AQUASTORE®
Tanks & Domes
Glass Tanks with a Heart of Steel™

Information Bulletin

Estimating Tank Service Life Made Perfectly Clear

When conducting a life cycle cost (LCC) analysis for a storage tank, estimating the life expectancy of the tank is very important. Life expectancy affects the period of evaluation, salvage value and ultimately the total life cycle cost. There are several different ways of reliably estimating tank life. A recent article by Mr. Bill Neighbors in the July 2010 Water and Wastes Digest titled "Specify Wisely" is one method, purely the **opinion** of one supplier, that appears to lack substantiated third-party accreditation.

The table below (Figure 1) from the "Specify Wisely" article describes a concept called PDT (Plate Design Thickness) to estimate tank life, but does not detail how PDT is calculated and does not reference any third-party independent source that recognizes the PDT methodology. The table implies that several noteworthy standards organizations estimate tank life using PDT. These organizations do not reference this PDT methodology in the standards noted in the table.

Figure 1

Design Code	Construction Type	LIQ Fusion 7000 FBE Tanks		Other Coated Tanks		Glass/Vitreous Enamel Tanks	
		PDT*	Service Life**	PDT*	Service Life**	PDT*	Service Life**
AWWA D102	Bolted	40-	60-80+	30+	40+	30+	30-40
AWWA D100	Welded	N/A	N/A	40+	60-80+	N/A	N/A
FM 4020	Bolted, Welded	40+	60-80+	30+	40+	30+	30-40
FM Principles	(not a valid listing)	N/A	N/A	10+	10-15+	N/A	N/A
NFPA-22	Bolted, Welded	40+	60-80+	30+	40+	30+	30-40
AISC	Bolted, Welded, Hybrid	40+	60-80+	20+	20-30+	25+	25-30+
EN 15282	Bolted - Glass Coated	N/A	N/A	N/A	N/A	25+	25-30+
API 650	Welded	N/A	N/A	40+	60-80+	N/A	N/A

* PDT: Plate design thickness in years. A function of steel tank design.
**Service life in years: A function of periodic maintenence and coatings.

Source: Water and Wastes Digest; July 2010

The article implies that one should only use plate thickness as a reliable method for estimating tank life. Plate thickness is only one potential factor that should be used in an analysis. Plate thickness can have some bearing on the service life of tanks that undergo attack from a failure in the paint or coating system. It is important to remember that every time a tank is sandblasted in preparation for repainting, plate thickness can be jeopardized.

Plate thickness has much less impact on the service life of tanks that utilize field proven coating systems that are truly fused to the steel plates such as glass-fused-to-steel technology. A properly coated sheet, incorporated into a professionally engineered tank design, does not rely on the thickness of the plate alone for maximum longevity.

None of the standards listed in the above table reference the term PDT and many of the standards listed do not even address tank service life. One exception is EN 15282 (also known as ISO 28765), which actually addresses and defines terms like design life, service life, etc. through direct references to the ISO 15686-1 standard (Building and Constructed Assets – Service Life Planning – Part 1: General Principals). ISO 15686 is a comprehensive guide to service life planning and estimating and provides defined methodologies for calculating service life published by a reputable, well respected, third-party standards organization.

The ISO calculation starts with Reference Service Life (RSL). RSL is the service life that a structure would expect in a certain, reference set of in-use conditions. Factors relating to the quality of the structure components, the design level of the structure, the work execution level, the interior operating environment, the exterior environment, the in-use operating conditions and finally the maintenance levels anticipated are then applied to the RSL.

The following table (Figure 2) provides an overview of a typical analysis under ISO 15686 as it relates to AWWA D103, a widely accepted standard for water storage tanks with glass-fused-to-steel coating technology.

Figure 2

ISO 15686 Methodology for Determination of Estimated Service Life			Relevant Conditions				
			To include:	Poor (0.8)	Assumed Reference (1.0)	Good (1.2)	Rankings
Inherent quality characteristics	A	Quality of Components	Material type and/or grade	Not to AWWA D103	Meets AWWA D103	Exceeds AWWA D103	Glass = 1.0
			Durability features – e.g. protection system - coatings	Less than AWWA D103	Meets AWWA D103	Exceeds AWWA D103	Glass = 1.2
	B	Design Level	Details of construction e.g. joints, fixings, etc.	Less than AWWA D103	Meets AWWA D103	Exceeds AWWA D103	Glass = 1.0
	C	Work Execution Level	Factory quality systems, site work programs	Not ISO 9001, No ability to repair site changes or damage	Not ISO 9001 (not required by AWWA); site changes & damage able to be repaired	ISO 9001; all site changes & damage able to be repaired	Glass = 1.2
Environment	D	Interior environment	Special features – e.g. condensation, immersion, etc.	Accelerated effect from interior environment	Moderate effect from interior environment	Limited or reduced effect from interior environment	Glass = 1.0
	E	Exterior environment	Special features – e.g. marine, polluted, acid rain, etc.	Accelerated effect from exterior environment	Moderate effect from exterior environment	Limited or reduced effect from exterior environment	Glass = 1.2
Operation Conditions	F	In-use conditions	Special features, e.g. vandalism	Difficult to repair	Moderate effort to repair	Easy to repair	Glass = 1.2
	G	Maintenance Level	Cyclical, including quality & level required	Frequent, costly	Moderate	Limited and low cost	Glass = 1.2

The formula from ISO 15686 to calculate the Estimated Service Life (ESL) is

$$ESL = RSL \times A \times B \times C \times D \times E \times F \times G$$

where A, B, C, D, E, F, G refer to the scores from the chart above, and the RSL is based on actual in-use experience or projected life from testing protocols. A recent survey of glass-fused-to-steel tanks showed that **over 95% of the 800+ glass-fused-to-steel tanks that were erected over 20 years ago and over 30 tanks that were erected over 30 years ago are still in service.** Based on this data from actual field installations, an RSL of 40 years for glass tanks is justifiable. The calculation for ESL for a glass-fused-to-steel tank is then

$$\mathbf{ESL}_{\text{Glass}} = 40 \times 1.0 \times 1.2 \times 1.0 \times 1.2 \times 1.0 \times 1.2 \times 1.2 \times 1.2 = 99 \text{ years (a 2.488 multiple on RSL)}$$

Using this recognized, third-party process for estimating **a tank life of 99 years for a glass-fused-to-steel provides a dramatically different perspective** than the unreferenced method described in the "Specify Wisely" article. The ISO based approach allows the user to compare different products and derive their own views of relative merits. The ISO based method is an example of appropriate and published methodology to assist engineers and operators making important technology decisions for their water storage requirements.

The values used to estimate tank service life should be based on the most accurate and pertinent information available. The Government even prioritizes the sources of this data[1] with the highest reliability being derived from actual performance data of the specific product under similar, if not identical, service conditions. Some tank manufacturers claim to have superior tank service life based on a coating process with less than 5 years of actual in-service experience. They try to bolster their claims by making references to tanks manufactured by other suppliers using other coatings. The fact is that the most reliable estimation of tank service life is derived from actual installation data that truly demonstrates 20-30+ year service life.

When you are analyzing the potential tank service life of multiple coating systems, use a reputable, third-party method based on actual product performance history to help you make your decision. The results will show that **Aquastore's® glass-fused-to-steel tanks are clearly the best choice.**

References

[1] United States Government Accounting Office "GAO Cost Estimating and Assessment Guide," GAO-09-3SP, March 2009