

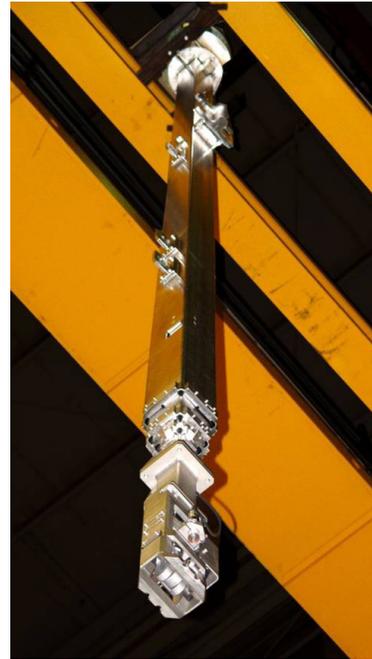
FuelMaster BWR Mast

Background

The new FuelMaster® boiling water reactor (BWR) mast, designed by PaR Nuclear, Inc., a subsidiary of Westinghouse, is a freefloating, free-swinging, telescoping mast developed as a replacement mast on existing BWR refueling and fuel-handling platforms. Made of 304 stainless steel tubing, the mast is a square, tubular design with one stationary section and three moving sections. PaR Nuclear designed this mast with the following objectives in mind: simplicity, ease of maintenance, interchangeability of components, and suitable clearances to prevent binding and crud traps.

Description

The FuelMaster mast is a gimbal-mounted design that is compatible with both PaR Nuclear and Stearns-Roger platforms. The gimbal design contains a spring system for damping impact forces on the mast in the vertical direction. The lower section of the mast also accommodates grapples that fit other PaR Nuclear masts, NF400 masts and NF500 masts. It easily connects to the grapple limit switches, lighting cables, grapple cylinder pneumatic plumbing and grapple camera. The square geometry of the mast design is stronger in bending than an equivalent-sized diameter circular mast due to its higher moments of inertia about the X and Y axes (horizontal centerlines).



FuelMaster BWR Mast

Testing

During the design phase, PaR Nuclear engineering completed mast structural analysis using a solid model and finite-element analysis. PaR Nuclear designed the mast using 3D solid modeling software and performed dynamic analyses on the mast using finite element analysis. Cycle testing was conducted in Taiwan at a training facility under real-life conditions for six weeks.

During the testing, the mast was removed and inspected repeatedly for wear, and no noticeable wear of the guides was observed. The mast functioned flawlessly over a full count of more than 16,000 cycles. Depending upon the size of a specific core, that cycle count would be between eight and 12 refueling outages.

Verified Properties

These calculations verified the structural integrity of the new BWR square mast when subjected to several worst-case scenario dynamic loadings. The analysis showed that the mast can withstand a section drop of any of the moving tubes, will not fail during two-blocking at motor stall torque, and will not yield during high-speed simultaneous bridge, trolley and hoist operations of 62, 40 and 50 feet-per-minute, respectively. The mast bearings between the mast tube sections are wear strips made of Delrin®. Delrin is a plastic material that is impact resistant, strong, stiff, dimensionally stable, wear and fatigue resistant, easily machineable, and chemical and moisture resistant. It is also low in friction, and has a wide temperature range.

Benefits

- Square geometry of the mast design is stronger in bending
- Components are easily interchangeable
- Mast bearings made of Delrin
- Lightweight, simple design
- Less susceptible to mast section hang-ups due to generous clearances
- Replaceable wear strips with long wear life
- Easy to maintain



BWR Grapple

FuelMaster is a trademark or registered trademark of PaR Nuclear, Inc., a subsidiary of Westinghouse Electric Company LLC, in the United States of America and may be registered in other countries throughout the world. All rights reserved. Unauthorized use is strictly prohibited.

Delrin, and other names used herein, may be trademarks of their respective owners.