RemLife™

High Temperature Creep, Fatigue and Creep-Fatigue Life assessment and Economic Viability Simulator

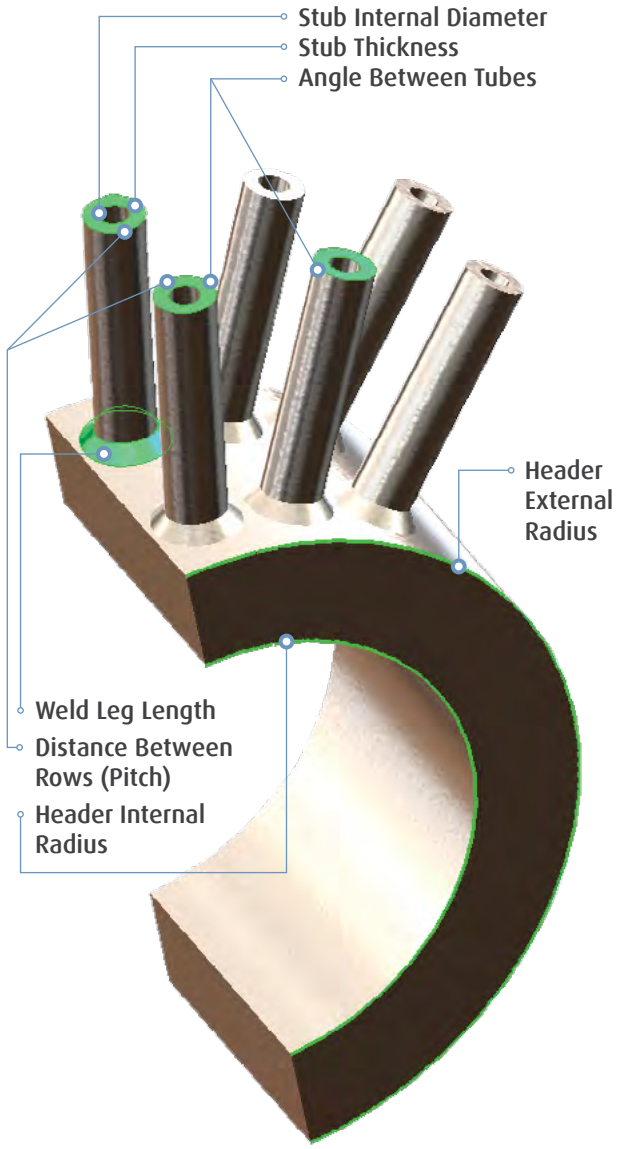
ALS RemLife™ asset integrity service approach.

Minimising risk and maximising reliability to deliver optimal productivity and asset returns are key goals for asset management. In Power and Process industries determining the remaining life of plant components plays a key role in effective asset management.

RemLife™ software is utilised by ALS engineers to perform rapid, cost effective and accurate remaining life assessments. This provides an understanding of the plant/component condition and damage caused by base load operation and cycling based on pressure, temperature and transient conditions. The ALS RemLife™ approach delivers outcomes superior to a Level 2 EPRI defined life assessment for creep rupture and creep fatigue.

The assessment of creep and fatigue damage and associated costs can be estimated for different operating regimes. This gives users the ability to rapidly run different load profiles and shifting strategies to gauge the impact on individual components and the plant as a whole.

The ALS RemLife™ approach enables asset managers to optimise asset productivity and maximise life-cycle profitability for their plants.



Remaining life assessment and cycling of plant within the Power Industry

Due to changes in demand and competition, many coal-fired plants and combined cycle gas plants are now subject to two-shift operation, load following and/or part-load running and higher operating conditions. A feature of two-shift operation is that units, once they are running at close to design output, are expected to respond rapidly to load changes on the system, thus ensuring that the grid maintains the specified frequency and voltage.

The rigorous demands imposed by load-varying operations in competitive markets, asset managers need to quantify the incremental costs of cycling generating units to ensure profitability and to better select, run, and upgrade production units. Furthermore, technical, operations, and maintenance staff need to understand, plan, and react to the complex nature and interaction of equipment, processes, and failure modes brought on by cycling.

Components and plant within other industries

The ability to break down complex plant into simple components enables RemLife™ to be utilised effectively in various other process industries where creep, low cycle fatigue and creep-fatigue may occur. This can include components such as refinery heaters, reactors, reformers, coker's etc.

High Temperature Creep, Fatigue and Creep-Fatigue Life assessment and Economic Viability Simulator utilising RemLife™ Software

RemLife™ software enables ALS Engineers to perform quick and accurate life assessment analyses of high temperature, high pressure industrial plant components. The Software is designed to breach the gap between "back of the envelope" calculations for base rupture and fully detailed finite element analysis for creep-rupture and combined creep-fatigue analysis. It enables a quick screening approach to see which plant components are at risk due to their past and planned future operating regime as well as a detailed approach for components which are determined to be at risk. Future operational regimes can be rapidly assessed and their impact on the component calculated.

