

DESIGN LIFE, SERVICE LIFE AND ECONOMIC LIFE

This TECHnote discusses how NATSPEC uses the terms Design life, Service life and Economic life which are sometimes used interchangeably or ambiguously by others.

DEFINITIONS

0171 *General requirements* defines design life and service life as follows:

- Design life: The period of time for which it is assumed, in the design, that an asset will be able to perform its intended purpose with only anticipated maintenance but no major repair or replacement being necessary.
- Service life: The period of time that an asset will meet the documented performance requirements.

These are the only two terms relating to the lifespan of an element that are used in the *Normal* style text of NATSPEC, but NATSPEC also refers to the term economic life in *Guidance* text. As it is only used in guidance, a definition for economic life is not provided in 0171 *General requirements* however, a definition would be:

- Economic life: The period of time from the acquisition of an asset to the time when the asset, while still physically capable of fulfilling its function and with only anticipated maintenance, ceases to be the lowest cost alternative for satisfying that function.

Other similar terms include asset life and useful life. See AS ISO 55000.

DIFFERENCES

The difference between design life and service life is that the latter is the actual period of time that the asset will meet its performance requirements, whereas design life is the period intended by the designer.

In principle, design life and service life should be the same, but they rarely are since the service life is dependent on factors such as the effectiveness of maintenance, operating environment, change in use and change in regulatory requirements. Effective maintenance can prolong the life of an asset beyond the life its designer intended while inadequate maintenance can lead to premature failure before it has reached its design life. Similarly, changes to regulatory requirements, such as phasing out the use of certain refrigerants, can mean that an asset can no longer function as intended despite being otherwise serviceable and functioning as the designer intended.

The definition of economic life suggested involves a different perspective: The asset still functions as intended but replacement may be a lower cost option than maintaining it because, for example, replacement parts needed to maintain it have become too expensive or there are more energy efficient alternatives with lower operating costs.

USING DESIGN LIFE AND SERVICE LIFE IN NATSPEC

Design life

Since NATSPEC is a specification for something that does not yet exist, in most instances the term used will be design life. To be meaningful and contractually enforceable, design life must be quantified in the specification. For example, 0741 *Ductwork* contains the following text:

Design life: 20 years.

Then later, it requires the following:

Nylon cable ties or nylon banding system tensioned with a proprietary device designed for the material used and which do not fail within the design life of the ductwork.

Taken together this means that nylon cable ties are required to not fail before 20 years. This is because the specifier wants not only the sheet metal to last 20 years but ancillary components like cable ties to also last that period since if they fail prematurely, they would reduce the service life of the whole ductwork system.

Where a specific design life is required, it can be documented in the relevant worksections. 0701 *Mechanical systems*, 0801 *Hydraulic systems*, 0901 *Electrical systems* and 1001 *Fire services systems* include *Optional* style prompts under the **DESIGN** clauses, intended for specifiers to address overall design life of services components and systems, if the design life of an individual services system or component is not covered in the individual services worksection. Using design life with no specific period can lead to ambiguity, and the contractor may not be required to provide the components or installation to satisfy any specific duration.

Service life

Since the service life of an asset can only be determined by considering its actual performance to date, it cannot be quantified in a specification like NATSPEC but it still has a place. For example, 0792 *Mechanical maintenance* requires that the contractor:

Maintain the mechanical systems for the documented maintenance period so that the performance and service delivery including indoor conditions and indoor air quality, reliability, service life, compliance with statutory requirements, energy efficiency and safety of the system is equal to or better than that at the beginning of the maintenance period . . .

That is, the maintenance must not diminish the service life.

Design life resources

Sources of design life values include:

- Standards such as AS/NZS 1170.0 provide a range of design lives (referred to as design working life in the standard) depending on application. This can vary from short for construction equipment to over 100 years for some critical structural elements. Some other standards dealing with design life include AS 2159, AS/NZS 2327, AS 3600 and AS 5100.5.
- Reference material. For example:
 - For HVAC equipment reference materials include AIRAH DA19 Table 2.1 (which refers to 'Economic (service) of Equipment'). ASHRAE provides a *Service Life and Maintenance Cost Database* (costdatabase.ashrae.org/default.asp) that can be used to obtain design life values based on data from hundreds of buildings and tens of thousands of equipment items installed in the US.
 - For timber, see WoodSolutions 05 *Timber service life design - Design guide for durability*.
- Client brief. Clients may specify design life in their brief which may be that of available equipment.
- Project specific requirements: There are projects where the design life information for typical buildings is not relevant. For example, temporary buildings for exhibitions or construction projects may only be in use for months.

VERIFYING DESIGN LIFE

Having specified a design life, the specifier should also consider how it is to be verified since this, of necessity, needs to be done at the beginning of the project. Depending on the asset, this can include:

- Verification by reference to precedent or documented evidence.
- Verification by calculation or test, for example:
 - AS/NZS 4654.1 Table A4 includes a heat aging test for waterproofing membranes.
 - Accelerated wear tests to AS 4586 can be carried out to determine the long-term performance and changes to slip resistance for pavers and tiles.