



PERMASTORE[®]
TANKS & SILOS

worldwide
containment
solutions



The Company

Permastore is the market leader in the manufacture and supply of Glass-Fused-to-Steel Tanks and Silos. Since 1959 the Company has been providing durable and cost effectively engineered containment solutions in Municipal, Industrial and Agricultural environments worldwide. Permastore exports to over 110 countries and in excess of 300,000 structures have been installed worldwide, each with the ability to withstand local environmental extremes, from the cold of the arctic to the heat of the desert. Permastore offers a complete range of diameter and height options with storage capacity solutions exceeding 50,000m³ (13,200,000 US Gallons).

- **ISO 9001:2008** – Accreditation of quality standards to guarantee Customer satisfaction.
- **International Standards** – Permastore's quality systems ensure that products meet or exceed the requirements of AWWA D103-09, EEA 7.20 and EN ISO 28765:2011 amongst others. PERMASTORE® structures are engineered with a predicted minimum 30 year design life in accordance with the requirements of ISO 15686 Part 1 (2011), Part 2 (2012) and Part 3 (2002) which provides a service life of up to 50 years.
- **International Bodies** – Permastore Quality Standards are verified by MPA NRW. Certified to NSF/ANSI 61. Approved by the UK Secretary of State under Regulation 31 for drinking water and listed by DWI (Drinking Water Inspectorate) in its List of Approved Products.
- **In-house Engineering Design and Contract Management** – This provides reassurance that all structures arrive on schedule and are fit for purpose.
- **Production** – All controlled at one manufacturing site, thereby simplifying the supply chain and providing a seamless service to meet Customers' requirements.
- **Technical Support** – An experienced team that interacts with our Customer base to ensure Customer demand is met.
- **Modern Manufacturing Facility** – A state of the art factory dedicated solely to the production of Glass-Fused-to-Steel product.
- **Advanced Glass-Fused-to-Steel Technology** – This provides the ultimate in corrosion resistance for the life of the structure.

The Solution

What is Glass-Fused-to-Steel?

Glass-Fused-to-Steel is a unique tank finish. Two materials are fused together to achieve the best of both materials – the strength and flexibility of steel combined with the corrosion resistance of glass. Applied to both interior and exterior surfaces, Glass-Fused-to-Steel is able to provide many years of trouble free service in harsh environments.

- High performance and hard wearing
- As strong and flexible as steel
- Inert silica glass
- Colour fast / UV stable

Features and Benefits of Glass-Fused-to-Steel



FEATURE	BENEFIT TO THE CUSTOMER
Modular Design	Site fabrication is not required simplifying build
Factory applied coating	Consistent quality not dependent on site conditions
Strong adhesion	Strength of steel with corrosion resistance of glass
Abrasion & UV resistance	Ensuring long term aesthetics and reduced maintenance costs
Lifetime coating, re-application not required	Reduced operational costs and downtime, improving the return on capital investment
Corrosion allowance not required	Reduced capital expenditure
Potable water compliant	Versatility at no extra cost

The Quality

Is **independently Certified** and meets or **exceeds** **International Quality Standards**

A philosophy enshrined in Permastore's procedures, which exceed the requirements of International Enamelling Standards. All industrial grade finishes are subject to 100% inspection and electrical testing of the contact surface. Any panel having a discontinuity is rejected. Permastore has earned this reputation by dedication to the highest quality and commitment to ZERO DISCONTINUITY (defect free at test voltage) glass fusion.



MPA NRW – Fully independent auditing of Permastore Quality Standards and product testing since 1986.



NSF/ANSI 61 – Certification for product quality and suitability for potable water storage.



ISO 9001:2008 – Accreditation of Quality Management Systems since 1996 to guarantee consistent customer satisfaction.



Installation

The modular tank system allows very rapid installation when compared to traditional concrete or welded tank construction. The structures supplied and installed by Permastore's Distributors are constructed in accordance with detailed construction guides by trained crews to give rapid and high quality completion on-site.



Tanks and silos are each supplied as a complete kit of components ready for assembly. The kit design includes features to ensure that the build can take place in the optimum time and be "right first time".

Tanks are usually designed to be mounted on prepared concrete foundations. However PERMASTORE® structures can include Glass-Fused-to-Steel floors or cones where required.

