PERMASTORE® TANKS & SILOS

worldwide containment solutions

THE GLOBAL MARKET LEADER

in modular Glass-Fused-to-Steel tank & silo design

- **BUY WITH CONFIDENCE –** in excess of 50 years' proven experience.
- **ADVANCED INNOVATIVE PRODUCT DEVELOPMENT OF GLASS-FUSED-TO-STEEL.**
- **LEADING THE MARKET WITH QUALITY** and independently audited standards.
- **BUY ONCE, BUY RIGHT** with proven product durability.
- **AT THE FOREFRONT OF THE INDUSTRY WITH CONTINUOUS RESEARCH AND DEVELOPMENT.**
- **OUR GLOBAL DISTRIBUTION NETWORK MAKES PERMASTORE NO 1 OR 2 IN EVERY MARKET WE OPERATE IN.**

INSIDE

THE TRUTH BEHIND THE PERMASTORE MARKET LEADERSHIP

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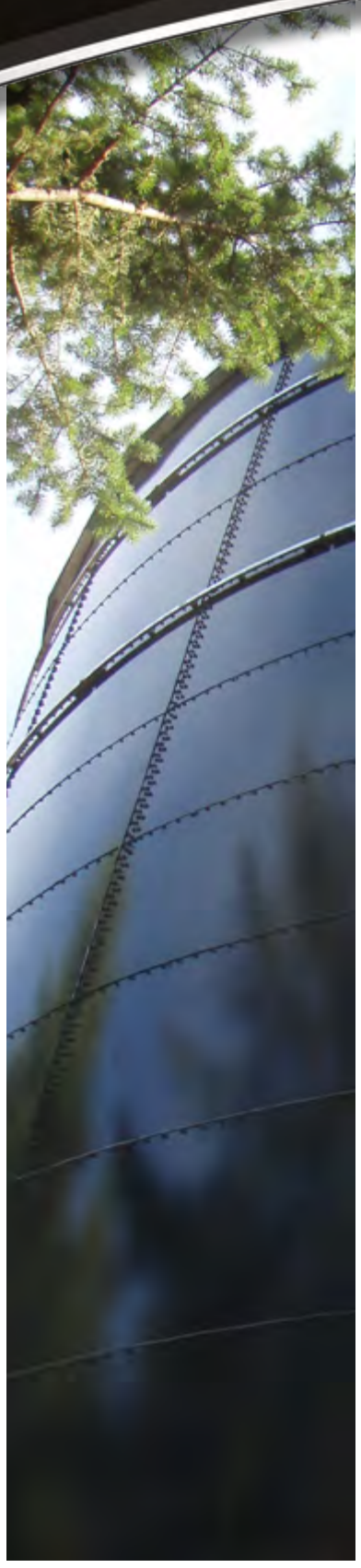

The Global market leader in modular Glass-Fused-to-Steel tank & silo design.

No company in the world is more focused on supplying the highest quality Glass-Fused-to-Steel tanks and silos than Permastore.

Over 50 years of experience linked to a dedicated development program has led to Glass-Fused-to-Steel innovation which clearly places Permastore at the forefront of this premium tank coating technology.

PERMASTORE® product offers market leading structural design together with a high performance coating, which consistently outperforms competitive Glass-Fused-to-Steel tanks and silos.

The **PERMASTORE®** Glass-Fused-to-Steel manufacturing system has repeatedly proven to be the recognised premium choice of coating above and beyond any other coating solution available in the global market.

Permastore is recognised as the global market leading manufacturer of bolted Glass-Fused-to-Steel tanks based at their dedicated state of the art facility in Eye in the UK.

PERMASTORE® tanks and silos are used in the storage and treatment of drinking water, wastewater, process water, agricultural effluents, and aggressive applications of industrial effluent, municipal waste, leachate and mining sector uses worldwide.

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Buy with confidence - in excess of 50 years' proven experience.

