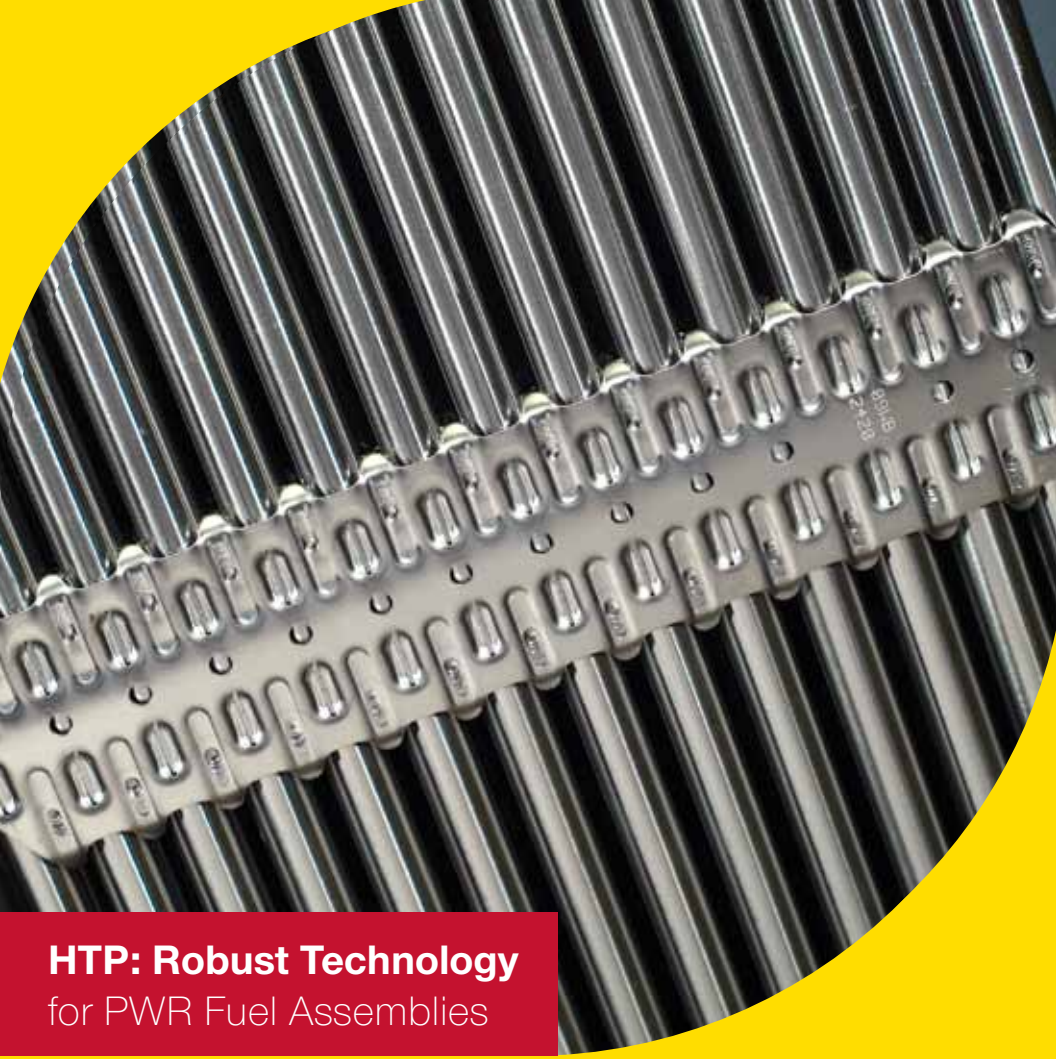