This modular bolted system gives the flexibility of construction techniques to suit local conditions. For example, tanks and silos can be built with a jacking system which allows the build work to be carried out at ground level, giving build time benefits and crew safety benefits.



The Market Sectors

Municipal

Potable Water



PERMASTORE® tanks are globally accepted for potable water applications.

The Company's Glass-Fused-to-Steel tank system has NSF/ANSI 61 certification and is approved by the UK Secretary of State under Regulation 31 for drinking water and listed by DWI (Drinking Water Inspectorate) in its List of Approved Products.

The hard, inert and hygienic surface of the Glass-Fused-to-Steel finish makes it simple to clean and disinfect water tanks.

A large range of water treatment processes can be accommodated within PERMASTORE® tanks, including borehole water, seawater desalination tanks, reverse osmosis (RO), permeate tanks, settling tanks, filtration tanks, disinfection tanks, coagulation/flocculation tanks, aeration tanks, activated sludge tanks, filter tanks, sedimentation tanks, chlorine contact tanks and dosing tanks, amongst others.

The bolted tank and silo system allows structural designs to be used in various configurations including water storage reservoirs, water standpipes, and elevated water distribution tanks.

Designs can accommodate secure tank storage for local environmental conditions, such as high wind speeds, snow loads, or seismic areas. Permastore offers a complete range of diameter and height options with storage capacity solutions exceeding 50,000 m³ (13,200,000 US Gallons).



Sewage Treatment



Glass-Fused-to-Steel tanks have a very high resistance to corrosive attack and abrasion, and so are ideally suited for use in sewage treatment applications. PERMASTORE® tanks have been successfully used for an extensive range of sewage treatment applications. Just some of the uses include:

- Clarifiers
- Aeration
- Membrane batch reactors (MBR)
- Sequential batch reactors (SBR)
- Thickener tanks
- Sludge holding
- Sludge mixing
- Sludge treatment
- Equalisation tanks
- Trickling/filter media tanks
- Settlement
- Grey water
- Storm water
- Sludge cake silos



Industrial

Industrial Effluent

There can be a high degree of variability in the effluent from industrial sources. This places a great emphasis on the ability of the storage and process tanks to withstand a range of aggressive liquids.

The PERMASTORE® Glass-Fused-to-Steel solution provides a high degree of protection for the tank for a large range of industrial processes from food waste to tannery effluent and leachate amongst others.

The advantages of the high corrosion resistance of Glass-Fused-to-Steel together with the modular nature of the tank build give customers significant benefits in containment security, project build times and life-time costs.



Process Water

With existing certification for potable water storage to NSF/ANSI 61 and approval by the UK Secretary of State under Regulation 31 for drinking water and listed by DWI (Drinking Water Inspectorate) in its List of Approved Products, PERMASTORE® tanks are proven to be ideal for process water applications.

For example, these can include food and beverage water requirements, or alternative water applications such as fish farms, or demineralised water storage for industry such as power plants.

These tanks take advantage of the inert properties of the Glass-Fused-to-Steel finish and the fact that it does not require recoating, giving users the re-assurance they require for these critical applications.



Bulk Solid Storage

PERMASTORE® silos with the hard, inert finish offered by Glass-Fused-to-Steel have exceptional resistance to abrasion and present a hygienic, low friction surface to the stored product. Some of the bulk storage applications include:

- Food production
- Coal
- Carbon black
- Fishmeal
- Limestone
- Powders
- Plastics
- Road salt
- Soya meal
- Grains or other whole or milled food stuffs

The designs of the silos are tailored to suit specific material properties and allow for a range of loading (filling) and unloading (discharge) systems. They also can incorporate roofs, cones and connections for pipework or sensors.



The Market Sectors

Biogas/Anaerobic Digestion

Permastore's history of anaerobic digestion (AD) tanks exceeds 40 years, and the Company's experience has expanded considerably over the decades. Glass-Fused-to-Steel tanks are utilised for mesophilic digesters, thermophilic digesters, pasteurising digesters and enhanced enzymic hydrolysis (EEH) digesters amongst various other processes and applications.

In the industrial sector using anaerobic digestion to create biogas is increasingly recognised as a valuable method to utilise waste streams to create renewable energy.

