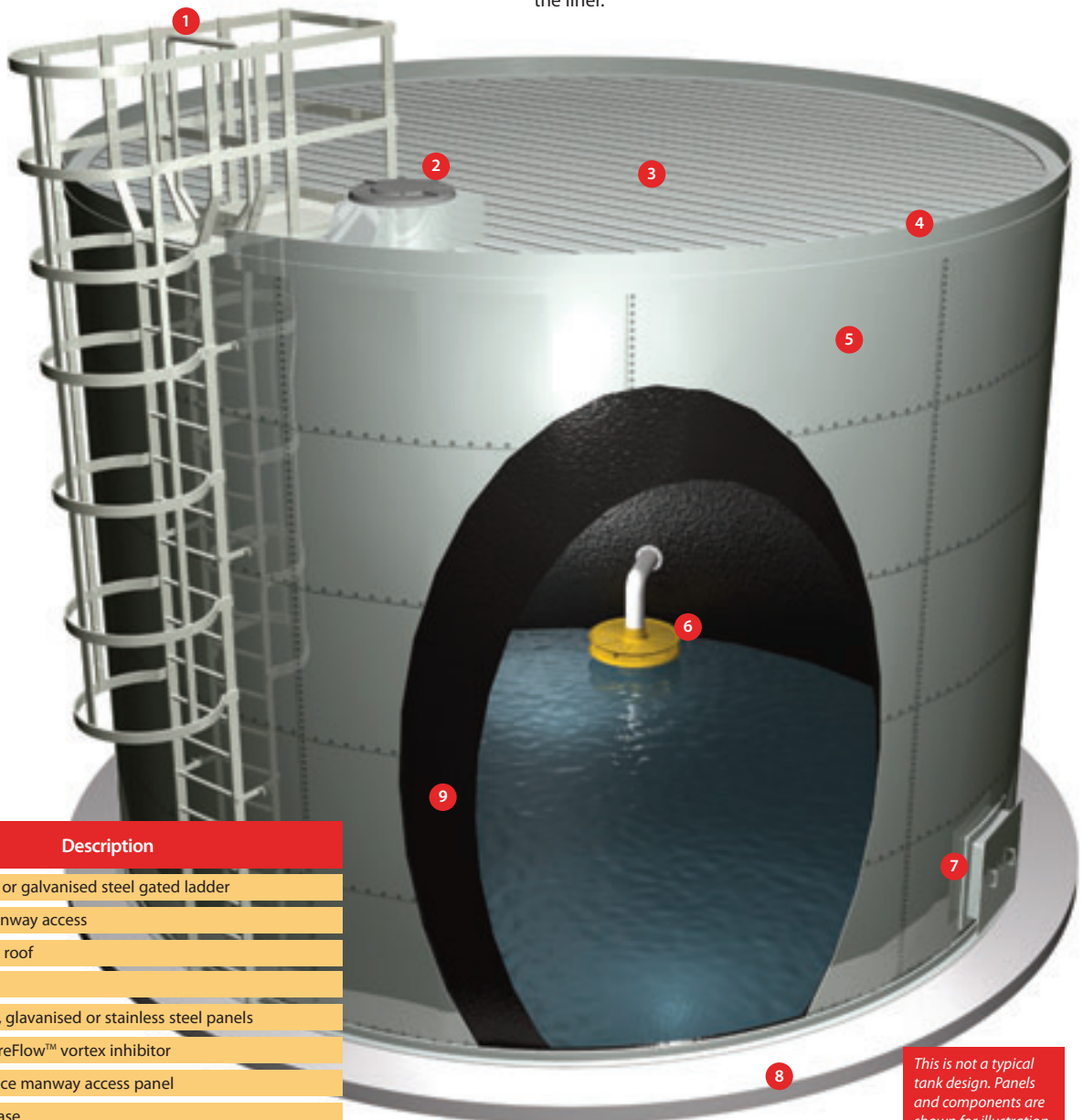
- ▶ Bolting sectional tank panels together eliminates the need for costly site welding and thick re-inforced concrete base structures
- ▶ The latest construction methods use hydraulic jacks allowing the tanks to be erected within days by a small team. This process also reduces health and safety risks by removing the requirement of working at height
- ▶ Cylindrical tank kits are conveniently packed onto pallets to create minimum cubic capacity and reduce shipping costs
- ▶ Standard Balmoral panels are held in stock enabling quick delivery
- ▶ Pre-installed liner sealed tanks can be re-located quickly and at minimal expense

## Tank capacities

Balmoral offers an extensive range of LPCB approved cylindrical tanks. A table of dimensions and capacities allows clients to select a design for their specific application. These options allow the flexibility to increase the tank height and reduce the diameter while maintaining the volume if the footprint is an issue. Alternatively, the diameter can be increased and height reduced if required.

## Tank sealing

Balmoral offers two types of tank sealant, liner and mastic; the most common being the liner sealed design. The inside of the tank shell is lined with a synthetic EPDM or butyl rubber liner. The purpose of the liner is to separate the water from the tank shell. The concrete base and shell are also lined with geo-textile matting to provide additional protection against damage to the liner.



	Description
1	Aluminium or galvanised steel gated ladder
2	600mm manway access
3	Heavy duty roof
4	Kick plate
5	Aluminium, galvanised or stainless steel panels
6	Balmoral FireFlow™ vortex inhibitor
7	Side entrance manway access panel
8	Concrete base
9	EPDM or butyl rubber liner

*This is not a typical tank design. Panels and components are shown for illustration purposes only.*

# Corrosion protection

## Corrosion protection: tank shell

Balmoral's cylindrical tank shell design is manufactured using pre-mill galvanized steel, with 305g/m<sup>2</sup> of zinc coating each side. On occasion, where heavier designs are required, the sheets will be hot dipped galvanized with more than 610g/m<sup>2</sup> zinc coating on either side. For specialised applications aluminium and stainless steel tank options are available.

All Balmoral tank fittings, flanges and accessories are also hot dipped galvanized as standard with options of epoxy or polyester coatings available. The galvanized coating of the tank shell along with the options of an epoxy performance coating for such applications as potable water or polyester coatings for aesthetic requirements guarantee long durability, low maintenance and extended life-cycle costs of the tank shell. Colour options for the epoxy or polyester coatings are available if required.

On standard galvanized tank designs, the coating of the tank shell doesn't mean a reduction of the galvanized zinc coatings, the epoxy and polyester coatings are in addition to the galvanizing process.

## Corrosion protection: tank components

Under the (LPCB) LPS 1276 approved design, galvanized roof purlins are kept out of the stored water thus extending the life of the tanks roof cover. All nuts, bolts and washers are spun galvanized coated, structural components such as top and bottom angles, wind stiffeners and access manways are hot dipped galvanized with in excess of 610g/m<sup>2</sup> of zinc coating.