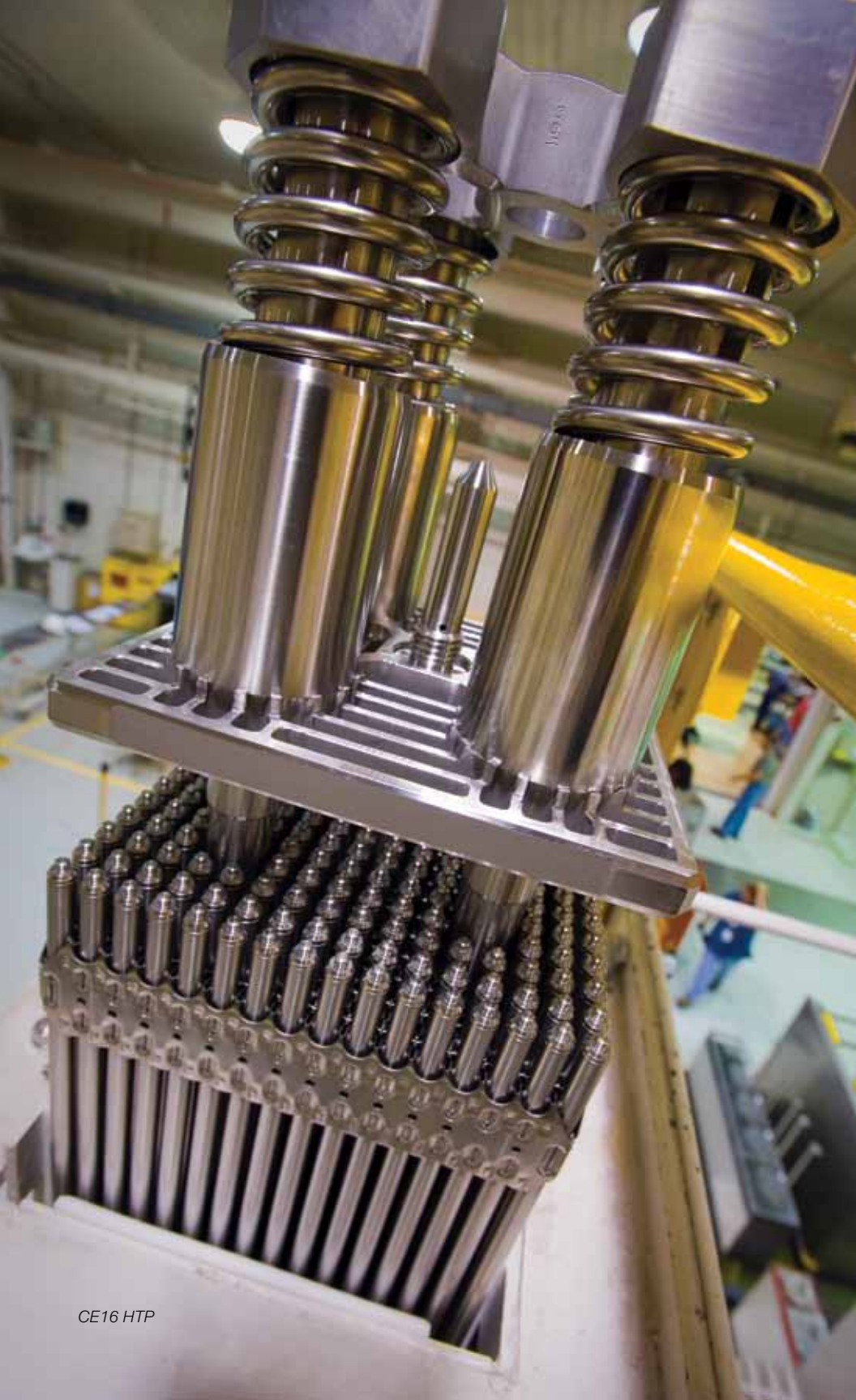