Almost any organic waste can be digested, opportunities have developed to utilise food processing waste, domestic waste and restaurant waste. In addition to this, combinations of waste streams can be processed incorporating municipal sludge effluent and farm waste such as animal slurry to generate "green" energy.

Biogas produced can be cleaned and introduced directly into the grid, or converted into electricity in combined heat and power engines (CHP). This also gives the opportunity to generate heat energy in the form of hot water.

At the end of the process the digested material can be considered for use as fertilizer, which increases the potential revenue streams.

Modular design allows the flexibility to accommodate various aspect ratios, process pressures and temperatures to suit a variety of AD processes, designs and applications.

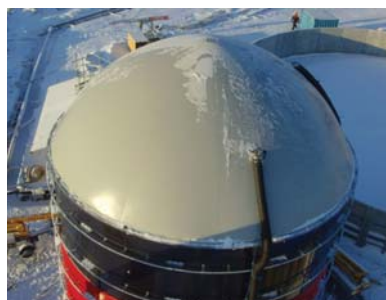
Glass-Fused-to-Steel is not only utilised for the tank walls but also in the roofs on tanks such as digesters. This gives the high degree of protection of Glass-Fused-to-Steel throughout a digester, especially in the highly aggressive gaseous zone.

These roofs are structurally designed to allow for local environmental loading and can also support centrally mounted mixer systems.

Additionally, Glass-Fused-to-Steel tanks can also be used for biogas storage by incorporation of double membrane covers.

The combination of Permastore's inert Glass-Fused-to-Steel finishes, combined with the strength of steel and the flexibility of modular construction give significant benefits over other types of digester structures. These include:

FEATURE	BENEFIT
Long life span	Reduced replacement costs and improved return on investment
Modular bolted tank construction	Rapid and cost effective site installation – Reducing project timescales, costs and requirement for on-site equipment
Flexibility to remodel and relocate	Tanks can be extended, dismantled and resited giving long-term asset value
Optimum corrosion resistance of Glass-Fused-to-Steel	Safe and secure storage with minimal maintenance costs
Complete range of diameter and height options with storage capacity solutions exceeding 50,000m ³ (13,200,000 US Gallons)	Most cost effective solution to meet customers' needs



Agricultural

Slurry

Farm pollution control has become important and effective and secure slurry storage is a critical part of the solution.

Local environmental agencies around the world are using legislation and support schemes to encourage farmers to upgrade their slurry management systems. This includes drivers such as the European Commission Nitrates Directive and the US Natural Resources Conservation Service Environmental Quality Incentives Programme (EQIP).

To safeguard the environment, slurry is required to be stored at certain times of the year. This is where the high level of security of the PERMASTORE® Glass-Fused-to-Steel tank system is particularly suited. PermaStore have been successfully supplying slurry tanks since the late 1960's, demonstrating the durability and longevity of the product in this harsh environment.

Complete range of diameter and height options are available with storage capacity solutions exceeding 50,000m³ (13,200,000 US Gallons).



Silos

PERMASTORE® Glass-Fused-to-Steel silos provide clean and efficient storage of grains and forage. The secure sealed system of storage with capacities from 250 to 1400 metric tonnes (275 to 1540 US tons), gives significant benefits to livestock producers:

- High quality feed grain
- Maximised nutrient value of the feed with lower moisture loss
- Natural conservation without use of chemicals
- No drying costs
- Exclusion of vermin and birds
- Natural suppression of diseases and weeds by the dark, oxygen limiting environment
- Suitability for organically grown produce
- Traceability of inputs for accreditation schemes
- Permits earlier harvesting to eliminate drying costs
- Harvesting flexibility and buffer storage for existing grain storage systems
- Greater palatability for livestock
- High digestibility for livestock
- High animal growth rates and feed conversion efficiency



The ECOFUSION® agricultural grade finish is subject to PermaStore's stringent manufacturing, inspection and testing regimes in accordance with BS and EN ISO standards.



ECOFUSION® is used for:

- Livestock effluent tanks
- Moist grain silos



The Market Sectors

Mining

The mining industry requires treatment tanks which must resist the highly abrasive nature of the contents and the corrosive environment of mining processes.

PERMASTORE® Glass-Fused-to-Steel tanks are ideal for this application. PERMASTORE® tanks are suited to tough environments where dependability is a vital characteristic. They can withstand the extremes of the environment in these remote locations, and the modular design principle of the tank kits offers ease of transport and assembly at site.