Consider what we have achieved so far...

1959 Our first installation for the agricultural sector **– 55 years ago!**

1968 Our first installation in the municipal water sector **– 46 years ago!**

1973 Our first anaerobic digester tanks **– 41 years ago!**

1977 Custom built Glassing plant at Eye **– 37 years ago!**

1992 Permastore was the first company to introduce high voltage testing setting the benchmark of holiday testing for coated steel tanks over two decades ago! Our competitors have only recently begun introducing similar tests to their quality programs, some only batch test. **Permastore tests every sheet***.

1992 In conjunction with the most searching holiday or defect test, Permastore also introduced a policy of **100% zero discontinuity** (defect free at test voltage) on ALL panels* and remain the only manufacturer supplying to this standard. Some competitors test at lower voltages or allow refinishing with epoxy paint touch-ups.

1998 "Off the shelf" sealants did not meet Permastore's specifications so we teamed up with one of the world's leading sealant manufacturers and co-developed a sealant specifically designed for water/wastewater applications: **Sikaflex®-TS Plus.**

1999 Permastore introduced the evolutionary 1400 series which incorporated the purpose designed "straight seam" 4 corner overlap jointing system developed especially for liquid storage which had been in successful use since the 1960's. Some competitors continue to use staggered jointing systems originally designed for dry storage applications, making them more vulnerable to the risk of leaking.

**on the contact surface of all Industrial Grade finishes*

2003 Permastore introduced an innovative electrostatic pre-coat glass application plant. This state of the art technology further improved quality, consistency and the performance of Permastore's glass coating, bringing enhanced product quality to our customers.

2010 As part of a green environmental initiative and product development program, with assistance from a Carbon Trust loan, our tunnel furnace underwent an extensive upgrade delivering enhanced technical features and reducing Permastore's carbon footprint.

2011 Permastore introduced a reduced diameter bolt hole design utilising modern sheet steel production technology benefits to offer consistently better precision and overall dimensional accuracy. This allows Distributors to assemble structures delivering a "tighter finished tank" once the tank has been built and filled.

2012 Introduction of state of the art tank design software coupled with 2D drawing and 3D modelling, helps deliver improved client visibility of their project.

2012 The furnace upgrade has allowed the introduction of new glassing technology providing enhanced technical features to the product by taking advantage of the significant benefits within the steel micro-structures that occur at lower firing temperature.

2013 Installation of a state of the art CNC Laser cutting machine, to support Permastore's continuous product development program and improved manufacturing efficiency to satisfy ever growing demand for larger capacity tanks to better meet customers needs.

AND IN 2014...

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And in 2014...

Further advances in "fusion" technology.

What may be surprising is how the Permastore composite has the strength and flexibility of steel combined with the corrosion resistance of glass.

The **PERMASTORE®** glass coating is designed to produce an extremely strong chemical bond to the steel during the fusion process. This places the glass in compression and it remains in compression even when the steel bends and flexes. Our glass coatings are designed to deliver strength and durability while the steel is in tension due to the contents load.

Permastore is globally recognised to have developed the highest performing glass coatings available. Our fusion process consistently delivers optimised bubble structures and this, coupled with our unique glass formulations, results in Permastore's unrivalled glass performance being the envy of our competitors.

Unlike fusion bonded epoxy coating systems that merely sit on the steel surface only forming a physical bond, **PERMASTORE®** glass coatings are both chemically fused to and physically combined with the steel substrate. This results in an unmatched, tough & durable bond.