HTP: Robust Technology
for PWR Fuel Assemblies

AREVA



CE16 HTP

Reliable fuel. Efficient fuel. Robust fuel.
We know what's important to you.

The HTP platform for PWR fuel provides universally proven reliability and robustness for every PWR lattice type in the United States. Globally, over 13,500 HTP fuel assemblies have been loaded into 45 reactors, with nearly half of these assemblies in the U.S. With a maximum achieved fuel assembly burnup of 70 GWd/mtU, the operating performance of HTP fuel is exceptional. And, HTP fuel is being universally applied to meet the challenges of the industry's most severe fretting environments, such as the Babcock & Wilcox 15x15 and Combustion Engineering 14x14 reactors.
Reliability and robustness = confidence you can count on.

Benefits

Experience you can count on – Over 13,500 fuel assemblies loaded globally

Performance you can count on – No fretting failures when used with HMP bottom end grid

Protection you can count on – FUELGUARD™ reduces the risk of unexpected outages due to debris-related failures at internal rod locations

CE14 HTP

HTP Spacer Grids

Unique. Innovative. The HTP spacer grid design combines fuel rod support and coolant flow mixing in a single component. The line-contact fuel rod support ensures a large contact area to provide the optimum resistance to grid-to-rod fretting (GTRF). This line-contact support provides the protection needed to confidently guard against fuel failures. Plus, the curved flow channels create a vortex flow pattern to increase coolant mixing and improve thermal-hydraulic (T/H) behavior.

Intermediate Flow Mixers

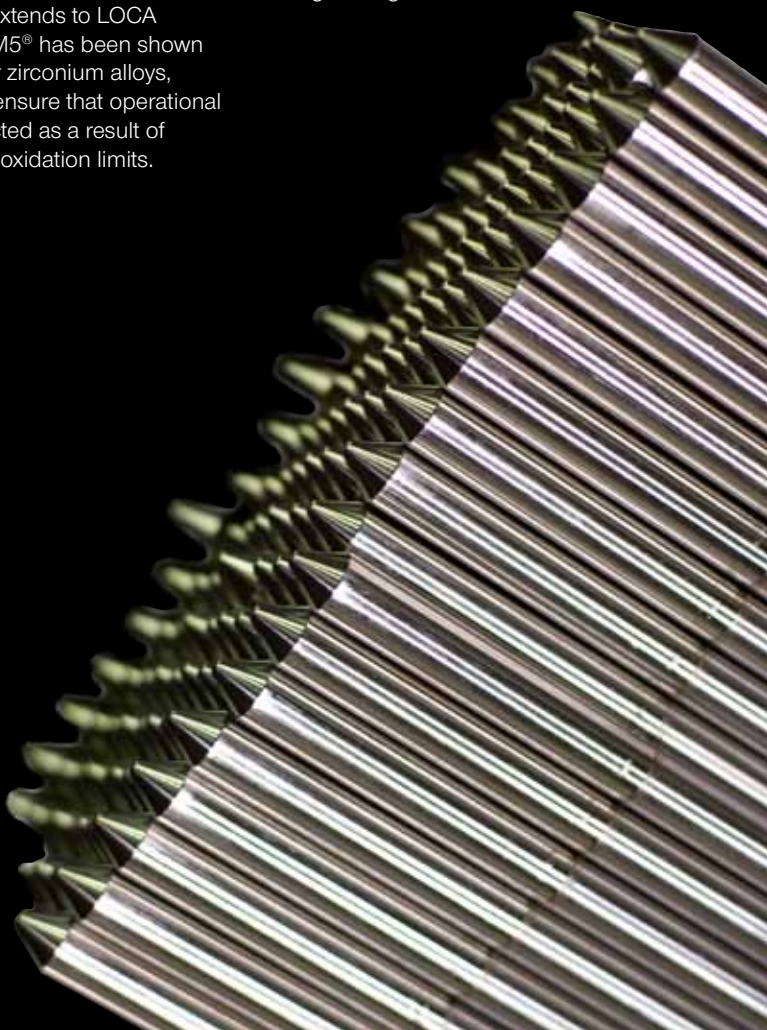
Intermediate Flow Mixers (IFMs) incorporate the same design concept as the HTP intermediate spacer grids. IFMs are available in select designs to improve T/H performance and help ensure optimal fuel efficiency and minimal fuel cycle costs.