# Case study

## Cylindrical sectional water tanks

### LPCB-type tank, Llantrisant, Wales

<b>Application</b>	Sprinkler firewater storage tank
<b>Tank type</b>	Pre-mill galvanised steel cylindrical
<b>Dimensions</b>	12.1 x Ø12.4m
<b>Capacity</b>	1300m <sup>3</sup>
<b>Scope of work</b>	Design, manufacture, install, test
<b>Installer</b>	Balmoral Tanks Ltd
<b>Date completed</b>	October 2011

This cylindrical tank installation is one of the largest and most comprehensive of its type carried out in the UK. The construction process involved the use of hydraulic jacks lifting each complete level, beginning with the top layer and roofing, until the finished working height of 12.1m was reached.

An EPDM liner membrane acts as the main sealant on the tank which is fixed to the top perimeter angle and the panel sheet material used is pre-milled galvanised steel with thicknesses ranging from 2-4mm.



# GRP SECTIONAL WATER TANKS

With an unrivalled reputation for quality and service Balmoral offers sectional tanks, which can be pre-insulated, up to 448m<sup>3</sup> capacity and erected to a height of 4m in 1m and 0.5m increments.

These tanks carry full LPCB approval for fire protection sprinkler systems. All panels are fully tested to resist pressures in excess of six times their working pressure.



# GRP sectional water tanks

## Design

The design of each GRP sectional tank panel is modelled using FEA software. This allows fine detail to be thoroughly investigated and improved before proceeding to mouldmaking and production.

## Materials

All materials used in the production and assembly of Balmoral GRP tanks are rigorously tested for potable and non-potable water compatibility. This includes long term material performance and mechanical properties, non-metallic components, adhesives, etc. Combined, these analyses form the basis of the company's extensive QC procedures.

## Manufacturing process

Balmoral sectional tank panels are hot press moulded in glass reinforced plastics (GRP) using isophthalic unsaturated polyester resins and glassfibre reinforcement.

The panels are moulded at temperatures up to 150°C under strict quality control disciplines. The process results in strong, consistent panels which are fully cured, dimensionally accurate with sharply defined profiles and smooth surfaces on both faces.

Drilling and finishing of the panels is undertaken in a purpose built controlled area, where high technology automated drilling equipment is used to complete production to exacting tolerance levels.

Mechanical property	Performance value
Method of manufacture	Hot Press Moulded
Specific gravity	1.8
Tensile strength	100 Mpa
Flexural strength	220 Mpa
Flexural modulus	12 Gpa
Impact strength	180 Kj/m <sup>2</sup>
Shore hardness	D90
Shear strength	94.1 Mpa
Glass content	>30%
Thermal expansion	2.0 x 10 <sup>-5</sup> /°C
Thermal conductivity	0.2 Kcal/m hr°C
Overall heat transmission	0.6 W/m <sup>2</sup> K
Water absorption	< 0.2%
Light transmission	Zero

Feature	Benefit
Design	Designed to BS EN 13280 (2001)
Automated manufacturing	Consistent product offering dimensional stability
Automated finishing	Provides high levels of accuracy
High grade materials	Improved resistance to bacterial growth, increased water resistance, reduced risk of osmotic attack. Colour RAL 7004
UV stabilised materials	Suitable for global climatic conditions
100% opacity	Prevents algae growth
Heavy duty cover	Low maintenance, resists wind and snow loadings. BS 6399 Pt1 (1996)
Integrated insulation	Provides U value of 0.6W/m <sup>2</sup> K. CFC and HCFC free. Suitable for water storage up to 38°C (Non-standard - price on application)
Exclusive sealant	WRAS approved, provides optimum performance under varying climatic conditions
Bracing	Designed to BS 6700:1997 to limit structure deformation
LPCB approved	Certificate No. 445b to LPS1276:Issue 1.1
QA	Balmoral Group is certified to BS EN ISO 9001:2000

# Tank construction

Balmoral GRP sectional fire sprinkler tanks may be specified as either externally flanged base (EFB) or internally flanged base (IFB). This allows the use of either flat continuous foundations, close centre beams, pier walls or bearer beams depending upon the type of base required. The internally built tank (IBT) to be supported as standard on an IFB foundation.

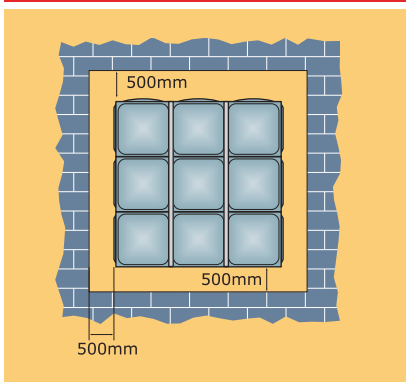
Generally, fire sprinkler tanks are IFB to sit on flat slabs to tolerances of 2mm p/m or 6mm p/6m. If this tolerance cannot be achieved, Balmoral can supply base levelling steels that can be skimmed and levelled from slabs within 15mm tolerance.

The EFB specification is fully self draining allowing ease of maintenance and cleaning.

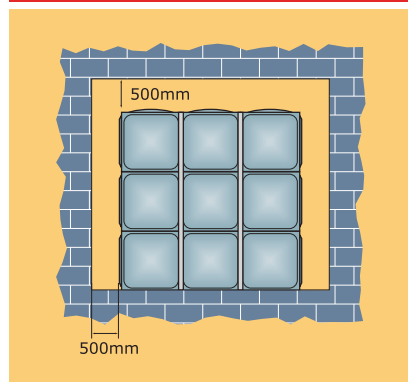
- Flexibility of panel sizes allows connections to be agreed on site to suit actual tank location
- Modular design provides ease of transport and flexibility of assembly on either a prepared flat and level concrete foundation, support walls or bearer beams
- Panels are rigidly supported by a combination of stainless steel tie rods internally and galvanised box sections externally
- Installation is carried out by Balmoral approved installers, fully trained to provide total unified responsibility

## Flange types

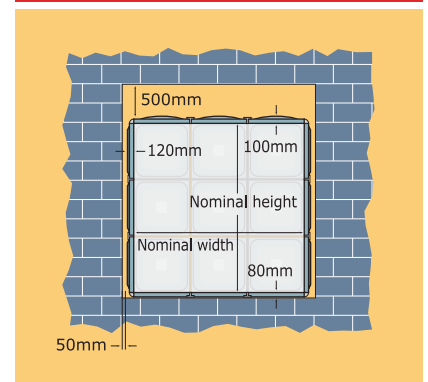
**EFB** Externally flanged base, externally flanged sides



**IFB** Internally flanged base, externally flanged sides

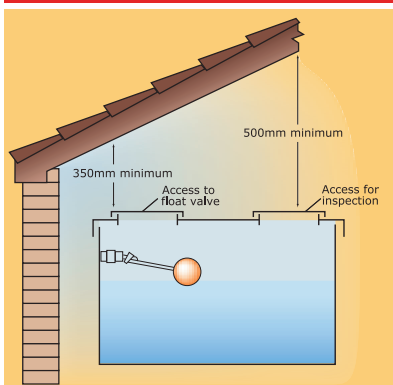


**IBT** Internally flanged base, internally flanged sides



- The dimensions shown above apply to tanks where the top of the tank is less than 2.5m above FFL. Where the top of tank is greater than 2.5m above FFL work at height equipment should be supplied. Dimensions increase to OD+750mm for fixed scaffold and OD+850mm for mobile tower
- IBT tanks to be tight to two adjacent walls only
- 500mm required underneath the EFB tank for installation
- IBT tanks maximum height: 3m