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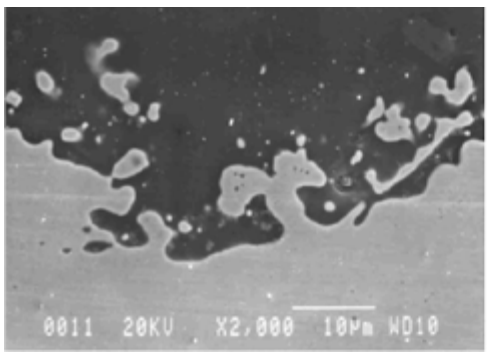
Leading the market with Quality and Independently audited standards

A number of competitive tank manufacturers using epoxy coating systems, use the term “fusion bonded” or “fusing” within their marketing materials and this has led to the common misconception that their epoxy coatings are also fused to the steel. **This is simply clever marketing but fundamentally untrue!**

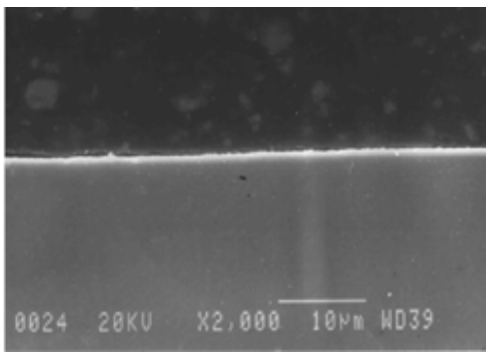
In order for there to be fusion of two materials there must be a chemical bond at a molecular level.

Our glass coatings are fused to the steel at temperatures ranging from 760°C (1400°F) to 860°C (1580°F) which facilitates the interfacial fusion reactions that combine the two materials. A typical factory applied “fusion bonded” epoxy is cured at a much lower temperature typically 200°C - 275°C (390°F - 525°F) which makes fusion between the epoxy and steel **impossible!** This is clearly demonstrated in cross section microscopic images below.

(Continues overleaf)



Glass-Fused-to-Steel



Epoxy coated steel

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This results in an epoxy coating which is typically susceptible to damage, delamination and ultimately corrosion.

Just compare the adhesion tests that Permastore conducts on sheets. Epoxy suppliers typically test their coating for adhesion to ASTM D3359 and this uses self adhesive "sticky tape", applying the tape and in turn removing it from the coating to confirm to spec adhesion levels. **In contrast, Glass-Fused-to-Steel is determined by significantly more demanding drop tests where the force applied to the coating has to be sufficient to deform the base metal substrate.**

Epoxy tank coating scratch resistance tests used by competitors (ASTM D3363) uses a 2H pencil drawn over the surface of the coating to test the scratch resistance of the coating to ensure the epoxy coating meets specifications. By comparison, glass tanks are used to process highly abrasive mining aggregates, due to the inherent hardness, impact resistance and excellent adhesion properties of **PERMASTORE®** glass coatings, which are measured against stringent international standards. **The scratch hardness of Glass-Fused-to-Steel surfaces is tested using the recognised Mohs scale where hard minerals are used to determine the surface hardness and this method is far more onerous than the pencil hardness test.**

YOU decide which is more credible. Highest finished quality glass coating on the market.
http://www.permastore.com/products/application-guide/

Permastore manufactures the highest quality glass coating available worldwide for Glass-Fused-to-Steel tanks and silos. Our unique pre-coat system and two additional individual layers of glass, formulated to deliver exceptional resistance to chemical corrosion, provides excellent physical and chemical resistance properties to the final product. ALL TRIFUSION® sheets are subject to an 1100V high voltage test (All TRIFUSION®PLUS sheets are tested at 1500V) and only 100% zero discontinuity (defect free at test voltage*) sheets are released into the market place. Not only is Permastore the manufacturer of the highest technically performing Glass-Fused-to-Steel sheets for tanks and silos, Permastore has developed a complete family of performance driven glass coatings suitable for a range of storage applications.

Please review our products in the Permastore brochure. Convinced of our global market leading quality, we are the only manufacturer who publish our independently audited quality standards, making them available on the Permastore website http://www.permastore.com/products/ for our customers to review.

**All specifications relate to contact surfaces*

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Buy once, buy right with proven product durability

What are the other benefits?

