



GRAPHALLOY® | Bearings for Nuclear Applications

DS2529-50

Nuclear Power Plants: Tough Environments for Bearings & Bushings

Nuclear Applications have various demands—corrosive environments, high temperatures, and specific material requirements due to radioactivity. Commonly used metal, plastic, and other bearing materials will often not work in these environments, so alternative bearing materials are necessary.

Advantages of Graphalloy

GRAPHALLOY materials, made from graphite-metal alloys, have the following advantages:

- ◆ **Self-lubricating:** Require no grease or oil
- ◆ **Temperature Range:** Operate from -450°F to +1000°F (-265°C to +535°C)
- ◆ **Submerged:** Operate in submerged conditions and hostile liquids. Will not swell. No lubricant to wash out.
- ◆ **Non-galling:** Will not gall when running against metal rotating parts
- ◆ **Improved Pump Efficiency:** Allow for tighter running clearances due to self-lubricating and non-galling features
- ◆ **Lower Vibration:** Due to tighter running clearances



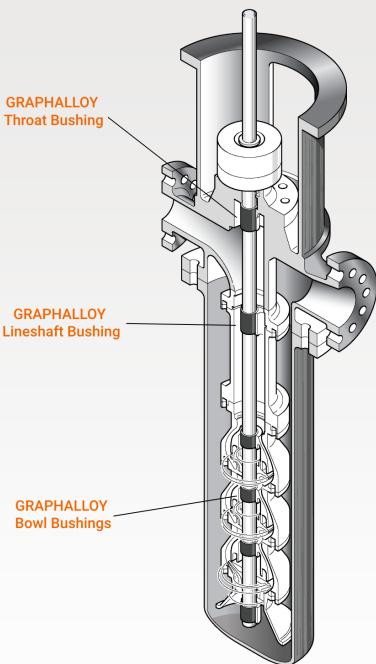
Where to Use Graphalloy

- ◆ Heater Drain Pumps
- ◆ Nuclear Research Applications
- ◆ Boiler Feed Pumps
- ◆ Spent Fuel Pools
- ◆ Circulating Pumps



Heater Drain Pump, Nuclear Power Plant

A full-service pump repair company received a contract to rebuild a heater drain pump for a nuclear power plant. The multistage vertical pump had been in service for eight years, and it was time for a complete overhaul. Eight years before, the original pump bearings were replaced with GRAPHALLOY bushings in order to increase meantime between repairs (MTBR), reduce maintenance and benefit from the self-lubricating and high-temperature characteristics of the material. Upon inspecting the existing bushings, the pump repair company found that after eight years of service, the running clearance had opened (increased) by only 0.003 inches to 0.010 inches from the original specifications. Since they were going to do a complete pump overhaul, they decided to also replace the bushings. There had been a slight increase in vibration, but the bushings were still working well. After this rebuild, the pump was put back into service and the power plant's maintenance manager expects it will be another eight years before they have to rebuild it again. The bushings are intended to be the sacrificial wear part and have proven themselves as a great option for this type of application.



Graphalloy Bearings Solve Spent Fuel Pool Bearing Issues

The water-pool option involves storing spent fuel assemblies under at least 20 feet of water, which provides adequate shielding from the radiation for anyone near the pool. To move the spent fuel rods, an X-Y Table is utilized. The X-Y table translates in either direction with linear bearings. Operating conditions were radioactive ambient water, light loading (5 to 10 lbs), linear motion was 0.5 ft/sec. The table operates from 4-8 hours at a time but may stay under water for weeks at a time. The X-Y table linear bearings traditionally use bronze SAE 660 bushings but have been having premature wear and seizing issues. The SAE 660 bushings were corroding in the radioactive water. Contaminates from fuel rods will likely fall onto the XY table and shafts. Corrosion failure would occur when the table would be sitting idle. After replacing the old bearings, the new Graphalloy bearings have been operating for more than 12 months without corroding or seizing. The problem was solved.



Graphalloy Bearings Provide Solution at Fermilab

Fermilab's MINOS (Main Injector Neutrino Oscillation Search) is designed to observe neutrino beam composition and energy distribution as it travels underground from Fermilab in Illinois to the Soudan Iron Mine in Minnesota. To produce this beam of neutrinos, a proton beam starts at the Main Injector accelerator. The protons are magnetically focused onto a target. It is the mechanical adjustment of these focusing tools (horns) that requires GRAPHALLOY bearings. This operation runs in a particularly hostile environment. It is radioactive and corrosive and is exposed to nitric acid and ionized air. Metallic bushings cannot be used. In addition, polymers, organics, plastics and oil cannot be used in the operation. Finally, the bearings must run dry. The unique properties of GRAPHALLOY provided the solution. GRAPHALLOY bushings were used to target and position the horns because other materials would corrode and freeze up.

