



FITNESS FOR SERVICE (FFS) EVALUATIONS

Avoid costly repairs and shut-downs of pressure equipment by using FFS evaluations

What is fitness for service (FFS)?

Fitness for service is defined as the ability to demonstrate the structural integrity of a damaged component while keeping the component (e.g. piping or pressure vessel) in service.

If you have experienced critical thickness reduction on a pressure vessel due to corrosion or erosion shortly before putting the equipment back into production, you will appreciate the value of a swift FFS evaluation.

FFS evaluations include:

- Identification of flawed and damaged mechanisms
- Evaluation of damage degree
- Acceptance criteria for fitness for service

Techniques and acceptance criteria:

- Remaining life evaluation incl. establishing an inspection interval
- Remediation methods

- In-service monitoring

Tools and experts needed for FFS

A thorough and quick FFS evaluation is based on the availability of a number of tools and a number of experts who are ready to perform their part of the evaluation. Ramboll Oil & Gas is able to supply software tools and experienced personnel.

Tools include:

- Vessel software
- Piping stress software
- Calculation software for API 579/ASME FFS-1

Experts include:

- Corrosion engineers
- Vessel design engineers
- Piping stress engineers
- FFS experts
- Welding/NDT engineers

Making the right decision quickly

In order to get your equipment

back on stream, the speed of decision making is vital. Down-time is costly in most industries. FFS evaluations allow for swift decision making; Can the equipment remain in service? Can / shall we repair the equipment? Is replacement equipment needed?

Alternative options to replacement or repair include:

- Reevaluation of corrosion allowance according to API 579/ASME FFS-01
- De-rating system pressure
- A combination of the above

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STRUCTURAL ENGINEERING FOR PRESSURIZED EQUIPMENT

Various design codes and standards for pressurized equipment provide rules for the design, fabrication, inspection and testing of new pressure vessels, piping systems and storage tanks. These codes do not address the fact that equipment will degrade while being in service. Any degrading is usually found during subsequent inspections in-service (as RBI) or at planned maintenance inspections or shutdowns.

The API 579 RP is a recognized standardization and provides guidance for conducting of fitness for service assessment techniques for pressurized equipment used in the oil industry. The guidelines provided in this recommended practice can be used to make run-repair-replace-rerate decisions to help ensure that pressurized equipment containing flaws, which have been identified by inspection, can continue to operate safely.

Ramboll's FFS competence

Ramboll has considerable experience with fitness for service evaluations working as a consultant for various clients. We have evaluated various vessels and piping systems, and we can assist in creating a contingency plan before inspections that will increase the speed of decision making.

Inspections reveal flaws

Inspections may reveal that the wall thickness in corroded/eroded areas does not fulfil the specified minimum requirements for wall thickness for the vessel or piping. When applying norms and codes such as ASME VIII, PD5500 or B31.3 for checking the pressurized equipment in its damaged situation, it is quite common to replace the equipment or take it out of service for repair. The fitness-for-service assessment can avoid this.

Expertise in working with API 579/ ASME FFS-1

Ramboll has software for vessel calculations and piping calculations including a catalogue of many of the special API 579 calculation levels. Among our employees we count vessel and piping design engineers, material experts, welding engineers, corrosion specialists etc.

Run, repair, replace decisions

Ramboll offers the opportunity to make a structured, verified evaluation, resulting in a run-repair-replace decision for equipment in order to:

- Ensure structural integrity and safety when having older equipment continuous to operate
- Furnish consistent life prediction
- Optimize maintenance and operation of existing facilities (e.g. establish monitoring/inspection programs re-rate the component)
- Maintain availability of older equipment
- Enhance long-term economic

viability

This evaluation approach is especially relevant for operators of pressure vessels, piping systems and tankages and for maintenance engineers.



LEFT

Corrosion found to be 1 mm below min. wall thickness. The FFS evaluation postponed the repair until next planned shut down.

RIGHT

Corrosion in piping system min. thickness of 1.2 mm below min. wall thickness. By FFS evaluation, the repair was postponed until next planned shut down.