PERMASTORE® glass coatings are silica rich and use blends of compounds to produce inert, inorganic UV stable and colourfast finishes making our product suitable for high-temperature regions. These properties are very important if your project is going to be exposed to high UV level locations. Permastore has 1000's of tanks installed in desert environments in the Middle East, Australia, North and South America so you can buy with confidence.

By comparison, fusion bonded epoxy tanks typically need recoating every 10 years due to the less durable nature of this coating. This requires costly blasting processes to remove old paint before repainting. This exercise is coupled with the requirement for tanks to be out of service for extended periods increasing maintenance costs.

Credible Design Life & Proven Service Life

PERMASTORE® structures are engineered with a predicted minimum 30 year design life in accordance with the requirements of ISO 15686-1:2011, ISO 15686-2:2012 and ISO 15686-3:2002 which provide the framework for determining and planning a service life of up to 50 years.

Permastore has structures in Europe within the agricultural industry that have been in service over 50 years. In the municipal water market we have structures that have been in service for over 45 years, with routine inspection and maintenance, and are still in good operating condition. This is testament to the longevity of the **PERMASTORE®** Glass-Fused-to-Steel coatings and has led to our quality reputation.

Advances in manufacturing processes and material enhancements, combined with improved safety in design, it is not unrealistic to expect a service life greatly exceeding 50 years! *

Buy once, buy right for your storage needs with **PERMASTORE®** Tanks & Silos.

** Subject to routine inspection and maintenance in accordance with Permastore guidelines*

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Published Glass Coating Quality Standards

Permastore's experience with Glass-Fused-to-Steel technology has given us great confidence in our product and this is demonstrated by our willingness to publish the quality standards of each of our glass coating finishes. These quality standards outline the minimum requirements which each and every panel supplied by our factory meets. Giving customer transparency and confidence in the purchased product!

The Quality Standards can be found on our website:
http://www.permastore.com/products/

But don't just take our word for it...

Permastore subjects itself and its products to external independent audit and inspection of its compliance with its published quality standards.

The random inspection confirms that our product meets or exceeds our published quality standards and also confirms our compliance to clause **10.3** of EN ISO 28765:2011. No other manufacturer subjects its products to independently audited testing.

Unlike the AWWA D103-09 Standard which is mainly focused on structural design and covers basic application requirements for a number of coatings including epoxy, Glass-Fused-to-Steel amongst others, the EN ISO 28765 Standard covers both the glass coating requirements and the tank's structural design requirements in great detail, including giving chemical resistance tests for the glass coating, and covers coatings standards for the most common tank process applications. As such EN ISO 28765 is the first dedicated international standard specifically created for the Glass-Fused-to-Steel tank and silo products.

Independent audited testing for chemical and physical performance in accordance with relevant international standards combined with our unrivalled practical experiences, prove again that PERMASTORE® glass coatings exceed other coating systems on the market for tanks and silos in virtually every aspect.

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At the forefront of the industry with continuous Research and Development