The bolted nature of the tanks allow them to be built very quickly when compared to welded structures. It also allows the existing tanks to be unbolted and moved on to new locations when required, significantly increasing asset value.

Both process and effluent treatment can be carried out in PERMASTORE® tanks in most applications which can include mines for gold, silver, coal, copper, diamonds, iron ore, cobalt, nickel, platinum, potash, rare earth metals, uranium, zinc and many other minerals.



Biofuels

The biofuel industry is growing around the world as an environmentally acceptable renewable energy source generated from biomass. Biofuel use can reduce emissions of green house gases, lower the demand for fossil fuels and is often supported by government subsidies.

The main biofuels are, bio-ethanol or alcohol made from fermentation and bio-diesel produced by transesterification. They are both derived from organic biomass. The plants manufacturing these biofuels therefore have requirements for tanks and silos for the input ingredients,



from sugar and starch crops such as sugar cane to vegetable oils or animal fats. Also storage is required for the finished product as well as for feed water and fire water tanks on-site. BIOTANQ® modular tanks and silos can be utilised in these areas giving significant benefits over traditional welded structures.

International Standards – For biofuels storage, Biotanq's quality systems provide a credible alternative to the API 650 standard for welded tanks and to the 12B specification for bolted tanks.

Benefits For The End User:

The BIOTANQ® Glass-Fused-to-Steel finish combined with its modular design and build concept, offers an array of benefits to contractors and end users.

- Long Life
- Low Capital Cost
- Low Maintenance Costs
- Rapid more economical Site Installation Times when compared to welded structures
- Economic Worldwide Shipments
- Flexible to Remodel, Extend, Dismantle and Resite
- Optimum Corrosion Resistance

Roofs, Covers and Ancillaries

Comprehensive Roof and Cover Range



PVC Cover



Dome Roof



Trough Deck Roof



Double Membrane Cover



Glass-Fused-to-Steel Roof

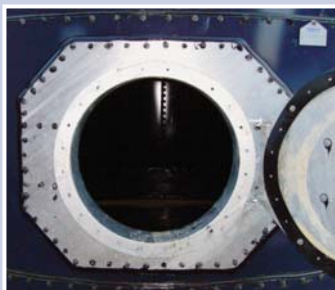
Comprehensive Ancillary Range and other available options



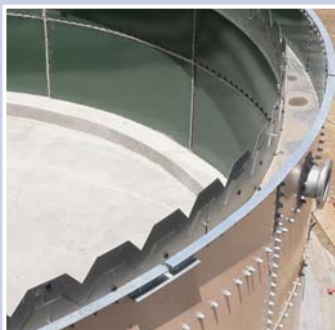
Ladders & Platforms



Connections



Manways



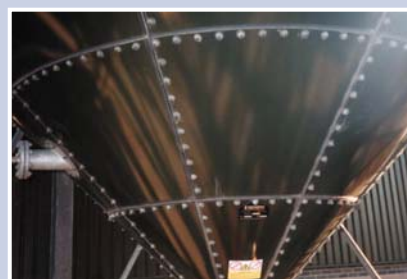
Launders



Walkways



Glass-Fused-to-Steel Floors



Cones



Viewports



Level Indicators

Industrial Glass Grades

ISO FUSION® V700

ISO FUSION® V700 is the primary industrial contact surface finish generally used for bulk solids, storm water, filter tanks and sludge storage. An established low cost solution delivering security and protection through Permastore's 100% inspection, high voltage zero discontinuity coating specification which is defect free at test voltage.

- **Application:** pH 3-9
- **Type:** 2 coat, 1 fire
- **Thickness:** 200-360 microns
- **Test Regime:** Zero discontinuities at 700V
- **Exceeds quality requirements of EEA 7.20**
- **Meets or exceeds the glass coating requirements of AWWA D103-09 – Section 10.4**
- **Meets or exceeds quality requirements of EN ISO 28765:2011***

HV ISO FUSION®

HV ISO FUSION® is the premium grade of the ISO FUSION® range. Combining the commercial benefits of ISO FUSION® glass and the established confidence associated with high voltage testing. Delivering a high grade zero discontinuity coating for optimum protection in specific areas of application which is defect free at test voltage.