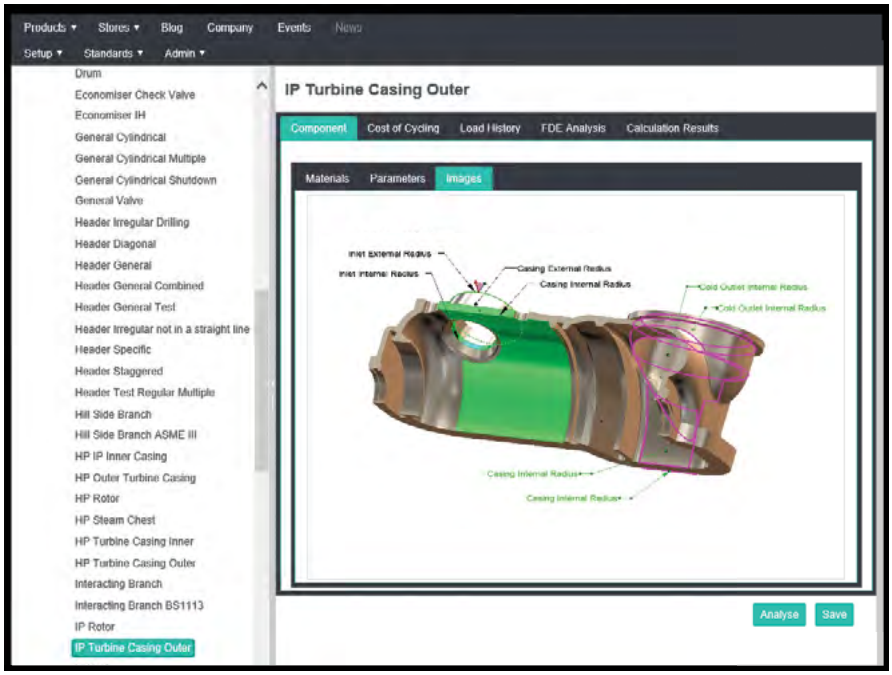
The RemLife™ software uses a combination of methodologies to calculate both the base rupture damage as well as the cyclic damage due to start-ups and shutdowns. This is achieved under the guidelines of the British Energy-R5/R6 assessment code, based on time fraction, ductility exhaustion, and strain energy density exhaustion. A number of international design standards are used for the calculations of primary and secondary stresses. These are based on the use of analytical expressions for the determination of thermal stress, using an analytical expression for metastable thermal stresses and mapped thermal stress response.

RemLife™ – High Temperature Remaining Life Economic Viability Module – is a simulator that allows the effects of unit cycling on both the damage sustained by the equipment and the economic benefits or not of the chosen cycling regime to be studied.

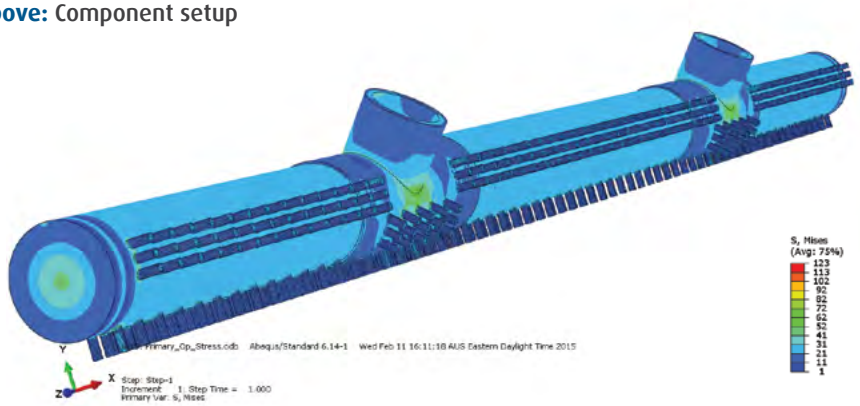
The principal factors to be considered during cyclic operation are:

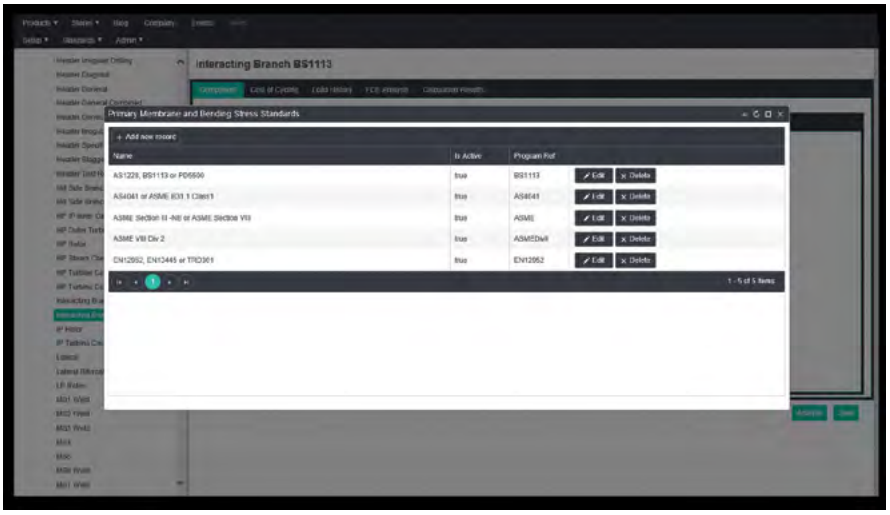
- Increased capital spend for component replacement;
- Increased routine O&M cost from higher wear and tear;
- Lower availability due to increase in failure rate and increased outage time;
- Increased fuel cost from reduced efficiency and non-optimum heat rate.