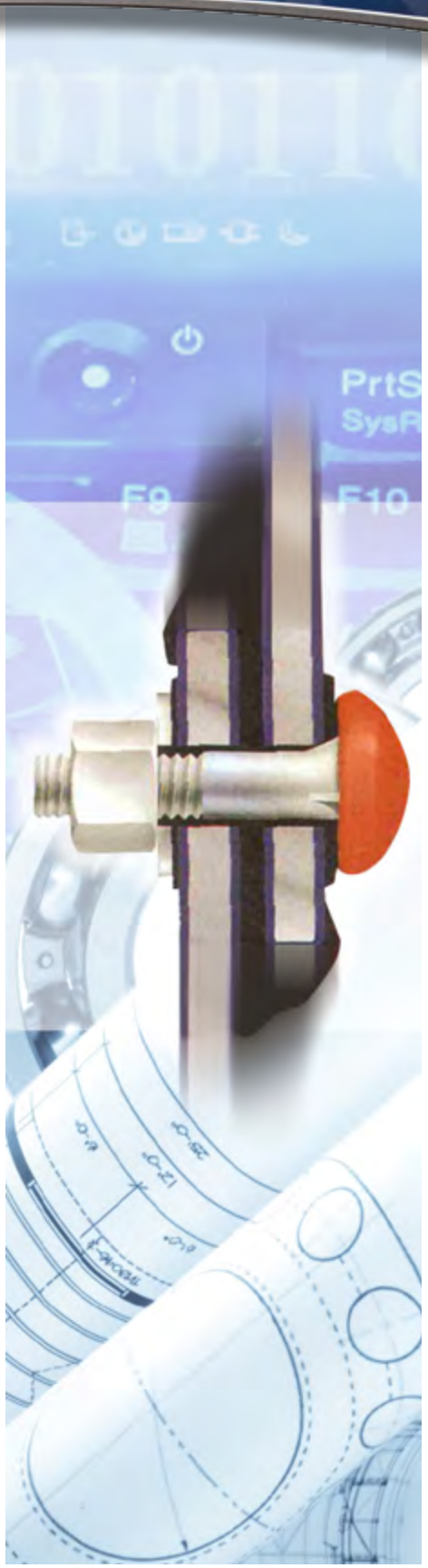
Edge Protection System

Permastore has been in the business of designing bolted tanks for many decades and has undertaken significant R&D both in our laboratories and in the field, testing and trying edge laminates and coated edges. There is a vulnerability during construction to the edges of any factory coated tank sheets dependent upon handling methods adopted onsite.

Permastore has developed an economical coating system that protects the sheet edges during transportation and installation. Once constructed in accordance with our build methodologies, all sheet edges are fully protected by an encapsulating bead of our purpose designed tank sealant, giving long term protection against both abrasion and tank contents.

So whether the solution you choose has a stainless laminate, bevelled and coated edges or other edge protection system these areas all remain vulnerable during the build process.

In the case of stainless steel edge coating, this has the significant disadvantage of introducing dissimilar metals in close proximity, which can actively promote and accelerate corrosion.



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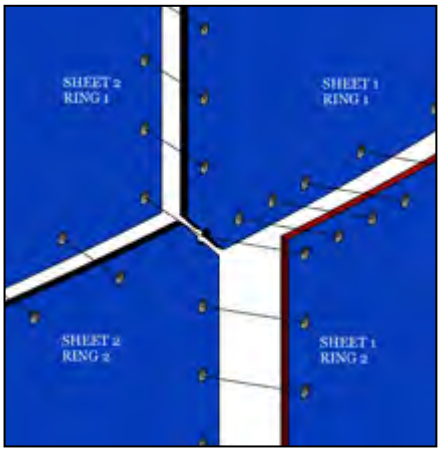
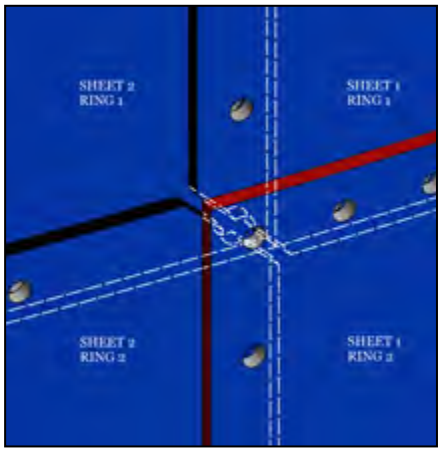
Straight seam 4 corner overlap joint

The **PERMASTORE®** solution utilises a straight seam joint that has been developed and designed specifically for liquid storage and successfully used in bolted tank design since the 1960's. The straight seam not only offers an aesthetically more pleasing finish, but it also performs an important function.