- **Application:** pH 3-10
- **Type:** 2 coat, 1 fire
- **Thickness:** 200-360 microns
- **Test Regime:** Zero discontinuities at 900V
- **Exceeds quality requirements of EEA 7.20**
- **Meets or exceeds the glass coating requirements of AWWA D103-09 – Section 10.4**
- **Meets or exceeds quality requirements of EN ISO 28765:2011***

TRI FUSION®

TRIFUSION® has rightfully become the standard by which all other finishes are assessed. This proven high quality contact surface finish sets the benchmark for use in the more demanding areas of industrial effluent treatment and sludge digestion. An additional protective layer, together with the zero discontinuity finish tested at an exacting 1100 Volts, provides exceptional security and continuous protection.

- **Application:** pH 2-11
- **Type:** 3 coat, 2 fire
- **Thickness:** 280-460 microns
- **Test Regime:** Zero discontinuities at 1100V
- **Exceeds quality requirements of EEA 7.20**
- **Meets or exceeds the glass coating requirements of AWWA D103-09 – Section 10.4**
- **Meets or exceeds quality requirements of EN ISO 28765:2011***

TRI FUSION® PLUS

TRIFUSION® PLUS finish takes Permastore's acclaimed TRIFUSION® standard to an even higher level, for use in the most extreme of environments. Aggressive chemical and high temperature processes can be considered with this high quality contact surface finish, offering zero discontinuity when tested to 1500 Volts.

- **Application:** pH 1-14
- **Type:** 3 coat, 2 fire
- **Thickness:** 340-500 microns
- **Test Regime:** Zero discontinuities at 1500V
- **Exceeds quality requirements of EEA 7.20**
- **Meets or exceeds the glass coating requirements of AWWA D103-09 – Section 10.4**
- **Meets or exceeds quality requirements of EN ISO 28765:2011***

* **Note:** EN ISO 28765:2011 Vitreous and porcelain enamels – Design of bolted steel tanks for the storage or treatment of water or municipal or industrial effluents and sludges, covers both the glass coating requirement and the tank structure design and as such is the first dedicated international standard specifically created for the Glass-Fused-to-Steel product applicable for water and wastewater applications.

A Zero Discontinuity policy applies to ISO FUSION® V700, HV ISO FUSION®, TRIFUSION® and TRIFUSION® PLUS for the tests shown.

All applications are subject to concentration and temperature considerations. All specifications relate to the contact surfaces only.

A detailed specification is available on request.

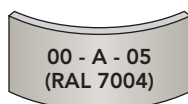
Application Guide

APPLICATION	ISO FUSION® V700	HV ISO FUSION®	TRIFUSION®	TRIFUSION® PLUS	INTERNAL COLOURS
Edible / Vegetable Oils	✓				20 - C - 40 (RAL 5013)
Dry Bulk Solids	✓				
Farm Digesters (Liquid Zone)	✓				
Storm / Fire Water	✓				
Potable Water (NSF / ANSI 61)	✓				
Filter Tanks	✓				
Municipal Sludge Storage (Open Topped)	✓				
Municipal Sludge Treatment (Open Topped)	✓				
Municipal Mesophilic Digester (Liquid Zone)	✓				
Drinking Water (DWI, Reg 31 Approved)		✓			20 - C - 40 (RAL 5013)
Municipal Backwash Effluent		✓			
Municipal Sludge Cake Storage		✓			
Farm Digesters (Roof & Rings Exposed to Gaseous Zone)			✓		14 - C - 40 (RAL 7009)
Municipal Sludge Storage (Tanks with Roof)			✓		
Municipal Sludge Treatment (Tanks with Roof)			✓		
Industrial Effluent and/or Aeration Process			✓		
Food Process Washings			✓		
Liquid Leachates			✓		
Municipal Mesophilic Digester (Roof & Rings Exposed to Gaseous Zone)			✓		
Thermophilic Digester (Liquid Zone)			✓		14 - C - 40 (RAL 7009)
Thermophilic Digester (Roof & Rings Exposed to Gaseous Zone)				✓	
High Temperature Applications				✓	
Aggressive / Chemical Industrial Effluent				✓	

Standard External Colours



Optional External Colours



Further external colours are available on request. All colour identification numbers are the closest visual match only. All panel exteriors are Glass-Fused-to-Steel environmental specification. Optional colours at additional cost.



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