

# FUELMASTER<sup>®</sup> Mast for Boiling Water Reactors

## Background

Westinghouse's fuel-handling equipment product line has been designing equipment to support all aspects of nuclear fuel handling since 1970.

## Description

The FUELMASTER<sup>®</sup> mast is a low-maintenance replacement for existing boiling water reactor (BWR) refueling bridge masts. FUELMASTER is compatible with PaR Nuclear, Stearns-Roger, and Sundstrand refueling bridge platforms.

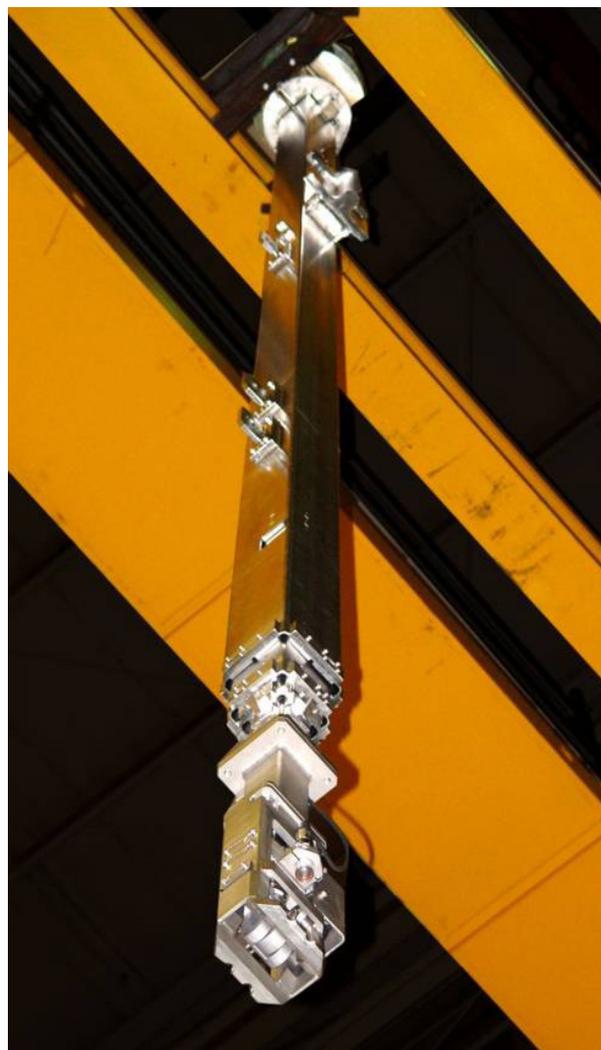
The design uses telescoping sections of stainless steel square tubing. The mast is gimbal mounted to facilitate free-swinging operation required for fuel-handling applications. The gimbal design also contains a spring system for damping impact forces on the mast in the vertical direction. The lower section of the mast accommodates existing grapples that fit PaR Nuclear, NF400, and NF500 masts.

Maintenance is minimized by taking advantage of suitable clearances between sections to prevent binding. The interchangeability of components allows any one mast section or individual component to be replaced. Annual maintenance of existing masts can last weeks.

## Features

- The mast was designed using 3D modeling software. Dynamic characteristics have been analyzed using finite element analysis.
- FUELMASTER can withstand a section drop of any of the moving tubes in the event of a hangup.
- FUELMASTER will not fail during two-blocking at motor stall torque.
- Mast bearing wear strips between the tube

sections are made of Delrin<sup>®</sup>, a plastic material that is wear, fatigue and impact resistant. Delrin is a low friction, strong, dimensionally stable, and easily machineable material that tolerates a wide temperature range and is chemical and moisture resistant.



FUELMASTER BWR mast

## Benefits

- Electro-polished 304 stainless steel aids in decontamination.
- Square geometry of the mast design is more resistant to bending than an equivalent-sized diameter circular mast due to its higher moments of inertia about the X and Y axes (horizontal centerlines).
- The design allows for high-speed, simultaneous operation of the bridge, trolley and hoist at 60, 40, and 50 feet per minute, respectively.
- The mast is less susceptible to mast section hangups due to appropriate clearances.
- It has a lightweight, simple design.
- Mast bearing wear strips are designed to accommodate operational and environmental conditions.
- Components are interchangeable. Any single mast section or component can be replaced.
- The lower section of the mast accommodates existing grapple limit switches, lighting cables, grapple cylinder pneumatic plumbing and cameras.

## Experience

### Operational Testing/Use

- Cycle testing was conducted in Taiwan at a training facility under real-life conditions for six weeks. During testing the mast was removed and inspected repeatedly for wear. No noticeable wear of the guides was observed. The mast functioned over a full count of more than 16,000 cycles. Depending upon the size of a specific core, this cycle count would be equivalent to between eight and twelve refueling outages.
- FUELMASTER masts have been in operation at numerous sites with no known issues for over nine years.



BWR grapple

*FUELMASTER is a trademark or registered trademark of Westinghouse Electric Company LLC, its affiliates and/or its subsidiaries 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 is a trademark or registered trademark of its respective owner. Other names may be trademarks of their respective owners.*