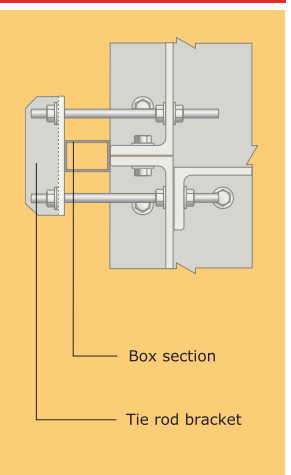
**Clearance requirements**  
All installations require a clearance of 500mm above manway. A minimum clearance of 350mm is required above the tank to comply with water regulations.



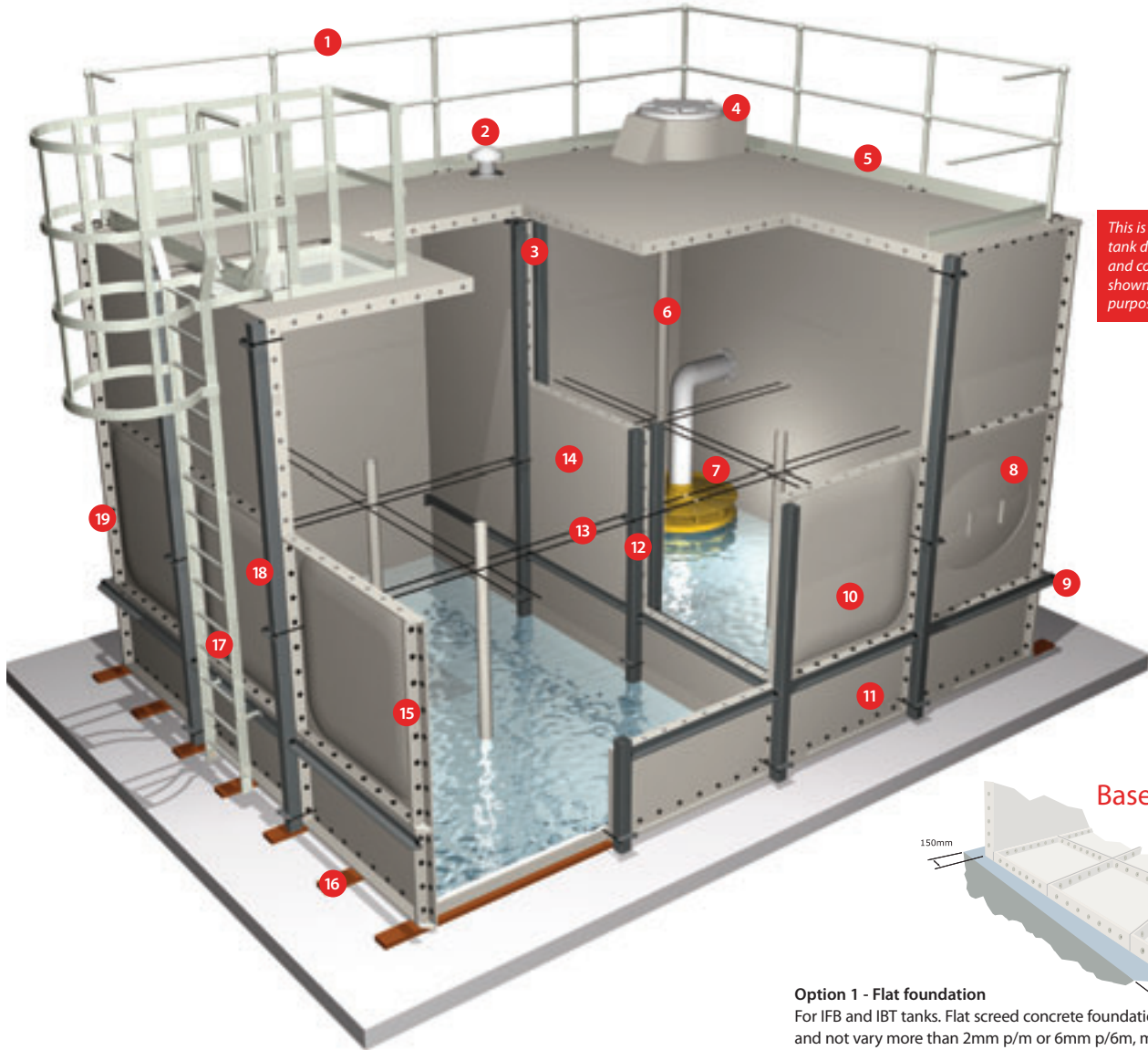
**External plan sizes (for IFB/EFB only)**

Height up to 1m	add 80mm for flanges
<b>= 80mm over the internal dimensions for each side</b>	
Height up to 1.5m	add 80mm for flanges add 80mm for galvanised box sections add 50mm for tie rod brackets
<b>= 210mm over the internal dimensions for each side</b>	
Height from 2 to 4m	add 80mm for flanges add 60mm for galvanised box sections add 50mm for tie rod brackets
<b>= 190mm over the internal dimensions for each side</b>	

**Flange detail**

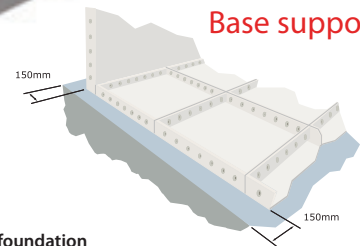


# GRP sectional fire tank construction



This is not a typical tank design. Panels and components are shown for illustration purposes only.

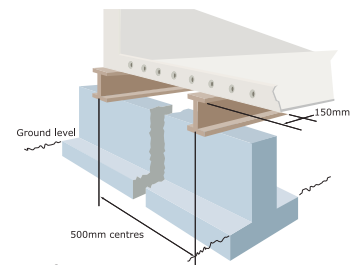
## Base support



### Option 1 - Flat foundation

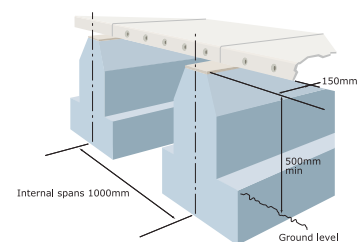
For IFB and IBT tanks. Flat screed concrete foundation to be level and not vary more than 2mm p/m or 6mm p/6m, measured laterally or diagonally.

Levelling steels are recommended due to difficulties in achieving +/- 2mm per metre over whole base area.



### Option 2 - Close centre beams

IFB and IBT tanks may also be supported by steel bearer beams.