The corner overlap ensures the joint is compressed equally across all four corners of the joint, the mitre sheet arrangement allows the straight seam joint to be achieved which in turn has been designed to place a bolt in the best possible position to effectively seal any leak path thus making the **PERMASTORE®** joint the best joint solution on the market.

Staggered seam designs were originally developed for silos used for dry bulk storage and have not been updated to manage the more demanding requirements and pressures involved in liquid storage and are therefore more vulnerable to the risk of leaking. The staggered seam design can create pipework, connection or manway orientation problems for installers, which are more challenging to accommodate near joints and seams.





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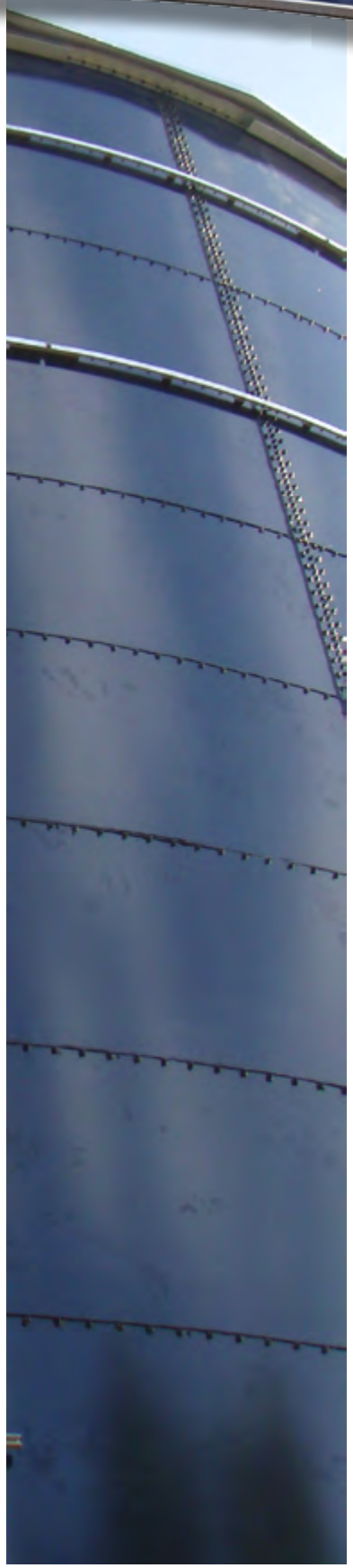
Importance of choosing the right partner for your next tank

Permastore is recognised as the market leading manufacturer of Glass-Fused-to-Steel bolted tanks and silos. However a structure is ONLY as good as its installer. It is therefore important to ensure that your structure is installed in accordance with the manufacturer's guidelines.

As a dedicated supplier of Glass-Fused-to-Steel products, Permastore prides itself on its excellent reputation and therefore takes its commitment to appoint suitably skilled distributors very seriously. Permastore operates through an extensive and highly experienced distributor network which reaches all regions of the world. Each distributor has been thoroughly trained on the correct methodology of achieving high quality installations of bolted steel tanks. Please see our website for our distributor locator. http://www.permastore.com/distributors/

Our Global distribution network makes **PERMASTORE®** No 1 or 2 in every market we operate in



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WHY CHOOSE PERMASTORE® TANKS & SILOS

The recognised market leader in glass enamel and coating systems available globally

A Company who is proven to be dedicated to development and product innovation

The only manufacturer whose product is independently quality audited to 100% zero discontinuity (defect free at test voltage*)

We are the only manufacturer who, since 1986, has had the confidence and reputation to publish full detailed Independently audited quality standards on all of our glass grades

The recognised technical leader in the field who has consistently led within the premium Glass-Fused-to-Steel tank and silo sector

The most extensive and experienced distributor network in the tank and silo market globally

CHOOSE THE RIGHT PARTNER CHOOSE PERMASTORE!!

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**All specifications relate to contact surfaces*