

# PRECISION ENGINEERING

for Nuclear and Seismic Stability in Heavy-Lift Applications

Our expertise in mission-critical projects, combined with decades of experience designing heavy-lift systems, such as shiplifts, positions Bardex® as a trusted provider for integrated solutions in demanding environments.



## NUCLEAR SUBMARINE-RELATED PROJECTS

Currently, only three shiplifts globally are equipped to handle nuclear submarines (two in operation; one under construction). These are not Bardex® systems; however, Bardex has significant experience working with equipment rated for nuclear sites, ensuring compliance with the rigorous processes and requirements necessary for such environments.

### Babcock Projects, United Kingdom

Bardex engineered two systems at Devonport Dockyard in Plymouth, England (Nine-dock and Fourteen-dock) used to refuel UK Royal Navy nuclear submarines. These specialized Transportation and Alignment (T&A) systems used Bardex's proprietary gripper jack skidding technology and automated controls, designed and built by Bardex, and were designed to move RAHs (Reactor Access Houses) over submarines, facilitating the replacement of nuclear cores. Hydraulic cylinders with integrated positioning sensors and laser guidance, synchronized through advanced hardware and software, maintain position and speed within 1mm accuracy over 90m of travel. The systems were built for a 30-year operational lifespan, with the supporting structure designed to last 50 years. While

these systems feature horizontally oriented cylinders, the design principles are nearly identical to those used in vertically oriented shiplift systems, underscoring Bardex's capability to adapt designs for similar applications.

**Duke Power Oconee Power Station Crane & Trolley System for Reactor Maintenance:** Bardex designed a 350-ton capacity crane and trolley system tailored for nuclear facilities located in South Carolina. This system was specifically engineered to replace steam generators and handle other components within the Containment Dome. The design prioritized precision, safety, and reliability, aligning with the stringent standards of the nuclear industry.



HMNB Devonport, Plymouth, England



Bardex® has an unblemished safety record. No Bardex shiplift system has ever experienced a significant failure resulting in damage or reportable incident.

## SPECIALIZED SUSCEPTIBILITIES AND PROTECTIONS

Bardex has successfully implemented key protections and mitigations:

- Electromagnetic Compatibility (EMC): Ensuring systems are immune to interference from external electromagnetic fields.
- Electrostatic Discharge (ESD): Safeguarding equipment and operations from the potential disruptions or damage caused by static electricity.
- Low-Frequency Transient Susceptibility: Designing systems to resist disruptions caused by transient low-frequency signals.
- Magnetic Field (DC) Susceptibility: Developing solutions that perform consistently even in environments with strong static magnetic fields.

## SEAMLESS INTEGRATION WITH HAZARDOUS-AREA STANDARDS

The requirements for nuclear environments often overlap with IEC standards for hazardous areas. This familiarity allows Bardex to design and implement systems that meet or exceed these specifications, ensuring operational safety and reliability.

## SEISMIC RESILIENCE

Shiplifts inherently offer a significant advantage over traditional drydocks in seismic resilience. When a shiplift platform is suspended by chains, it effectively behaves as an isolated system, free to sway in response to seismic activity. This isolation minimizes the transmission of earthquake forces, ensuring that neither the platform nor the vessel it supports sustains damage, provided adequate clearance is maintained around the platform to prevent contact with sidewalls.



*Our chain jacks for multi-billion dollar offshore oil and gas assets are larger than even the largest shiplift chain jacks and must be designed to the notoriously rigorous safety standards of the industries.*