### Option 3 - Pier walls

For EFB tanks allowing self drain. 1m centres required.

	Description
1	Handrailing and supports
2	Screened air vent
3	A4 stainless steel internal fasteners and fixings
4	Float valve chamber (type AB and AF air gaps available)
5	Kick plate
6	uPVC tubular roof support struts
7	Balmoral FireFlow™ vortex inhibitor
8	Side entrance manway access panel
9	Galvanised steel external bracing
10	Hot press moulded GRP panels BS EN 13280 (2001)
11	0.5 x 1m hot press moulded panel
12	316 Grade stainless steel partition supports
13	316 Grade stainless steel internal tie rods
14	Partition panels
15	Hot press moulded GRP corner section
16	500mm centred 100x50mm high galvanised levelling steels
17	Aluminium or galvanised steel gated ladder
18	Galvanised or stainless steel external fasteners and fixings
19	WRAS approved BALSEAL sealing strip

# Case study

## GRP sectional water tanks

### Maesydderwen School - Powys, Wales

<b>Application</b>	Sprinkler firewater storage tank
<b>Tank type</b>	M100 GRP hot press sectional tank
<b>Dimensions</b>	6m x 3.5m x 3m deep
<b>Capacity</b>	55m <sup>3</sup>
<b>Scope of work</b>	Design, manufacture and install
<b>Installer</b>	Balmoral Tanks Ltd
<b>Date completed</b>	July 2012

This sectional GRP sprinkler tank is a typical school project with an effective capacity of 55,000 litres split to provide 2 x 27,500 litre operation.

The tank is fitted with immersion heaters and all required ancillaries in accordance with LPS 1276 including contents gauges, drain valves, hinged float valve chambers, side entry manways, vortex inhibitors and float valves.

The external ladder and handrail are manufactured in compliance to BS4211 which includes kick plate and a self-closing gate at the top of the caged ladder. Level switches are fitted for high and low readings to be sent to the BMS system.

The tank was erected by Balmoral AIRS-approved installers.





# PRESSED STEEL SECTIONAL WATER TANKS



Pressed steel tanks with capacities up to 1300m<sup>3</sup> have been installed for water supply projects, food and process industries, hotels, railways, hospitals and many more. This is a proven technology, providing tanks and supporting towers with an outstanding track record.

Pressed steel tanks can be found throughout the UK and around the world, particularly in the emerging nations, where water – the basis of life – is often difficult to obtain and has to be preciously guarded.

The development of Balmoral Tanks' EPDM rubber sealing system has made safe storage of this valuable resource even more certain.

Tanks can be provided for ground level installation or elevated on steel structures that are specifically designed and fabricated by Balmoral Tanks.



Member  
**bafsa**  
British Automatic Fire Sprinkler Association



**WRAS**  
APPROVED PRODUCT



ROMÂNIA  
MINISTERUL SĂNĂTĂȚII  
INSTITUTUL DE SĂNĂTATE PUBLICĂ BUCUREȘTI  
COMISIA DE AVIZARE



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BRITISH WATER



HORSELEY BRIDGE TANKS®  
A Balmoral Tanks Ltd product

# Pressed steel sectional water tanks

## General construction

Balmoral pressed steel tanks are bolted mild steel sectional water storage containers. Plates are hot-pressed in our factory in the UK to BS1564:1975 Type 1. The panels are manufactured in 1m<sup>2</sup> and 1.22m<sup>2</sup> (4ft<sup>2</sup>) sizes with thicknesses ranging from 4-6mm depending on tank depth and use. Steel used in plates, stays, cleats, etc, conforms to BSEN10025:1993 S275JR (43A equivalent).

Plate dimensions are 1m or 4ft square. Half plates are available. Tank plates are bolted together using an approved sealant. For ease of access to bolts, tanks are supplied with external flanges unless customers specify otherwise.

To support pressures exerted by the tank's contents, the sides of all tanks at the junction of four plates are supported by rolled steel angle stays attached to cleats of equal strength bolted to tank plates. The pattern of internal stays depends on tank size and varies between horizontal, vertical and diagonal.

## Storage of liquids

The bolted construction of the tanks allows storage of water up to 90°C. Temperatures in excess of this would require the tank to be fully seam welded. For clarification of storing other liquids please consult our engineering department.

To maintain water quality, tanks should be periodically drained, cleaned and disinfected. To ensure continued water supply during cleaning, divided tanks can be supplied where one compartment is used while the other is cleaned. See BS6700:1997 for additional advice.

## Cover and roofs

The roof construction of all steel sectional tanks is designed to support the weight of maintenance personnel and their equipment. Design superimposed load is 0.75kN per m<sup>2</sup>.

Flat covers can be provided for use inside buildings. Pitched roofs are recommended for outdoor use to allow rainwater to run off. All roofs are fitted with a lockable 600mm<sup>2</sup> hinged and sealed manhole. Screened (0.65mm mesh) cowl ventilators are provided as standard.

The ends of pitched roofs are closed with stiffened gable fillers which are bolted to the roof and wall plates.

All joints incorporate jointing strip to make them weather and vermin proof.

Pressed steel tanks are not designated as pressure vessels, but in special circumstances the roof can be constructed from standard plates to allow a slight internal pressure. If this is required, please consult our engineering department.



## Laser cutting

Balmoral Tanks uses the latest laser cutting technology to bring high levels of accuracy to its panels. The cutters use a 3D capability providing precise, repeatable, burr-free profiles and are BSEN ISO 9001 certified.

## Towers

When a constant pressure head of water is required for supply purposes, tanks can be mounted on a steel tower at a suitable height. Towers must be designed with suitable seismic and wind loads to BS5950 Pt1:1990.

