GNF2

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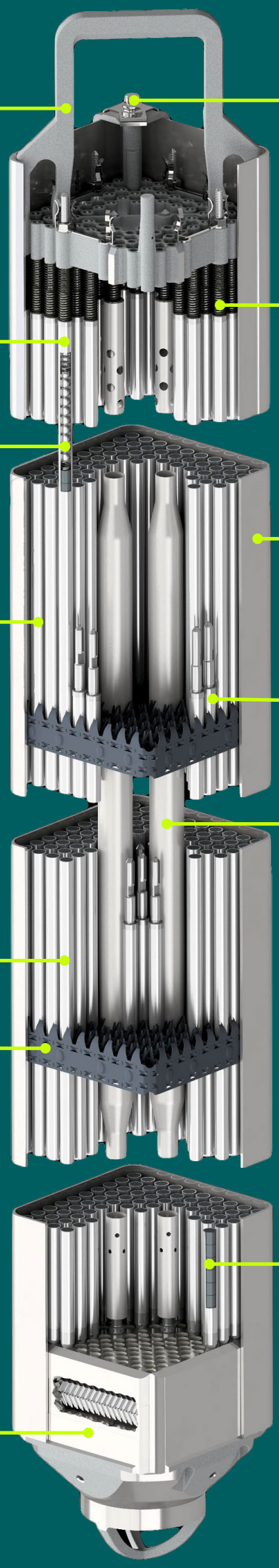

Upper Tie Plate

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

GNF2 bundles consist of fuel rods arranged in a 10×10 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.

Short Part-Length Fuel Rod

Short part-length fuel rods are strategically located to optimize thermal/hydraulic performance and reactivity margins. The multiple lengths improve the ratio of fuel to moderator to compensate for steam generation.

Spacer

The primary function of the spacer is to hold the fuel rods in the proper location. The GNF2 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 the liquid film on their outer surface which is important for cooling.

Lower Tie Plate With Defender® 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 GNF2 lower tie plate is fitted with the highly efficient Defender® 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 due to thermal expansion and the effects of neutron bombardment on the zirconium alloy cladding.

Channel

The zirconium alloy channel surrounds the fuel bundle, protecting it and providing its structural strength. The channel provides a well defined coolant flow path through the fuel bundle for steam generation and differentiates the bundle internal flow path for steam generation from the intra-assembly gap through which liquid water flows that provides for high neutron moderation. The space between the four channels in a core cell also creates the pathway through which the control blade is able to move into and out of the core.

Long Part-Length Fuel Rod

Long part-length fuel rods are strategically located within the bundle to reduce the two-phase pressure drop for improved thermal/hydraulic performance and cold shutdown margin.

Water Rod

Hollow zirconium alloy tubes, with water inlet holes near the bottom and exit holes near the top, allow water to be channeled from the bottom end of the bundle to the upper part of the bundle without boiling for improved neutron moderation. Careful sizing and location of the water rods within the bundle allow for efficient use of uranium, thereby maximizing power while minimizing the required uranium enrichment. Water rods with welded tabs are used to maintain the fuel spacers at the correct elevations in the bundle.

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 needs for a year.

GNF

Global Nuclear Fuel