



BWR-The Areva Particle Separator

A feedwater clean-up device – a flexible and efficient solution to debris in the reactor and fuel assembly systems

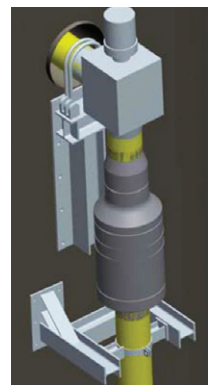
BACKGROUND

It's always important to avoid debris in the feedwater systems at boiling waters reactors (BWRs). Fuel failures are commonly caused by clad fretting due to debris entering the reactor and fuel assembly. Another aspect is that debris in the systems increases the dose rate in the containment.

The AREVA solution is the Particle Separator. The units are installed in the reactor vessel inlet feedwater piping and removes the feedwater debris before it enters the reactor.

THE PARTICLE SEPARATOR

The Particle Separator is of axial centrifugal separators type. A swirling action generates in the incoming flow, which drives the particles to the outer wall where they are collected in a chamber. Before the flow leaves the Particle Separator, the swirl is stopped, and the flow becomes undisturbed downstream the separator. The Particle Separator is easily emptied during every outage by mobile drain equipment, and the collected particles can be analyzed.



The Particle Separator is intended to be installed as close to the RPV as possible to catch particles from both main feed water flow and sub-flows. Normally it is installed in the feed water lines inside containment, but depending on local circumstances this might vary.

Installation is achieved by removing a section of piping and replacing it with the Particle Separator. It occupies only a slightly larger diameter than the pipe removed, and has attachment locations for supports that might be required. The whole unit is constructed of stainless steel, enabling it to be applied to any system without being affected by water chemistry and corrosion issues.

The Particle Separator has been developed for installation in an upwards, downwards or horizontal flow.





THE BENEFITS

The Particle Separator provides:

- > High degree of separation rate of big to very small particles
- > High degree of separation rate also at reduced flow rates
- > Low pressure drop (7–12 psig drop)
- > Robust design with no moving or rotating parts
- > Compact design to simplify the installation
- > Stable and undisturbed flow downstream the Particle Separator
- > A passive component – requires no additional I&C installation
- > The design is qualified according to requirements in B31.1 Power Piping to ASME Section III Class 1
- > Pipe sizes from 6 to 20 inches in diameter
- > Machining from homogeneous forgings and mechanized GTAW with narrow gap joint design of circumferential welds

DELIVERY

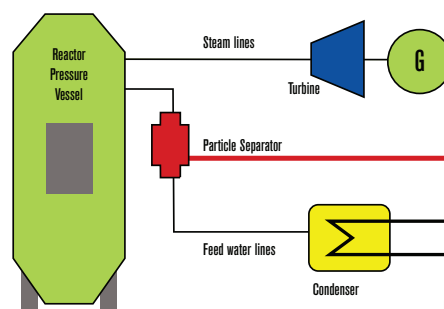
AREVA has the experiences of all activities from feasibility study to installation. We can provide products and services to match the customer needs, such as:

- > Supply of Particle Separator component
- > Site installation
- > Supply engineering change documentation
- > Mobile drain equipment to remove foreign debris from Particle Separators
- > Design pipe routing layout and support modifications as required
- > Structural verification of piping system as required
- > Overall project management and implementation
- > Up-front feasibility study to assess best-installation strategies

EXPERIENCE

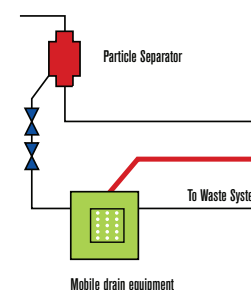
AREVA is today the only company in the world that has the experience of all the activities from feasibility study to installation. The Particle Separator is currently installed and operating at six different BWR plants. The first units were installed in 1994 and have since demonstrated successful separation performance.

INSTALLATION OF PARTICLE SEPARATOR



MOBILE DRAIN EQUIPMENT

System for emptying the Debris Trap



DEBRIS COLLECTED AND REMOVED
FROM AN OPERATING BWR