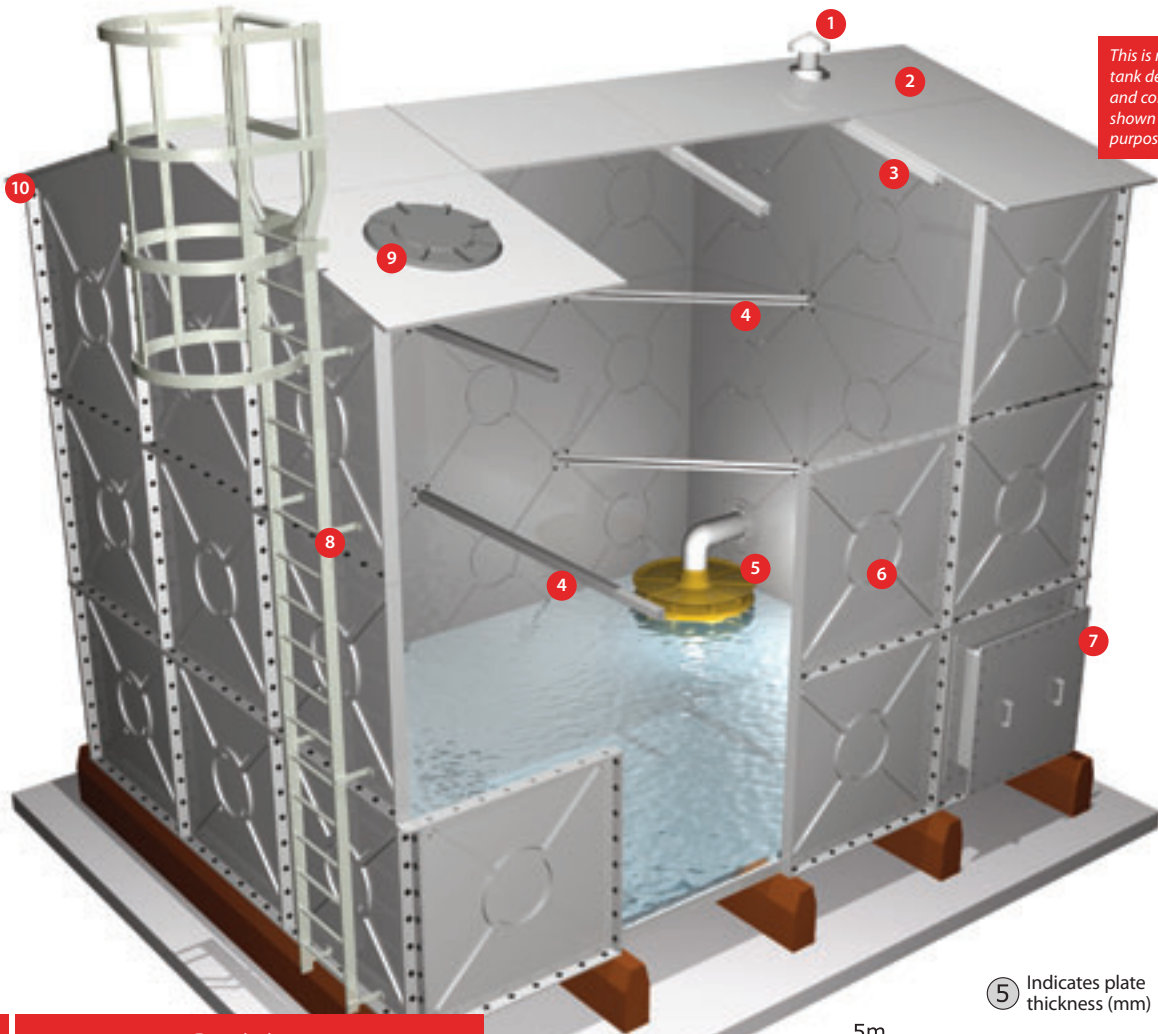
## Surface coatings and finishes

A wide range of coatings can be applied to the inside and outside of the tanks which include hot dip galvanising (BSEN ISO 1461:1999) and WRAS approved systems. Balmoral Tanks also offers a DWI (Drinking Water Inspectorate) approved coating which meets the requirements of Regulations 31-33 (Reg 25 in Scotland) of the Water Supply (Water Quality) regulations.

Balmoral Tanks provides a full design and supply service for towers, to BS5950. When specifying tower requirements it may be advisable to anticipate future increases in tank capacity. Customers are advised to consider foundation requirements and to let Balmoral know what additional loadings on towers may be required in the future.

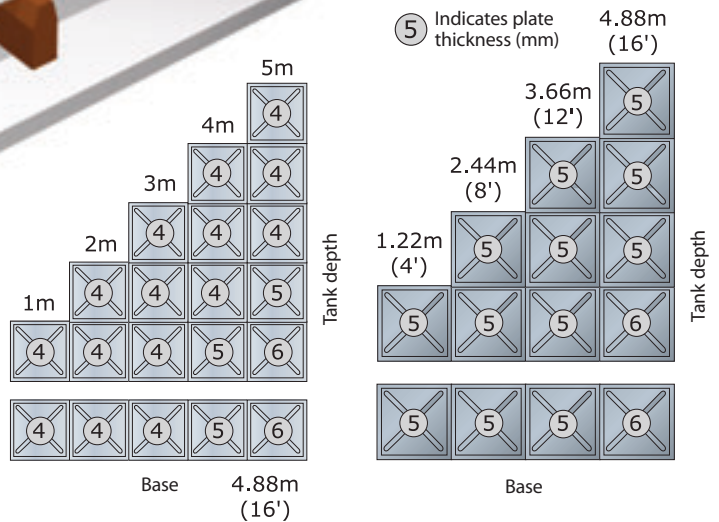
On request Balmoral can supply loading and uplift details enabling contractors to design suitable foundations.

# Pressed steel sectional tank construction



*This is not a typical tank design. Panels and components are shown for illustration purposes only.*

	Description
1	Screened air vent
2	Pitched weatherproof cover
3	Rafter
4	Internal bracing
5	Balmoral FireFlow™ vortex inhibitor
6	Hot press steel sectional tank panel
7	Low level access manway
8	Aluminium or galvanised steel gated ladder
9	600mm manhole access
10	Gable end fillers



## Design, performance and construction

LPCB approved for fire fighting sprinkler application
Manufactured under formal quality assurance procedures to BSEN ISO9001.
Tough, vandal resistant for unsupervised sites
Easy to build, only moderate skills required
No on-site welding, no fire hazard
Flexible system, capacity almost infinitely extendable
Low physical profile (at ground level)

Ideal for temporary requirements being simple to dismantle
Technical support provided for site measurements and advice
Technical drawings provided
Full tank erection and site inspection by trained staff
Design and supply of steel towers for elevated tanks
Proven track record over many years



# TECHNICAL SERVICES

Balmoral Tanks' technical services team provides comprehensive inspection, maintenance, repair and refurbishment services on all tank products whether they are of Balmoral origin or not.

A wide range of tank types are covered including:

- ▶ Steel cylindrical and sectional
- ▶ GRP sectional
- ▶ Rotationally moulded
- ▶ Glass fused to steel
- ▶ Epoxy steel
- ▶ Concrete
- ▶ Welded

On completion of the tank assessment a written report is provided including photographs, conclusions and remedial work recommendations.

Services include:	GRP sectional	Steel sectional	Cylindrical
Visual site inspection - internal and external	✓	✓	✓
Ultrasonic thickness measurement (UTM)		✓	✓
Thickness coating measurement (TCM)		✓	✓
ROV inspection	✓	✓	✓
Repair and maintenance	✓	✓	✓
Upgrade and refurbishment	✓	✓	✓
Service level agreement	✓	✓	✓
Engineering support	✓	✓	✓
Cleansing and disinfection	✓	✓	✓

# Technical services

## Health and Safety

Balmoral Tanks' technical services teams place the highest priority on health and safety. Full and comprehensive risk assessment and method statement documentation is carried out and completed with personnel certification being issued to the customer.

Technicians are fully trained to ensure all works are carried out safely and in compliance with current legislative standards. They hold full accreditation and have many years of experience in tank installation and technical services. Tank owners and operators can have 100% confidence in the company's technical and practical capabilities.