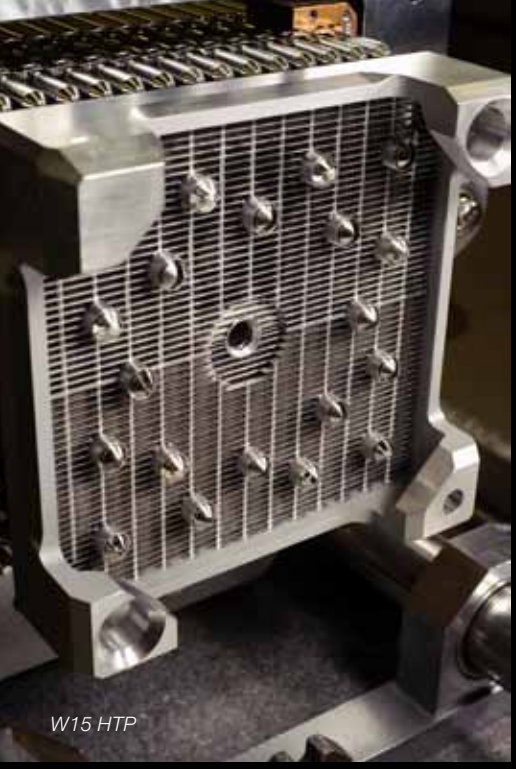
High Burnup Fuel Rods

M5®, AREVA's standard fuel rod cladding, is anything but standard. In fact, more than three million fuel rods having M5® cladding have completed their operation or are operating in 12,528 fuel assemblies in 79 commercial reactors worldwide since 1993. Ensuring significant margins with regard to corrosion and hydriding under demanding duty, high burnup, and stringent water chemistry conditions, M5®, an advanced zirconium alloy, introduces a unique combination of both chemistry and material processing that yields extraordinary behavior. Relative to other zirconium alloys, M5® is a low-oxidizing alloy with a low hydrogen pickup factor — meaning less embrittlement and greater reliability at higher burnups. This exceptional performance also extends to LOCA conditions, where M5® has been shown to outperform other zirconium alloys, thereby helping to ensure that operational limits are not impacted as a result of burnup-dependent oxidation limits.

HMP Bottom End Grid

Worried about fretting failures in your fuel assemblies? The worrying stops here with the HMP end grid. In fact, there have been no known fretting failures in fuel assemblies that are designed with the combination of HTP intermediate spacer grids and HMP end grids. Complementing the HTP intermediate spacer design and increasing the resistance to grid-to-rod-fretting failures, the HMP spacer grids are built from the same design concept as HTP, but fabricated from Alloy 718. The HMP spacer grid has enhanced strength and relaxation characteristics and straight (non-mixing) flow channels, making this spacer grid ideal for supporting the fuel rods with increased margin against flow-induced vibration and resulting fretting damage.





W15 HTP

Robust FUELGUARD™

FUELGUARD™ has been in use since 1988 to trap debris and has been loaded onto over 8,000 PWR assemblies. Providing a “no-line-of-sight” flow path for the coolant that is very effective at trapping debris, FUELGUARD™ is a proven solution to eliminating debris-related fuel failures. The bottom nozzle design has shown a level of robustness making it resistant to impact damage by large pieces of debris. Larger particles are trapped by the close spacing of the blades while long linear particles (wires, pins, etc.) are trapped by the curved path through the filter blades. Since its introduction, no debris-related failures have been known to occur at internal rod locations on an assembly using FUELGUARD™.

MONOBLOC™ Guide Tubes

MONOBLOC™ guide tubes have a single outer diameter with a reinforced dashpot. The added thickness of the MONOBLOC™ guide tube increases the lateral stiffness of the fuel assembly, thereby yielding a more robust assembly that resists twist and bow. MONOBLOC™ has been in use since 1998 and has been irradiated on over 27,600 fuel assemblies worldwide. In its application, MONOBLOC™ has had a measurable effect in improving control rod drop times and reducing fuel assembly distortion.

W15 HTP

Welded Structure

The HTP platform is built around a welded structural cage where intermediate spacer grids and IFMs are directly welded to the fuel assembly guide tubes. The HMP bottom end grid is also tightly captured by rings that are directly welded to the guide tubes. This direct coupling between grids and guide tubes results in the stiffness and robustness required to endure handling and resist fuel assembly bow and twist.

Reactor Types Supported by HTP

Babcock & Wilcox
15x15

Combustion Engineering
14x14
15x15
16x16

Westinghouse
14x14
15x15
17x17

Mark-B HTP

AREVA supplies solutions for carbon-free power generation. Its expertise and know-how in this field are setting the standard, and its responsible development is anchored in a process of continuous improvement.

As the global nuclear industry leader, AREVA's unique integrated offer to utilities covers every stage of the fuel cycle, nuclear reactor design and construction, and related services. The group is also expanding considerably in renewable energies – wind, solar, bioenergies, hydrogen and storage – to be one of the top three in this sector worldwide in 2012.

Every day, AREVA's 48,000 employees cultivate the synergies between these two major carbon-free offers, helping to supply safer, cleaner and more economical energy to the greatest number of people.

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Energy is our future, don't waste it!

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