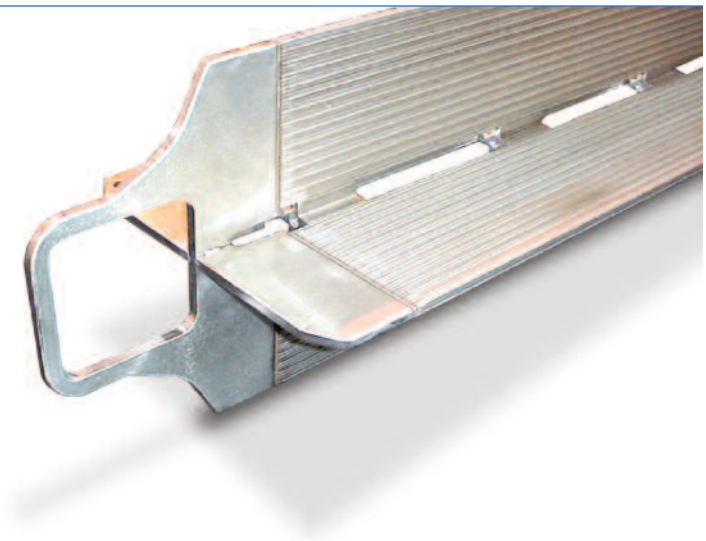
GE Hitachi
Nuclear Energy

Marathon™ Control Rods

fact sheet



Increased Operating Life

GE Hitachi Nuclear Energy's Marathon™ control rod was designed to satisfy customer needs for longer control rod lifetimes, greater mechanical design margins, and to mitigate previous control rod technical issues.

Marathon™ control rods are designed to achieve their full nuclear life without challenging mechanical integrity. All analyses confirm that nuclear considerations dictate Marathon™ control rod end-of-life before any mechanical limits are reached. The Marathon™ design is based on a high-purity, low cobalt stainless steel tube with a square outer envelope. Tubes are mated edge-to-edge vertically to form the rod's characteristic four wing cruciform shape.

The Marathon™ control rod's structural design improvements reduce both the surface area and volume of stainless steel in the irradiation zone. This reduced volume of stainless steel combined with the use of low cobalt, radiation-resistant stainless steel, reduces cobalt 60 release to the coolant. The longer control rod life reduces the number of rods that must be replaced and disposed. The overall result is less exposure to site personnel.

Low Heat Laser for High Quality Welds

An innovative dual-beam laser welding process was developed to complete more than 400 linear meters of weld in each Marathon™ control rod. Two focused Nd: YAG laser beams simultaneously weld both sides of the control rod in a proprietary weld sequence at speed greater than 3 meters/minute. The laser beams, with their extremely low heat input and fiber optic delivery path, are positioned by an automated laser guided tracking system that places the .4mm beam within +/- .02 mm of the weld centerline between each square tube, resulting in high quality autogenous welds with negligible tube distortion.

Each tube is a pressure boundary for its neutron absorber material. The absorber tube corners protrude beyond the tube's cylindrical pressure boundary to provide a flat wear surface for the rod. The choice and quantity of absorber material determine the rod's initial worth and lifetime capability.

After the absorber is loaded into the tubes, they are backfilled with helium and end plugs are welded in place. The integrity of the end plug welds is verified by helium leak checks. With the upper handle and lower velocity limiter attached, the finished control rod is once again helium leak checked. Most importantly, the design is single-failure proof, where by the interior tube volumes are isolated from each other.

Benefits

- Extends operating life
- Improves resistance to stress corrosion cracking
- Adds design flexibility
- Reduced radiation exposure to site personnel
- Enhances ALARA improvements

Features

- Designed to achieve their full nuclear life without challenging mechanical integrity
- Low cobalt, radiation-resistant stainless steel tubing
- Greater mechanical design margins

For more information, contact your GE Hitachi Nuclear Energy sales representative or visit us at www.ge-energy.com/nuclear

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