## Certification

SMSTS	Site Management Safety Training Scheme
CPCS	Construction Plant Competence Scheme
CSCS	Construction Skills Certification Scheme
CCNSG	Client/Contractor National Safety Group
IPAF	International Powered Access Federation
PASMA	Prefabricated Access Supply & Manufacture Association
CITB	Confined Space Trained

## Risk assessment and visual inspection

Balmoral Tanks' technical teams carry out external and internal inspections on all types of installation. Inspections focus on the tank material, eg, steel (galvanized or epoxy), GRP, concrete, etc, as well as identifying the design of tank, whether it is sectional bolted, welded or one-piece moulded.

Roof structures and supports are inspected and all ancillaries, fittings and fasteners are checked for signs of deterioration and potential failure. If the tank is of mastic sealed design all external seams are checked for signs of leaks. Similar external inspection methods are used on liner sealed tanks for signs of piercings.

Tank inspections can be complex and the following parameters are always taken into consideration:

- ▶ Tank isolation and draining
- ▶ Access and egress (confined space)
- ▶ Working at height (access equipment)
- ▶ Tank cleaning
- ▶ Health and safety controls

During internal inspections all safety procedures are implemented with current certification being issued and adhered to at all times.

# Technical services

## Ultrasonic thickness measurement (UTM)

An ultrasonic thickness gauge is designed to measure material thickness whilst eliminating the depth of coating on metal substrates.

### The Balmoral Technical Services UTM gauge:

- ▶ Ignores the coating thickness
- ▶ Provides data output
- ▶ Is hand held and robust
- ▶ Benefits from a backlit display

The thickness of materials cannot always be determined by direct measurement as access to both sides is not always possible. The effects of corrosion and erosion on the reverse of a metal panel may reduce its thickness significantly without being visually apparent on the outside of the tank.

All UTM readings are gauged on the material to be tested with calibration beforehand using a 10mm transducer probe and three known test materials in echo-to-echo mode.

## Thickness coating measurement (TCM)

Such a device has the capability to measure coating thicknesses whilst eliminating material depths. The digital reading is fast, reliable and accurate.

### The Balmoral Technical Services TCM gauge:

- ▶ Ignores the material thickness
- ▶ Provides data output
- ▶ Is hand held and robust
- ▶ Benefits from a backlit display

An internal probe provides greater stability during measurement allowing for consistent, repeatable and accurate results. Clients are provided with a test certificate and set of calibration foils following each inspection.

## ROV inspection

A remotely operated vehicle (ROV) may appear to be overly-technical when carrying out an internal tank inspection, however, when the following points are considered it is undoubtedly the safest and most cost effective method available:

- ▶ Improved health and safety procedures
- ▶ No isolation of water supply or decommissioning of mechanical operations
- ▶ No disruption of water services
- ▶ No insurance premium payments for removing tank from service
- ▶ One man operation means reduced inspection costs
- ▶ No access equipment required for carrying out operations at height
- ▶ Highly detailed inspection
- ▶ No confined space working
- ▶ Inspection completed in a single day
- ▶ Inspection carried out at a time to suit customer requirements
- ▶ External tank inspection can be carried out simultaneously

### ROV inspection includes:

- ▶ ROV micro submersible unit
- ▶ Umbilical tether
- ▶ Deployment tether unit
- ▶ Digital HD colour video camera
- ▶ Report, including images and recommendations
- ▶ Fully edited video and DVD options

On completion of an ROV inspection, Balmoral will provide a full report inclusive of images and DVD footage with conclusions and remedial works recommendations. Inspections are scheduled to cause minimal disruption.



## Repair, maintenance and refurbishment

Balmoral provides a wide-ranging service, including:

- ▶ Roof repairs, replacements and upgrades
- ▶ Internal liners or replacement liners (EPDM or butyl)
- ▶ Access hatches
- ▶ Protective coatings
- ▶ Panel sheet repairs/replacement
- ▶ Fixings and sealants
- ▶ Concrete screeds
- ▶ Concrete tank lining
- ▶ Ancillary items
- ▶ Tank cleaning
- ▶ Complete removal and replacement tanks

On completion of a repair, maintenance or refurbishment project the customer receives a checklist to confirm that all works have been carried out to their total satisfaction.

## Service level agreement

Balmoral Tanks offers a wide range of service level agreements (SLAs) to suit client and facility management requirements. Created around engineering response times and/or pre-scheduled product coverage the company's technical services teams provide international coverage. Bespoke packages are provided to clients with unique requirements whatever the location.

## Engineering support

Maintenance, repair and service works are fully supported by Balmoral's engineering team. Advice is given on how existing installations can be brought up to current national and international standards including the improvement and addition of ancillary equipment.

Company engineers work to global standards providing analysis and design support on all tank upgrades and service provision.



# Tank installation

Balmoral Tanks provides a full UK tank erection service. Each site is inspected by a qualified supervisor prior to tank erection ensuring site and base suitability. An experienced Balmoral team will build your tank and leave it ready for commissioning. Supervisors can also be provided for overseas contracts. Customers should, however, observe the following check points before calling Balmoral to site:

## Tank supports

Externally flanged tanks at ground/floor level require dwarf walls or piers, made of steel universal beams, brick or concrete, with footings suitable for the bearing capacity of the sub-soil. The walls should be at least 500mm high and must run in one direction only with centres at 1000mm or 1220mm depending on the plate dimensions. They should extend at least 150mm beyond the tank at each end.

Dwarf walls should be between 150 and 225mm wide and should taper to no more than 110mm at the top to give access for spanners when bolting the bottom joints.

Supports for tanks of 3660mm and over should ideally have capping flats under the bottom flanges to give a greater bearing surface. Alternatively, steel supports may be used, in which case customers are advised to consult Balmoral engineers regarding their design.

## Access

To allow access to bolts, a clearance of 500mm should be provided all round the tank. When tanks are fitted with covers, a distance of 750mm should be left between the cover and any ceiling to allow access to the manhole. It is the customer's responsibility to ensure adequate clearance around the tank.

## Health and safety

Balmoral Tanks reserves the right to refuse to carry out work in unsafe conditions. Erectors will observe site safety rules under relevant national and local health and safety regulations.

## Delays

Balmoral Tanks reserves the right to make additional charges for delays caused by preparatory work not being completed in accordance with its requirements.

