

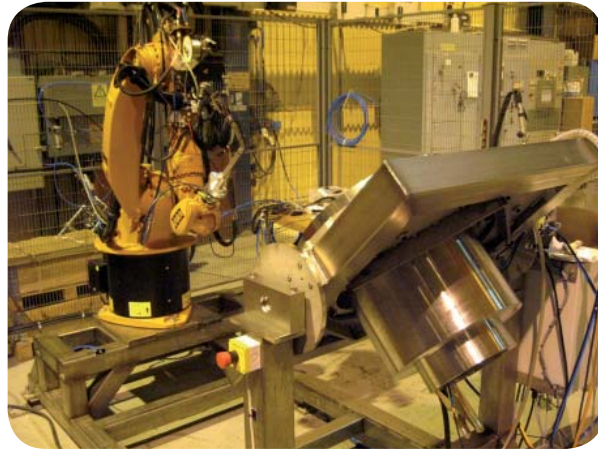
# Foreign Debris Remover for BWR and PWR Applications

» A vortex particle separation system for efficient debris removal in nuclear power plant systems

## Debris Control

Eliminating debris in nuclear power plant systems is critical for plant safety and reliable operations. In the Boiling Water Reactors (BWRs), fuel failures can be caused by clad fretting due to debris entering the reactor and fuel assembly areas from the Main Feedwater and Auxiliary Feedwater systems. Additionally, debris in the feedwater and condensate systems can cause increased dose rates to plant personnel. In the Pressurized Water Reactors (PWRs), the steam generator tubes are susceptible to damage from debris impingement.

The AREVA solution is our Foreign Debris Remover (FDR), which is installed in existing plant systems to remove debris before it enters the reactor vessel or steam generators. Unlike a filter system that results in unacceptable pressure drops, the FDR cyclone or vortex separator uses centrifugal forces to separate particles with minimal pressure drop. Also unlike with a filter, there is no risk that small parts will break from the FDR cyclone and increase the debris.



## The AREVA Foreign Debris Remover

The AREVA FDR system works on the principle of centrifugal separation. Internal vanes impart a swirling action, which separates the particles via centrifugal force. The force drives the particles to the outer wall where they are collected in a chamber for removal. The FDR is easily emptied during an outage.

The flow downstream of the separator is restored to unaffected flow conditions, such that system flow instrumentation is unaffected.

The FDR is intended to be installed as close as possible to the component being protected (reactor vessel, steam generator, etc.) to catch particles from both main feedwater flow and other system inputs.

Installation is achieved by removing a section of piping and replacing it with the FDR. It is installed integral to the system piping via welded or flanged connections and has attachments for any supports that might be required. The FDR is constructed of stainless steel, enabling it to be applied to any system without causing water chemistry or corrosion issues.

## Features and Benefits

- High degree of separation rate for particle sizes ranging from small to large
- High degree of separation rate also at reduced flow rates
- Low pressure drop (7-12 psig drop)
- Delta P does not increase with accumulated particle separation
- Robust design with no moving or rotating parts
- Compact design to simplify installation
- Stable and undisturbed flow at two-pipe diameters downstream of the separator
- Passive component – requires no additional electrical or I&C support systems
- Can be installed in pipe sizes ranging from 6 to 20 inches in diameter
- Machined from homogeneous forgings

## Delivery

AREVA has the skills and experience to perform a complete turn-key project from the feasibility study through the installation. We can provide products and services to match your needs, such as:

- Supply of the AREVA FDR
- Develop engineering design change package
- Site installation
- Structural verification of piping system as required
- Flow and thermal hydraulic analyses
- Overall project management and implementation

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## Experience

Today, AREVA is the only company in the world that has experience performing the full range of activities from the feasibility study to installation. AREVA FDR systems are currently installed and operating in six BWR plants in Europe. The first units were installed in 1994 and are still demonstrating successful debris separation performance.

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