This gives the ability to rapidly run different load profiles and shifting strategies to gauge the impact on individual components and the unit as a whole.



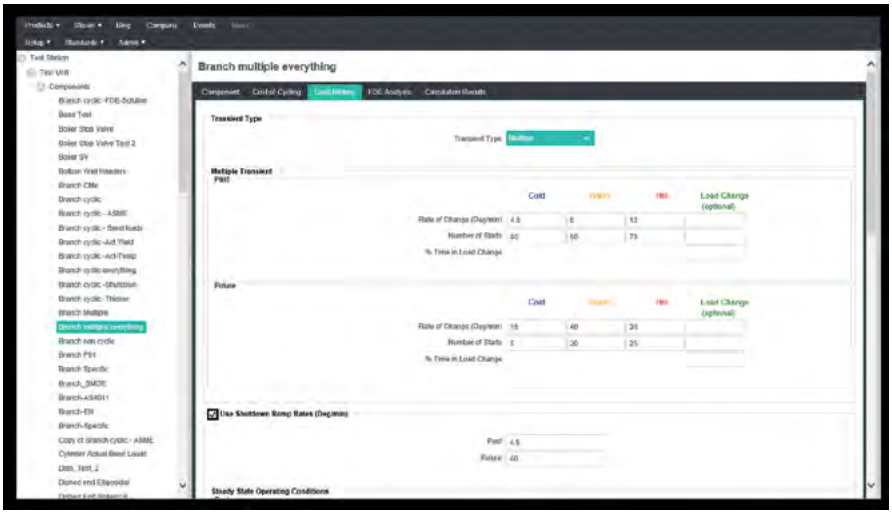
Above: Component setup



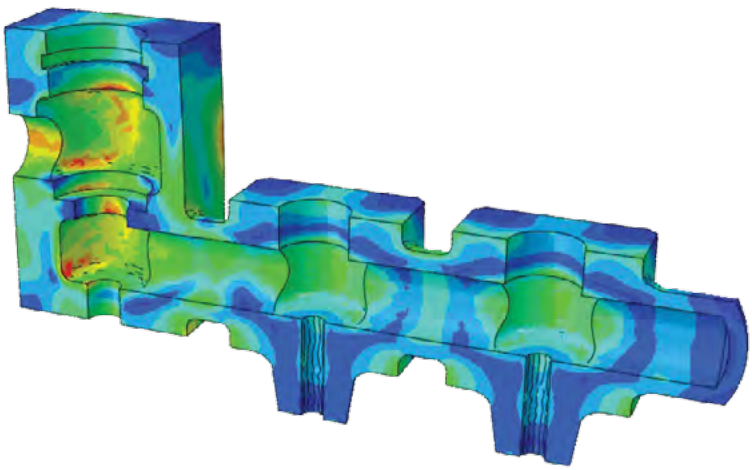


Above: Primary Membrane and Bending Stress Standards

Above: Materials and Properties



Above: Load history



Primary and Secondary Stresses

Stress calculations can be performed utilising the following codes or via Finite element analysis:

- AS4041
- AS1228, BS1113
- BS5500
- EN12952
- EN13445
- ASME III NB-NC
- ASME B31.1
- ASME VIII
- TRD301

Creep-Fatigue Calculations

Utilise the methodologies supported by following approaches:

R5-R6, API579 and RCC-MR:

- Time Fraction Approach
- Ductility Exhaustion
- Strain Energy Density Exhaustion

Extensive Material Library

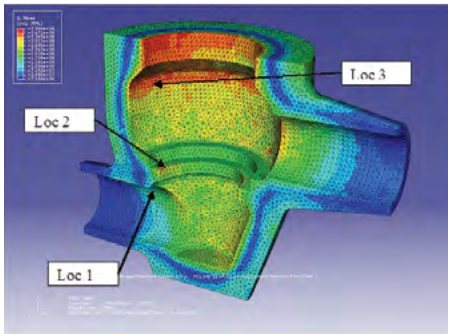
Detailed materials properties are available for a range of materials. The database contains extensive properties for each material including:

- Elastic and physical constants
- Monotonic tensile data
- Criteria for insignificant creep
- Distinction between creep brittle and creep ductile material
- Creep rupture data
- Shakedown factors
- Continuous cycling (fatigue) data
- Stress relaxation data
- Creep ductility data

RemLife™ Calculations

The following calculations are typically performed as part of the assessment study:

- Determine the loading history
- Calculate metastable thermal stresses
- Determine the cyclic stress-strain deformation loops
- Obtain creep-fatigue endurances
- Calculate the total creep-fatigue damage
- Assess whether crack initiation will occur
- Calculate economic consequences of cyclic damage



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Have absolute confidence in your assets and talk to our RemLife™ specialists about your next project:

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