## Minimum space requirements around tanks

Tank type	Top of tank <2.5m above FFL	Top of tank >2.5m above FFL		Above tank	Under tank	
		Fixed scaffold	Mobile tower		IFB	EFB
GRP sectional	OD + 500mm	OD + 750mm	OD + 850mm	500mm	0	500mm
Steel sectional	OD + 500mm	OD + 750mm	N/A	500mm	0	500mm
Cylindrical	OD + 1m (500mm must be foundation extension)	OD + 1m (500mm must be foundation extension)		1200mm	N/A	N/A
Accessories	Tanks with caged ladders require OD + 1m			1200mm	N/A	N/A
	Large connections and low level access: ensure sufficient space is allowed					

## Foundation requirements

Tank type		Requirement	Dimension	Level tolerance
GRP sectional	IFB - FS	Flat continuous support	ID + 200mm	2mm in any metre and 6mm in any 6m
	IFB - CCS	Steels at 500mm centres	ID + 200mm	2mm in any metre and 6mm in any 6m
	EFB	Piers/steels at 1m centres	ID + 200mm	2mm in any metre and 6mm in any 6m
	IBT	Any of the above	ID + 200mm	2mm in any metre and 6mm in any 6m
Steel sectional	EFB metric	Piers/steels at 1m centres	ID + 300mm	Plus or minus 3mm in any metre
	EFB imperial	Piers/steels at 1.22m centres	ID + 300mm	Plus or minus 3mm in any metre
Cylindrical	All	Flat continuous support	ID + 500mm	Plus or minus 5mm in any metre around perimeter of tank
Accessories	All foundations should be free from any local protuberances and irregularities			
	Specific details should always be checked prior to building of foundations			



# **ACCESSORIES AND ANCILLARIES**

# Accessories and ancillaries

For optimum functionality the following accessories will usually be installed on a Balmoral fire fighting sprinkler tank:

- ▶ A reliable water supply connection (usually direct from the service main) capable of refilling a full holding capacity tank in 36 hours or with sufficient flow to replenish a reduced capacity tank in 30, 60 or 90 minutes as necessary
- ▶ Flow testing facility to prove the flow rate of the infill. Adequate drainage should be provided for disposal of water during testing
- ▶ Float or Ball valve/s on the tank infill pipe. These must be located in a secure housing on the tank roof
- ▶ A dual element electric immersion heater to prevent ice forming on the water surface in the area of the ball/float valves on external tanks
- ▶ Electric float switches to transmit signals to the BMS or fire control panels to indicate the high/low level volume of water in the tank
- ▶ A drain valve at low level
- ▶ A gated ladder to allow personnel to get to the inspection and maintenance platform on the tank roof
- ▶ Third party pump suction pipe with an electrically monitored gate valve, locked open
- ▶ A rigid roof that excludes daylight, can withstand snow loads and prevents any matter falling into and contaminating the water
- ▶ Most tanks have a vortex inhibitor fitted at the inlet of the pump suction pipe to prevent air getting drawn into the pump. For LPCB approved tanks the vortex inhibitor must be an approved type. For NFPA and FM Global contracts the vortex inhibitor must be constructed as detailed in their data sheets. See p27 for further information
- ▶ Trace heating and lagging to all exposed water filled pipes, by others
- ▶ A 25mm warning pipe is installed just above the high water level to give an early warning of ball valve malfunction
- ▶ An AB airgap arrangement with side spill over weir assembly and cowl
- ▶ A larger bore overflow pipe
- ▶ An access hatch is provided at ground level to allow access during tank construction and evacuate personnel in an emergency
- ▶ A contents gauge or device which shows the level of water in the tank
- ▶ Some sprinkler tanks will have a fire brigade inlet installed. This allows the brigade to 'top up' the sprinkler water storage if necessary.
- ▶ A sump can be formed in the concrete tank base. This allows the sprinkler pump to draw water to a lower level from the tank.



Type AB cowl

Ground level access hatch

# Accessories and ancillaries

## Ball Float Valve

These are installed at the end of the incoming water supply pipe and automatically keep the tank full.

## Vortex inhibitor

These are installed on the suction pipes inside the tank to stop a water vortex forming and air being drawn into the pump. See page 27 for more information on the Balmoral FireFlow vortex inhibitor.

## Pipe connections

Customers are asked to provide full details when ordering. The type of pipe connection should be specified together with the relevant standard to which the coupling flanges are drilled or the pipes screwed. To assist delivery, the size and position of each connection should also be specified at the time of ordering. Ball and gate valves and all pipework, including bends and flanges, can be supplied if specified at the time of ordering.

Connections can be supplied as flanged stools to BS4504, ASA or DIN standards, or, for small pipework, screwed sockets to BS1387. The connections are fitted to the plates in positions agreed at the time of order.

## Pipework configuration

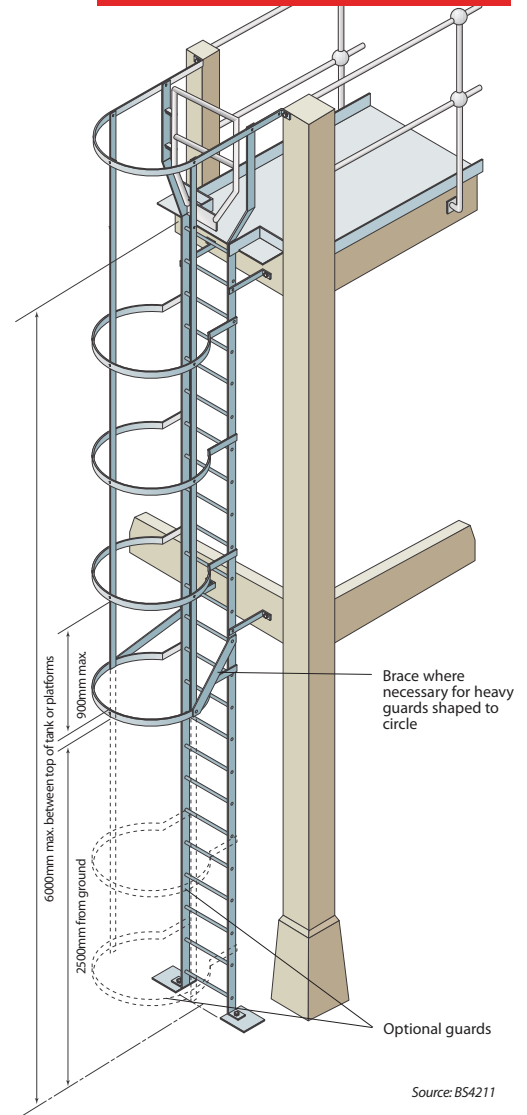
The inlet or delivery pipe can enter the tank through either the side wall at the top of the tank or into a raised chamber. Flow can be controlled through a ball valve, equilibrium float valve or automatic float switch.

Overflows should be positioned in accordance with the required air gap, and all outlets (suction), drains and overflows will come through the side walls of the tanks.

Overflows and warning pipes terminate at high level, horizontally, and can be extended to the floor if required.



Fixed ladder  
Typical arrangement of a fixed ladder according to BS4211



# Balmoral FireFlow™

## LPCB approved vortex inhibitor

Fire fighting water tanks require a large, fast flowing volume of water with a vortex inhibitor playing a key role in preventing air being drawn into the system and reducing the flow. Vortex inhibitors are fitted to the outlet pipe of the pumped water system.

