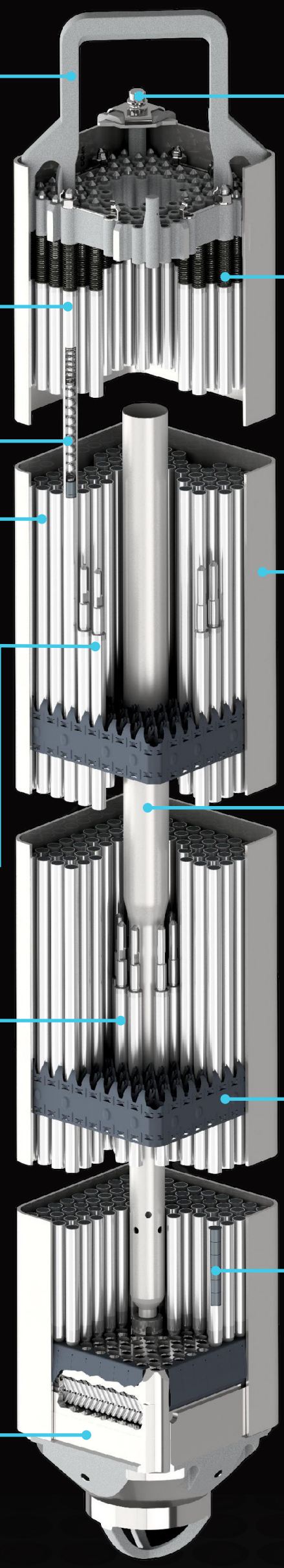
GNF3



UPPER TIE PLATE

The upper tie plate fixes the top end of the fuel rods into the appropriate position, supports the channel and provides a handle by which the bundle can be lifted and moved. The upper tie plate is specifically designed to minimize flow resistance.

TIE ROD

Eight tie rods located on the peripheral edges of the fuel bundle are similar to standard fuel rods, except for their threaded end plugs. These tie rods hold the upper and lower tie plates into their position in the bundle structure.

RETAINER SPRING

These springs are located within each fuel rod at the top of the pellet column. The retaining force provided by these springs prevents pellet movement during shipment to the reactor site.

FUEL ROD

GNF3 bundles consist of fuel rods arranged in a 10x10 array (with some of the rods removed to provide space for the water rods). Each rod has fuel pellets contained within zirconium alloy cladding and capped with zirconium alloy end plugs. The cladding outer surface transfers the fission energy to the coolant. The fuel rod also contains the radioactive fission products released by the fuel pellets. The pellets have various U235 enrichments distributed among the fuel rods to optimize the distribution of power within the bundle for most efficient fuel usage.

LONG PART-LENGTH FUEL ROD

Long part-length fuel rods are strategically located near the peripheral sides of the 10x10 fuel rod matrix to reduce the two-phase pressure drop for improved thermal/hydraulic performance and cold shutdown margin.

SHORT PART-LENGTH FUEL ROD

Short part-length fuel rods are strategically located adjacent to and beneath the smaller diameter portion of the axially varying water rod to optimize thermal/hydraulic performance and reactivity margins. The multiple lengths improve the ratio of fuel to moderator to compensate for steam generation.

LOWER TIE PLATE WITH DEFENDER PLUS® DEBRIS FILTER

The lower tie plate fixes the position of the bottom end of the fuel rods and supports the bundle weight. Its bottom end centers the bundle in the core fuel support (i.e., ensures the bundle properly sits in the core) and it provides the entrance for the coolant flow into the bundle. The GNF3 lower tie plate is fitted with the high efficiency Defender Plus® debris filter to prevent potentially damaging debris from entering the bundle with the coolant flow.

CHANNEL FASTENER

The channel fastener attaches the channel to a post on the upper tie plate. Springs on the channel fastener interact with adjacent fuel assemblies to maintain contact with the top guide to assure proper positioning of the bundle in the core and to maintain a clear passageway for movement of the control blades.

EXPANSION SPRING

Springs at the top of each full-length fuel rod and water rod allow the constant weight of the channel and the occasional load from handling equipment to be shared by or distributed among the fuel rods while still allowing each rod to grow (or change length) independently during operation. Rods grow during thermal expansion and the effects of neutron bombardment on the zirconium alloy cladding.

CHANNEL

The axially varying channel, fabricated from pre-oxidized NSF material, surrounds the fuel bundle, protecting it and providing its structural strength. The channel is uniform thickness except the upper portion where the side walls of the channel are reduced to improve neutron efficiency. The channel provides a well-defined coolant flow path through the fuel bundle for steam generation while maintaining a controlled space between the four channels in a core cell through which the control blade is able to move into and out of the core.

WATER ROD

An axially varying water rod, where the diameter in the lower portion of the water rod is smaller than the upper portion of the water rod is fabricated from a hollow zirconium alloy tube and allows water to enter through inlet flow holes near the base and flow to the upper portions of the bundle. The water rod is designed to provide sub-cooled water to the upper portion of the bundle for improved neutron moderation and efficient use of uranium, thereby maximizing power while minimizing the required uranium enrichment. The welded tabs are used to maintain the fuel spacers at the correct elevations in the bundle.

SPACER

The primary function of the spacer is to hold the fuel rods in the proper location. The GNF3 spacer has been modified from the GNF2 design by modifying the spring design and overall height of the spacer to provide improved mechanical strength. The mixing vanes located on top of each spacer also improves fuel performance by mixing the water such that the fuel rods remain surrounded by water and untouched by vapor bubbles. This allows the bundle to operate at higher powers without losing liquid film on their outer surface which is important for cooling.

FUEL PELLET

The fuel pellets are made of high-density ceramic uranium dioxide and are stacked within the cladding tubes. The fissile uranium is the energy source that produces power through the chain reaction. One pellet, the size of a fingertip, provides as much energy as 149 gallons of oil, one ton of coal or 17,000 cubic feet of natural gas. Five pellets can meet a household's electricity need for a year.

GNF

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