framatome

AFA 3G

A Globally Proven PWR Fuel Assembly Design

The most used fuel assembly design in pressurized water reactors (PWRs) worldwide

Challenge

Growing pressure to maximize fuel efficiency whilst increasing burnups to meet industry demands is making PWR operations considerably more complex. This is compounded by demands to extend plant lifetime. Finding an advanced and modern solution to fulfill these requirements, which is equally based on a proven design with sufficient operational feedback, presents a considerable challenge.

Solution

Our AFA 3G design provides a comprehensive solution to these challenges. As such, it is the most used PWR fuel assembly design worldwide.

At Framatome we are constantly upgrading our AFA 3G design family to find the most advanced solution to the latest safety, economic and operational challenges. Our experience with AFA 3G design includes 76 PWRs across the globe. This vast experience and operational feedback is used to further optimize the AFA 3G design.

AFA 3G helps meet your plant lifetime needs

Our AFA 3G fuel assemblies provide the higher burnups required in the industry as a result of the $M5_{Framatome}$ cladding and the Q12 structural material, whilst maintaining their robustness.

In addition, the thermal-hydraulic performance of the AFA 3G fuel assemblies has been improved. This is largely achieved thanks to the mid-span mixing grids, which provide greater mixing at mid-span elevation, meaning fuel efficiency in plants can be maximized.

AFA 3G fuel assemblies are available for 17x17 PWRs in different lengths (12 and 14 feet), as well as for EPR reactors and 15x15 PWRs. They can be operated with both mixed oxide fuel and enriched reprocessed uranium.

Customer benefits

- Cost savings through greater plant efficiency due to improved thermal-hydraulic performance
- Highest standards derived from vast experience worldwide with the AFA 3G design family
- Greater plant reliability at high burnups due to high quality fuel assembly components and advanced materials
- Greater performance during fuel assembly handling operations due to improved spacer grid design, which rules out hang-up issues

Your performance
is **our** everyday **commitment**

Technical information

High-burnup $M5_{Framatome}$ fuel rods

$M5_{Framatome}$ presents greater reliability at higher burnups due to its low-oxidizing nature. $M5_{Framatome}$ also significantly outperforms several other zirconium alloys under loss-of-coolant accident conditions, reducing the potential impact on operational limits due to burnup oxidation limits.

Improved grid

AFA 3G grids increase handling performance and contribute to fuel assembly bow reduction. The geometry of the outer strap guide vanes has been optimized and their strength boosted by extensions at the inner straps' ends, guaranteeing vane geometrical stability in case of interaction. Motion limiters have also been implemented to limit inward motion of the peripheral rods under external loads and so to reduce the geometrical interference between grids of adjacent assemblies.

Mid span mixing grids (MSMGs)

Framatome MSMGs, which have an advanced coolant mixing function, improve the thermal-hydraulic performance of the AFA 3G design. These MSMGs are made from recrystallized $M5_{Framatome}$ alloy strips and feature half-button type dimples to avoid fuel rod contact with the mixing vanes, which are connected to the guide thimbles by tabs stamped from the strips.

Anti-debris bottom nozzle

The anti-debris bottom nozzle on the AFA 3G design ensures the efficient operation of the fuel assembly. Thanks to its anti-debris filter, the bottom nozzle allows any debris to be trapped, which alternatively would damage the FA.

Q12 alloy

Guide thimbles provide improved resistance to creep, enhancing the performance against fuel assembly bow. Q12 will also be implemented on all 14 ft AFA 3G spacers.

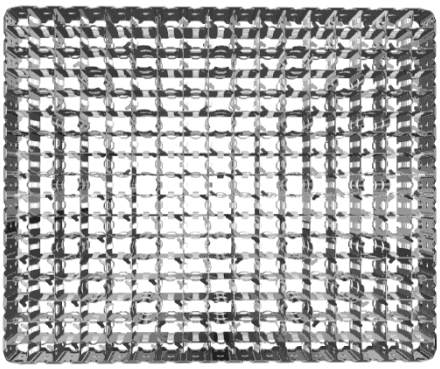


Fig 1. AFA 3G mixing grid

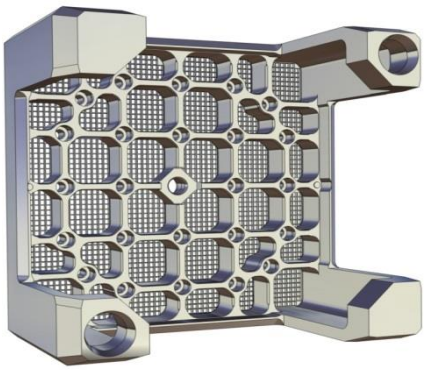


Fig 2. Anti-debris bottom nozzle

Key figures

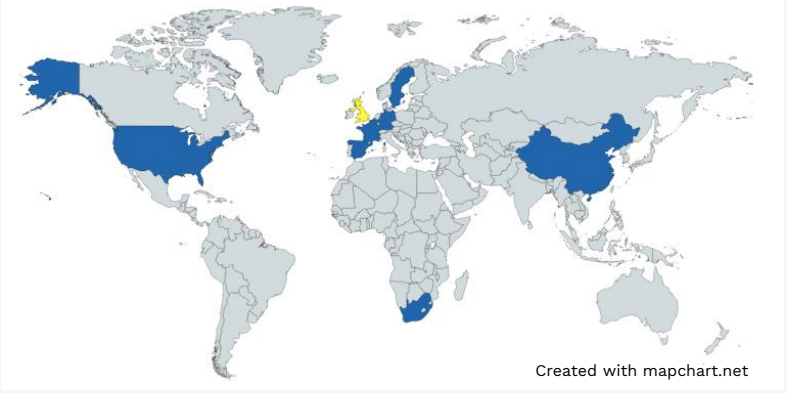
1996 Year of the first AFA 3G reloads

38,700 AFA 3G fuel assemblies irradiated by the end of 2019

63 GWd/t fuel assembly burnup achieved

References

- Belgium
- China
- France
- Germany
- South Africa
- Spain
- Sweden
- US
- UK (planned)



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