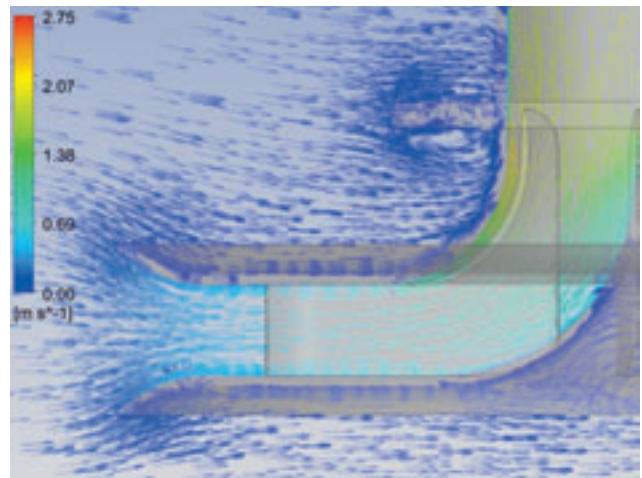
As LPCB standards require the usable water level to be no less than 100mm above the lowest suction point, the height of the vortex inhibitor also affects the effective capacity within a sprinkler tank.

Simple vortex inhibitors are available commercially; however the Balmoral FireFlow vortex inhibitor provides a significantly improved design which optimises both the capacity of the tank and the flow rate.

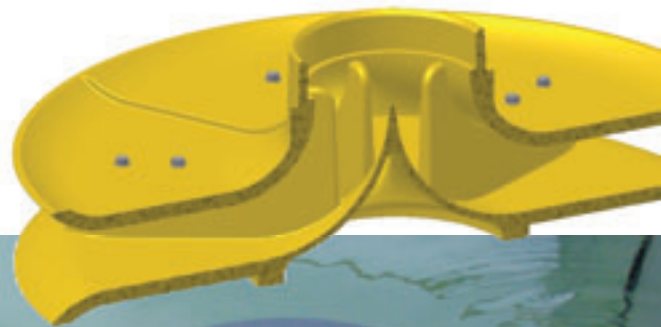
Balmoral's LPCB-approved vortex inhibitor was designed using computation fluid dynamics to remove turbulent areas that would otherwise reduce the flow rate.

Balmoral's unique design fully meets the requirements of LPCB's LPS 2070 and BS EN 12845 standards, including pipe dimensions, flow rate and mechanical strength, but with the advantage of increasing the effective capacity of the tank and decreasing the suction loss through the vortex inhibitor by an industry-leading 30%.

The injection moulded vortex inhibitors are made from structural thermosetting polyurethane, are fully corrosion resistant and range from 80-450mm in diameter. These PU materials are used by Balmoral's offshore division at water depths of 2000m and beyond.



This image is taken from a computational fluid dynamics analysis of the Balmoral FireFlow vortex inhibitor which clearly shows a smooth and uniform flow leading to drag reduction and a decrease in suction requirements



# Contracts and customer commitment

## Estimating

With the investment in the newly designed in house estimating system Balmoral aim to provide a quick turnaround time for all quotations. Where needed all estimates can include drawings in both 2D and 3D for improved clarity of specification and understanding of the detail within our offer. Balmoral has once again shown a commitment to putting our customers needs first and our estimating team stand ready.

## Design

Our team of sales and estimating staff are trained to assist in any design requests that are needed together with a back room staff of designers ready to assist. Our staff are able to provide clarification and assistance on such issues as legislation, the most efficient route to sizing your tank, site requirements, health & safety and the full scope of supply needed for each type of tank.

## Contracts

All customer orders are reviewed to ensure that client expectations fall in line with the scope of supply. Our contracts management team are there to provide a single point of contact and ensure all drawings, logistics and programming needs are fully understood and met.

## Customer commitment

Recognising today's requirement for rapid and accurate enquiry responses, Balmoral Tanks has committed significant investment to its IT resource. Coupled with this is a determination to assist clients in their day-to-day tasks through the strategic use of the company's website as a working business tool.

Balmoral Tanks offers the following online services:

- ▶ Enquiry submission
- ▶ Current product information
- ▶ Technical detail
- ▶ Tank selection: Guidance on capacities and overall dimensions
- ▶ Documentation: Base drawings; operation and maintenance manuals
- ▶ Industry standards and water regulations

A dedicated web team operates at the Aberdeen HQ on a programme of continuous improvement. Visit [www.balmoralfiretanks.com](http://www.balmoralfiretanks.com) to see how you can benefit by using our electronic communication procedures.



# Balmoral Group

Balmoral Group Holdings Ltd is a privately owned business headquartered in Aberdeen, UK, and has been providing solutions to the civil and environmental, building and energy sectors since 1980.

The enterprise is built upon research, development and technical innovation. It is this commitment to progress that has helped the company achieve its status as a market leader in its chosen fields of operation.

The company has, for a number of years, successfully operated manufacturing processes at Balmoral Park which are approved and strictly regulated by the Scottish Environment Protection Agency under Part B of the Environmental Protection Act 1990.

Balmoral Tanks Ltd, a division of Balmoral Group Holdings Ltd, is a leading European engineering design and manufacturing company.

As a result of significant investment in people and plant, the company produces what is believed to be the most comprehensive range of tank products available from a single source in the EU.

Civil engineering, wastewater treatment, drainage, fuel oil containment, bulk liquid, fire fighting and potable water storage sectors are all key sectors for the company.



**“I, and many of my team, have been designing and manufacturing tanks since the 1960s”**

Dr James S Milne, CBE, DL, Hon DBA, DHC  
Chairman and Managing Director, Balmoral Group Holdings Ltd



*Balmoral Park, the company's 45 acre HQ*

**Balmoral GRP sectional water tanks** provide water storage in capacities of 1m<sup>3</sup>-1000m<sup>3</sup> and are erected to heights of 4m in 1m and 0.5m increments. With an unrivalled reputation for quality and service, Balmoral GRP sectional tanks can be pre-insulated and carry full WRAS and LPCB approvals.

**Hot pressed steel tanks** are designed and manufactured by Balmoral Tanks under the brand name of Horseley Bridge. Established in 1880, Horseley Bridge pioneered the use of bolted sectional water tanks.

**Rotationally moulded tanks** ranging from capacities of 500-67,000 litres are currently produced. It is this flexibility and comprehensive product range that gives Balmoral Tanks its competitive advantage.

**Cylindrical sectional tanks** are manufactured in aluminium, galvanised and stainless steel. The range of materials on offer provides customers with cost effective and project specific options in the fire protection, potable and irrigation water storage sectors.

The vast majority of Balmoral Tanks' products are accredited and approved by numerous agencies: BBA; IAB; IP; LPCB; OFTEC and WRAS to name but a few. In gaining these accreditations Balmoral has raised the integrity and standards of the tank industry around the world.

Visit [balmoraltanks.com](http://balmoraltanks.com) for a comprehensive overview of the company and its products.

## Quality Assurance

Balmoral Tanks is certified to BS EN ISO 9001. The company's QA manuals are available for examination by all clients.



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#### SALES

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